PRESIDENCY UNIVERSITY
Presidency University Act, 2013 of the Karnataka Act No. 41 of 2013 | Established under Section 2(f) of UGC Act, 1956
Approved by AICTE, New Delhi

PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

Program Regulations and Curriculum 2025-2029

BACHELOR OF TECHNOLOGY (B.Tech.) in COMPUTER SCIENCE AND ENGINEERING (Data Science)

based on Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

(As amended up to the 24th Meeting of the Academic Council held on 3rd August 2024. This document supersedes all previous guidelines)

Regulations No.: PU/AC-24.05/SOCSE04/CSD/2025-2029

Resolution No. 5 of the 24th Meeting of the Academic Council held held on 3rd August 2024, and ratified by the
Board of Management in its 24th Meeting held on 5th August 2024

(As amended upto 24th Meeting of the Academic Council held on 3rd August 2024, and ratified by the Board of Management in its 24th Meeting held on 5th August 2024.)

AUGUST -2024

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PART A – PROGRAM REGULATIONS

1. Vision & Mission of the University and the School / Department

1.1 Vision of the University

To be a Value-driven Global University, excelling beyond peers and creating professionals of integrity and character, having concern and care for society.

1.2 Mission of the University

- Commit to be an innovative and inclusive institution by seeking excellence in teaching, research and knowledge-transfer.
- Pursue Research and Development and its dissemination to the community, at large.
- Create, sustain and apply learning in an interdisciplinary environment with consideration for ethical, ecological and economic aspects of nation building.
- Provide knowledge-based technological support and services to the industry in its growth and development.
- To impart globally-applicable skill-sets to students through flexible course offerings and support industry's requirement and inculcate a spirit of new-venture creation.

1.3 Vision of Presidency School of Computer Science and Engineering

To be a value based, practice-driven School of Computer Science and Engineering, committed to developing globally-competent Engineers, dedicated to transforming Society.

1.4 Mission of Presidency School of Computer Science and Engineering

- Cultivate a practice-driven environment with a contemporary Learning-pedagogy, integrating theory and practice.
- Attract and nurture world-class faculty to excel in Teaching and Research, in the field of Core Computer Science and Engineering.
- Establish state-of-the-art facilities for effective Teaching and Learning-experiences.
- Promote Interdisciplinary Studies to nurture talent and impart relevant skill-sets for global impact.
- Instill Entrepreneurial and Leadership Skills to address Social, Environmental, and Community-needs.

2. Preamble to the Program Regulations and Curriculum

This is the subset of Academic Regulations and it is to be followed as a requirement for the award of B. Tech degree.

The Curriculum is designed to take into the factors listed in the Choice Based Credit System (CBCS) with focus on Industrial Based Project Learning, Industrial Training, and Internship to enable the students to become eligible and fully equipped for employment in industries, choose higher studies or entrepreneurship.

In exercise of the powers conferred by and in discharge of duties assigned under the relevant provision(s) of the Act, Statutes and Academic Regulations of the University,

the Academic Council hereby makes the following Regulations.

3. Short Title and Applicability

a. These Regulations shall be called the Bachelor of Technology Degree Program Regulations and Curriculum 2025-2029.
b. These Regulations are subject to, and pursuant to the Academic Regulations.
c. These Regulations shall be applicable to the ongoing Bachelor of Technology Degree Programs of the 2025-2029 batch, and to all other Bachelor of Technology Degree Programs which may be introduced in future.
d. These Regulations shall supersede all the earlier Bachelor of Technology Degree Program Regulations and Curriculum, along with all the amendments thereto.
e. These Regulations shall come into force from the Academic Year 2024-2025.

4. Definitions

In these Regulations, unless the context otherwise requires:

a. *"Academic Calendar" means the schedule of academic and miscellaneous events as approved by the Vice Chancellor;*
b. *"Academic Council" means the Academic Council of the University;*
c. *"Academic Regulations" means the Academic Regulations of the University;*
d. *"Academic Term" means a Semester or Summer Term;*
e. *"Act" means the Presidency University Act, 2013;*
f. *"AICTE" means All India Council for Technical Education;*
g. *"Basket" means a group of courses bundled together based on the nature/type of the course;*
h. *"BOE" means the Board of Examinations of the University;*
i. *"BOG" means the Board of Governors of the University;*
j. *"BOM" means the Board of Management of the University;*
k. *"BOS" means the Board of Studies of a particular Department/Program of Study of the University;*
l. *"CGPA" means Cumulative Grade Point Average as defined in the Academic Regulations;*
m. *"Clause" means the duly numbered Clause, with Sub-Clauses included, if any, of these Regulations;*
n. *"COE" means the Controller of Examinations of the University;*
o. *"Course In Charge" means the teacher/faculty member responsible for developing and organizing the delivery of the Course;*
p. *"Course Instructor" means the teacher/faculty member responsible for teaching and evaluation of a Course;*
q. *"Course" means a specific subject usually identified by its Course-code and Course-title, with specified credits and syllabus/course-description, a set of references, taught by some teacher(s)/course-instructor(s) to a specific class (group of students) during a specific Academic Term;*
r. *"Curriculum Structure" means the Curriculum governing a specific Degree Program offered by the University, and, includes the set of Baskets of Courses along with minimum credit requirements to be earned under each basket for a degree/degree*

with specialization/minor/honours in addition to the relevant details of the Courses and Course catalogues (which describes the Course content and other important information about the Course). Any specific requirements for a particular program may be brought into the Curriculum structure of the specific program and relevant approvals should be taken from the BOS and Academic Council at that time.

s. *"DAC" means the Departmental Academic Committee of a concerned Department/Program of Study of the University;*

t. *"Dean" means the Dean / Director of the concerned School;*

u. *"Degree Program" includes all Degree Programs;*

v. *"Department" means the Department offering the degree Program(s) / Course(s) / School offering the concerned Degree Programs / other Administrative Offices;*

w. *"Discipline" means specialization or branch of B.Tech. Degree Program;*

x. *"HOD" means the Head of the concerned Department;*

y. *"L-T-P-C" means Lecture-Tutorial-Practical-Credit – refers to the teaching – learning periods and the credit associated;*

z. *"MOOC" means Massive Open Online Courses;*

aa. *"MOU" means the Memorandum of Understanding;*

bb. *"NPTEL" means National Program on Technology Enhanced Learning;*

cc. *"Parent Department" means the department that offers the Degree Program that a student undergoes;*

dd. *"Program Head" means the administrative head of a particular Degree Program/s;*

ee. *"Program Regulations" means the Bachelor of Technology Degree Program Regulations and Curriculum, 2025-2029;*

ff. *"Program" means the Bachelor of Technology (B.Tech.) Degree Program;*

gg. *"PSCSE" means the Presidency School of Computer Science and Engineering;*

hh. *"Registrar" means the Registrar of the University;*

ii. *"School" means a constituent institution of the University established for monitoring, supervising and guiding, teaching, training and research activities in broadly related fields of studies;*

jj. *"Section" means the duly numbered Section, with Clauses included in that Section, of these Regulations;*

kk. *"SGPA" means the Semester Grade Point Average as defined in the Academic Regulations, 2021;*

ll. *"Statutes" means the Statutes of Presidency University;*

mm. *"Sub-Clause" means the duly numbered Sub-Clause of these Program Regulations;*

nn. *"Summer Term" means an additional Academic Term conducted during the summer break (typically in June-July) for a duration of about eight (08) calendar weeks, with a minimum of thirty (30) University teaching days;*

oo. *"SWAYAM" means Study Webs of Active Learning for Young Aspiring Minds.*

pp. *"UGC" means University Grant Commission;*

qq. *"University" means Presidency University, Bengaluru; and*

rr. *"Vice Chancellor" means the Vice Chancellor of the University.*

5. Program Description

The Bachelor of Technology Degree Program Regulations and Curriculum 2025-2029 are subject to, and, pursuant to the Academic Regulations. These Program Regulations shall be applicable to the following ongoing Bachelor of Technology (B.Tech.) Degree Programs of 2025-2029 offered by the Presidency School of Computer Science and Engineering (PSCS):

1. Bachelor of Technology in Computer Science and Engineering, abbreviated as CSE
2. Bachelor of Technology in Computer Science and Technology (Big Data), abbreviated as CBD
3. Bachelor of Technology in Computer Science and Engineering (Block Chain), abbreviated as CBC
4. Bachelor of Technology in Computer Science and Technology (Dev Ops), abbreviated as CDV
5. Bachelor of Technology in Computer Science and Engineering (Cyber Security), abbreviated as CCS
6. Bachelor of Technology in Computer Science and Engineering (Internet of Things), abbreviated as CIT
7. Bachelor of Technology in Computer Science and Engineering (Data Science), abbreviated as CSD
8. Bachelor of Technology in Computer Science and Technology, abbreviated as CSG
9. Bachelor of Technology in Information Science and Technology, abbreviated as IST
10. Bachelor of Technology in Computer Science and Information Technology, abbreviated as CSI
11. Bachelor of Technology in Computer Science and Engineering (Networks), abbreviated as CSN
12. Bachelor of Technology in Computer Engineering, abbreviated as COM
13. Bachelor of Technology in Information Science and Engineering, abbreviated as ISE and
14. Bachelor of Technology in Computer Science and Engineering (Artificial Intelligence and Machine Learning) abbreviated as CAI
15. Bachelor of Technology in Robotics and Artificial Intelligence Engineering, abbreviated as RAI
16. Bachelor of Technology in Artificial Intelligence and Data Science Engineering, abbreviated as AID

5.1 These Program Regulations shall be applicable to other similar programs, which may be introduced in future.

5.2 These Regulations may evolve and get amended or modified or changed through appropriate approvals from the Academic Council, from time to time, and shall be binding on all concerned.

5.3 The effect of periodic amendments or changes in the Program Regulations, on the students admitted in earlier years, shall be dealt with appropriately and carefully, so as to ensure that those students are not subjected to any unfair situation whatsoever, although they are required to conform to these revised Program Regulations, without any undue favour or considerations

6. Minimum and Maximum Duration

6.1 Bachelor of Technology Degree Program is a Four-Year, Full-Time Semester based program. The minimum duration of the B.Tech. Program is four (04) years and each year comprises of two academic Semesters (Odd and Even Semesters) and hence the duration of the B.Tech. program is eight (08) Semesters.

6.2 A student who for whatever reason is not able to complete the Program within the normal period or the minimum duration (number of years) prescribed for the Program, may be allowed a period of two years beyond the normal period to complete the mandatory minimum credits requirement as prescribed by the concerned Program Regulations and Curriculum. In general, the permissible maximum duration (number of years) for completion of Program is 'N' + 2 years, where 'N' stands for the normal or minimum duration (number of years) for completion of the concerned Program as prescribed by the concerned Program Regulations and Curriculum.

6.3 The time taken by the student to improve Grades/CGPA, and in case of temporary withdrawal/re-joining (Refer to Clause 16.1 of Academic Regulations), shall be counted in the permissible maximum duration for completion of a Program.

6.4 In exceptional circumstances, such as temporary withdrawal for medical exigencies where there is a prolonged hospitalization and/or treatment, as certified through hospital/medical records, women students requiring extended maternity break (certified by registered medical practitioner), and, outstanding sportspersons representing the University/State/India requiring extended time to participate in National/International sports events, a further extension of one (01) year may be granted on the approval of the Academic Council.

6.5 The enrolment of the student who fails to complete the mandatory requirements for the award of the concerned Degree (refer Section 19.0 of Academic Regulations) in the prescribed maximum duration (Sub-Clauses 18.1 and 18.2 of Academic Regulations), shall stand terminated and no Degree shall be awarded.

7 Programme Educational Objectives (PEO)

After four years of successful completion of the program, the graduates shall be able to:

PEO 1: Demonstrate proficiency as a Computer Engineering professional, applying technical knowledge and skills effectively in various engineering fields.

PEO 2: Become a teaching and research professional in the areas of Computer Science and Engineering, engaging in lifelong learning to stay at the forefront of the field.

PEO 3: Contribute as a key member of a consultancy team in the Computer Science and Engineering industry, providing expert solutions to complex problems.

PEO 4: Emerge as an entrepreneur in the fields of Computer Science and related areas, creating innovative solutions and businesses.

8 Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

8.1 Programme Outcomes (PO)

On successful completion of the Program, the students shall be able to:

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

8.2 Program Specific Outcomes (PSOs):

On successful completion of the Program, the students shall be able to:

PSO 1 Illustrate comprehensive knowledge of computer science to describe fundamental ideas, investigate computational issues, and apply theoretical understanding in the design of efficient and reliable systems.

PSO2 Employ software development skills, domain expertise in data science, and programming knowledge to create effective, real-life systems, preparing students for opportunities in technical careers, advanced studies, innovation, research or self-driven enterprises.

PSO3 Apply techniques of data engineering involving collecting, cleaning, storing, and managing structured and unstructured data using databases, data lakes, and cloud platforms to support efficient data-driven systems.

9 Admission Criteria (as per the concerned Statutory Body)

The University admissions shall be open to all persons irrespective of caste, class, creed, gender or nation. All admissions shall be made on the basis of merit in the qualifying examinations; provided that forty percent of the admissions in all Programs of the University shall be reserved for the students of Karnataka State and admissions shall be made through a Common Entrance Examination conducted by the State Government or its agency and seats shall be allotted as per the merit and reservation policy of the State Government from time to time**.** The admission criteria to the B.Tech. Program is listed in the following Sub-Clauses:

9.1 An applicant who has successfully completed Pre-University course or Senior Secondary School course (+2) or equivalent such as (11+1), 'A' level in Senior School Leaving Certificate Course from a recognized university of India or outside or from Senior Secondary Board or equivalent, constituted or recognized by the Union or by the State Government of that Country for the purpose of

issue of qualifying certificate on successful completion of the course, may apply for and be admitted into the Program.

9.2 Provided further, the applicant must have taken Physics and Mathematics as compulsory subjects in the Pre-University / Higher Secondary / (10+2) / (11+1) examination, along with either Chemistry / Biology / Electronics / Computer Science / Biotechnology subject, and, the applicant must have obtained a minimum of 45% of the total marks (40% in case of candidates belonging to the Reserved Category as classified by the Government of Karnataka) in these subjects taken together.

9.3 The applicant must have appeared for Joint Entrance Examinations (JEE) Main / JEE (Advanced) / Karnataka CET / COMED-K, or any other State-level Engineering Entrance Examinations.

9.4 Reservation for the SC / ST and other backward classes shall be made in accordance with the directives issued by the Government of Karnataka from time to time.

9.5 Admissions are offered to Foreign Nationals and Indians living abroad in accordance with the rules applicable for such admission, issued from time to time, by the Government of India.

9.6 Candidates must fulfil the medical standards required for admission as prescribed by the University.

9.7 If, at any time after admission, it is found that a candidate had not in fact fulfilled all the requirements stipulated in the offer of admission, in any form whatsoever, including possible misinformation and any other falsification, the Registrar shall report the matter to the Board of Management (BOM), recommending revoking the admission of the candidate.

9.8 The decision of the BOM regarding the admissions is final and binding.

10 Lateral Entry / Transfer Students requirements

10.1 Lateral Entry

The University admits students directly to the second year (3rd Semester) of the B.Tech. Degree program as per the provisions and/or regulations of the Government of Karnataka pertaining to the "Lateral Entry" scheme announced by the Government from time to time. Further, the general conditions and rules governing the provision of Lateral Entry to the B.Tech. Program of the University are listed in the following Sub-Clauses:

10.1.1 Admission to 2nd year (3rd Semester) of the B.Tech. Degree program shall be open to the candidates who are holders of a 3-year Diploma in Engineering (or equivalent qualification as recognized by the University), who have secured not less than forty-five percentage (45%) marks in the final year examination (5th and 6th Semesters of the Diploma Program) in the appropriate branch of Engineering. Provided that, in case of SC / ST and OBC candidates from Karnataka the minimum marks for

eligibility shall be forty percent (40%).

10.1.2 Provided further that, candidates seeking Lateral Entry may be required to complete specified bridge Courses as prescribed by the University. Such bridge Courses, if any, shall not be included in the CGPA computations.

10.1.3 All the existing Regulations and Policies of the University shall be binding on all the students admitted to the Program through the provision of Lateral Entry.

10.1.4 The Course requirements prescribed for the 1st Year of the B.Tech. Program shall be waived for the student(s) admitted through Lateral Entry and the duration of the B.Tech. Program for such students is three (03) years, commencing from the 3rd Semester (commencement of the 2nd Year) of the B.Tech. Program and culminating with the 8th Semester (end of the 4th Year) of the B.Tech. Program.

10.1.5 Provided that, if a Lateral Entry student misses any mandatory program specific courses that are typically offered in the 1st year (1st or 2nd semesters), then those courses must be cleared by the students as soon as possible, preferably during the Summer Term.

10.1.6 The existing Program Regulations of the concerned Program to which the student is admitted through the provision of Lateral Entry shall be binding on the student with effect from the 3rd Semester of the Program. i.e., the Program Structure and Curriculum from the 3rd to 8th Semesters of the Program concerned shall be binding on the student admitted through Lateral Entry. Further, any revisions / amendments made to the Program Regulations thereafter, shall be binding on all the students of the concerned Program.

10.1.7 All the Courses (and the corresponding number of Credits) prescribed for the 1st Year of the concerned B.Tech. Program shall be waived for the student(s) admitted to the concerned B.Tech Program through Lateral Entry. Further, the *Minimum Credit Requirements* for the award of the B.Tech. Degree in the concerned Program shall be prescribed / calculated as follows:

The ***Minimum Credit Requirements*** for the award of the Bachelor of Technology (B.Tech.) Degree prescribed by the concerned Bachelor of Technology Degree Program Regulations and Curriculum, 2025-2029, minus the number of Credits prescribed / accepted by the Equivalence Committee for the 1st Year (1st and 2nd Semesters) of the B.Tech. Program.

For instance, if the *Minimum Credit Requirements* for the award of the Bachelor of Technology (B.Tech.) Degree as prescribed by the Regulations for B.Tech. (Computer Science and Engineering-Data Science) is "N" Credits, and, if the total credits prescribed in the 1st Year (total credits of the 1st and 2nd Semesters) of the Program concerned is "M" Credits, then the *Minimum Credit Requirements* for the award of the B.Tech. in Computer Science and Engineering for a student who joins the Program through the provision of the Lateral Entry, shall be "N – M" Credits.

10.1.8 Further, no other waiver except the Courses prescribed for the 1st year of the

B.Tech. Program of the University shall be permissible for students joining the B.Tech. Program through the provision of Lateral Entry.

10.2 Transfer of student(s) from another recognized University to the 2nd year (3rd Semester) of the B.Tech. Program of the University

A student who has completed the 1st Year (i.e., passed in all the Courses / Subjects prescribed for the 1st Year) of the B.Tech/B.E/B.S., Four-Year Degree Program from another recognized University, may be permitted to transfer to the 2nd Year (3rd Semester) of the B.Tech. Program of the University as per the rules and guidelines prescribed in the following Sub-Clauses:

10.2.1 The concerned student fulfils the criteria specified in Sub-Clauses 10.1.1, 10.1.2 and 10.1.3.

10.2.2 The student shall submit the Application for Transfer along with a non-refundable Application Fee (as prescribed by the University from time to time) to the University no later than July 10 of the concerned year for admission to the 2nd Year (3rd Semester) B.Tech. Program commencing on August 1 on the year concerned.

10.2.3 The student shall submit copies of the respective Marks Cards / Grade Sheets / Certificates along with the Application for Transfer.

10.2.4 The transfer may be provided on the condition that the Courses and Credits completed by the concerned student in the 1st Year of the B.Tech. / B.E. / B.S. Four Degree Program from the concerned University, are declared equivalent and acceptable by the Equivalence Committee constituted by the Vice Chancellor for this purpose. Further, the Equivalence Committee may also prescribe the Courses and Credits the concerned students shall have to mandatorily complete, if admitted to the 2nd Year of the B.Tech. Program of the University.

10.2.5 The Branch / Discipline allotted to the student concerned shall be the decision of the University and binding on the student.

11 Change of Branch / Discipline / Specialization

A student admitted to a particular Branch of the B.Tech. Program will normally continue studying in that Branch till the completion of the program. However, the University reserves the right to provide the option for a change of Branch, or not to provide the option for a change of Branch, at the end of 1st Year of the B.Tech. Program to eligible students in accordance with the following rules and guidelines framed by the University from time to time.

11.1 Normally, only those students, who have passed all the Courses prescribed for the 1st Year of the B.Tech. Program and obtained a CGPA of not less than 6.50 at the end of the 2nd Semester, shall be eligible for consideration for a change of Branch.

11.2 Change of Branch, if provided, shall be made effective from the commencement of the 3rd Semester of the B.Tech. Program. There shall be no provision for change of Branch thereafter under any circumstances

whatsoever.

11.3 The student provided with the change of Branch shall fully adhere to and comply with the Program Regulations of the concerned Branch of the B.Tech. Program, the Fee Policy pertaining to that Branch of the B.Tech. Program, and, all other rules pertaining to the changed Branch existing at the time.

11.4 Change of Branch once made shall be final and binding on the student. No student shall be permitted, under any circumstances, to refuse the change of Branch offered.

11.5 The eligible student may be allowed a change in Branch, strictly in order of *inter se* merit, subject to the conditions given below:

11.5.1 The actual number of students in the 3rd Semester in any particular Branch to which the transfer is to be made, should not exceed the intake fixed by the University for the concerned Branch;

11.5.2 The actual number of students in any Branch from which transfer is being sought does not fall below 75% of the total intake fixed by the University for the concerned Branch.

The process of change of Branch shall be completed within the first five days of Registration for the 3rd Semester of the B.Tech. Program.

12 Specific Regulations regarding Assessment and Evaluation (including the Assessment Details of NTCC Courses, Weightages of Continuous Assessment and End Term Examination for various Course Categories)

12.1 The academic performance evaluation of a student in a Course shall be according to the University Letter Grading System based on the class performance distribution in the Course.

12.2 Academic performance evaluation of every registered student in every Course registered by the student is carried out through various components of Assessments spread across the Semester. The nature of components of Continuous Assessments and the weightage given to each component of Continuous Assessments (refer Clause 8.8 of Academic Regulations) shall be clearly defined in the Course Plan for every Course, and approved by the DAC.

12.3 Format of the End-Term examination shall be specified in the Course Plan.

12.4 Grading is the process of rewarding the students for their overall performance in each Course. The University follows the system of Relative Grading with statistical approach to classify the students based on the relative performance of the students registered in the concerned Course except in the following cases:

- Non-Teaching Credit Courses (NTCC)
- Courses with a class strength less than 30

Absolute grading method may be adopted, where necessary with prior approval of concerned DAC.

Grading shall be done at the end of the Academic Term by considering the

aggregate performance of the student in all components of Assessments prescribed for the Course. Letter Grades (Clause 8.10 of Academic Regulations) be awarded to a student based on her/his overall performance relative to the class performance distribution in the concerned Course. These Letter Grades not only indicate a qualitative assessment of the student's performance but also carry a quantitative (numeric) equivalent called the Grade Point.

12.5 **Assessment Components and Weightage**

S.No	Credit Structure [L-T-P-C]	Percentage/ Marks	CA		Mid-Term		End-term		Project	Total	Exam Conducted by
			Theory	Practical	Theory	Practical	Theory	Practical			
1	3-0-0-3	Percentage	25%	-	25%	-	50%	-	-	100 %	Mid-Term & End Term by CoE
		Marks	50	-	50	-	100	-	-	200	
2	2-0-2-3	Percentage	12.50 %	12.50 %	12.50%	12.50%	25%	25%	-	100 %	Mid-Term & End Term by CoE * Except for full stack courses
		Marks	25	25	25	25	50	50	-	200	
3	1-0-4-3	Percentage	-	25%	10%	40%	5%	20%	-	100 %	Mid-Term & End Term by School
		Marks	-	25	10	40	5	25	-	100	
4	2-0-4-4	Percentage	12.50 %	12.50 %	10%	15%	20%	30%	-	100 %	*Mid-Term & End Term by CoE
		Marks	25	25	20	30	40	60	-	200	
5	0-0-4-2	Percentage	-	50%	-	-	-	-	50%	100 %	Project evaluated by IC at School level
		Marks	-	50	-	-	-	-	50	100	
6	0-0-2-1	Percentage	-	100%	-	-	-	-	-	100 %	Only CA at School Level
		Marks	-	100	-	-	-	-	-	100	
7	3-0-2-4	Percentage	12.50 %	12.50 %	15%	10%	30%	20%	-	100 %	Mid-Term & End Term by CoE
		Marks	25	25	30	20	60	40	-	200	
8	2-0-0-2	Percentage	25 %	-	25%	-	50%	-	-	100 %	Mid-Term & End Term by CoE
		Marks	50	-	50	-	100	-	-	200	

*CSE3426-Front End Full stack development

CSE3427-Java Full Stack Development

CSE3428-.Net Full Stack development

The exact weightages of Evaluation Components shall be clearly specified in the concerned PRC and respective Course Plan.

Normally, for Practice/Skill based Courses, without a defined credit structure (L–T–P) [NTCC], but with assigned Credits (as defined in Clause 5.2 of the Academic Regulations), the method of evaluation shall be based only on Continuous Assessments. The various components of Continuous Assessments, the distribution of weightage among such components, and the method of

evaluation/assessment, shall be as decided and indicated in the Course Plan/PRC. The same shall be approved by the respective DAC.

12.6 **Minimum Performance Criteria:**

12.6.1 **Theory only Course and Lab/Practice Embedded Theory Course**

A student shall satisfy the following minimum performance criteria to be eligible to earn the credits towards the concerned Course:

a. A student must obtain a minimum of 30% of the total marks/weightage assigned to the End Term Examinations in the concerned Course.

b. The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of the components of Continuous Assessments, Mid Term Examinations and End Term Examinations in the concerned Course.

12.6.2 **Lab/Practice only Course and Project Based Courses**

The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of all assessment components in the concerned Course.

12.6.3 A student who fails to meet the minimum performance criteria listed above in a Course shall be declared as "Fail" and given "F" Grade in the concerned Course. For theory Courses, the student shall have to re-appear in the "Make-Up Examinations" as scheduled by the University in any subsequent semester, or, re-appear in the End Term Examinations of the same Course when it is scheduled at the end of the following Semester or Summer Term, if offered. The marks obtained in the Continuous Assessments (other than the End Term Examination) shall be carried forward and be included in computing the final grade, if the student secures the minimum requirements (as per Clauses 8.9.1 and 8.9.2 of Academic Regulations) in the "Make-Up Examinations" of the concerned Course. Further, the student has an option to re-register for the Course and clear the same in the summer term/ subsequent semester if he/she wishes to do so, provided the Course is offered.

13 Additional clarifications - Rules and Guidelines for Transfer of Credits from MOOC, etc. – Note: These are covered in Academic Regulations

The University allows students to acquire credits from other Indian or foreign institutions and/or Massive Open Online Course (MOOC) platforms, subject to prior approval. These credits may be transferred and counted toward fulfilling the minimum credit requirements for the award of a degree. The process of transfer of credits is governed by the following rules and guidelines:

13.1 The transfer of credits shall be examined and recommended by the Equivalence Committee (Refer ANNEXURE B of Academic Regulations) and approved by the Dean - Academics.

13.2 Students may earn credits from other Indian or foreign Universities/Institutions with which the University has an MOU, and that MOU shall have specific provisions, rules and guidelines for transfer of credits. These transferred credits shall be counted towards the minimum credit requirements for the award of the degree.

13.3 Students may earn credits by registering for Online Courses offered by *Study Web of Active Learning by Young and Aspiring Minds* (SWAYAM) and *National Program on Technology Enhanced Learning* (NPTEL), or other such recognized Bodies/ Universities/Institutions as approved by the concerned BOS and Academic Council from time to time. The concerned School/Parent Department shall publish/include the approved list of Courses and the rules and guidelines governing such transfer of credits of the concerned Program from time to time. The Rules and Guidelines for the transfer of credits specifically from the Online Courses conducted by SWAYAM/ NPTEL/ other approved MOOCs are as stated in the following Sub-Clauses:

13.3.1 A student may complete SWAYAM/NPTEL/other approved MOOCs as mentioned in Clause 17.3 (As per Academic Regulations) and transfer equivalent credits to partially or fully complete the mandatory credit requirements of Discipline Elective Courses and/or the mandatory credit requirements of Open Elective Courses as prescribed in the concerned Curriculum Structure. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective Courses and the Open Elective Courses as prescribed by the Curriculum Structure of the concerned Program.

13.3.2 SWAYAM/NPTEL/ other approved MOOCs as mentioned in Clause 17.3 (As per Academic Regulations) shall be approved by the concerned Board of Studies and placed (as Annexures) in the concerned PRC.

13.3.3 Parent Departments may release a list of SWAYAM/NPTEL/other approved MOOCs for Pre-Registration as per schedule in the Academic Calendar or through University Notification to this effect.

13.3.4 Students may Pre-Register for the SWAYAM/NPTEL/other approved MOOCs in the respective Departments and register for the same Courses as per the schedule announced by respective Online Course Offering body/institute/ university.

13.3.5 A student shall request for transfer of credits only from such approved Courses as mentioned in Sub-Clause 13.3.2 above.

13.3.6 SWAYAM/NPTEL/other approved MOOCs Courses are considered for transfer of credits only if the concerned student has successfully completed the SWAYAM/NPTEL/other approved MOOCs and obtained a certificate of successful/satisfactory completion.

13.3.7 A student who has successfully completed the approved SWAYAM/NPTEL/ other approved MOOCs and wants to avail the provision of transfer of equivalent credits, must submit the original Certificate of Completion, or such similar authorized documents to the HOD concerned, with a written request for the transfer of the equivalent credits. On verification of the Certificates/Documents and approval by the HOD concerned, the Course(s) and equivalent Credits shall have forwarded to the COE for processing of results of the concerned Academic Term.

13.3.8 The credit equivalence of the SWAYAM/NPTEL/other approved MOOCs are based on Course durations and/or as recommended by the Course offering body/institute/university. The Credit Equivalence mapped to SWAYAM/ NPTEL approved Courses based on Course durations for transfer of credits is summarized in Table shown below. The Grade will be calculated from the marks received by the Absolute Grading Table 8.11 in the Academic Regulations.

Table 2: Durations and Credit Equivalence for Transfer of Credits from SWAYAM-NPTEL/ other approved MOOC Courses

Sl. No.	Course Duration	Credit Equivalence
1	4 Weeks	1 Credit
2	8 Weeks	2 Credits
3	12 Weeks	3 Credits

13.3.9 The maximum permissible number of credits that a student may request for credit transfer from MOOCs shall not exceed 20% of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree. The University shall not reimburse any fees/expense; a student may incur for the SWAYAM/NPTEL/other approved MOOCs.

13.4 The maximum number of credits that can be transferred by a student shall be limited to forty percent (40%) of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree. However, the grades obtained in the Courses transferred from other Institutions/MOOCs, as mentioned in this Section (13.0), shall not be included in the calculation of the CGPA.

13.5 Mandatory Non-Credit Course Completion Requirements: All mandatory non-credit courses shall be satisfactorily completed by the student as part of the degree requirements. These courses will be evaluated and awarded letter grades based on the following criteria:

S (Satisfactorily Completed): Awarded when the student successfully completes all prescribed course requirements.

NC (Not Completed): Awarded when the student fails to meet the prescribed course requirements.

A student receiving an NC grade must reappear for and complete the course in accordance with the guidelines prescribed by the University.

In the case of non-taught and non-credited mandatory courses—where students are advised to undertake learning through MOOC platforms—there shall be a clearly defined Course Catalogue and a corresponding Course Plan. The Course Plan shall outline the assessment components, which will form the basis for evaluation.

PART B – PROGRAM STRUCTURE

14. Structure / Component with Credit Requirements Course Baskets & Minimum Basket wise Credit Requirements

The B.Tech. (Computer Science and Engineering-Data Science) Program Structure (2025-2029) totaling 160 credits. Table 3 summarizes the type of baskets, number of courses under each basket and the associated credits that are mandatorily required for the completion of the Degree.

Table 3: B.Tech. (Computer Science & Engineering-Data Science) 2025-2029: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets

Sl. No.	Baskets	Credit Contribution
1	Humanities and Social Sciences including Management Courses (HSMC)	10
2	Basic Science Courses (BSC)	24
3	Engineering Science Courses (ESC)	22
4	Professional Core Courses (PCC)	64
5	Project Work (PRW)	16
6	Professional Elective Courses (PEC)	18
7	Open Elective Courses (OEC)	06
8	Mandatory Courses (MAC)*	0
	Total Credits	**160 (Minimum)**

* Please refer to Table 3.8, (where the number '8' corresponds to the serial number of the Mandatory course basket.)

In the entire Program, the practical and skill based course component contribute to an extent of approximately 61% out of the total credits of 160 for B.Tech. (Computer Science and Engineering-Data Science) program of four years' duration.

15. Minimum Total Credit Requirements of Award of Degree

As per the AICTE guidelines, a minimum of 160 credits is required for the award of a B.Tech. degree.

16. Other Specific Requirements for Award of Degree, if any, as prescribed by the Statutory Bodies,

16.1 The award of the Degree shall be recommended by the Board of Examinations and approved by the Academic Council and Board of Management of the University.

16.2 A student shall be declared to be eligible for the award of the concerned Degree if she/he:

a. Fulfilled the Minimum Credit Requirements and the Minimum Credits requirements under various baskets;

b. Secure a minimum CGPA of 4.50 in the concerned Program at the end of the Semester/Academic Term in which she/he completes all the requirements for the award of the Degree as specified in Sub-Clause 19.2.1 of Academic Regulations**;**

c. No dues to the University, Departments, Hostels, Library, and any other such Centers/ Departments of the University; and

d. No disciplinary action is pending against her/him.

PART C: CURRICULUM STRUCTURE

17.Curriculum Structure – Basket Wise Course List (not Semester Wise)
List of Courses Tabled – aligned to the Program Structure
(Course Code, Course Name, Credit Structure (LTPC), Contact Hours, Course Basket, Type of Skills etc., as applicable).

Baskets
HSMC - Humanities and Social Sciences (including Management courses) (HSMC)
BSC - Basic Science Courses ESC - Engineering Science Courses
PCC - Professional Core Course
PEC - Professional Elective Courses
OEC - Open Elective Courses
EEC - Employment Enhancement Courses
MAC - Mandatory Course

Table 3.1:
List of Humanities and Social Sciences including Management Courses (HSMC)

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill	Pre-requisite
1	ENG1900	English for Technical Communication	2	0	0	2	2	S	Nil
2	DES1146	Introduction to Design Thinking	1	0	0	1	1	F	Nil
3	ENG2501	Advanced English	2	0	0	2	2	S	Nil
4	FIN1002	Essentials of Finance	3	0	0	3	3	S	Nil
5	APT4005	Aptitude for Employability	0	0	2	1	2	AT	Nil
6	PPS3018	Preparedness for Interview	0	0	2	1	2	SS	Nil
		Total	8	0	4	10	12		

Table 3.2: List of Basic Science Courses (BSC)

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill	Pre-requisite
1	MAT2301	Calculus and Differential Equations	3	1	0	4	4	F	Nil
2	PHY2501	Optoelectronics and Quantum Physics	3	0	0	3	3	F	Nil

3	PHY2504	Optoelectronics and Quantum Physics Lab	0	0	2	1	2	F	Nil
4	MAT2402	Probability and Statistics	3	1	0	4	4	F	Nil
5	CHE2501	Chemistry of Smart Materials	3	0	0	3	3	S	Nil
6	CHE2502	Chemistry of Smart Materials Lab	0	0	2	1	2	S	Nil
7	MAT2303	Linear Algebra and Vector Calculus	3	1	0	4	4	EM	Nil
8	MAT2301	Calculus and Differential Equations	3	1	0	4	4	F	Nil
		Total	**18**	**4**	**4**	**24**	**26**		

Table 3.3: List of Engineering Science Courses (ESC)

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill	Pre-requisite
1	MEC1006	Engineering Graphics	2	0	0	2	2	**S**	Nil
2	CSE1500	Computational Thinking using Python	2	0	2	3	4	**S**	Nil
3	ECE2022	Digital Design	2	0	0	2	2	**F/S**	Nil
4	ECE2052	Digital Design Lab	0	0	2	1	2	**F/S**	Nil
5	CIV1200	Foundations of Integrated Engineering	2	0	0	2	2	**S**	Nil
6	EEE1200	Basics of Electrical and Electronics Engineering	3	0	0	3	3	**F/S**	Nil
7	EEE1250	Basics of Electrical and Electronics Engineering Lab	0	0	2	1	2	**F/S**	Nil
8	ECE1511	Design Workshop	1	0	2	2	3	**S/EM**	Nil
9	CSE2264	Essentials of AI	3	0	0	3	3	**S/EM**	Nil
10	CSE2265	Essentials of AI Lab	0	0	2	1	2	**S/EM**	Nil
11	CSE2274	Competitive Programming and Problem Solving	0	0	4	2	4	**S/EM**	Nil
		Total	**15**	**0**	**14**	**22**	**29**		

Table 3.4: List of Professional Core Courses (PCC)

S. No	Course Code	Course Name	L	T	P	C	Contact Hours	Type of Skills/ Focus	Pre-requisites/ Co-requisites
1	**CSE2000**	**Problem Solving using C**	**2**	**0**	**0**	**2**	**2**	**S**	**Nil**
2	**CSE2001**	**Problem Solving using C Lab**	**0**	**0**	**4**	**2**	**4**	**S**	**Nil**
3	**CSE2051**	**Data Communication and Computer Networks**	**3**	**0**	**0**	**3**	**3**	**S**	**Nil**
4	**CSE2052**	**Data Communication and Computer Networks Lab**	**0**	**0**	**2**	**1**	**2**	**S**	**Nil**
5	**CSE2053**	**Data Structures**	**3**	**0**	**0**	**3**	**3**	**S**	**Nil**
6	**CSE2054**	**Data Structures Lab**	**0**	**0**	**2**	**1**	**2**	**S**	**Nil**
7	**CSE2055**	**Object Oriented Programming Using Java**	**3**	**0**	**0**	**3**	**3**	**S/EM**	**Nil**
8	**CSE2056**	**Object Oriented Programming Using Java Lab**	**0**	**0**	**2**	**1**	**2**	**S/EM**	**Nil**
9	CSD1712	Statistical Foundations for Data Science	3	0	0	3	**3**	S	MAT2403
10	CSD1713	Statistical Foundations Lab for Data Science Lab	0	0	2	1	**2**	S	MAT2403
11	**CSE2057**	**Computer Organization and Architecture**	**3**	**0**	**0**	**3**	**3**	**S**	**Nil**
12	**CSE2058**	**Web Technologies**	**3**	**0**	**0**	**3**	**3**	**S/EM**	**Nil**
13	**CSE2059**	**Web Technologies Lab**	**0**	**0**	**2**	**1**	**2**	**S/EM**	**Nil**
14	**CSE2060**	**Database Management Systems**	**3**	**0**	**0**	**3**	**3**	**S**	**Nil**
15	**CSE2061**	**Database Management Systems Lab**	**0**	**0**	**2**	**1**	**2**	**S**	**Nil**
16	**CSE2062**	**Analysis of Algorithms**	**3**	**1**	**0**	**4**	**4**	**S**	**Nil**
17	**CSE2063**	**Analysis of Algorithms Lab**	**0**	**0**	**2**	**1**	**2**	**S**	**Nil**
18	**CSE2066**	**Theory of Computation**	**3**	**0**	**0**	**3**	**3**	**S**	**Nil**
19	CSD2002	Introduction to Data Science	3	0	0	3	3	F	NIL
20	CSD2007	R programming for Data Science	3	0	0	3	**2**	S/EM	**Nil**
21	CSD2008	R programming Lab for Data Science	0	0	2	1	**2**	S/EM	**Nil**
22	**CSE2069**	**Operating Systems**	**3**	**0**	**0**	**3**	**3**	**S**	**Nil**
23	**CSE2070**	**Operating Systems Lab**	**0**	**0**	**2**	**1**	**2**	**S/EM**	**Nil**
24	CSD2009	Data Handling and Visualization	2	0	0	2	2	S/EM	Nil
25	CSD2010	Data Handling and Visualization Lab	0	0	4	2	2	S/EM	Nil

26	**CSE2071**	**Software Design and Development**	**3**	**0**	**0**	**3**	**3**	**S**	**Nil**
27	CSD2021	Machine Learning for Intelligent data Science	3	0	0	3	3	S/EM	Nil
28	CSD2024	Machine Learning Lab for Intelligent data Science	0	0	2	1	2	S/EM	Nil
29	CSD2501	Predictive Analytics	2	0	0	2	2	S/EM	CSE1500
30	CSD2502	Predictive Analytics Lab	0	0	2	1	4	S/EM	CSE1500
Total No. of Credits						**64**			

18. Practical / Skill based Courses – Internships / Thesis / Dissertation / Capstone Project Work / Portfolio / Mini project

Table 3.5 : List of course in Project Work basket (PRW)

S.No	Course Code	Course Name	L	T	P	C
1	CSE7000	Internship				2
2	CSE7100	Mini Project				4
3	CSE7300	Capstone Project	-	-	-	10
		Total No. of Credits				**16**

Practical / Skill based Courses like internship, project work, capstone project, research project / dissertation, and such similar courses, where the pedagogy does not lend itself to a typical L-T-P-C Structure as defined in Clause 5.1 of the Academic Regulations, are simply assigned the number of Credits based on the quantum of work / effort required to fulfill the learning objectives and outcomes prescribed for the concerned Courses. Such courses are referred to as Non-Teaching Credit Courses (NTCC). These Courses are designed to provide students with hands-on experience and skills essential for their professional development. These courses aim to equip students with abilities in problem identification, root cause analysis, problem-solving, innovation, and design thinking through industry exposure and project-based learning. The expected outcomes are first level proficiency in problem solving and design thinking skills to better equip B.Tech. graduates for their professional careers. The method of evaluation and grading for the Practical / Skill based Courses shall be prescribed and approved by the concerned Departmental Academic Committee (refer Annexure A of the Academic Regulations). The same shall be prescribed in the Course Handout.

18.1 Internship

A student may undergo an Internship for a period of 4-6 weeks in an industry / company or academic / research institution during the Semester Break between 4th and 5th Semesters or 6th and 7th Semesters, subject to the following conditions:

18.1.1 The Internship shall be in conducted in accordance with the Internship Policy prescribed by the University from time to time.

18.1.2 The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Internship to a student;

18.1.3 The number of Internships available for the concerned Academic Term. Further, the available number of internships shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Internship, as stated in Sub-Clause 18.1.2 above.

18.1.4 A student may opt for Internship in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the Internship on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Internship confirms to the University that the Internship shall be conducted in accordance with the Program Regulations and Internship Policy of the University.

18.1.5 A student selected for an Internship in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Internship Policy of the University.

18.2 Mini Project

A student may opt to do a Project Work for a period of 4-6 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Internship during the Semester Break between 4th and 5th Semesters or 6th and 7th Semesters or during the 5th / 6th / 7th Semester as applicable, subject to the following conditions:

18.2.1 The Project Work shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

18.2.2 The student may do the project work in an Industry / Company or academic /

research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.2.1). Provided further, that the Industry / Company or academic / research institution offering such project work confirms to the University that the project work will be conducted in accordance with the Program Regulations and requirements of the University.

18.3 Capstone Project

A student may undergo a Capstone Project for a period of 12-14 weeks in an industry / company or academic / research institution in the 7th / 8th Semester as applicable, subject to the following conditions:

18.3.1 The Capstone Project shall be in conducted in accordance with the Capstone Project Policy prescribed by the University from time to time.

18.3.2 The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Capstone Project to a student;

18.3.3 The number of Capstone Project available for the concerned Academic Term. Further, the available number of Capstone Project shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Capstone Project, as stated in Sub-Clause 18.3.2 above.

18.3.4 A student may opt for Capstone Project in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the I Capstone Project on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Capstone Project confirms to the University that the Capstone Project shall be conducted in accordance with the Program Regulations and Capstone project Policy of the University.

18.3.5 A student selected for a Capstone Project in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Capstone Project Policy of the University.

18.4 Research Project / Dissertation

A student may opt to do a Research Project / Dissertation for a period of 12-14 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Capstone Project, subject to the following conditions:

18.4.1 The Research Project / Dissertation shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

The student may do the Research Project / Dissertation in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.4.4). Provided further, that the Industry / Company or academic / research institution offering such Research Project / Dissertation confirms to the University that the Research Project / Dissertation work will be conducted in accordance with the Program Regulations and requirements of the University.

19.List of Elective Courses under various Specializations / Stream Basket

Type of Skill
F - Foundation S - Skill Development EM – Employability EN – Entrepreneurship SS-Soft Skills AT-Aptitude Training

Course Caters to
GS - Gender Sensitization ES - Environment and sustainability HP - Human values and Professional Ethics

Table 3.6 : Professional Electives Courses/Specialization Tracks – Minimum of 9 credits is to be earned by the student in a particular track and overall 18 credits.

Track 1 - Machine Learning and Artificial Intelligence (ML & AI)										
S.No		**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	C.H	Type of Skill	Pre Requisite
PEC 1	**Sem V**	CSD3416	Probabilistic Modelling for Machine Learning	3	0	0	3	3	F	MAT2402
		CSD3405	Text Mining and Analytics	2	0	2	3	4	EM	CSE2064
PEC-II	SemVI	CSE3426	Front End Full Stack Development*	2	0	2	3	S/ EM		CSE2058
PEC III	Sem VI	CSE3427	Java Full Stack Development*	2	0	2	3	S/ EM		CSE2059
		CSE3428	.Net Full Stack Development*	2	0	2	3	S/ EM		CSE2058
PEC - IV	Sem VII	CSD3412	Graph Analytics	3	0	0	3	3	EM	MAT2303
PEC- IV		CSD3415	NextGen Predictive Analytics	2	0	2	3	4	EM	CSD2011
PEC - V		CSD3406	Business Intelligence and Analytics	3	0	0	3	3	EM	CSD2009
PEC - VI		CSD3411	Cybersecurity and Data Privacy	3	0	0	3	3	EM	-
Track 2 - Business Analytics and Data Visualization										
S.No		**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	C.H	Typeof Skill	Pre Requisite

PEC 1	Sem V	CSD3413	Data Visualization and Dashboards	3	0	0	3	3	S	CSD2009
		CSD3402	Web Data Analytics	2	0	2	3	4	EM	CSE1500
PEC-II	SemVI	CSE3426	Front End Full Stack Development*	2	0	2	3	S/ EM		CSE2058
PEC III	Sem VI	CSE3427	Java Full Stack Development*	2	0	2	3	S/ EM		CSE2059
		CSE3428	.Net Full Stack Development*	2	0	2	3	S/ EM		CSE2058
PEC - IV	Sem VII	CSD3404	E-Business and Marketing Analytics	2	0	2	3	4	EM	CSD2002
PEC- IV		CSD3410	IoT and Sensor Data Analysis	3	0	0	3	3	EM	CSE1014
PEC - V		CSD3409	Financial Data Analysis	2	0	2	3	4	EM	CSD2002
PEC - VI		CSD3401	Business Continuity and Risk Analysis for Data Science	3	0	0	3	3	EM	CSD2002
Track 3 – Computational Mathematics and Statistics										
S.No		**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	C.H	Typeof Skill	Pre Requisite
PEC 1	Sem V	CSD3407	Statistical Inference and Modelling	3	0	0	3	3	S/ EM	MAT2402
		CSD3414	Statistics-Driven Data Science	2	0	2	3	4	S/ EM	MAT2402
PEC-II	SemVI	CSE3426	Front End Full Stack Development*	2	0	2	3	4	S/ EM	CSE2058
PEC III	Sem VI	CSE3427	Java Full Stack Development*	2	0	2	3	4	S/ EM	CSE2059
		CSE3428	.Net Full Stack Development*	2	0	2	3	4	S/ EM	CSE2058
PEC - IV	Sem VII	CSD3408	Data Mining and Warehousing	3	0	0	3	3	EM	CSE1510
		CSD2006	Edge AI and IoT Analytics	3	0	0	3	3	EM	
PEC- IV		CSD3417	Scientific Computing for Intelligent Systems	3	0	0	3	3	EM	CSE1500
PEC - V		CSD3403	Optimization for Data Science	2	0	2	3	4	F	MAT1003
PEC - VI		CSD3418	Feature Engineering and Model Optimization	3	0	0	3	3	EM	CSE1500

Track 04: Special Basket										
1	CAI3427	Language Models for Text Mining+	2	0	2	3	4	S/E M	CSE2264
2	CAI3428	Practical Deep Learning with TensorFlow+	2	0	2	3	4	S/E M	CSE2264
3	CAI3429	Deep Learning Techniques for Computer Vision+	2	0	2	3	4	S/E M	MAT2402

Track -5 Mandatory Non-Credited Course (Offered for Lateral Entry students in higher semester wherever applicable in MOOC mode)**									
1	LAW7601	Indian Constitution **	0	0	0	0	-	F	Nil
2	CHE7601	Environmental Studies **	0	0	0	0	-	F	Nil
3	CIV7601	Universal Human Values and Ethics **	0	0	0	0	-	F	Nil

4	PPS1025	Industry Readiness Program - I	0	0	2	0	2	SS	Nil
5	PPS1026	Industry Readiness Program - II	0	0	2	0	2	SS	Nil
6	APT4002	Introduction to Aptitude	0	0	2	0	2	AT	Nil
7	APT4004	Aptitude Training - Intermediate	0	0	2	0	2	AT	Nil
8	APT4006	Logical and Critical Thinking	0	0	2	0	2	AT	Nil
*Mandatory for Students selected for Tech Mahindra and Capgemini									
** Offered for Lateral Entry students in higher semester wherever applicable in MOOC mode									
+Mandatory for Students Selected for Samsung Innovation Campus									

20. List of Open Electives to be offered by the School / Department (Separately for ODD and EVEN Semesters.

Type of Skill
F - Foundation
S - Skill Development
EM – Employability
EN – Entrepreneurship

Course Caters to
GS - Gender Sensitization
ES - Environment and sustainability
HP - Human values and Professional Ethics

Baskets
HSMC - Humanities and Social Sciences (including Management courses) (HSMC)
BSC - Basic Science Courses ESC - Engineering Science Courses
PCC - Professional Core Course
PEC - Professional Elective Courses
OEC - Open Elective Courses
EEC - Employment Enhancement Courses
MAC - Mandatory Course

Table 3.7: Open Elective Courses Baskets: Minimum Credits to be earned from this Basket is 06

Course Code	Course Name	L	T	P	C	Type of Skill/ Focus	Course Caters to	Pre-requisites/ Co-requisites	Anti-requisites	Future Courses that need this as a Prerequisite
Chemistry Basket										
CHE1003	Fundamentals of Sensors	3	0	0	3	S	ES	-	-	-
CHE1004	Smart materials for IOT	3	0	0	3	S	ES	-	-	-
CHE1005	Computational Chemistry	2	0	0	2	S	ES	-	-	-
CHE1006	Introduction to Nano technology	3	0	0	3	S	ES	-	-	-
CHE1007	Biodegradable electronics	2	0	0	2	S	ES	-	-	-
CHE1008	Energy and Sustainability	2	0	0	2	S	ES	-	-	-

CHE1009	3D printing with Polymers	2	0	0	2	S	ES	-	-	-
CHE1010	Bioinformatics and Healthcare IT	2	0	0	2	S	ES	-	-	-
CHE1011	Chemical and Petrochemical catalysts	3	0	0	3	S	ES	-	-	-
CHE1012	Introduction to Composite materials	2	0	0	2	S	ES	-	-	-
CHE1013	Chemistry for Engineers	3	0	0	3	S	ES	-	-	-
CHE1014	Surface and Coatings technology	3	0	0	3	S	ES	-	-	-
CHE1015	Waste to Fuels	2	0	0	2	S	ES	-	-	-
CHE1016	Forensic Science	3	0	0	3	S	ES	-	-	-
Civil Engineering Basket										
CIV1001	Disaster mitigation and management	3	0	0	3	S	-	-	-	-
CIV1002	Environment Science and Disaster Management	3	0	0	3	FC	-	-	-	-
CIV2001	Sustainability Concepts in Engineering	3	0	0	3	S	-	-	-	-
CIV2002	Occupational Health and Safety	3	0	0	3	S	-	-	-	-
CIV2003	Sustainable Materials and Green Buildings	3	0	0	3	EM	-	-	-	-
CIV2004	Integrated Project Management	3	0	0	3	EN	-	-	-	-
CIV2005	Environmental Impact Assessment	3	0	0	3	EN	-	-	-	-
CIV2006	Infrastructure Systems for Smart Cities	3	0	0	3	EN	-	-	-	-
CIV2044	Geospatial Applications for Engineers	2	0	2	3	EM	-	-	-	-
CIV2045	Environmental Meteorology	3	0	0	3	S	-	-	-	-
CIV3046	Project Problem Based Learning	3	0	0	3	S	-	-	-	-
CIV3059	Sustainability for Professional Practice	3	0	0	3	EN	-	-	-	-

Commerce Basket										
COM2001	Introduction to Human Resource Management	2	0	0	2	F	HP/GS	-	-	-
COM2002	Finance for Non Finance	2	0	0	2	S	-	-	-	-
COM2003	Contemporary Management	2	0	0	2	F	-	-	-	-
COM2004	Introduction to Banking	2	0	0	2	F	-	-	-	-
COM2005	Introduction to Insurance	2	0	0	2	F	-	-	-	-
COM2006	Fundamentals of Management	2	0	0	2	F	-	-	-	-
COM2007	Basics of Accounting	3	0	0	3	F	-	-	-	-
Computer Science Basket (not to be offered for Computer Science and Engineering students)										
CSE2002	Programming in Java	2	0	2	3	S/EM	-	-	-	-
CSE2003	Social Network Analytics	3	0	0	3	S	GS	-	-	-
CSE2004	Python Application Programming	2	0	2	3	S/ EM	-	-	-	-
CSE2005	Web design fundamentals	2	0	2	3	S/ EM/EN	-	-	-	-
Design Basket										
DES1001	Sketching and Painting	0	0	2	1	S	-	-	-	-
DES1002	Innovation and Creativity	2	0	0	2	F	-	-	-	-
DES1121	Introduction to UX design	1	0	2	2	S	-	-	-	-
DES1122	Introduction to Jewellery Making	1	0	2	2	S	-	-	-	-
DES1124	Spatial Stories	1	0	2	2	S	-	-	-	-
DES1125	Polymer Clay	1	0	2	2	S	-	-	-	-
DES2001	Design Thinking	3	0	0	3	S	-	-	-	-
DES1003	Servicability of Fashion Products	1	0	2	2	F	ES	-	-	-
DES1004	Choices in Virtual Fashion	1	0	2	2	F	ES, GS, HP	-	-	-
DES1005	Fashion Lifestyle and Product Diversity	1	0	2	2	F	ES, GS, HP	-	-	-
DES1006	Colour in Everyday Life	1	0	2	2	F	ES	-	-	-
DES2080	Art of Design Language	3	0	0	3	S	-	-	-	-

DES2081	Brand Building in Design	3	0	0	3	S	-	-	-	-
DES2085	Web Design Techniques	3	0	0	3	S	-	-	-	-
DES2089	3D Modeling for Professionals	1	0	4	3	S	-	-	-	-
DES2090	Creative Thinking for Professionals	3	0	0	3	S	-	-	-	-
DES2091	Idea Formulation	3	0	0	3	S	-	-	-	-
Electrical and Electronics Basket										
EEE1002	IoT based Smart Building Technology	3	0	0	3	S	-	-	-	-
EEE1003	Basic Circuit Analysis	3	0	0	3	S	-	-	-	-
EEE1004	Fundamentals of Industrial Automation	3	0	0	3	S	-	-	-	-
EEE1005	Electric Vehicles & Battery Technology	3	0	0	3	S	-	-	-	-
EEE1006	Smart Sensors for Engineering Applications	3	0	0	3	S	-	-	-	-
Electronics and Communication Basket										
ECE1003	Fundamentals of Electronics	3	0	0	3	F	-	-	-	-
ECE1004	Microprocessor based systems	3	0	0	3	F	-	-	-	-
ECE3089	Artificial Neural Networks	3	0	0	3	S	-	-	-	-
ECE3097	Smart Electronics in Agriculture	3	0	0	3	F/EM	-	-	-	-
ECE3098	Environment Monitoring Systems	3	0	0	3	F/EM	-	-	-	-
ECE3102	Consumer Electronics	3	0	0	3	F/EM	-	-	-	-
ECE3103	Product Design of Electronic Equipment	3	0	0	3	S/F/ EM / EN	-	-	-	-
ECE3106	Introduction to Data Analytics	3	0	0	3	F/EM	-	-	-	-
ECE3107	Machine Vision for Robotics	3	0	0	3	F/EM	-	-	-	-
English Basket										
ENG1008	Indian Literature	2	0	0	2	-	GS/ HP	-	-	-
ENG1009	Reading Advertisement	3	0	0	3	S	-	-	-	-

ENG1010	Verbal Aptitude for Placement	2	0	2	3	S	-	-	-	-
ENG1011	English for Career Development	3	0	0	3	S	-	-	-	-
ENG1012	Gender and Society in India	2	0	0	2	-	GS/ HP	-	-	-
ENG1013	Indian English Drama	3	0	0	3	-	-	-	-	-
ENG1014	Logic and Art of Negotiation	2	0	2	3	-	-	-	-	-
ENG1015	Professional Communicatio n Skills for Engineers	1	0	0	1	-	-	-	-	-
DSA Basket										
DSA2001	Spirituality for Health	2	0	0	2	F	HP	-	-	-
DSA2002	Yoga for Health	2	0	0	2	S	HP	-	-	-
DSA2003	Stress Management and Well Being	2	0	0	2	F	-	-	-	-
Kannada Basket										
KAN1001	Kali Kannada	1	0	0	1	S	-	-	-	-
KAN1003	Kannada Kaipidi	3	0	0	3	S	-	-	-	-
KAN2001	Thili Kannada	1	0	0	1	S	-	-	-	-
KAN2003	Pradharshana Kale	1	0	2	2	S	-	-	-	-
KAN2004	Sahithya Vimarshe	2	0	0	2	S	-	-	-	-
KAN2005	Anuvadha Kala Sahithya	3	0	0	3	S	-	-	-	-
KAN2006	Vichara Manthana	3	0	0	3	S	-	-	-	-
KAN2007	Katha Sahithya Sampada	3	0	0	3	S	-	-	-	-
KAN2008	Ranga Pradarshana Kala	3	0	0	3	S	-	-	-	-
Foreign Language Basket										
FRL1004	Introduction of French Language	2	0	0	2	S	S	-	-	-
FRL1005	Fundamentals of French	2	0	0	2	S	S	-	-	-
FRL1009	Mandarin Chinese for Beginners	3	0	0	3	S	S	-	-	-
Law Basket										
LAW1001	Introduction to Sociology	2	0	0	2	F	HP		-	-
LAW2001	Indian Heritage and Culture	2	0	0	2	F	HP/GS		-	-

LAW2002	Introdcution to Law of Succession	2	0	0	2	F	HP/GS		-	-
LAW2003	Introduction to Company Law	2	0	0	2	F	HP		-	-
LAW2004	Introduction to Contracts	2	0	0	2	F	HP	-	-	-
LAW2005	Introduction to Copy Rights Law	2	0	0	2	F	HP	-	-	-
LAW2006	Introduction to Criminal Law	2	0	0	2	F	HP	-	-	-
LAW2007	Introduction to Insurance Law	2	0	0	2	F	HP	-	-	-
LAW2008	Introduction to Labour Law	2	0	0	2	F	HP	-	-	-
LAW2009	Introduction to Law of Marriages	2	0	0	2	F	HP/GS	-	-	-
LAW2010	Introduction to Patent Law	2	0	0	2	F	HP	-	-	-
LAW2011	Introduction to Personal Income Tax	2	0	0	2	F	HP	-	-	-
LAW2012	Introduction to Real Estate Law	2	0	0	2	F	HP	-	-	-
LAW2013	Introduction to Trademark Law	2	0	0	2	F	HP	-	-	-
LAW2014	Introduction to Competition Law	3	0	0	3	F	HP	-	-	-
LAW2015	Cyber Law	3	0	0	3	F	HP	-	-	-
LAW2016	Law on Sexual Harrassment	2	0	0	2	F	HP/GS	-	-	-
LAW2017	Media Laws and Ethics	2	0	0	2	F	HP/GS	-	-	-
Mathematics Basket										
MAT2008	Mathematical Reasoning	3	0	0	3	S	-	-	-	-
MAT2014	Advanced Business Mathematics	3	0	0	3	S	-	-	-	-
MAT2041	Functions of Complex Variables	3	0	0	3	S	-	-	-	-
MAT2042	Probability and Random Processes	3	0	0	3	S	-	-	-	-
MAT2043	Elements of Number Theory	3	0	0	3	S	-	-	-	-
MAT2044	Mathematical Modelling and Applications	3	0	0	3	S	-	-	-	-
Mechanical Basket										

MEC1001	Fundamentals of Automobile Engineering	3	0	0	3	F	-	-	-	-
MEC1002	Introduction to Matlab and Simulink	3	0	0	3	S/EM	-	-	-	-
MEC1003	Engineering Drawing	1	0	4	3	S	-	-	-	-
MEC2001	Renewable Energy Systems	3	0	0	3	F	ES	-	-	-
MEC2002	Operations Research & Management	3	0	0	3	F	-	-	-	-
MEC2003	Supply Chain Management	3	0	0	3	S/ EM/ EN	-	-	-	-
MEC2004	Six Sigma for Professionals	3	0	0	3	S/EM	-	-	MEC2008	-
MEC2005	Fundamentals of Aerospace Engineering	3	0	0	3	F	-	-	-	-
MEC2006	Safety Engineering	3	0	0	3	S/EM	ES	-	-	-
MEC2007	Additive Manufacturing	3	0	0	3	F/EM	-	-	-	-
MEC3069	Engineering Optimisation	3	0	0	3	S/EM	-	-	-	-
MEC3070	Electronics Waste Management	3	0	0	3	F/S	ES	-	-	-
MEC3071	Hybrid Electric Vehicle Design	3	0	0	3	S/EM	ES	-	-	-
MEC3072	Thermal Management of Electronic Appliances	3	0	0	3	S/EM	-	-	-	-
MEC3200	Sustainable Technologies and Practices	3	0	0	3	S/EM	-	-	-	-
MEC3201	Industry 4.0	3	0	0	3	S/EM	-	-	-	-
Petroleum Basket										
PET1011	Energy Industry Dynamics	3	0	0	3	FC	ES	-	NIL	-
PET1012	Energy Sustainability Practices	3	0	0	3	FC	ES	-	NIL	-
Physics Basket										
PHY1003	Mechanics and Physics of Materials	3	0	0	3	FC / SD				
PHY1004	Astronomy	3	0	0	3	FC				
PHY1005	Game Physics	2	0	2	3	FC / SD				
PHY1006	Statistical Mechanics	2	0	0	2	FC				

PHY1007	Physics of Nanomaterials	3	0	0	3	FC				
PHY1008	Adventures in nanoworld	2	0	0	2	FC				
PHY2001	Medical Physics	2	0	0	2	FC	ES			
PHY2002	Sensor Physics	1	0	2	2	FC / SD				
PHY2003	Computational Physics	1	0	2	2	FC				
PHY2004	Laser Physics	3	0	0	3	FC	ES			
PHY2005	Science and Technology of Energy	3	0	0	3	FC	ES			
PHY2009	Essentials of Physics	2	0	0	2	FC				
Management Basket- I										
MGT2007	Digital Entrepreneurship	3	0	0	3	S/EM/EN	-	-	-	-
MGT2015	Engineering Economics	3	0	0	3	S	-	-	-	-
MGT2023	People Management	3	0	0	3	S/EM/ EN	HP	-	-	-
Management Basket- II										
MGT1001	Introduction to Psychology	3	0	0	3	F	HP	-	-	-
MGT1002	Business Intelligence	3	0	0	3	EN	-	-	-	-
MGT1003	NGO Management	3	0	0	3	S	-	-	-	-
MGT1004	Essentials of Leadership	3	0	0	3	EM/ EN	GS/ HP	-	-	-
MGT1005	Cross Cultural Communication	3	0	0	3	S/EM/ EN	HP	-	-	-
MGT2001	Business Analytics	3	0	0	3	S/ EM/EN	-	-	-	-
MGT2002	Organizational Behaviour	3	0	0	3	F	HP	-	-	-
MGT2003	Competitive Intelligence	3	0	0	3	S	-	-	-	-
MGT2004	Development of Enterprises	3	0	0	3	S/EM/EN	-	-	-	-
MGT2005	Economics and Cost Estimation	3	0	0	3	S/EM	-	-	-	-
MGT2006	Decision Making Under Uncertainty	3	0	0	3	S	-	-	-	-
MGT2008	Econometrics for Managers	3	0	0	3	S	-	-	-	-
MGT2009	Management Consulting	3	0	0	3	S/EM/EN	-	-	-	-
MGT2010	Managing People and Performance	3	0	0	3	S/EM/EN	HP/GS	-	-	-

MGT2011	Personal Finance	3	0	0	3	F	-	-	-	-
MGT2012	E Business for Management	3	0	0	3	S/EM	-	-	-	-
MGT2013	Project Management	3	0	0	3	EN / EM	GS/HP/ES	-	-	-
MGT2014	Project Finance	3	0	0	3	EN / EM	HP	-	-	-
MGT2016	Business of Entertainment	3	0	0	3	EM/ EN	-	-	-	-
MGT2017	Principles of Management	3	0	0	3	S/EM/ EN	-	-	-	-
MGT2018	Professional and Business Ethics	3	0	0	3	S/EM/ EN	HP	-	-	-
MGT2019	Sales Techniques	3	0	0	3	S/EM/ EN	HP	-	-	-
MGT2020	Marketing for Engineers	3	0	0	3	S/EM/ EN	HP	-	-	-
MGT2021	Finance for Engineers	3	0	0	3	S/EM/ EN	HP	-	-	-
MGT2022	Customer Relationship Management	3	0	0	3	S/EM/ EN	HP	-	-	-
Media Studies Basket										
BAJ3050	Corporate Filmmaking and Film Business	0	0	4	2	EM	HP	-	-	-
BAJ3051	Digital Photography	2	0	2	3	EM	HP	-	-	-
BAJ3055	Introduction to News Anchoring and News Management	0	0	2	1	EM	-	-	-	-

Table 3.8 : List of Mandatory Courses (MAC)

S.No	Course Code	Course Name	L	T	P	C
1	CHE7601	Environmental Studies	-	-	-	0
2	LAW7601	Indian Constitution	-	-	-	0
3	CIV7601	Universal Human Values and Ethics	-	-	-	0
4	PPS1025	Industry Readiness Program - I	0	0	2	0
5	PPS1026	Industry Readiness Program - II	0	0	2	0
6	APT4002	Introduction to Aptitude	0	0	2	0
7	APT4004	Aptitude Training - Intermediate	0	0	2	0
8	APT4006	Logical and Critical Thinking	0	0	2	0
					Total No. of Credits	**0**

21.List of MOOC Courses

21.1 Presidency University students are given the opportunity to study abroad in International Universities through a selection process coordinated by the Office of International Affairs (OIA). Such selected students need to complete their credits for the semester that they are abroad in the following way:

21.1.1. The student needs to study and complete School Core and Program Core Courses in offline mode only.
21.1.2. Massive Open Online Course (MOOC) courses maybe given for Open Elective and Discipline Elective Courses. These courses need to be approved by the concerned BOS and Academic Council from time to time.
21.1.3. SWAYAM/NPTEL/ other approved MOOCs shall be approved by the concerned Board of Studies and placed in the concerned PRC.
21.1.4. Student shall register for these courses in the ERP of Presidency University.
21.1.5. For these MOOC courses faculty coordinators are identified. These faculty should have undergone similar MOOC courses and therefore should be familiar with the mode of class conduction, types of assessments and evaluation procedures.
21.1.6. Study materials shall be provided to the students as video lectures shared by the MOOCs Coordinator(s), or the students may access the approved MOOCs Portal directly. The mode of class conduction is determined by the MOOCs coordinator(s) as detailed in the Course Catalogue and Course Plan.
21.1.7. The question paper shall be prepared by the MOOCs coordinator(s).
21.1.8. Students write the exams in online mode. These exams are scheduled and conducted by the School.
21.1.9. Results are evaluated by School and given to the Office of the Controller of Examinations (CoE).
21.1.10. The details of the duration, credits and evaluation are given below:

Sl#	Duration	Credits	Evaluation
1.	12 weeks	3	Continuous Assessment –50 Marks Mid Term –50 Marks End Term-100 Marks
2.	8 weeks	2	Mid Term-50 Marks End Term-100 Marks
3	4 weeks	1	End Term-100 Marks

21.2 List of MOOC – B.Tech. Computer Science and Engineering Program(Data Science).

Table 3.9: MOOC Professional Elective Courses for B.Tech. Computer Science and Engineering Program (Data Science) Duration is 4 weeks (01 credit) / 8 weeks (02 credits) / 12 weeks (03 credits)

Sl.	Course Code	Course Name	L	T	P	C	Contact Hours
1	CSE3111	Artificial Intelligence: Search Methods for Problem Solving	3	0	0	3	3
2	CSE3112	Privacy and Security in Online social media	3	0	0	3	3
3	CSE3113	Computational Complexity	3	0	0	3	3
4	CSE3114	Deep Learning for Computer Vision	3	0	0	3	3
5	CSE3115	Learning Analytics Tools	3	0	0	3	3
6	CSE502	Technical Skills in JAVA	0	0	6	3	6
7	CSE503	Technical Skills in Python	0	0	6	3	6
8	CSE504	Comprehensive Technical Skills	0	0	1	5	1
9	CSE505	The Joy of Computing Using Python	3	0	0	3	3
10	CSE3119	Coding Skills in Python	3	0	0	3	3
11	CSE3121	Parallel Computer Architecture	3	0	0	3	3
12	CSE3124	Games and Information	3	0	0	3	3

13	CSE3140	Introduction to Industry 4.0 and Industrial Internet of Things	3	0	0	3	3
14	CSE3142	Affective Computing	3	0	0	3	3
15	CSE3196	Foundations of Cyber Physical Systems	3	0	0	3	3
16	CSE3197	Getting Started with Competitive Programming	3	0	0	3	3
17	CSE3198	GPU Architectures and Programming	3	0	0	3	3
18	CSE3199	Artificial Intelligence: Knowledge Representation and Reasoning	3	0	0	3	3
19	CSE3200	Programming in Modern C++	3	0	0	3	3
20	CSE3201	Circuit Complexity Theory	3	0	0	3	3
21	CSE3202	Basics of Computational Complexity	3	0	0	3	3
22	CSE3212	Introduction to Computer and Network Performance Analysis using Queuing	1	0	0	1	1
23	CSE3213	C Programming and Assembly Language	1	0	0	1	1
24	CSE3214	Python for Data Science	1	0	0	1	1
25	CSE3215	Software Conceptual Design	1	0	0	1	1
26	CSE3117	Industrial Digital Transformation	3	0	0	3	3
27	CSE3118	Blockchain for Decision Makers	3	0	0	3	3
28	CSE3349	Technology for Lawyers	3	0	0	3	3
29	CSE3430	Deep Learning for Natural Language Processing	3	0	0	3	3
30	CSE3431	Machine Learning for Engineering and Science Applications	3	0	0	3	3
31	CSE3432	Algorithms in Computational Biology and Sequence Analysis	3	0	0	3	3
32	CSE3433	Introduction to Large Language Models (LLMs)	3	0	0	3	3
33	CSE3434	Quantum Algorithms and Cryptography	3	0	0	3	3

21.3 MOOC - Open Elective Courses for B. Tech. (Computer Science and Engineering-Data Science)

Table 3.10: MOOC Open Elective Courses

Open Elective Courses Duration is 4 weeks (01 credit)/ 8 weeks (02 credits)/ 12 weeks (03 credits)

Sl. No.	Course code	Course Name	L	T	P	C
1	BBA2022	Supply Chain digitization	3	0	0	3
2	BBA2021	E Business	3	0	0	3
3	BBB2016	Business Analytics for Management Decisions	3	0	0	3
4	BBB2015	Artificial Intelligence for Investments	3	0	0	3
5	MEC3001 *	Design and Development of Product	1	0	0	1
6	ENG3004 **	Perspectives of Neurolinguistics	1	0	0	1
7	PPS4009 ***	Working in Contemporary Teams	1	0	0	1
8	MGT3001	Data Analysis and Decision Making	3	0	0	3

Note :

** MEC3001 is offered to the students who had 1 credit shortage because of implementation of CBCS system during their 1st year.*

*** ENG3004 is offered to the students who had 2 credits shortage along with the MEC3001 because of implementation of CBCS System during their 1st year.*

**** PPS4009 is offered to only International students in place of Interview Preparedness course of their batch mates.*

22. **Recommended Semester Wise Course Structure / Flow including the Programme / Discipline Elective Paths / Options**

Sl. No.		Course Name	L	T	P	Credits	Contact Hours	Type of Skill	Pre-requisite	Basket
Semester 1 - PHY Cycle			15	1	8	19	24			
1	MAT2301	Calculus and Differential Equations	3	1	0	4	4	F	Nil	BSC
2	PHY2501	Optoelectronics and Quantum Physics	3	0	0	3	3	F	Nil	BSC
3	MEC1006	Engineering Graphics	2	0	0	2	2	S	Nil	ESC
4	ENG1900	English for Technical Communication	2	0	0	2	2	S	Nil	HSMC
5	CSE1500	Computational Thinking using Python	2	0	2	3	4	S	Nil	ESC
6	ECE2022	Digital Design	2	0	0	2	2	F/S	Nil	ESC
7	DES1146	Introduction to Design Thinking	1	0	0	1	1	F	Nil	HSMC
8	PHY2504	Optoelectronics and Quantum Physics Lab	0	0	2	1	2	F	Nil	BSC
9	PPS1025	Industry Readiness Program – I	0	0	2	0	2	S	Nil	MAC
10	ECE2052	Digital Design Lab	0	0	2	1	2	F/S	Nil	ESC
Semester 2 - CHE Cycle			17	1	12	22	30			
1	MAT2402	Probability and Statistics	3	1	0	4	4	F	Nil	BSC
2	CHE7601	Environmental Studies	0	0	0	0	0	F	Nil	MAC
3	CIV1200	Foundations of Integrated Engineering	2	0	0	2	2	S	Nil	ESC
4	CHE2501	Chemistry of Smart Materials	3	0	0	3	3	S	Nil	BSC
5	CSE2200	Problem Solving using C	2	0	0	2	2	S	Nil	PCC
6	ENG2501	Advanced English	2	0	0	2	2	S	Nil	HSMC
7	EEE1200	Basics of Electrical and Electronics Engineering	3	0	0	3	3	F/S	Nil	ESC
8	LAW1007	Indian Constitution and Professional Ethics for Engineers	1	0	0	0	1	F	Nil	MAC
9	CSE2201	Problem Solving using C Lab	0	0	4	2	4	S	Nil	PCC
10	CHE2502	Chemistry of Smart Materials Lab	0	0	2	1	2	S	Nil	BSC
11	PPS1026	Industry Readiness Program – II	0	0	2	0	2	S	Nil	MAC
12	EEE1250	Basics of Electrical and Electronics Engineering Lab	0	0	2	1	2	F/S	Nil	ESC
13	ECE1511	Design Workshop	1	0	2	2	3	S/EM	Nil	ESC
Semester 3			18	1	10	23	29			
1	MAT2303	Linear Algebra and Vector Calculus	3	1	0	4	4	EM	Nil	BSC
2	CSE2251	Data Communication and Computer Networks	3	0	0	3	3	S	Nil	PCC
3	CSE2252	Data Communication and Computer Networks Lab	0	0	2	1	2	S	Nil	PCC
4	CSE2253	Data Structures	3	0	0	3	3	S	Nil	PCC
5	CSE2254	Data Structures Lab	0	0	2	1	2	S	Nil	PCC
6	CSE2255	Object Oriented Programming Using Java	3	0	0	3	3	S/EM	Nil	PCC
7	CSE2256	Object Oriented Programming Using Java Lab	0	0	2	1	2	S/EM	Nil	PCC
8	CSD1712	Statistical Foundations for Data Science	3	0	0	3	3	S	MAT2403	PCC
9	CSD1713	Statistical Foundations Lab for Data Science Lab	0	0	2	1	2	S	MAT2403	PCC
10	CSE2057	Computer Organization and Architecture	3	0	0	3	3	S	Nil	PCC

11	CIV7601	Universal Human Values	0	0	0	0	0	F	Nil	MAC
12	APT4002	Introduction to Aptitude	0	0	2	0	2	AT	Nil	MAC
Semester 4			18	2	10	24	30			
1	MAT2404	Discrete Mathematics	3	1	0	4	4	F	Nil	BSC
2	CSE2258	Web Technologies	3	0	0	3	3	S/EM	Nil	PCC
3	CSE2259	Web Technologies Lab	0	0	2	1	2	S/EM	Nil	PCC
4	CSE2260	Database Management Systems	3	0	0	3	3	S	Nil	PCC
5	CSE2261	Database Management Systems Lab	0	0	2	1	2	S	Nil	PCC
6	CSE2262	Analysis of Algorithms	3	1	0	4	4	S	Nil	PCC
7	CSE2263	Analysis of Algorithms Lab	0	0	2	1	2	S	Nil	PCC
8	CSE2064	Essentials of AI	3	0	0	3	3	S/EM	Nil	ESC
9	CSE2065	Essentials of AI Lab	0	0	2	1	2	S/EM	Nil	ESC
10	FIN1002	Essential of Finance	3	0	0	3	3	S	Nil	HSMC
11	APT4004	Aptitude Training-Intermediate	0	0	2	0	2	AT	Nil	MAC
Semester 5			17	0	10	23	27			
1	CSE2266	Theory of Computation	3	0	0	3	3	S	Nil	PCC
2	CSD2002	Introduction to Data Science	3	0	0	3	3	F	NIL	PCC
3	CSD2007	R programming for Data Science	3	0	0	3	3	S/EM	Nil	PCC
4	CSD2008	R programming Lab for Data Science	0	0	2	1	2	S/EM	Nil	PCC
5	CSE2069	Operating Systems	3	0	0	3	3	S	Nil	PCC
6	CSE2070	Operating Systems Lab	0	0	2	1	2	S/EM	Nil	PCC
7	CSD2009	Data Handling and Visualization	2	0	0	2	2	S/EM	Nil	PCC
8	CSD2010	Data Handling and Visualization Lab	0	0	4	2	4	S/EM	Nil	PCC
9	CSEXXX	Professional Elective – I	3	0	0	3	3	S/EM	Nil	PEC
10	CSE7000	Internship	0	0	0	2	0	S/EM	Nil	PRW
11	APT4006	Logical and Critical Thinking	0	0	2	0	2	S/EM	Nil	HSMC
Semester 6			17	0	10	22	27			
1	CSE2071	Software Design and Development	3	0	0	3	3	S	Nil	PCC
2	CSD2021	Machine Learning for Intelligent data Science	3	0	0	3	3	S/EM	Nil	PCC
3	CSD2024	Machine Learning Lab for Intelligent data Science	0	0	2	1	2	S/EM	Nil	PCC
4	CSD2501	Predictive Analytics	2	0	0	2	2	S/EM	CSE1500	PCC
5	CSD2502	Predictive Analytics Lab	0	0	2	1	2	S/EM	CSE1500	PCC
6	CSE2074	Competitive Programming and Problem Solving	0	0	4	2	4	S/EM	Nil	ESC
7	CSEXXX	Professional Elective – II	3	0	0	3	3	S	Nil	PEC

8	CSEXXX X	Professional Elective – III	3	0	0	3	3	S	Nil	PEC
9	XXXXXX X	Open Elective – I	3	0	0	3	3	S	Nil	OEC
10	**APT4005**	**Aptitude for Employability**	**0**	**0**	**2**	**1**	**2**	**S**	**Nil**	**HSMC**
Semester 7			**12**	**0**	**0**	**17**	**14**			
1	CSEXXX X	Professional Elective – IV	3	0	0	3	3	S	Nil	PEC
2	CSEXXX X	Professional Elective – V	3	0	0	3	3	S	Nil	PEC
3	CSEXXX X	Professional Elective – VI	3	0	0	3	3	S	Nil	PEC
4	XXXXXX X	Open Elective – II	3	0	0	3	3	S	Nil	OEC
5	**CSE7100**	**Mini Project**	**0**	**0**	**0**	**4**	**0**	**S**	**Nil**	**PRW**
6	**PPS3018**	**Preparedness for Interview**	**0**	**0**	**2**	**1**	**2**	**SS**	**Nil**	**HSMC**
Semester 8			**0**	**0**	**0**	**10**	**0**			
1	**CSE7300**	**Capstone Project**	**0**	**0**	**0**	**10**	**0**	**S/EM**	**Nil**	**PRW**
			114	**5**	**56**	**160**	**174**			

Course Catalogue

Course Code: CSD1710	Course Title: Data Handling and Visualization Type of Course: 1] Integrated	L- T-P-C	2	0	0	2
Version No.	1.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	The purpose of the course is to install a strong foundation of scientific process orientation that is the cornerstone of effective data handling, and creative design thinking appended with strong programming skills to create meaningful visualizations of data. The student should have prior knowledge of python programming and basic knowledge of data concepts. The associated laboratory provides an opportunity to strengthen student's skillset in the arena of Data Preprocessing and Visualization. With a good knowledge in the fundamental concepts of the various libraries for handling and visualizing data the student can gain a stronghold in Data Science enabling the student to be an effective analyst for prospective employers. **Keywords:** Visualization, Preprocessing, Data Cleaning, Data extraction.					
Course Outcomes	On successful completion of this course the students shall be able to: 1] Understand the various types of data, apply and classify the principles of data visualization- L1 & L2 2] Illustrate the visualization techniques to a problem and its associated dataset-L3 3] Implement interactive visualization for better insight using various visualization tools-L3 4] Demonstrate the visualization concepts practically using Python-L3					
Course Content:						
Module 1	**Introduction to Data Visualization (Comprehension)**	Assignment	Programming activity			**7 Sessions**
Topics: Data collection, Data Preparation Basic Models- Overview of data visualization - Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation, Interacting with Databases, Data Cleaning and Preparation, Handling Missing Data, Data Transformation. Python Libraries: NumPy, pandas, matplotlib, GGplot, Introduction to pandas Data Structures						
Module 2	**Data Visualization Techniques**	Assignment	Programming activity			**7 Sessions**
Topics: Scalar and point techniques – vector visualization techniques – matrix visualization, Visualization Techniques for Trees, Graphs, and Networks, Multidimensional data, Visual Variables- Networks and Trees - Map Color and Other Channels- Manipulate View- Heat Map.						
Module 3	**Visual Analysis of data from various domain** (Application)	Assignment	Programming activity			**8 Sessions**

Topics: Time-oriented data visualization – Spatial data visualization, Text data visualization – Multivariate data visualization and case studies, Finance- marketing-insurance-healthcare etc.				
Module 4	**Visualization of Streaming Data** (Application)	Assignment	Programming activity	**8 Sessions**
Topics: Guidelines for designing successful visualizations, Data visualization dos and don'ts, Best practices of Data Streaming, processing streaming data for visualization, presenting streaming data, streaming visualization techniques, streaming analysis.				
1] Problem Solving: Choose an appropriate set of visualization elements and design for a dashboard. 2] Programming: Implementation of the chosen dashboard				
Text Books 1] McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media. 2] Munzner, T., "Visualization Analysis and Design", CRC Press, (2015). 3] Dr. Ossama Embarak, "Data Analysis and Visualization Using Python", Apress,(2018)				

Course Code: CSD1711	**urse Title:** CSD1711 **Data Handling and Visualization Lab** **pe of Course: Program Core**	**P- C**	0		1
Version No.					
Course Pre-requisites					
Anti-requisites					
urse Description	This lab-oriented course provides practical exposure to data acquisition, preprocessing, analysis, and visualization techniques using modern tools and platforms. Students will learn to work with structured and unstructured datasets, perform data cleaning, transformation, and derive insights using descriptive and inferential statistical techniques. The course emphasizes hands-on experience with data visualization libraries and tools to create meaningful graphical representations that support data-driven decision-making.				
ourse Objective	1. To introduce students to the fundamental concepts of data handling, including data acquisition, cleaning, and transformation. 2. To provide hands-on experience with tools and libraries used for data manipulation and visualization. 3. To develop the ability to perform exploratory data analysis and derive meaningful insights from datasets. 4. To equip students with the skills to create effective visual representations of data for communication and decision-making. 5. To encourage the use of real-world datasets in solving practical problems through data visualization techniques.				
urse Out Comes	**On successful completion of the course the students shall be able to:** CO1: Implement cleaning and transforming structured and unstructured data using Python libraries, and apply data abstraction and validation techniques to prepare data for analysis. CO2: Apply appropriate visualization techniques—scalar, vector, matrix, and network-based—along with visual variables and layout manipulations to effectively represent complex and multidimensional data.				

	CO3: Analyze and visualize domain-specific datasets, such as those from finance, healthcare, and marketing, using suitable visualization strategies tailored to time-oriented, spatial, textual, and multivariate data. CO4: Implement visualizations for real-time streaming data by following best practices in streaming analysis, and present dynamic insights through responsive and interactive visual dashboards.
urse Content:	

Module 1: Data Handling and Preparation

1. **Program 1**: Collect structured and unstructured data from online sources (CSV, JSON, API, etc.) and load it using Python.
2. **Program 2**: Explore and summarize datasets using NumPy and pandas (head, describe, info, etc.).
3. **Program 3**: Perform data cleaning: handle missing values using mean/median/mode/drop strategies.
4. **Program 4**: Perform data transformation: normalization, encoding categorical data, and feature scaling.
5. **Program 6**: Demonstrate task and data abstraction with a case study (e.g., customer dataset), and validate using statistical summaries.

Module 2: Data Visualization Techniques

6. **Program 6**: Visualize scalar and point data using line charts, bar charts, and scatter plots (matplotlib/seaborn).
7. **Program 7**: Apply vector visualization techniques (e.g., quiver plots or flow fields).
8. **Program 8**: Use heatmaps and matrix visualizations to display correlation matrices or similarity scores.
9. **Program 9**: Visualize hierarchical data using tree maps or dendrograms.
10. **Program 10**: Create network graphs for social or connectivity datasets using networkx and visualize them.
11. **Program 11**: Apply visual variables (color, shape, size) and map interactions to adjust views (zoom, filter, etc.).

Module 3: Visual Analysis of Data from Various Domains

12. **Program 12**: Time-series analysis and visualization for stock market data using line plots, moving averages, etc.
13. **Program 13**: Visualize spatial data using geopandas or folium (e.g., crime rate by district, COVID-19 map).
14. **Program 14**: Text data visualization using word clouds, word frequency histograms, or topic modeling visualization.
15. **Program 15**: Visualize multivariate data from a real-world case (e.g., healthcare: patient records with multiple attributes).

Module 4: Visualization of Streaming Data

16. **Program 16**: Demonstrate streaming data analysis techniques (e.g., rolling averages, anomaly detection).
17. **Program 17**: Final mini-project: Design and present a complete streaming data visualization solution with annotations and user interaction.

Text Book

1. Dr. Ossama Embarak, “Data Analysis and Visualization Using Python”, Apress,(2018)
2. Wes McKinney "Python for Data Analysis" Edition: 3rd Edition (2022) Publisher: O’Reilly Media

ferences

R1 : "Interactive Data Visualization for the Web" by Scott Murray- Edition: 2nd Edition (2017)- Publisher: O’Reilly Media

alogue preparedby	S.Saravana Kumar
ommended by the Board of Studies on	
te of Approval by the Academic Council	

Course Code: CSE1510	**Course Title: Database Management Systems** **Type of Course: Theory**	**L-T-P-C**	3	0	0	3
Version No.						
Course Pre-requisites	Foundational understanding of data types, data structures, basic programming knowledge, familiarity with operating systems and file management. Basic knowledge of set theory, logic, and discrete mathematics to understand relational algebra and query formulation.					
Anti-requisites	NIL					
Course Description	This course introduces the foundational principles of database management systems, including data models, schemas, and architectures. This course provides a solid foundation on the relational model of data and the use of relational algebra. It develops skills in SQL for data definition, manipulation, and control, enabling students to construct and execute complex queries. The course also introduces the concept of object oriented and object relational databases and modern database technologies like **NoSQL.** The also course allows the students to gain insights into data storage structures and indexing strategies for optimizing query performance.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain **Employability** through **Problem Solving** Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Describe the fundamental elements of relational database management systems. [Understand] 2. Examine databases using SQL query processing and Optimization. [Apply] 3. Design simple database systems applying the normalization constraints and demonstrate the database transaction processing, recovery, and security. [Apply] 4. Interpret the concept of advanced databases and its applications. [Apply]					
Course Content:						

Module 1	**Introduction to Database Modelling and Relational Algebra(Understand)**	Assignment	**Problem Solving**	**10 Sessions**

Topics:
Introduction to Database: Schema, Instance, 3-shema architecture, physical and logical data independence, Data isolation problem in traditional file system, advantages of database over traditional file systems. Entity Relationship (ER) Model, ER Model to Relational Model, Examples on ER model.
Relational Algebra with selection, projection, rename, set operations, Cartesian product, joins (inner and outer joins), and division operator. Examples on Relational Algebra Operations.

Module 2	**Fundamentals of SQL and Query Optimization (Apply)**	Assignment	**Programming**	**11 Sessions**

Topics:
SQL Database Querying, DDL, DML, Constraints, Operators, Set Operators, Aggregate Functions, Joins, Views, Procedures, Functions and Triggers.
Database programming issues and techniques: Embedded SQL, Dynamic SQL; SQL / PSM and NoSQL.
Query Optimization: Purpose, transformation of relational expressions, estimating cost and statistics of expression, choosing evaluation plans, linear and bushy plans, dynamic programming algorithms.

Module 3	**Relational Database Design & Transaction Management (Apply)**	Assignment	**Problem Solving**	**12 Sessions**

Topics:
Relational database design: Problems in schema design, redundancy and anomalies, Normal Forms based on Primary Keys-(1NF,2NF, 3NF), Boyce-Codd Normal Form, Multi valued Dependency (Fourth Normal Form), Join Dependencies (Fifth Normal Form), lossy and lossless decompositions, Database De-normalization.
Transaction Management: The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; The write-ahead log protocol; Check pointing; Recovering from a System Crash; Media Recovery; Other approaches and interaction with concurrency control.

Module 4	**Advanced DBMS Topics (Apply)**	**Assignment**	**Case Study**	**12 Sessions**

Topics:
Advanced topics: Object oriented database management systems, Deductive database management systems, Spatial database management systems, Temporal database management systems, Constraint database management systems.
New database applications and architectures such as Data warehousing, Multimedia, Mobility, NoSQL, Native XML databases (NXD), Document-oriented databases, Statistical databases.

Targeted Application & Tools that can be used:
Application Area: Relational database systems for Business, Scientific and Engineering Applications.
Tools/Simulator used: MySQL DB for student practice.
Also demonstration of ORACLE DB on object-relational database creation and JDBC connection.

1. Problem Solving: Constructing ER-Diagrams for a given real time requirements, Normalizing the databases, querying the databases using relational algebra.
2. Programming: Implementation of any given scenario using MySQL.

Text Books:
T1. Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Publication, 7th Edition, 2018.
T2. RamaKrishna & Gehrke, "Database Management Systems" 3rd Edition, 2018, McGraw-Hill Education.
T3. W. Lemahieu, S. vanden Broucke and B. Baesens, "Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data", Cambridge University Press, 2018.

References
R1 Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill ,7th Edition, 2019.
R2 M. Kleppmann, "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems", O'Reilly, 2017.

Topics relevant to development of "FOUNDATION SKILLS": S - Skill Development: Relational database design using ER- Relational mapping, Implementation of given database scenario using MYSQLDB. Topics relevant to development of Employability: Develop, test and implement computer databases, creatingsophisticated, interactive and secure database applications Topics relevant to "HUMAN VALUES &PROFESSIONAL ETHICS": Nil

Course Code:CSE 7100	**Course Title: Mini Project** **Type of Course:**	**L- T-P- C**	0	0	0	4
Version No.	**1.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify the engineering problems related to local, regional, national or global needs. (Understand) 2. Apply appropriate techniques or modern tools for solving the intended problem. (Apply) 3. Design the experiments as per the standards and specifications. (Analyze) 4. Interpret the events and results for meaningful conclusions. (Evaluate) 5. Appraise project findings and communicate effectively through scholarly publications. (Create)					
Catalogue prepared by	Dr. Sampath A K					
Recommended by the Board of Studies on						
Date of Approval bythe Academic Council						

Course Code: **CSE2510**	**Course Title:** Competitive Programming and Problem Solving **Type of Course: Program Core**	L-T-P-C	0	0	4	2
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	**NIL**					
Course Description	The **Competitive Programming and Problem Solving** course equips students with efficient problem-solving skills for coding competitions and real-world challenges. Starting with brute-force solutions, students learn to optimize time and space complexity using advanced techniques like dynamic programming, greedy algorithms, and backtracking. Hands-on practice on platforms like CodeChef and Codeforces helps tackle problems involving number theory, data structures, and algorithmic paradigms. By understanding CP constraints and fostering a strategic mindset, students gain the confidence to excel in competitions, technical interviews, and practical applications.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1 : Understanding the issues of online platforms and Competitive Programming (CP) and developing brute force coding for commonly asked CP problems. CO2 : Analyzing the space and time complexity of brute force solutions and designing efficient solutions. CO3 : Evaluating the applicability of suitable algorithmic approaches to solve relevant CP problems. CO4: Creating efficient solutions of CP problems using the learnt algorithmic approaches.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Competitive Programming and Problem Solving** and attain **Skill Development** through **Experiential Learning** techniques.					

Module 1: Introduction to Competitive Programming

Overview of Efficient Coding for Problem Solving and CP: Introduction to competitive programming (CP); revisit of complexity analysis; introduction to online platforms such as codechef, codeforces etc and online submission; constraints during CP, online testing process and common errors such as TLE; use of STL

Module 2: Number Theory for Problem-Solving

Use of Number Theory for problem-solving: reducing time/space complexity of brute force coding solution of Sieve Method, Inverse Module, Euclidian Method of factorization; efficient coding for Permutation Combination; XORing based and pattern-based solutions.

Module 3: Optimizing Time & Space Using Sequential Storage

Coding for Optimizing time and Space using Sequential Storage: two pointer approach; problem-solving using arrays and strings such as rotation on sorted arrays, duplicate removal, string matching algorithms; Kadane's algo, stacks, priority-queues and hashing based efficient coding; median based problems and alternate solutions.

Module 4: Non-Linear Data Structures

Applying Non-Linear Data Structures for real-life problems: design of efficient solutions for problems such as finding loops in a linked list, memory efficient DLL, block reversal in LL; problem solving using trees and binary trees, Catalan numbers, applications of graphs, spanning tree and path algos for CP problems with reduced time/space complexity.

Module 5: Problem Solving using Advanced Topics

CP Problem Solving using Advanced Topics: concept of disjoint sets and their efficient representation, algorithmic approaches such as Greedy, Backtracking, Dynamic Programming and applying them for CP problems using bottom-up dynamic programming.

List of Laboratory Tasks:

1. You are given the finishing times of 'N' runners in a marathon. Write a program to find the runner who finished in the third position. **Focus:** Basic data structures (arrays), sorting algorithms (e.g., insertion sort, selection sort), and basic input/output.

2. In the same marathon, you are given the finishing times of 'N' runners and their bib numbers. Write a program to efficiently find the top 10 runners and their corresponding bib numbers. **Focus:** Efficient sorting algorithms (e.g., merge sort, quick sort), data structures like priority queues, and optimizing for large datasets.
3. A library maintains a list of books with their unique IDs. Write a program to check if a given book ID is present in the library. Focus: Searching algorithms (linear search), basic data structures (arrays or lists).
4. The library wants to implement a system to quickly find books by their titles. Suggest an efficient data structure (e.g., a hash table or a trie) and explain how to implement it to achieve fast book lookups. Focus: Understanding the trade-offs between different data structures, choosing the most appropriate data structure for a specific problem, and implementing efficient search operations.
5. An online store sells products with different prices. Write a program to calculate the total cost of a given list of products. **Focus:** Basic arithmetic operations, working with arrays or lists to store product prices.
6. The online store offers discounts based on the total purchase amount. Design an algorithm to efficiently calculate the final cost of an order, considering different discount rules (e.g., percentage discounts, fixed amount discounts, tiered discounts). Focus: Algorithmic design, conditional statements, handling complex scenarios with multiple rules, and potentially using dynamic programming techniques for optimization.
7. You are given two integers, 'a' and 'm'. Calculate 'a' raised to the power 'm' modulo a large prime number 'p'. **Focus:** Basic modular arithmetic operations (modular exponentiation), understanding the modulo operator.
8. In a secure communication system, you need to efficiently compute the modular exponentiation for very large values of 'm'. Implement and analyze the efficiency of the binary exponentiation algorithm for this task. **Focus:** Efficient algorithms for modular exponentiation (binary exponentiation), time complexity analysis, and understanding the importance of efficient algorithms in cryptography.
9. You have a deck of 'N' cards. Calculate the total number of possible hands of size 'K' that can be drawn from the deck. **Focus:** Basic combinatorics (combinations), factorial calculations.
10. In a card game, you need to calculate the probability of drawing certain combinations of cards (e.g., a pair, a three-of-a-kind) from a shuffled deck. Design an efficient algorithm to calculate these probabilities. **Focus:** Advanced combinatorics (permutations and combinations with repetitions), probability calculations, and optimizing calculations to avoid overflows.
11. You are given a network of devices represented as a graph. Determine if there is a path between two given devices in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search).
12. In a secure network, you need to detect and isolate compromised devices. Design an algorithm that efficiently identifies devices that exhibit anomalous behavior (e.g., unusual traffic patterns) using XOR-based techniques for data comparison and pattern matching. **Focus:** Applying XOR operations for data comparison and pattern recognition, understanding the properties of XOR (e.g., commutative, associative), and designing algorithms for network anomaly detection.
13. You are given an array representing the speeds of cars on a highway. Find the minimum time required for all cars to pass a certain point. **Focus:** Basic array traversal, finding the minimum element in an array.
14. In a more realistic scenario, cars have different lengths. Implement a two-pointer approach to simulate the movement of cars and determine the minimum time for all cars to pass a given point. **Focus:** Two-pointer technique, simulating real-world scenarios with arrays, optimizing time complexity.
15. Given a string, find the number of occurrences of a specific substring within the string. **Focus:** Basic string manipulation, string matching (brute-force approach).
16. Implement the KMP (Knuth-Morris-Pratt) string matching algorithm to efficiently find all occurrences of a given pattern within a large text document. **Focus:** Advanced string matching algorithms, understanding the concept of the "next" array in KMP, optimizing for large input sizes.
17. An online auction platform receives bids for different items. Implement a data structure (e.g., a priority queue) to efficiently track the highest bid for each item. **Focus:** Priority queues, insertion and extraction operations on priority queues, basic implementation of a priority queue using an array or a suitable library.
18. The auction platform needs to handle a large number of bids concurrently. Design and implement a system that efficiently processes bids, updates the highest bid for each item, and handles potential race conditions. **Focus:** Concurrent data structures and algorithms, thread safety, handling race conditions, optimizing for high-throughput scenarios.
19. A social network can be represented as a graph where users are nodes, and connections between users are edges. Write an algorithm to find if two given users are connected in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search), basic graph representation (adjacency list or adjacency matrix).

20. In a large social network, efficiently finding the shortest path between two users is crucial. Implement Dijkstra's algorithm to find the shortest paths between users in the network, considering edge weights (e.g., representing the strength of connections). **Focus:** Shortest path algorithms (Dijkstra's algorithm), graph algorithms with weighted edges, optimizing for large graphs.
21. A file system can be modeled as a tree structure. Implement a function to traverse the file system and print the names of all files and directories. **Focus:** Tree traversal algorithms (depth-first search or breadth-first search), basic tree representation (using nodes and pointers).
22. Design and implement a file system that supports efficient operations like creating directories, deleting files, and finding files based on their names or paths. Consider using a combination of tree structures and hash tables for efficient indexing and searching. **Focus:** Designing and implementing file system structures, using multiple data structures together, optimizing for common file system operations.
23. An online shopping cart can be represented as a tree, where each node represents an item or a category of items. Write an algorithm to calculate the total price of all items in the shopping cart. **Focus:** Tree traversal, calculating sums within a tree structure.
24. Implement a system that allows customers to apply discounts and coupons to their shopping carts. Consider using a combination of trees and other data structures (e.g., hash tables) to efficiently apply discounts and calculate the final price. **Focus:** Applying discounts and promotions to tree-like structures, efficient implementation of discount rules, optimizing for complex pricing scenarios.
25. In a social network, users can form groups. Given a list of friendships, determine if all users in a specific group are connected (directly or indirectly) through friendships. **Focus:** Disjoint set union (DSU) data structure, basic connectivity checks.
26. Design an efficient algorithm to find the minimum number of new friendships needed to connect all users in the social network into a single, connected component. **Focus:** Applying DSU for finding connected components, greedy algorithms, optimization for minimizing connections.
27. A treasure hunt involves a series of clues leading to the final treasure. Given a list of possible paths and their associated costs, find the cheapest path to reach the treasure. **Focus:** Greedy algorithms (e.g., Dijkstra's algorithm for shortest paths), basic graph representation.
28. In a more complex treasure hunt, there are time constraints associated with each path. Design an algorithm to find the fastest path to the treasure while considering both path costs and time constraints.

Focus: Combining greedy approaches with other techniques (e.g., priority queues), handling multiple constraints, optimizing for time-critical scenarios.

29. In a simplified chess game with only rooks, determine the minimum number of moves required for a rook to reach a specific target square on an empty board. **Focus:** Breadth-first search (BFS) on a graph (the chessboard), basic graph traversal.
30. In a more realistic chess game with multiple pieces and obstacles, implement a minimax algorithm with alpha-beta pruning to determine the best move for a player. **Focus:** Game tree search, minimax algorithm, optimization techniques like alpha-beta pruning, handling complex game states.

Targeted Application & Tools that can be used:

1. C or C++ Compiler (g++): The standard compiler for CP. Familiarize students with compilation flags (e.g., -O2 for optimization).
2. IDE (Integrated Development Environment): Code:: Blocks, Visual Studio, CLion, or similar IDEs. These provide debugging capabilities, code completion, and other helpful features.
3. Online Judges (CodeChef, Codeforces, LeetCode, HackerRank): Essential for practicing and submitting solutions.
4. Debugger (gdb): Crucial for understanding code execution and finding bugs. Origin, excel and Mat lab soft wares for programming and data analysis.
5. Number Theory Libraries: Some libraries provide pre-built functions for number theory operations (though often it's better to implement them yourself for learning).
6. Wolfram Alpha: A useful tool for verifying number theory calculations and exploring concepts.
7. **String Libraries:** Familiarize students with the string manipulation functions available in C++.
8. **Graph Visualization Tools:** Tools like Graphviz can be helpful for visualizing graphs and understanding graph algorithms.
9. **DP Debugging Techniques:** Practice debugging DP solutions, as they can be complex. Visualizing the DP table can be helpful.

Text Books:

1. **Guide to Competitive Programming: Learning and Improving Algorithms Through Contests" (3rd Edition), *Antti Laaksonen, springer, 2024***
2. **"Data Structures and Algorithms in Java: A Project-Based Approach" – *Dan S. Myers, Cambridge University Press***

Reference Books:

1. **Data Structures and Algorithmic Thinking with Python/C++/Java", *Narasimha Karumanchi, 5th Edition, Career Monk, 2017.***
2. **Introduction to Algorithms, Thomas H. Cormen (Author), Charles E. Leiserson (Author), Ronald L. Rivest , fourth edition April 2022**

Web Resources

1. **https://nptel.ac.in/courses/106106231**
2.

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Assessment Type

- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.)
- Quiz
- End Term Exam
- Self-Learning

Course Code: CSD3417	Course Title: Scientific Computing for Intelligent Systems Type of Course: Discipline Elective/ Theory Only Course	L- T-P- C	3	0	0	3
Version No.		2.0				
Course Pre-requisites						
Anti-requisites		NIL				
Course Description		This course introduces the fundamentals of scientific computing techniques tailored for intelligent systems. It covers numerical methods, data-driven modeling, optimization, and high-performance computing frameworks. Emphasis is placed on applying computational strategies to AI, machine learning, and large-scale simulation problems.				
Course Objective		The objective of the course is to familiarize the learners with the concepts of Data Mining and attain Employability through Problem Solving Methodologies				
Course Out Comes		Upon successful completion of this course, students will be able to: 1. Apply numerical techniques to solve scientific and engineering problems. 2. Develop and optimize intelligent algorithms using scientific computing methods. 3. Implement data-driven and model-based solutions in real-world intelligent systems. 4. Utilize parallel and high-performance computing tools to handle computational complexity.				
Course Content:						

Module 1	Fundamentals of Scientific Computing	Assignment		Data Collection	10 Sessions
	Topics: Floating point arithmetic and error analysis, Matrix operations and linear algebra, Interpolation, approximation, and numerical differentiation/integration				
Module 2	Solving Scientific Problems using Numerical Methods	Quiz		Problem Solving	10 Sessions
	Topics: Numerical solutions to linear and non-linear equations, Eigenvalue problems, Ordinary and partial differential equations				
Module 3	Intelligent Systems and Computational Modeling	Assignment		Problem Solving	10Sessions
	Topics: Basics of intelligent systems and soft computing, Computational modeling in intelligent applications, Data-driven modeling techniques for simulations				
Module 4	High-Performance and Parallel Computing for AI	Assignment		Problem Solving	10 Sessions
	Introduction to HPC frameworks (MPI, OpenMP, CUDA), Scientific computing libraries (NumPy, SciPy, TensorFlow, PyTorch), Case studies in scientific applications of AI and machine learning				
	1. **"Numerical Analysis"** by Richard L. Burden and J. Douglas Faires, Cengage Learning, 11th Edition, 2022. 2. **"Scientific Computing: An Introductory Survey"** by Michael T. Heath, McGraw Hill Education, 2nd Edition, 2018.				
	References: **R1** "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney, O'Reilly Media, 3rd Edition, 2022**.** **R2 "**Parallel and High-Performance Computing" by Robert Robey and Yuliana Zamora, O'Reilly Media, 2021. . **Additional web-based resources:** W1. https://onlinecourses.swayam2.ac.in/cec20_cs12/preview Text book of Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufmann Publishers, 2012. W2.https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=7&sid=e2d7362a-fd3049a98f0393e963521dbd%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=377411&db=nlebk https://nptel.ac.in/courses/105105157				
	Topics relevant to "EMPLOYABILITY SKILLS": Data Mining Techniques, FP Growth for developing Employability Skills through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.				

Catalogue prepared by		Shaik Salma Begum
Recommended by the Board of Studies on		
Date of Approval by the Academic		

Council		

Course Code: CSD3418	Course Title: Feature Engineering and Model Optimization Type of Course: Discipline Elective/ Theory Only Course	L- T-P- C	3	0	0	3
Version No.		2.0				
Course Pre-requisites						
Anti-requisites		NIL				
Course Description		This course provides a deep dive into the techniques of transforming raw data into valuable inputs for machine learning models through effective feature engineering. It explores strategies for feature selection, transformation, dimensionality reduction, and hyperparameter tuning. Emphasis is placed on model optimization techniques including regularization, ensemble methods, and automated machine learning pipelines.				
Course Objective		The objective of the course is to familiarize the learners with the concepts of Data Mining and attain Employability through Problem Solving Methodologies				
Course Out Comes		Upon successful completion of this course, students will be able to: 5. Apply various feature engineering techniques to preprocess and transform data effectively. 6. Evaluate and optimize machine learning models using advanced tuning and selection techniques. 7. Integrate feature engineering and model optimization strategies into complete machine learning pipelines.				
Course Content:						

Module 1	Introduction to Feature Engineering	Assignment		Data Collection	10 Sessions
	Topics: Understanding data types and quality, Missing value handling, outlier detection, encoding categorical variables, Feature scaling and normalization techniques				
Module 2	Feature Selection and Extraction	Quiz		Problem Solving	10 Sessions
	Topics: Filter, wrapper, and embedded methods, Principal Component Analysis (PCA), LDA, t-SNE, Feature importance and interpretability in models				
Module 3	Model Optimization Techniques	Assignment		Problem Solving	10Sessions
	Topics: Hyperparameter tuning (Grid Search, Random Search, Bayesian Optimization), Cross-validation strategies, Regularization techniques (L1, L2, ElasticNet)				
Module 4	Advanced Techniques and AutoML	Assignment		Problem Solving	11 Sessions

	Feature generation using domain knowledge and interactions, Ensemble learning and stacking, Introduction to AutoML frameworks (e.g., AutoSklearn, H2O.ai, TPOT)
	3. Feature Engineering and Selection: A Practical Approach for Predictive Models",Author: Max Kuhn, Kjell Johnson, Publisher: CRC Press, Taylor & Francis Group, Year: 2019 4. "Hands-On Feature Engineering with Python", Author: Soledad Galli, Publisher: Packt Publishing, Year: 2020
	References: **R1 "Automated Machine Learning: Methods, Systems, Challenges",** Editors: Frank Hutter, Lars Kotthoff, Joaquin Vanschoren, Publisher: Springer, Year: 2021 **R2 "Machine Learning Engineering",** Author: Andriy Burkov, Publisher: True Positive Inc., Year: 2020 **Additional web-based resources:** W1. https://onlinecourses.swayam2.ac.in/cec20_cs12/preview Text book of Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufmann Publishers, 2012. W2.https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=7&sid=e2d7362a-fd3049a98f0393e963521dbd%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=377411&db=nlebk https://nptel.ac.in/courses/105105157
	Topics relevant to "EMPLOYABILITY SKILLS": Data Mining Techniques, FP Growth for developing Employability Skills through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Catalogue prepared by		Shaik Salma Begum
Recommended by the Board of Studies on		
Date of Approval by the Academic Council		

Course Code: CSE1505	**Course Title: Web Technologies Laboratory** **Type of Course: Program core lab course**		**L-T- P-C**	0	0	2	1
Version No.		1.0					
Course Pre-requisites		Database Management Systems-CSE3156					
Anti-requisites		**NIL**					
Course Description		This course highlights the comprehensive introduction to scripting languages that are used for creating web-based applications. The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills.					
Course Objective		**The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.**					
Course Outcomes		**On successful completion of this course the students shall be able to:** **CO1:** Implement web-based application using client-side scripting languages. **(Apply)** **CO2**: Apply various constructs to enhance the appearance of a website.					

		(Apply) **CO3:** Apply server-side scripting languages to develop a web page linked to a database. **(Apply)**
Course Content:		

List of Laboratory Tasks:

Experiment No. 1: Demonstration of XHTML features

Level 1: Demonstration of various XHTML Tags (Level 1)

Level 2: Design and develop static web pages for an online Book store (Level 2).

Experiment No. 2: Application of CSS in web designing

Level 1: Design a document using XHTML and CSS to create a catalog of items for online electronic shopping.

Level 2: Create and save XML document for students' information and display the same using cascaded style sheet.

Experiment No. 3: Application of PHP in web designing.

Level 1: Write a PHP program to read the personal information of a person such as first name, last name, age, permanent address, and pin code entered by the user into a table created in MySQL. Read the same information from the database and display it on the front end.

Level 2: Using PHP develop a web page that accepts book information such as ISBN number, title, authors, edition, and publisher and store information submitted through the web page in MySQL database.

Experiment No. 4: Building a website.

Build a website for organizing an International Conference. The conference website must be able to collect the author's details and upload a file.

Targeted Application & Tools that can be used: Xampp web server to be used to demonstrate PHP.

Project work/Assignment:

Assignments are given after completion of each module which the student need to submit within the stipulated deadline.

Textbook(s):

1] Robert. W. Sebesta, "*Programming the World Wide Web*", Pearson Education, 9th Edition, 2016.

2]Paul Deitel, Harvey Deitel, Abbey Deital,"Internet & World Wide Web How to Program", Fifth Edition, Pearson Education, 2021.

3]CSS Notes for Professionals, ebook available at https://books.goalkicker.com/CSSBook/ (Retrieved on Jan. 20, 2022)

4]Deitel, Deitel, Goldberg,"*Internet & World Wide Web How to Program*", Fifth Edition, Pearson Education, 2021.

Reference Book(s):

R1. Randy Connolly, Ricardo Hoar,"Fundamentals of Web Development", Pearson Education India,
1st. Edition.2016.

R2. Jeffrey C. Jackson,"Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition,2016.

Additional web-based resources

W1. W3schools.com

W2. Developer.mozilla.org/en-US/docs/Learn

W3. docs.microsoft.com

W4. informit.com/articles/ The Relationship Between Web 2.0 and Social Networking

https://presiuniv.knimbus.com/user#/home

Topics related to development of "FOUNDATION":

Web, WWW, Web browsers, Web servers, Internet.

CSS, PHP.

Designing the website for healthcare.

The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.

Course Code: CSE1504	**Course Title: Web Technologies** **Type of Course: Program core** **Theory Only**	**L- T-P- C**	2-0-0-2	
Version No.	2.0			
Course Pre-requisites	**NIL**			
Anti-requisites	**NIL**			
Course Description	This course highlights the basic web design using Hypertext Markup Language and Cascading Style Sheets. Students will be trained in planning and designing effective web pages by writing code using current leading trends in the web domain, enhancing web pages with the use of page layout techniques, text formatting, graphics, images, and multimedia. The focus is on popular key technologies that will help students to build Internet- and web-based applications that interact with other applications and with databases.			
Course Objective	**The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.**			
Course Outcomes	**On successful completion of this course the students shall be able to:** **CO1:** Implement web-based application using client-side scripting languages. **(Application level)** **CO2**: Apply various constructs to enhance the appearance of a website. **(Application level)** **CO3**: Illustrate java-script concepts to demonstration dynamic web site**(Application level)** **CO4:** Apply server-side scripting languages to develop a web page linked to a database. **(Application level)**			
Course Content:				
Module 1	**Introduction to XHTML**	Quizzes and Assignments	Quizzes on various features of XHTML, simple applications	**8 Sessions**
Topics: Basics: Web, WWW, Web browsers, Web servers, Internet. XHTML: Origins and Evolution of HTML and XHTML: Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Frames, Syntactic Differences between HTML and XHTML.				
Module 2	**Advanced CSS**	Quizzes and assignments	Comprehension based Quizzes and assignments; Application of CSS in designing webpages	**8 Sessions**
Topics: **CSS:** Introduction to CSS, Defining & Applying a style, Creating style sheets, types of style sheet, selectors, CSS font properties, border properties, Box model, opacity, CSS pseudo class and pseudo-elements. **Advanced CSS:** Layout, Normal Flow, Positioning Elements, Floating Elements, Responsive Design, CSS Frameworks **XML:** Basics, demonstration of applications using XML				
Module 3	**Fundamentals of JavaScript**	Quizzes and assignments	Application of JavaScript for dynamic web page designing	**7 Sessions**
Topics: JavaScript: Introduction to JavaScript, Basic JavaScript Instructions, Functions, Methods & Objects, Decisions and Loops, Document Object Model, Event handling, handling window pop-ups, JavaScript validation.				

Module 4	**PHP – Application Level**	Quizzes and assignments	Application of PHP in web designing	**7 Sessions**
Topics: **PHP:** Introduction to server-side Development with PHP, Arrays, $GET and $ POST, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP.				
Targeted Application & Tools that can be used: **Xampp web server to be used to demonstrate PHP.**				
Project work/Assignment:				
Assignments are given after completion of each module which the student need to submit within the stipulated deadline.				
Textbook(s): 1] Robert. W. Sebesta, "*Programming the World Wide Web*", Pearson Education, 8th Edition, 2015. 2] *CSS Notes for Professionals*, ebook available at https://books.goalkicker.com/CSSBook/ (Retrieved on Jan. 20, 2022) 3] Deitel, Deitel, Goldberg,"*Internet & World Wide Web How to Program*", Fifth Edition, Pearson Education, 2021.				
References 1] Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", Pearson Education India, 1st. Edition.2016. 2] Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition,2016.				
Topics related to development of "FOUNDATION": Web, WWW, Web browsers, Web servers, Internet. CSS, PHP. Designing for healthcare. **for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.** **E-References** **pu.informatics.global, https://sm-nitk.vlabs.ac.in/**				

Course Code: CSD3403	**urse Title: Optimization Techniques for Data Science** **e of Course: Theory Integrated**	**-P-C**					**3**
Version No.							
Course Pre-requisites	**MAT 1001**						
Anti-requisites							
Course Description	This course provides a comprehensive introduction to optimization techniques with a strong focus on their applications in data science and machine learning. Students will explore the mathematical foundations of optimization, including convexity, duality, and gradient-based methods, and apply them to solve real-world problems involving regression, classification, clustering, and neural network training. The course covers both unconstrained and constrained optimization, delves into modern algorithms like stochastic gradient descent and Adam, and introduces advanced topics such as non-convex optimization and hyperparameter tuning. Through a blend of theory, algorithmic development, and hands-on coding assignments, students will gain the skills needed to formulate and solve optimization problems critical to effective data-driven decision making.						
Course Objectives	The objective of the course is to familiarize the learners with the concepts of **Optimization for data science** and attain **Experiential Learning** and **Problem Solving** techniques.						

urse Out Comes	On successful completion of this course the students shall be able to: 1. Describe the fundamental concepts of optimization, including convexity, gradients, and optimality conditions. [Remember] 2.Implement and analyze unconstrained optimization algorithms such as gradient descent, stochastic gradient descent, and quasi-Newton methods for solving machine learning models.[Remember] 3. Apply constrained optimization techniques, including KKT conditions and duality theory, to solve problems in support vector machines and resource-constrained data science scenarios. [Apply] 4.Evaluate and implement advanced optimization methods—including non-convex optimization, hyperparameter tuning, and metaheuristic approaches—in practical data science workflows.[Apply]
urse Content:	

dule 1	ndations of Optimization	ignment		**16 Sessions [L-8 + P-8]**

pics:
Introduction to Optimization in Data Science - Types of Optimization Problems: Convex vs. Non-convex - Mathematical Foundations: Vectors, Norms, Gradients, Hessians - Linear Algebra essentials for optimization - Convex sets and functions -Optimization Problem Formulation- First-order and Second-order Optimality Conditions.

dule 2	**constrained Optimization Techniques**	ignment		**16 Sessions [L-8 + P-8]**

pics:
Gradient Descent and Variants - Stochastic Gradient Descent (SGD)- Mini-batch Gradient Descent - Momentum, RMSProp, Adam. Newton's Method and Quasi-Newton Methods (BFGS, L-BFGS) - Line Search and Step Size Strategies- Convergence Analysis.

dule 3	nstrained Optimization and Duality	iz		**16 Sessions [L-8 + P-8]**

pics:
grange Multipliers - Karush-Kuhn-Tucker (KKT) Conditions- Convex Optimization with Constraints- Duality Theory: Lagrangian Dual, Strong/Weak Duality- Quadratic Programming (QP), Linear Programming (LP)- Optimization in Support Vector Machines (SVM).

dule 4	vanced Topics and Applications in Data Science	ni Project		**12 Sessions [L-6 + P-6]**

Topics:
Non-convex Optimization in Deep Learning -Optimization landscapes of neural networks - Saddle points and local minima -Bayesian Optimization-Hyperparameter Tuning (Grid Search, Random Search, BO)-Optimization in Clustering (e.g., k-means)-Large-scale and Online Optimization-Metaheuristic Methods: Genetic Algorithms, Simulated Annealing.

List of Laboratory Tasks:

- **Sheet 1:**
  Implement objective functions and gradients using NumPy
  Visualization of convex functions and gradient descent paths
- **Sheet 2:**
  Optimization of logistic regression, linear regression
  Comparative study of different optimizers on benchmark datasets
- **Sheet 3:**

Use of CVXPY for solving constrained optimization problems

plementing SVM with quadratic programming

o Sheet 4:

Hyperparameter optimization for ML models using Optuna

plement a basic neural network optimizer from scratch

Targeted Application & Tools that can be used: Google Colab

oject work/Assignment: Mention the Type of Project /Assignment proposed for this course

3] Programming: problem solving and implement it using optimization techniques.
4] Real-world data science problem involving optimization

xt Book

4] Stephen Boyd and Lieven Vandenberghe "Convex Optimization" , 1st Edition (2004), Cambridge University Press.
5] Jorge Nocedal and Stephen J. Wright "Numerical Optimization" 2nd Edition (2006), Springer.
6] Sébastien Bubeck "Convex Optimization: Algorithms and Complexity", 1st Edition (2015), Now Publishers.
7] Suvrit Sra, Sebastian Nowozin, and Stephen J. Wright "Optimization for Machine Learning" 1st Edition (2011), MIT Press.

E Book Link

1. https://web.stanford.edu/~boyd/cvxbook/bv_cvxbook.pdf
2. https://www.math.uci.edu/~qnie/Publications/NumericalOptimization.pdf
3. https://sbubeck.com/Bubeck15.pdf
4. https://vim.ustc.edu.cn/_upload/article/files/86/7f/bf0a1fff499994d5fd8d17a7b5d5/c0feccd1-f58a-40ca-8e2e-720d276be00c.pdf

Web Links:

1. Technology Enabled Learning - NPTEL offers as Course on "Optimization for Data Science" by Prof. Pravesh Biyani , IIT, Delhi.

ferences

1] R. Fletcher , Practical Methods of Optimization" 2nd Edition (2021)- Wiley-Interscience publishers
2] Amir Beck "First-Order Methods in Optimization" 1st Edition (2017), SIAM-Society for Industrial and Applied Mathematics publishers.

Topics relevant to development of "Skill Development":
Formulating optimization problems from real-world scenarios.

Catalogue prepared by	Dr.S.Saravana Kumar
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: CSE7000	**Course Title: Internship** **Type of Course:**	**L- T-P- C**	-	-	-	2
Version No.	**1.0**					

Course Pre- requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**
Anti-requisites	**NIL**
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify the engineering problems related to local, regional, national or global needs. (Understand) 2. Apply appropriate techniques or modern tools for solving the intended problem. (Apply) 3. Design the experiments as per the standards and specifications. (Analyze) 4. Interpret the events and results for meaningful conclusions. (Evaluate)

Course Code: CSD3414	Course Title: Statistics-Driven Data Science Type of Course: Discipline Elective/ Theory Only Course		L- T-P-C	2	0	2	3
Version No.		2.0					
Course Pre-requisites							
Anti-requisites		NIL					
Course Description		This course offers a comprehensive introduction to statistical methods and their application in data science. Students will learn to explore, analyze, and interpret complex datasets using statistical reasoning. Emphasis is placed on data visualization, statistical modeling, inference, and hypothesis testing for real-world problem solving.					
Course Objective		The objective of the course is to familiarize the learners with the concepts of Data Mining and attain Employability through Problem Solving Methodologies					
Course Out Comes		8. Apply statistical concepts and methods for data preprocessing, exploration, and analysis. 9. Construct and validate predictive models using statistical techniques. 10. Interpret data insights using visualization and statistical inference to support data-driven decisions.					
Course Content:							

Module 1	Foundations of Statistics for Data Science	Assignment		Data Collection	10 Sessions
	Topics: Descriptive statistics, probability distributions, Sampling techniques, Central Limit Theorem, Estimation and confidence intervals				
Module 2	Statistical Inference and Hypothesis Testing	Quiz		Problem Solving	10 Sessions
	Topics: Parametric and non-parametric tests, p-values, t-tests, ANOVA, chi-square tests, Error types, power of tests, multiple testing corrections				
Module 3	Regression and Statistical Modeling	Assignment		Problem Solving	10Sessions
	Topics: Linear and logistic regression, Model selection and regularization (Lasso, Ridge), Assumptions diagnostics and multicollinearity				
Module 4	Advanced Topics in Statistical Data Science	Assignment		Problem Solving	10 Sessions
	Time series analysis and forecasting, Bayesian statistics and decision theory, Introduction to statistical learning and unsupervised techniques (clustering, PCA)				
	Text Book 1. **"Practical Statistics for Data Scientists"** by Peter Bruce, Andrew Bruce, and Peter Gedeck, 2nd Edition, O'Reilly Media, **2020**. 2. **"An Introduction to Statistical Learning: with Applications in R"** by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, 2nd Edition, Springer, **2021**. 3. **"The Elements of Statistical Learning"** by Trevor Hastie, Robert Tibshirani, and Jerome Friedman, 2nd Edition, Springer, **2023** (Corrected Reprint).				
	References R1 "Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python" Authors: Peter Bruce, Andrew Bruce, and Peter Gedeck, Publisher: O'Reilly Media, Edition: 2nd Edition, 2020 R2 "An Introduction to Statistical Learning: with Applications in R", Authors: Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Publisher: Springer, Edition: 2nd Edition, 2021 Additional web-based resources W1. https://onlinecourses.swayam2.ac.in/cec20_cs12/preview Text book of Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufmann Publishers, 2012. W2.https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=7&sid=e2d7362a-fd3049a98f0393e963521dbd%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=377411&db=nlebk https://nptel.ac.in/courses/105105157				
	Topics relevant to "EMPLOYABILITY SKILLS": Data Mining Techniques, FP Growth for developing Employability Skills through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.				

Catalogue prepared by		Shaik Salma Begum
Recommended by the Board of Studies on		

Date of Approval by the Academic Council		

urse Code: CSD1713	Course Title: Statistical Foundations for Data Science Lab pe of Course: Discipline elective Lab Integrated	**T-P-C**	0			1
rsion No.						
urse Pre-requisites						
ti-requisites	L					
urse Description	This course provides an in-depth introduction to statistics and machine learning theory, methods, and algorithms for data science. Topics include multiple regression, kernel learning, sparse regression, generalized linear models, supervised and unsupervised learning, deep learning, covariance learning, factor models, principal component analysis, and more. The course emphasizes the applicability and limitations of these methods using mathematical statistics and real-world data sets.					
urse Objectives	The objective of the course is to familiarize the learners with the concepts of **Statistical Foundations for Data Science** and attain **Employability** through **Participative Learning** techniques.					
urse OutComes	On successful completion of this course, students can expect to achieve the following outcomes: CO1: Understand the rise and significance of Big Data in various fields such as Biological Sciences, Health Sciences, Computer and Information Sciences, Economics and Finance, Business and Program Evaluation, Earth Sciences, and Astronomy. [Understand] CO2: Develop a strong foundation in multiple linear regression and the Gauss-Markov theorem. [Apply] CO3: Apply linear regression with random design and partial linear regression. [Apply] CO4: Apply the power method and learn about factor models and structured covariance learning. [Apply]					

Course Content: **No. of Sessions: 15 (30 hours)**

List of Programs

Experiment 1: Use big data to predict patient outcomes.
Experiment 2: Predict stock market trends using big data.
Experiment 3: Segment customers based on purchasing behavior.
Experiment 4: Apply statistical learning techniques to high-dimensional data.
Experiment 5: The Gauss-Markov Theorem
Experiment 6: Statistical Tests - Weighted Least-Squares
Experiment 7: Box-Cox Transformation

Experiment 8: Ridge Regression - Bias-Variance Tradeoff
Experiment 9: Ridge Regression Solution Path - Kernel Ridge Regression
Experiment 10: Debias of Regularized Regression Estimators
Experiment 11: Inference in Generalized Linear Models (GLMs)
Experiment 12: Partial Linear regression
Experiment 13: Power Method: To implement the Power Method for finding the largest eigenvalue and corresponding eigenvector.
Experiment 14: Factor model and high-dimensional PCA
Experiment 15: Hierarchical clustering

Targeted Application & Tools that can be used:

Torch, Google Colaboratory, Spider, Jupiter Notebook

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Sentiment analysis of Facebook and Twitter data

Dataset resource link:

https://www.kaggle.com/datasets

REFERENCE MATERIALS:

Textbook(s):

T1 Fan, J., Li, R., Zhang, C.-H., and Zou, H. (2020). Statistical Foundations of Data Science. CRC Press.

T2 Wainwright, M. J. (2019). *High-dimensional statistics: A non-asymptotic viewpoint.* Cambridge University Press.

Reference Book(s):

R1. James, G., Witten, D., Hastie, T.J., Tibshirani, R. and Friedman, J. (2013). *An Introduction to Statistical Learning with Applications in R* . Springer, New York.

R2. Hastie, T.J., Tibshirani, R. and Friedman, J. (2009). *The elements of Statistical Learning: Data Mining, Inference, and Prediction* (2nd ed). Springer, New York.

R3. Buehlmann, P. and van de Geer, S. (2011). *Statistics for High-Dimensional Data: Methods, Theory and Applications*. Springer, New York.

R1: Fan, J., Li, R., Zhang, C.-H., and Zou , Statistical Foundations of Data Science. CRC Press.

E book link

R2: W. N. Venables, D. M. Smith and the R Core Team, https://cran.r-roject.org/doc/manuals /R-intro.pdf, October,2022

eb resources:

W1. https://www.youtube.com/playlist?list=PLOU2XLYxmsIK9qQfztXeybpHvru-TrqAP

https://presiuniv.knimbus.com/user#/

Catalogue prepared by	
Recommended by the Board of Studies on	BOS NO: 17 th. BOS held on 22/12/22
Date of Approval by the Academic Council	Academic Council Meeting No.x , Dated xx/xx/23

urse Code: D1712	**urse Title: Statistical Foundations for Data Science** **pe of Course: Theory**	**T-P-C**	3	0 0	3
rsion No.					
urse Pre-requisites	NIL				

ti-requisites	L
urse Description	This course provides an in-depth introduction to statistics and machine learning theory, methods, and algorithms for data science. Topics include multiple regression, kernel learning, sparse regression, generalized linear models, supervised and unsupervised learning, deep learning, covariance learning, factor models, principal component analysis, and more. The course emphasizes the applicability and limitations of these methods using mathematical statistics and real-world data sets.
urse Objective	e objective of the course is to familiarize the learners with the concepts of **Statistical Foundations for Data Science** and attain **Employability** through **Participative Learning** techniques.
urse Out Comes	On successful completion of the course the students shall be able to: 1) Understand the rise and significance of Big Data in various fields such as Biological Sciences, Health Sciences, Computer and Information Sciences, Economics and Finance, Business and Program Evaluation, Earth Sciences, and Astronomy. 2) Develop a strong foundation in multiple linear regression and the Gauss-Markov theorem. 3) Apply linear regression with random design and partial linear regression. 4) Apply the power method and learn about factor models and structured covariance learning.
urse Content:	

dule 1	Introduction	signment	gramming	**No. of Classes:10**

Topics:

Introduction to bigdata, Rise of Big Data and Dimensionality in -Biological Sciences ,Health Sciences , Computer and Information Sciences , Economics and Finance, Business and Program Evaluation, Earth Sciences and Astronomy - Impact of Big Data - Impact of Dimensionality , Computation of Noise Accumulation , Spurious Correlation , Statistical theory - Aim of High-dimensional Statistical Learning.

dule 2	ltiple Linear Regression	signment	gramming	**No. of Classes:12**

Topics:

Multiple Linear Regression, The Gauss-Markov Theorem , Statistical Tests - Weighted Least-Squares , Box-Cox Transformation , Model Building and Basis Expansions, Polynomial Regression - Spline Regression , Multiple Covariates , Ridge Regression - Bias-Variance Tradeoff - Penalized Least Squares - Bayesian Interpretation - Ridge Regression Solution Path - Kernel Ridge Regression , Exponential family 231 5.1.2 Elements of generalized linear models , Maximum likelihood , Computing MLE: Iteratively reweighed least squares , Deviance and Analysis of Deviance, Regularization parameters, Refitted Cross-validation, Extensions to Nonparametric Modeling.

dule 3	erence in linear regression	signment	gramming	**No. of Classes:14**

Topics:

Inference in linear regression - Debias of regularized regression estimators , Choices of weights , Inference for the noise level , Inference in generalized linear models , Desparsified Lasso , Decorrelated score estimator - Test of linear hypotheses , Numerical comparison - Asymptotic efficiency 345 7.3.1 Statistical efficiency and Fisher information, Linear regression with random design , Partial linear regression , Gaussian graphical models - Inference via penalized least squares , Sample size in regression and graphical models , General solutions , Local

semi-LD decomposition , Data swap , Gradient approximation

dule 4	ncipal Component Analysis	signment	gramming	**No. of Classes:9**

pics:

Principal Component Analysis -Introduction to PCA , Power Method , Factor Models and Structured Covariance Learning , Factor model and high-dimensional PCA-Cluster Analysis - K-means clustering , Hierarchical clustering , Model-based clustering , Spectral clustering , Data-driven choices of the number of clusters , Variable Selection in Clustering , Sparse K-means clustering , Sparse model-based clustering , Sparse Mixture of Experts Model, Correlation Screening, Generalized and Rank Correlation Screening, Nonparametric Screening, Sure Screening and False Selection.

rgeted Application & Tools that can be used:

ols: Torch, Google Colaboratory, Spider, Jupiter Notebook

oject work/Assignment:

xt Book

TextBook(s):

T1 Fan, J., Li, R., Zhang, C.-H., and Zou, H. (2020). Statistical Foundations of Data Science. CRC Press.

T2 Wainwright, M. J. (2019). *High-dimensional statistics: A non-asymptotic viewpoint.* Cambridge University Press.

References

R1. James, G., Witten, D., Hastie, T.J., Tibshirani, R. and Friedman, J. (2013). *An Introduction to Statistical Learning with Applications in R* . Springer, New York.

R2. Hastie, T.J., Tibshirani, R. and Friedman, J. (2009). *The elements of Statistical Learning: Data Mining, Inference, and Prediction* (2nd ed). Springer, New York.

R3. Buehlmann, P. and van de Geer, S. (2011). *Statistics for High-Dimensional Data: Methods, Theory and Applications*. Springer, New York.

Book link

R1: Fan, J., Li, R., Zhang, C.-H., and Zou , Statistical Foundations of Data Science. CRC Press.

E book link

R2: W. N. Venables, D. M. Smith and the R Core Team, https://cran.r-roject.org/doc/manuals /R-intro.pdf, October,2022

eb resources:

W1. https://www.youtube.com/playlist?list=PLOU2XLYxmsIK9qQfztXeybpHvru-TrqAP
https://presiuniv.knimbus.com/user#/

Topics relevant to "EMPLOYABILITY SKILLS": - Asymptotic efficiency 345 7.3.1 Statistical efficiency and Fisher information, Linear regression with random design , Partial linear regression **for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout..**

Catalogue prepared by	Ms.Radhika Sreedharan
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

urse Code:CSD1703	**urse Title: Introduction to Data Science** **pe of Course: Program Core**	**P-C**	3	0	0	3
rsion No.						
ti-requisites	L					
urse Description	This course offers a comprehensive introduction to the interdisciplinary field of Data Science. Students will explore the data science lifecycle, beginning with data acquisition and progressing through cleaning, exploratory analysis, visualization, and basic predictive modeling. Emphasis is placed on using Python-based tools (Pandas, NumPy, Matplotlib, Seaborn, Scikit-learn) to perform real-world data tasks. The course fosters critical thinking, statistical reasoning, and data-driven decision-making essential for modern data science roles.					
urse Objectives	To introduce students to the fundamentals and workflow of Data Science To impart practical experience with Python tools used in data analysis To develop understanding of data exploration, transformation, and visualization techniques To build foundational knowledge of statistical methods and basic predictive modeling					
urse Out Comes	CO1: Describe the stages of the data science lifecycle and tools used CO2: Perform data wrangling, cleaning, and exploratory analysis with Python CO3: Create and interpret data visualizations for effective communication CO4: Apply basic statistical concepts and develop predictive models					
urse Content:						
dule 1	**roduction to Data Science**	**iz**	**owledge based**	**10 Hours**		
Introduction to Data Science: Definitions and Applications, Data Science Lifecycle, Python for Data Science: Syntax, Variables, Data Types, Control Flow, Setting up Environment: Jupyter Notebook, Anaconda, Google Colab, Working with Python Libraries: NumPy and Pandas Basics, Real-world applications of Data Science (case studies from healthcare, finance, and social media)						
dule 2	**ta Wrangling and Exploration**	**signment**	**plementation**	**12 Hours**		
DataFrames and Series in Pandas , Data Cleaning: Missing Values, Duplicates, Data Type Conversion, Data Transformation: Sorting, Filtering, Merging, Grouping,Feature Engineering Basics, Exploratory Data Analysis (EDA): Descriptive Statistics, Distributions, Outlier Detection, Hands-on: Analyzing a public dataset (e.g., Titanic, Iris)						
dule 3	**ta Visualization and Communication**	**rm paper/Assignment**	**plementation**	**11 Hours**		
Introduction to Data Visualization: Importance & Principles,Visualization with Matplotlib and Seaborn Line Charts, Bar Charts, Histograms, Boxplots, Pairplots, Heatmaps, KDE plots, and advanced visualizations, Creating Dashboards using Plotly or Streamlit (Intro), Data Storytelling: How to Present Data Insights Effectively , Project: Create an interactive EDA dashboard						

dule 4	roduction to Statistics & Predictive Modeling	rm paper/Assignment	plementation	12 Hours

Descriptive Statistics: Mean, Median, Mode, Variance, Standard Deviation, Probability Basics and Distributions , Hypothesis Testing: t-Test, p-value, Confidence Intervals, Correlation and Causation, Introduction to Regression:

- Simple and Multiple Linear Regression
- Classification Overview: Logistic Regression

Introduction to Model Evaluation: Accuracy, Confusion Matrix, Precision, Recall, Case Study: Predictive modeling on a real dataset

xtbook(s):

Title: *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter* ,**Author:** Wes McKinney,**Publisher:** O'Reilly Media, **Edition:** 3rd Edition, 2023

ferences:

1. **Title:** *Practical Statistics for Data Scientists: 50+ Essential Concepts,***Authors:** Peter Bruce, Andrew Bruce, Peter Gedeck, **Publisher:** O'Reilly Media, 2nd Edition (2021)
2. **Title:** *Doing Data Science,* **Authors:** Cathy O'Neil, Rachel Schutt, **Publisher:** O'Reilly Media
3. **Title:** *An Introduction to Statistical Learning with Applications in R,***Authors:** Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, **Publisher:** Springer, 2nd Edition (2021)

Catalogue prepared by	Dr.Saira Banu
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	Academic Council Meeting No.

Course Code: CSD1501	**urse Title: R Programming For Data Science** **pe of Course: Theory Only**	- P- C	0			2
Version No.						
Course Pre-requisites	**L**					
Anti-requisites	-					
urse Description	This course is designed to provide the core concepts of data analytics in the R environment. Initially train them with basic R, then progressively increase the difficulty as they move along in the course, capping with advanced techniques through case studies. Mastering the core concepts and techniques of data analytics in R, will help the students to apply their knowledge to a wide range of Data Analytics. R is now considered one of the most popular analytics tools in the world.					
ourse Objective	This lab-based course equips students with practical skills in R programming for statistical computing and data analysis. Students will work hands-on with real-world datasets to perform data preprocessing, visualization, and modeling. The course covers key machine learning algorithms including regression, classification, and dimensionality reduction using R. By the end of the course, students will develop, implement, and evaluate end-to-end analytics workflows using R and RStudio.					
urse Out Comes	**After successful completion of the lab course, students will be able to:** **CO1: Develop foundational R scripts to manage data types, structures, and apply basic transformations.** **CO2: Visualize and explore data using ggplot2 and dplyr, drawing meaningful insights.**					

	CO3: Implement and evaluate regression, classification, and dimensionality reduction models using R. **CO4: Execute mini-projects demonstrating analytical thinking and data-driven problem-solving using real-world datasets.**
urse Content:	

t of Laboratory Tasks:

1. Introduction to R and RStudio
   a. Setting up R and RStudio
   b. Basic R syntax and data types
   c. Arithmetic operations in R
   d. Working with variables and assignments.
   e. Printing and displaying data
2. Working with directory in R, Loading and handling data in R

Data Structures in R

   a. Vectors: creating, indexing, and operations
   b. Matrices and arrays
   c. Lists and data frames
   d. Factors and character vectors
   e. Basic data manipulation and exploration
3. Data Visualization with ggplot2
   a. Installing and loading ggplot2
   b. Creating scatter plots, bar plots, line plots, and histograms
   c. Customizing plot aesthetics and themes
   d. Faceting and combining plots
4. Data Transformation with dplyr.
   a. Introduction to dplyr package
   b. Selecting, filtering, and arranging data
   c. Grouping and summarizing data
   d. Joining and merging data sets
5. Introduction to Machine Learning with R
   a. Installing and loading necessary packages
   b. Splitting data into training and testing sets
   c. Building a simple machine learning model
   d. Model evaluation and prediction
6. Correlation and covariance
   a. Find the correlation matrix.
   b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data
7. Regression model - Create a regressionmodel for a given dataset
8. Implement the multiple regression model for the given dataset.
9. Principal Component Analysis - Perform PrincipalComponent Analysis(PCA) using R
10. Implement k-NearestNeighbors (kNN) classification using R
11. Evaluate theperformance of NaiveBayes classifier usingR.
12. Evaluate the performance of the Decision Tree classifier using R.
13. Evaluate the performance of Random Forest Classifier using R.
14. Mini Project - Applying R programming skills to areal-world dataset
    a. Data cleaning, visualization, analysis,and interpretation
    b. Presentation of findings

geted Application & Tools that can be used

Tools: RStudio / Google Colab

Project work/Assignment:

ignment:

ring the course, students would need to do coding assignments to learn to train and use different models.

Sample coding assignments include:

alysis of Sales Report of a Clothes Manufacturing Outlet.

mcast Telecom Consumer Complaints. **Web Data Anslysis**
t Book : **1)** ***Hands-On Programming with R: Write Your Own Functions and Simulations,*** **Author: Garrett Grolemund, Publisher: O'Reilly Media,Year: 2023** **2)** ***R for Data Science: Import, Tidy, Transform, Visualize, and Model Data,*** **Authors: Hadley Wickham, Mine Çetinkaya-Rundel, Garrett Grolemund,Publisher: O'Reilly Media,Edition: 2nd Edition, 2023.**

Course Code: CSE 3035	**urse Title: R Programming For Data Science** **e of Course: Theory Only -Program Core**	**- P- C**	3			3
Version No.						
Course Pre-requisites	**L**					
Anti-requisites	.					
urse Description	This course is designed to provide the core concepts of data analytics in the R environment. Initially train them with basic R, then progressively increase the difficulty as they move along in the course, capping with advanced techniques through case studies. Mastering the core concepts and techniques of data analytics in R, will help the students to apply their knowledge to a wide range of Data Analytics. R is now considered one of the most popular analytics tools in the world.					
ourse Objective	The objective of the course is to familiarize the learners with the concepts of **R Programming For Data Science** and attain **Skill Development** through **Experiential Learning** techniques.					
urse Out Comes	**On successful completion of this course the students shall be able to:** CO1: Summarize the R functions effectively to perform fundamental data analysis. **[Understand]** CO2: Apply suitable statistical methods to interpret diverse types of data **[Apply]** CO3:Illustrate Regression analysis on provided datasets **[Apply]** CO4: Demonstrate analytical and evaluative skills in machine learning classification **[Apply]**					
urse Content:						
Module 1	**roduction TO R**	ignment	a Collection/Interpretation			**12 Sessions**
Topics: **Introduction to R, Overview of data analysis, Working with directory in R, Loading and handling data in R, Data Visualization with ggplot2, Data Transformation with dplyr.**						
Module 2	**loratory Data Analysis**	ding Assignment	Case Study			**11 Sessions**
ics: **Exploring a new dataset, Anomalies in numerical data, Visualizing relations between variables, Assumptions of Linear Regression, Validating Linear Assumption, Missing Values, Covariation, Patterns and Models, ggPlot2 Calls.**						
Module 3	**gression Analysis**	ding Assignment	Project			**10 Sessions**
ics: **ntroduction, Types of Regression Analysis Models, Linear Regression, Simple Linear Regression, Non-Linear Regression, Regression Analysis with Multiple Variables, Cross Validation, Principal Component Analysis, Factor Analysis.**						
Module 4	**ssification**	iz	Project			**12 Sessions**
ics:						

Introduction, Different types of Classification, Logistic Regression, Support Vector Machines, K-Neatest Neighbors, Naïve Bayes Classifier, Decision Tree Classification, Random Forest Classification, Evaluation.
Text Book 1. Hadley Wickham and Garrett Grolemund, R for Data Science Import, Tidy, Transform, Visualize, and Model Data, O'Reilly Media, 2017. 2. Thomas Mailund, Beginning Data Science in R, Data Analysis, Visualization, and Modelling for the Data Scientist, APress, 2022. 3. Gareth James Daniela Witten Trevor Hastie Robert Tibshirani, An Introduction to Statistical Learning Gareth James Daniela Witten Trevor Hastie Robert Tibshirani with Applications in R, Springer, 2017.
ferences 1. Nina Zumel and John Mount Foreword By Jeremy Howard and Rachel Thomas, Practical Data Science with R, MANNING SHELTER ISLAND, 2020. 2. Dr. Bharati Motwani, "Data Analytics using R", Wiley, 2019. **Web resources:** 1. https://machinelearningmind.com/2019/10/27/assumptions-of-linear-regression-how-to-validate-and-fix/ 2. https://www.geeksforgeeks.org/machine-learning-model-evaluation/ 3. https://www.geeksforgeeks.org/r-programming-for-data-science/ 4. https://r4ds.had.co.nz/ 5. https://nptel.ac.in/courses/106102064
Topics relevant to "SKILL DEVELOPMENT": Regression model, classifier for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

Course Code: AID1702	**urse Title:** Machine Learning Lab for Intelligent Data Science **pe of Course: Lab**	**P- C**	0		1
Version No.					
Course Pre-requisites	-				
Anti-requisites	-				
urse Description	This lab course offers hands-on experience in applying machine learning and intelligent data processing techniques to real-world problems. Students will explore data preprocessing, model building, feature engineering, and intelligent analytics using modern tools and frameworks. The course emphasizes practical implementation through use cases in healthcare, finance, IoT, and smart systems.				
Course Objective	1.To provide practical experience in implementing machine learning algorithms and intelligent data workflows. 2.To develop skills in preprocessing, model evaluation, feature engineering, and real-world intelligent data applications.				
urse Out Comes	**On successful completion of the course the students shall be able to:** CO1 : Apply machine learning algorithms for both supervised and unsupervised tasks. **CO2**: Perform data preprocessing, feature engineering, and model optimization. **CO3**: Use model evaluation techniques and address overfitting and bias. **CO4**: Build intelligent data-driven solutions for industry-relevant applications.				

urse Content:

t of Laboratory Tasks:

Lab No.	Title	Description
1	**Data Preprocessing and Cleaning**	Handle missing values, categorical encoding, outlier detection, and feature scaling using Python.
2	**Exploratory Data Analysis (EDA)**	Visualize and summarize data distributions, relationships, and patterns using seaborn/matplotlib.
3	**Model Evaluation Metrics**	Implement and compare Accuracy, Precision, Recall, F1-Score, ROC-AUC across classifiers.
4	**Linear and Logistic Regression**	Predict outcomes using regression models and interpret coefficients and ROC curves.
5	**Decision Trees and Random Forests**	Build interpretable and ensemble models; analyze feature importance.
6	**Gradient Boosting (XGBoost / LightGBM)**	Apply boosting models and tune parameters for performance.
7	**Support Vector Machines (SVM)**	Implement classification with SVM; explore linear vs kernel SVMs.
8	**k-Nearest Neighbors (k-NN)**	Build k-NN models for classification and regression tasks.
9	**Neural Network (FFNN)**	Train a simple feedforward neural network with backpropagation in Keras or PyTorch.
10	**Hyperparameter Tuning**	Use GridSearchCV, RandomizedSearchCV, or Optuna for model optimization.
11	**Dimensionality Reduction**	Apply PCA, LDA, and t-SNE for visualization and preprocessing.

12	**Autoencoders for Feature Learning**	Use autoencoders for unsupervised feature extraction.
13	**Data Annotation and Labeling Tools**	Explore and use tools like Label Studio, CVAT for supervised data labeling.
14	**Smart Application Case Study I – Healthcare**	Build a disease prediction model (e.g., diabetes, heart disease).
15	**Smart Application Case Study II – Finance / IoT**	Implement fraud detection or traffic forecasting with real-world datasets.

Text Book

1.***Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow,*****Author**: Aurélien Géron, **Publisher**: O'Reilly Media,**Edition**: 3rd Edition,**Year**: **2023,ISBN**: 9781098125974

Course Code: AID1701	**urse Title: Machine Learning for Intelligent Data Science** **pe of Course: Theory**	**T- P- C**	2	0	0	2
Version No.						
Course Pre-requisites	Basic programming (Python/Java/R), Linear Algebra, Probability & Statistics, Intro to Data Science					
Anti-requisites	-					
urse Description	Through the study of incident response and contingency planning, including incident response plans, disaster recovery plans, and business continuity plans, this course aims to help students comprehend the principles of risk management. This course explores the intersection of machine learning and intelligent data science, focusing on how learning algorithms empower smart, data-driven systems. Students will gain a solid foundation in supervised and unsupervised learning, delve into deep learning, and learn how to apply these techniques to build intelligent applications across domains such as healthcare, finance, and IoT. With a blend of theory and hands-on practice, the course emphasizes model interpretability, ethical AI, and real-world problem-solving using intelligent automation. Students will work with modern tools and frameworks (such as Python, Scikit-learn, TensorFlow, and PyTorch) to build robust, scalable models that drive intelligent decision-making. By the end of the course, learners will be equipped to design, implement, and evaluate machine learning pipelines within intelligent data science systems, making them well-prepared for roles in data science, applied AI, and analytics.					
ourse Objective	e objective of the course is to familiarize the learners with the concepts of **Machine Learning for Intelligent Data Sciencey** and attain **Employability** through **Participative Learning** techniques.					
urse Out Comes	**On successful completion of the course the students shall be able to:** 1. Understand and apply the fundamental concepts of machine learning within intelligent data science systems. 2. Design and implement supervised learning models to solve real-world intelligent system problems. 3. Apply intelligent data preprocessing and feature engineering techniques to enhance model performance 4. Analyze and implement intelligent data science solutions for domain-specific applications.					

urse Content:	
dule 1: Foundations of Machine Learning and Intelligent Systems	**essions**
	Introduction to Machine Learning in the context of Intelligent Data Science- Types of Learning: Supervised, Unsupervised, Semi-supervised, Reinforcement- Model evaluation metrics (Accuracy, Precision, Recall, F1-Score, ROC-AUC)- Bias-Variance Tradeoff and Overfitting/Underfitting- Cross-validation and Model Selection. Data preprocessing: handling missing data, encoding, feature scaling.
dule 2: Supervised Learning for Smart Systems	**Sessions**
	Linear and Logistic Regression - Decision Trees, Random Forests, Gradient Boosting (XGBoost, LightGBM)- Support Vector Machines- k-Nearest Neighbors- Neural Networks: Basics of Feedforward and Backpropagation-Hyperparameter tuning (Grid Search, Random Search, Bayesian Optimization**)**
dule 3 Intelligent Data Processing and Feature Engineering	**Sessions**
	Smart Data Preprocessing (Outlier Detection, Noise Handling, Missing Data Imputation) - Feature Engineering using AI: Automated Feature Selection, Transformation, and Extraction- Dimensionality Reduction (PCA, LDA, t-SNE, Autoencoders)-Introduction to Feature Stores and MLOps Pipelines- Data Annotation and Labeling Tools (for supervised tasks)
Module 4 Applications and Case Studies of Intelligent Data Science	**7 Sessions**
	Intelligent Data Science in: Smart Healthcare (e.g., disease prediction, patient monitoring) - Finance (e.g., fraud detection, credit scoring) - Marketing (e.g., personalized targeting, churn prediction)- Smart Cities & IoT (e.g., traffic forecasting, energy optimization).
	Text Book 1. *"Intelligent Systems for Machine Learning: A Modern Approach to Automated AI"* **Author:** Dr. Zhiyao Duan, Dr. Sameer Singh, and Dr. Anna Koop,**Publisher:** Springer Nature,**Edition:** 1st Edition (2023),**ISBN:** 9783031325843
	ferences **1.** Alice Zheng and Amanda Casari "Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists" by -Edition: 1st Edition (2018)-Publisher: O'Reilly Media **2.** Christopher M. Bishop "Pattern Recognition and Machine Learning" Edition: 1st Edition (2006).Publisher: Springer **3.** Kevin P. Murphy "Machine Learning: A Probabilistic Perspective" Edition: 1st Edition (2012) *Publisher*: MIT Press **4.** Yoshua Bengio, and Aaron Courville "Deep Learning" by Ian Goodfellow, Edition: 1st Edition (2016) Publisher: MIT Press **5.** Foster Provost and Tom Fawcett "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" Edition: 1st Edition (2013) Publisher: O'Reilly Media.

	Web resources: **6.** NPTEL Course – Introduction to Machine Learning https://nptel.ac.in/courses/106/106/106106202/ **7.** Google Machine Learning Crash Course https://developers.google.com/machine-learning/crash-course **8.** Coursera – Machine Learning by Andrew Ng (Supervised Models) https://www.coursera.org/learn/machine-learning
	Topics relevant to "EMPLOYABILITY SKILLS": Data Preprocessing (Missing data handling, encoding, scaling)- Dimensionality Reduction Techniques (PCA, t-SNE, Autoencoders) **for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.**
Catalogue prepared by	Dr.S.Saravana Kumar
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: CSE 3035	**urse Title: R Programming For Data Science** **e of Course: Theory Only -Program Core**	- P- C	3			3
Version No.						
Course Pre-requisites	L					
Anti-requisites	-					
urse Description	This course is designed to provide the core concepts of data analytics in the R environment. Initially train them with basic R, then progressively increase the difficulty as they move along in the course, capping with advanced techniques through case studies. Mastering the core concepts and techniques of data analytics in R, will help the students to apply their knowledge to a wide range of Data Analytics. R is now considered one of the most popular analytics tools in the world.					
ourse Objective	The objective of the course is to familiarize the learners with the concepts of **R Programming For Data Science** and attain **Skill Development** through **Experiential Learning** techniques.					
urse Out Comes	**On successful completion of this course the students shall be able to:** CO1: Summarize the R functions effectively to perform fundamental data analysis. **[Understand]** CO2: Apply suitable statistical methods to interpret diverse types of data **[Apply]** CO3:Illustrate Regression analysis on provided datasets **[Apply]** CO4: Demonstrate analytical and evaluative skills in machine learning classification **[Apply]**					
urse Content:						

Module 1	**roduction TO R**	ignment	ta Collection/Interpretation	**12 Sessions**
Topics: **Introduction to R, Overview of data analysis, Working with directory in R, Loading and handling data in R, Data Visualization with ggplot2, Data Transformation with dplyr.**				
Module 2	**oloratory Data Analysis**	ding Assignment	Case Study	**11 Sessions**
pics: **Exploring a new dataset, Anomalies in numerical data, Visualizing relations between variables, Assumptions of Linear Regression, Validating Linear Assumption, Missing Values, Covariation, Patterns and Models, ggPlot2 Calls.**				
Module 3	**gression Analysis**	ding Assignment	Project	**10 Sessions**
pics: **ntroduction, Types of Regression Analysis Models, Linear Regression, Simple Linear Regression, Non-Linear Regression, Regression Analysis with Multiple Variables, Cross Validation, Principal Component Analysis, Factor Analysis.**				
Module 4	**ssification**	iz	Project	**12 Sessions**
pics: **Introduction, Different types of Classification, Logistic Regression, Support Vector Machines, K-Neatest Neighbors, Naïve Bayes Classifier, Decision Tree Classification, Random Forest Classification, Evaluation.**				

Text Book

4. Hadley Wickham and Garrett Grolemund, R for Data Science Import, Tidy, Transform, Visualize, and Model Data, O'Reilly Media, 2017.
5. Thomas Mailund, Beginning Data Science in R, Data Analysis, Visualization, and Modelling for the Data Scientist, APress, 2022.
6. Gareth James Daniela Witten Trevor Hastie Robert Tibshirani, An Introduction to Statistical Learning Gareth James Daniela Witten Trevor Hastie Robert Tibshirani with Applications in R, Springer, 2017.

ferences

3. Nina Zumel and John Mount Foreword By Jeremy Howard and Rachel Thomas, Practical Data Science with R, MANNING SHELTER ISLAND, 2020.
4. Dr. Bharati Motwani, "Data Analytics using R", Wiley, 2019.

Web resources:

6. https://machinelearningmind.com/2019/10/27/assumptions-of-linear-regression-how-to-validate-and-fix/
7. https://www.geeksforgeeks.org/machine-learning-model-evaluation/
8. https://www.geeksforgeeks.org/r-programming-for-data-science/
9. https://r4ds.had.co.nz/
10. https://nptel.ac.in/courses/106102064

Topics relevant to "SKILL DEVELOPMENT": Regression model, classifier for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSD1501	**urse Title: R Programming For Data Science** **pe of Course: Theory Only**	**- P- C**	0			2
Version No.						
Course Pre-requisites	**L**					
Anti-requisites	-					

urse Description	This course is designed to provide the core concepts of data analytics in the R environment. Initially train them with basic R, then progressively increase the difficulty as they move along in the course, capping with advanced techniques through case studies. Mastering the core concepts and techniques of data analytics in R, will help the students to apply their knowledge to a wide range of Data Analytics. R is now considered one of the most popular analytics tools in the world.
ourse Objective	This lab-based course equips students with practical skills in R programming for statistical computing and data analysis. Students will work hands-on with real-world datasets to perform data preprocessing, visualization, and modeling. The course covers key machine learning algorithms including regression, classification, and dimensionality reduction using R. By the end of the course, students will develop, implement, and evaluate end-to-end analytics workflows using R and RStudio.
urse Out Comes	**After successful completion of the lab course, students will be able to:** **CO1: Develop foundational R scripts to manage data types, structures, and apply basic transformations.** **CO2: Visualize and explore data using ggplot2 and dplyr, drawing meaningful insights.** **CO3: Implement and evaluate regression, classification, and dimensionality reduction models using R.** **CO4: Execute mini-projects demonstrating analytical thinking and data-driven problem-solving using real-world datasets.**
urse Content:	

t of Laboratory Tasks:

1. Introduction to R and RStudio
   a. Setting up R and RStudio
   b. Basic R syntax and data types
   c. Arithmetic operations in R
   d. Working with variables and assignments.
   e. Printing and displaying data
2. Working with directory in R, Loading and handling data in R

Data Structures in R

   a. Vectors: creating, indexing, and operations
   b. Matrices and arrays
   c. Lists and data frames
   d. Factors and character vectors
   e. Basic data manipulation and exploration

3. Data Visualization with ggplot2
   a. Installing and loading ggplot2
   b. Creating scatter plots, bar plots, line plots, and histograms
   c. Customizing plot aesthetics and themes
   d. Faceting and combining plots
4. Data Transformation with dplyr.
   a. Introduction to dplyr package
   b. Selecting, filtering, and arranging data
   c. Grouping and summarizing data
   d. Joining and merging data sets
5. Introduction to Machine Learning with R
   a. Installing and loading necessary packages
   b. Splitting data into training and testing sets
   c. Building a simple machine learning model
   d. Model evaluation and prediction
6. Correlation and covariance
   a. Find the correlation matrix.
   b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data

7. Regression model - Create a regressionmodel for a given dataset
8. Implement the multiple regression model for the given dataset.
9. Principal Component Analysis - Perform PrincipalComponent Analysis(PCA) using R
10. Implement k-NearestNeighbors (kNN) classification using R
11. Evaluate theperformance of NaiveBayes classifier usingR.
12. Evaluate the performance of the Decision Tree classifier using R.
13. Evaluate the performance of Random Forest Classifier using R.
14. Mini Project - Applying R programming skills to areal-world dataset
    c. Data cleaning, visualization, analysis,and interpretation
    d. Presentation of findings

geted Application & Tools that can be used

Tools: RStudio / Google Colab

Project work/Assignment:

ignment:

ring the course, students would need to do coding assignments to learn to train and use different models.

Sample coding assignments include:

alysis of Sales Report of a Clothes Manufacturing Outlet.

mcast Telecom Consumer Complaints.

Web Data Anslysis

t Book :

1) ***Hands-On Programming with R: Write Your Own Functions and Simulations,*** **Author: Garrett Grolemund, Publisher: O'Reilly Media,Year: 2023**

2) ***R for Data Science: Import, Tidy, Transform, Visualize, and Model Data,*** **Authors: Hadley Wickham, Mine Çetinkaya-Rundel, Garrett Grolemund,Publisher: O'Reilly Media,Edition: 2nd Edition, 2023.**

Course Code: CSD3407	**Course Title: Statistical Inference and Modeling** **Type of Course:1] Program Core**	**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.	1.0					
Course Pre-requisites	Introduction to Probability Calculus II					
Anti-requisites	**NIL**					
Course Description	This course introduces students to the principles and methods of statistical inference and modeling. Topics include estimation, hypothesis testing, confidence intervals, and both parametric and non-parametric models. Emphasis is placed on understanding theoretical foundations and applying statistical models to real-world data through computational tools. The course aims to build a strong conceptual and practical understanding of inference and modeling to prepare students for more advanced statistical and data science coursework. Students will learn how to analyze data, draw meaningful conclusions, and build predictive models using statistical techniques.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Statistica Inference and Modeling for **Employability** through **Problem Solving** Methodologies.					

Course Out Comes		On successful completion of this course the students shall be able to: 1. Apply sampling and estimation procedures to appropriately use and construe complex data. (Understand) 2. Design experiments by ANOVA and determine the existence of a statistically significant difference among several groups means. (Apply) 3. Develop appropriate regression models to predict the desired parameters. (Apply) 4. Apply non-parametric tests for uncertain distributions and decision analysis to identify feasible and viable decision alternatives. (Apply)
Course Content:		

Module 1	**SAMPLING AND ESTIMATION, HYPOTHESIS TESTING**	Assignment	**14 Hours**

Random vs Non-random sampling, Errors in sampling, Central Limit Theorem, Types of estimates, Estimating population mean using z and t statistics, Confidence interval estimation, Maximum likelihood estimation. Procedure for Hypothesis testing, Two tailed and one tailed Hypothesis testing, Type 1 and Type 2 errors, Hypothesis testing using z and t statistics, Chi-square test

urse Code: **E1500**	**urse Title: Computational Thinking using Python** **pe of Course: ESC**	**T-P-C**	2	0	2	3
rsion No.						
urse Pre-requisites						
ti-requisites	L					
urse Description	The course efficiently introduces fundamental ideas including conditionals, loops, functions, lists, strings, and tuples through some inspiring examples. It then discusses dynamic programming like handling exceptions and file usage. In terms of data structures, the course covers Python dictionaries, classes, and objects for constructing user-defined datatypes like linear and binary search.					
urse Object	The objective of the course is to familiarize the learners with the concepts of **Computational Thinking using Python** and attain **Skill Development** through **Participative Learning** techniques.					
urse Out Comes	On successful completion of the course the students shall be able to: 5) Describe algorithmic solutions for basic computing issues.. (Understand) 6) Explain data types and operators. (Understand) 7) Demonstrate control structures and Functions. (Apply) 8) Apply the data structures for the given data. (Apply) 9) Demonstrate the file operations. (Apply)					
urse Content:						

dule 1	**Computational Thinking And Problem Solving**	signment		ogramming	**6 Sessions**
Topics: Fundamentals of Computing– Identification of Computational Problems Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi					
dule 2	**tatypes, Expressions, Statements**	signment		ogramming	**essions**
Topics: Python interpreter and interactive mode,debugging; values and types: int, float, boolean, string , and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.					
dule 3	**ntrol flow, Functions, Strings**	signment		ogramming	**essions**
Topics: Conditionals:Boolean values and operators, conditional (if), alternative (if else),chained conditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values,parameters, local and global scope, function composition, recursion; Strings: string slices,immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.					
dule 4	**ts, Tuples, Dictionaries**	signment		ogramming	**essions**
pics: ts: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing- list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.					
dule 5	**es**	signment		ogramming	**essions**
es and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).					
ject work/Assignment: 1. **Assignment 1 on (Module 1 and Module 2)** 2. **Assignment 2 on (Module 3 and Module 4 & 5)**					
Text Book 1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021 2. Eric Matthes, Python Crash Course,: A Hands-On, Project-Based Introduction to Programming, 3rd Edition, 2023					
References 1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016. 2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017. **Web Resources** W1. https://onlinecourses.nptel.ac.in/noc20_cs70/preview					

Topics relevant to development of "Employability": Data structures using python.
Topics relevant to "PROFESSIONAL ETHICS": Naming and coding convention for simple programs using python.

Course Code: CSE2000	**Course Title: Program Solving Using C** **Type of Course: Theory**	**L- T-P-C**	2	0	0	2
Version No.	1.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. ACAlso by learning the basic programming constructs they can easily switch over to any other language in future.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Problem Solving Using C and attain Employability through Problem Solving Methodologies.					
Course Outcomes	**On successful completion of this course the students shall be able to:** 1. Write algorithms and to draw flowcharts for solving problems 2. Demonstrate knowledge and develop simple applications in C programming constructs 3. Develop and implement applications using arrays and strings 4. Decompose a problem into functions and develop modular reusable code 5. Solve applications in C using structures and Union 6. Design applications using Sequential and Random Access File Processing.					
Course Content:						
Module 1	Introduction to C Language	Quiz	Problem Solving	**6 Sessions**		
Topics: Introduction to Programming – Algorithms – Pseudo Code - Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.						
Module 2	Introduction to Arrays and Strings	Quiz	Problem Solving	**6 Sessions**		
Topics: **Arrays:** Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs – Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs – Matrix operations. **Strings:** Introduction – Declaring and Initializing String Variables – Reading Strings from Terminal – Writing String to Screen – String Handling Functions.						
Module 3	Functions and Pointers	Quiz	Problem Solving	**6 Sessions**		
Topics: **Functions:** Introduction – Need for User-defined functions – Elements of User-Defined Functions: declaration, definition and function call–Categories of Functions – Recursion. **Pointers:** Introduction – Declaring Pointer Variables – Initialization of Variables – Pointer Operators – Pointer Arithmetic – Arrays and Pointers – Parameter Passing: Pass by Value, Pass by Reference.						

Course Code: CSE2001	Course Title: Program Solving Using C Lab Type of Course: Lab	L- T-P-C	0	0	4	2
Version No.	1.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. ACAlso by learning the basic programming constructs they can easily switch over to any other language in future.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Problem Solving Using C and attain Employability through Problem Solving Methodologies.					
Course Outcomes	**On successful completion of this course the students shall be able to:** 1. Write algorithms and to draw flowcharts for solving problems 2. Demonstrate knowledge and develop simple applications in C programming constructs 3. Develop and implement applications using arrays and strings 4. Decompose a problem into functions and develop modular reusable code 5. Solve applications in C using structures and Union 6. Design applications using Sequential and Random Access File Processing.					
Course Content:						

List of Practicals:

Lab Sheet 1: 10 Sessions

Program 1: Sum of Two Numbers
Program 2: Find the Greatest of Three Numbers
Program 3: Check Even or Odd using Conditional Operator
Program 4: Print Multiplication Table using Loop
Program 5: Count Digits in a Number using While Loop
Program 6: Demonstration of Preprocessor Directives
Program 7: Simple Calculator using Switch Case

Lab Sheet 2: 10 Sessions

Program 1: Check Whether a Number is Positive, Negative or Zero
Program 2: Find the Sum of First N Natural Numbers
Program 3: Check Whether a Number is Prime or Not
Program 4: Find Factorial of a Number
Program 5: Reverse a Number
Program 6: Simple Number Guessing Game

Lab Sheet 3: 10 Sessions

Program 1: Linear Search in a One-Dimensional Array
Program 2: Bubble Sort on an Integer Array
Program 3: Matrix Addition (2D Arrays)
Program 4: Count Vowels in a String
Program 6: Selection Sort on an Array

Lab Sheet 4: 10 Sessions

Program 1: Sum of Two Numbers Using User-Defined Function
Program 2: Factorial Using Recursion
Program 3: Swap Two Numbers Using Call by Value (No Swap)
Program 4: Swap Two Numbers Using Call by Reference (With Swap)
Program 5: Pointer Basics - Access and Modify Variable via Pointer

Program 6: Accessing Array Elements Using Pointers **Lab Sheet 5: 10 Sessions** Program 1: Basic Structure Usage Program 2: Input and Display Array of Structures Program 3: Array Inside Structure (Student Marks) Program 4: Structure with Nested Structures (Date of Birth) Program 5: Union Example and Member Access **Lab Sheet 6: 10 Sessions** Program 1: Write to a File (Text Mode) Program 2: Read from a File (Text Mode) Program 3: Append Data to a File Program 4: Count Characters, Words and Lines in a File Program 5: Write and Read Structure to/from a Binary File Program 6: Random Access in File (Update a Record)
Text Book(s): **1. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316- 513-0.**
Reference Book(s): **1. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.** **2. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.** **3. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015** **4. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.** **5. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.**
Web Links and Video Lectures: **1. https://nptel.ac.in/courses/106/105/106105171/** **2. https://archive.nptel.ac.in/courses/106/104/106104128/**

Catalogue preparedby	**Dr.S.Saravana Kumar**
Recommended by theBoard of Studies on	
Date of Approval by the Academic Council	

Course Code: CSE2255	**Course Title:** CSE2255 - Object Oriented Programming Using Java **Type of Course: Theory - PCC**	**L-T- P- C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	Nil					
Anti-requisites	Nil					
Course Description	This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Problem-Solving using JAVA and attain **SKILL DEVELOPMENT** through **EXPERIENTIAL LEARNING** techniques					
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1:** Describe the basic programming concepts. [Understand] **CO2:** Apply the concept of classes, objects and methods to solve problems. [Application]					

	CO3: Apply the concept of arrays and strings. [Appy] **CO4:** Implement inheritance and polymorphism building secure applications. [Apply] **CO5:** Apply the concepts of interface and error handling mechanism. [Apply]			
Course Content:				
Module 1	**Basic Concepts of Programming and Java**	Assignment	Problem Solving	**9 Sessions**
Topics: Introduction to Principles of Programming: Process of Problem Solving, Java program structure, Download Eclipse IDE to run Java programs, Sample program, Data types, Identifiers, Variables, Constants in java, Operators, Assignments and Expression, Basic Input/ Output functions, Control Statements: Branching and Looping.				
Module 2	**Classes, objects, methods and Constructors**	Assignment	Problem Solving	**10 Sessions**
Topics: Classes, Objects and Methods: Introduction to object Oriented Principles, defining a class, adding data members and methods to the class, access specifiers, instantiating objects, reference variable, accessing class members and methods. Static Polymorphism: Method overloading, constructors, constructor overloading, this keyword, static keyword, Nested classes, Accessing members in nested classes.				
Module 3	**Arrays, String and String buffer**	Assignment	Problem Solving	**8 Sessions**
Topics: Arrays: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Array of objects. String: Creation & Operation. String builder class, methods in String Buffer.				
Module 4	**Inheritance and Polymorphism**	Assignment	Problem Solving	**10 Sessions**
Topics: Inheritance: Defining a subclass, Types of Inheritance, super keyword. Dynamic Polymorphism: Method overriding. Final keyword: with data members, with member functions and with class. Abstract keyword: with data members, with member functions and with class, Exception handling.				
Module 5	**Input & Output Operation in Java**	Assignment	Problem Solving	**8 Sessions**
Input/output Operation in Java(java.io Package), Streams and the new I/O Capabilities, Understanding Streams, working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces.				

Text Book

T1 Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Education, 11th Edition,2019.

References

R1. Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Tenth Edition, Pearson 2015.

R2: James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.4th Edition, 2000.

R3. E. Balagurusamy, "Programming with Java", Tata McGraw Hill Education, 6th Edition, 2019.

E book link R1: http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-1.pdf

E book link R2: Java(tm) Design Patterns: A Tutorial([PDF] [7qmsenjl97t0] (vdoc.pub)

Web **resources**

ps://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q

ps://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to development of "Skill Development":

1. Static Polymorphism
2. Method overloading, constructors
3. constructor overloading
4. this keyword
5. static keyword and Inner classes
6. Inheritance and Polymorphism.

for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component

mentioned in course handout.

Course Code: CSEXXXX	**Course Title:** CSE2256 - Object Oriented Programming Using Java Lab **Type of Course: Lab - PCC**	**L-T- P- C**	0	0	4	2
Version No.	2.0					
Course Pre-requisites	CSEXXXX – Problem Solving Using C					
Anti-requisites	Nil					
Course Description	This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Problem-Solving using JAVA and attain **SKILL DEVELOPMENT** through **EXPERIENTIAL LEARNING** techniques					
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1:** Demonstrate basic programming concepts. [Apply] **CO2:** Apply the concept of classes, objects and methods to solve problems. [Application] **CO3:** Apply the concept of arrays and strings. [Appy] **CO4:** Implement inheritance and polymorphism building secure applications. [Apply] **CO5:** Apply the concepts of interface and error handling mechanism. [Apply]					
Course Content:						
Module 1	**Basic Concepts of Programming and Java**	Assignment	Problem Solving	**12 Sessions**		
Download Eclipse IDE to run Java programs, Sample programs on Data types, Identifiers, Variables, Constants in java, Operators, Assignments and Expression, Basic Input/ Output functions, Control Statements: Branching and Looping.						
Module 2	**Classes, objects, methods and Constructors**	Assignment	Problem Solving	**14 Sessions**		
Problem solving using Classes, Objects and Methods: defining a class, adding data members and methods to the class, access specifiers, instantiating objects, reference variable, accessing class members and methods. Use Static Polymorphism: Method overloading, constructors, constructor overloading, this keyword, static keyword, Nested classes, Accessing members in nested classes.						
Module 3	**Arrays, String and String buffer**	Assignment	Problem Solving	**10 Sessions**		
Using Arrays and Strings : Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Array of objects. String: Creation & Operation. String builder class, methods in String Buffer.						
Module 4	**Inheritance and Polymorphism**	Assignment	Problem Solving	**12 Sessions**		
Inheritance: Defining a subclass, Types of Inheritance, super keyword. Dynamic Polymorphism: Method overriding. Final keyword: with data members, with member functions and with class. Abstract keyword: with data members, with member functions and with class, Exception handling.						
Module 5	**Input & Output Operation in Java**	Assignment	Problem Solving	**12 Sessions**		
Input/output Operation in Java(java.io Package), Streams and the new I/O Capabilities, Understanding Streams, working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces.						
P1: Programming Exercises on Basic Concepts. LEVEL 1: Discuss about datatypes and variables. LEVEL 2: Demonstrate a simple java program P2: Programming Exercises on Basic Concepts. LEVEL 1: Discuss about datatypes and variables.						

LEVEL 2: Demonstrate a simple java program
P3: Programming Exercises on operators, expressions based on a given scenario.
LEVEL 1: Explain operators, expressions.
LEVEL 2: Demonstrate operators
P4: Programming Exercises Command Line Arguments based on a given scenario.
LEVEL 1: Explain command line arguments
LEVEL 2: Demonstrate command line arguments
P5: Programming Exercises on basic Input/ Output functions and Control Statements: Branching
LEVEL 1: Explain Input/ Output functions
LEVEL 2:Demonstrate Control Statements: Branching
P6: Programming Exercises on Control Statements: Looping
LEVEL 1: Explain variour loops.
LEVEL 2:Demonstrate Control Statements: Looping
P7: Programming Exercises on Creating Objects, classes on a given scenario.
LEVEL 1: Illustrate class, object and methods.
LEVEL 2: Execute java program using class and objects
P8: Programming Exercises on Adding methods and Constructors to the class based on a given scenario.
LEVEL 1: Illustrate methods and constructors
LEVEL 2: Execute java program using methods and constructors
P9: Programming Exercises on methods based on a given scenario.
LEVEL 1: Illustrate method overloading
LEVEL 2: Apply method overloading for the given scenario.
P10: Programming Exercises on methods based on a given scenario.
LEVEL 1: Illustrate constructors overloading
LEVEL 2: Apply constructor overloading for the given scenario
P11: Programming Exercises on methods for static members bassed on a given scenario.
LEVEL 1: Benefits of usage static members
LEVEL 2: Usage of Static Members for the given scenario
P12: Programming Exercises on static methods based on a given scenario.
LEVEL 1: Benefits of usage static methods
LEVEL 2: Usage of Static Methods for the given scenario.
P13: Programming Exercises on nested Classes based on a given scenario.
LEVEL 1: Benefits of usage nested classes
LEVEL 2: Apply the concept of usage of nested classes for the given scenario
P14: Programming Exercises on Arrays and its built-in functions based on a given scenario.
LEVEL 1: Illustrate one dimensional arrays and its functions.
LEVEL 2: Demonstrate programs with single-dimensional arrays and operations.
P15: Programming Exercises on Arrays and its built-in functions based on a given scenario.
LEVEL 1: Illustrate multi dimensional arrays and its functions.
LEVEL 2: Demonstrate programs with multi-dimensional arrays and operations.
P16: Programming Exercises on String Class and its built-in functions based on a given scenario.
LEVEL 1: Explain about String class and String methods.
LEVEL 2: Execute simple java applications for String and StringBuffer operations
P17: Programming Exercises on String Buffer Class and its built-in functions based on a given scenario.
LEVEL 1: Explain about StringBuffer class and String methods.
LEVEL 2: Execute simple java applications for String and StringBuffer operations
P18: Programming Exercises on String Builders and its built-in functions based on a given scenario.
LEVEL 1: Explain about String Builders.
LEVEL 2: Execute java applications for String Builders
P19: Programming Exercises on single, multi level Inheritance and super keyword based on given scenario.
LEVEL 1: Explain single and multi level inheritance.
LEVEL 2: Demonstrate simple applications for the different types of inheritance
P20: Programming Exercises hierarchical Inheritance and super keyword based on given scenario.
LEVEL 1: Explain hierarchical inheritance.
LEVEL 2: Demonstrate simple applications for hierarchical inheritance
P21: Programming Exercises on Overriding.

LEVEL 1: Differentiate method overloading and method overriding.
LEVEL 2: Demonstrate simple program with dynamic method dispatch.
P22: Programming Exercises on Final based on given scenario.
LEVEL 1: Implement programs using concept of final.
LEVEL 2: Use final keyword for the given problem
P23: Programming Exercises on Abstract keyword based on given scenario.
LEVEL 1: Implement programs using concept of Abstract.
LEVEL 2: Use abstract keyword for the given problem
P24: Programming Exercises on Interface based on a given scenario.
LEVEL 1: Differentiate abstract class about interface
LEVEL 2: Implement interfaces in the given problem
P25: Programming Exercises on Exception Handling based on a given scenario.
LEVEL 1: Explain exception handling
LEVEL 2: Solve the given problem using exception handling mechanism.
P26: Programming Exercises on Character Stream Classes based on a given scenario.
LEVEL 1: Explain Character Stream Classes
LEVEL 2: Solve the given problem using Character Stream Class.
P27: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.
P28: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.
P29: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.
P30: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.

Targeted Application & Tools that can be used : JDK /Eclipse IDE/Visual Studio Code / net Beans IDE.

Text Book

T1 Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Education, 11th Edition,2019.

References

R1. Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Tenth Edition, Pearson 2015.

R2: James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.4th Edition, 2000.

R3. E. Balagurusamy, "Programming with Java", Tata McGraw Hill Education, 6th Edition, 2019.

E book link R1: http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-1.pdf

E book link R2: Java(tm) Design Patterns: A Tutorial([PDF] [7qmsenjl97t0] (vdoc.pub)

Web **resources**

ps://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q

ps://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to development of "Skill Development":

1. Static Polymorphism
3. Method overloading, constructors
4. constructor overloading
5. this keyword
6. static keyword and Inner classes
7. Inheritance and Polymorphism.

for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

Course Code: **CSE2251**	**Course Title:** Data Communications and Computer Networks **Type of Course:** **Theory / PCC**	**L- T-P- C**	3	**0**	0	**3**
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	**NIL**					
Course Description	The objective of this course is to provide knowledge in data communications and computer networks, its organization and its implementation, and gain practical experience in the installation, monitoring, and troubleshooting of LAN systems. The associated laboratory is designed to implement and simulate various networks using Cisco packet tracer, NS2. All the lab exercises will focus on the fundamentals of creating multiple networks, topologies and analyzing the network traffics.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Communications and Computer Networks and attain Employability through Problem Solving Methodologies.					
Course Outcomes	On successful completion of the course, the students shall be able to: 1] Ilustrate the Basic Concepts Of Data Communication and Computer Networks. 2] Analyze the functionalities of the Data Link Layer. 3] Apply the Knowledge of IP Addressing and Routing Mechanisms in Computer Networks. 4] Demonstrate the working principles of the Transport layer and Application Layer.					
Course Content:						
Module 1	Introduction and Physical Layer- CO1	Assignment	Problem Solving	**7 Sessions**		
Introduction to Computer Networks and Data communications, Network Components – Topologies, Transmission Media –Reference Models -OSI Model – TCP/IP Suite. Physical Layer -Analog and Digital Signals – Digital and Analog Signals – Transmission - Multiplexing and Spread Spectrum.						
Module 2	Reference Models and Data Link Layer – CO2	Assignment	Problem Solving	**7 Sessions**		
Data Link Layer - Error Detection and Correction – Parity, LRC, CRC, Hamming Code, Flow Control and Error Control, Stop and Wait, ARQ, Sliding Window, Multiple Access Protocols, CSMA/CD,CSMA/CA, IEEE 802.3, IEEE 802.11 Ethernet.						
Module 3	Network Layer –CO3	Assignment	Problem Solving	**10 Sessions**		
Network Layer Services - Network Layer Services, Switching Techniques, IP Addressing methods- IPv4 IPV6 – Subnetting. Routing, - Distance Vector Routing – RIP-BGP-Link State Routing –OSPF-Multi cast Routing-MOSPF- DVMRP – Broad Cast Routing. EVPN-VXLAN, VPLS, ELAN.						
Module 4	Transport and Application Layer - CO3	Assignment	Problem Solving	**10 Sessions**		
Transport Layers - Connection management – Flow control – Retransmission, UDP, TCP, congestion control, – Congestion avoidance (DECbit, RED) The Application Layer: Domain Name System (DNS), Domain Name Space, SSH, FTP, Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – – SNMP, Web Services, Virtual Networking.						

Targeted Application & Tools that can be used: Cisco Packet Tracer, Wireshark, and NS2.

Case Study/Assignment: Choose and analyze a network from any organization/Assignment proposed for this course in CO1-CO4

Problem Solving: Choose and appropriate devices and implement various network concepts.

Programming: Simulation of any network using NS2.

Text Book(s):

1. 1. Behrouz A. Forouzan, “Data Communications and Networking 5E”, 5 th Edition, Tata McGraw-Hill, 2017.

2. Andrew S Tanenbaum, Nick Feamster & David J Wetherall, “Computer Networks” Sixth Edition, Pearson Publication, 2022

Reference(s):

1.References

1. “Computer Networking: A Top-Down Approach”, Eighth Edition, James F. Kurose, Keith W. Ross, Pearson publication, 2021.

2. William Stallings, Data and Computer Communication, 8th Edition, Pearson Education, 2007.

3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.

E- Resources:

1. **https://archive.nptel.ac.in/courses/106/105/106105183/**
2. **http://www.nptelvideos.com/course.php?id=393**
3. **https://www.youtube.com/watch?v=3DZLItfbqtQ**
4. **https://www.youtube.com/watch?v= fIdQ4yfsfM**
5. **https://www.digimat.in/keyword/106.html**
6. **https://puniversity.informaticsglobal.com/login**

Course Code: CSE1504	**Course Title: Web Technologies** **Type of Course: Program core** **Theory**		**L-T- P-C**	2	0	0	2
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	**NIL**					
Course Description	This course highlights the comprehensive introduction to scripting languages that are used for creating web-based applications. The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills.					
Course Objective	**The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.**					
Course Outcomes	**On successful completion of this course the students shall be able to:** **CO1:** Implement web-based application using client-side scripting languages. **(Apply)** **CO2**: Apply various constructs to enhance the appearance of a website. **(Apply)** **CO3:** Apply server-side scripting languages to develop a web page linked to a database. **(Apply)**					
Course Content:						
Module 1	**Introduction to XHTML**	Quizzes and Assignments	Quizzes on various features of XHTML, simple applications			**20 Sessions**
	Basics: Web, WWW, Web browsers, Web servers, Internet. **XHTML:** Origins and Evolution of HTML and XHTML: Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Frames, Syntactic Differences between HTML and XHTML, Demonstration of applications using XHTML for Responsive web pages.					
Module 2	**Advanced CSS**	Quizzes and assignments	Comprehension based Quizzes and assignments; Application of CSS in designing webpages			**20 Sessions**
	Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks					
XML: Basics, Demonstration of applications using XML with XSLT.						

Module 3	**PHP – Application Level**	Quizzes and assignments	Application of PHP in web designing	**20 Sessions**

PHP: Introduction to server-side Development with PHP, Arrays, Superglobal Arrays, $GET and $ POST, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object Oriented Design, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP, Applications.

List of Laboratory Tasks:

Experiment No. 1: Demonstration of XHTML features

Level 1: Demonstration of various XHTML Tags (Level 1)
Level 2: Design and develop static web pages for an online Book store (Level 2).

Experiment No. 2: Application of CSS in web designing

Level 1: Design a document using XHTML and CSS to create a catalog of items for online electronic shopping.

Level 2: Create and save XML document for students' information and display the same using cascaded style sheet.

Experiment No. 3: Application of PHP in web designing.

Level 1: Write a PHP program to read the personal information of a person such as first name, last name, age, permanent address, and pin code entered by the user into a table created in MySQL. Read the same information from the database and display it on the front end.

Level 2: Using PHP develop a web page that accepts book information such as ISBN number, title, authors, edition, and publisher and store information submitted through the web page in MySQL database.

Experiment No. 4: Building a website.

Build a website for organizing an International Conference. The conference website must be able to collect the author's details and upload a file.

Targeted Application & Tools that can be used: **Xampp**
web server to be used to demonstrate PHP.

Project work/Assignment:

Assignments are given after completion of each module which the student need to submit within the stipulated deadline.

Textbook(s):

1] Robert. W. Sebesta, "*Programming the World Wide Web*", Pearson Education, 9th Edition, 2016.
2]Paul Deitel, Harvey Deitel, Abbey Deital,"Internet & World Wide Web How to Program", Fifth Edition, Pearson Education, 2021.

3]CSS Notes for Professionals, ebook available at https://books.goalkicker.com/CSSBook/ (Retrieved on Jan. 20, 2022)

4]Deitel, Deitel, Goldberg,"*Internet & World Wide Web How to Program*", Fifth Edition, Pearson Education, 2021.

Reference Book(s):

R1. Randy Connolly, Ricardo Hoar,"Fundamentals of Web Development", Pearson Education India, 1st. Edition.2016.

R2. Jeffrey C. Jackson,"Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition,2016.

Additional web-based resources

W1. W3schools.com
W2. Developer.mozilla.org/en-US/docs/Learn
W3. docs.microsoft.com
W4. informit.com/articles/ The Relationship Between Web 2.0 and Social Networking
https://presiuniv.knimbus.com/user#/home

Topics related to development of "FOUNDATION":

1. Web, WWW, Web browsers, Web servers, Internet.
2. CSS, PHP.
3. Designing the website for healthcare.

The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.

Course Code: CSE1505	**Course Title: Web Technologies Lab** **Type of Course: Program core lab course**	**L-T- P-C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	**NIL**					
Course Description	This course highlights the comprehensive introduction to scripting languages that are used for creating web-based applications. The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills.					
Course Objective	**The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.**					

Course Outcomes		**On successful completion of this course the students shall be able to:** **CO1:** Implement web-based application using client-side scripting languages. **(Apply)** **CO2**: Apply various constructs to enhance the appearance of a website. **(Apply)** **CO3:** Apply server-side scripting languages to develop a web page linked to a database. **(Apply)**
Course Content:		

Module 1	**Introduction to XHTML Features**	Quizzes and Assignments	Quizzes on various features of XHTML, simple applications		**8 Sessions**
	Standard XHTML Document Structure, Basic Text Markup such as headings, paragraphs, lists, tables, forms, and semantic tags.				
Module 2	**CSS Styling**	Quizzes and assignments	Comprehension based Quizzes and assignments; Application of CSS in designing webpages		**10 Sessions**
	Apply CSS3 to style HTML elements, including layout techniques, color schemes, typography, and responsive design principles.				

XML: Basics, Demonstration of applications using XML with XSLT.				
Module 3	**PHP – Application Level**	Quizzes and assignments	Application of PHP in web designing	**12 Sessions**
PHP: Introduction to server-side Development with PHP, Arrays, Superglobal Arrays, $GET and $ POST, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object Oriented Design, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP, Applications.				

List of Laboratory Tasks:

Experiment No. 1: Demonstration of XHTML features

Level 1: Demonstration of various XHTML Tags (Level 1)
Level 2: Design and develop static web pages for an online Book store (Level 2).

Experiment No. 2: Application of CSS in web designing

Level 1: Design a document using XHTML and CSS to create a catalog of items for online electronic shopping.

Level 2: Create and save XML document for students' information and display the same using cascaded style sheet.

Experiment No. 3: Application of PHP in web designing.

Level 1: Write a PHP program to read the personal information of a person such as first name, last name, age, permanent address, and pin code entered by the user into a table created in MySQL. Read the same information from the database and display it on the front end.

Level 2: Using PHP develop a web page that accepts book information such as ISBN number, title, authors, edition, and publisher and store information submitted through the web page in MySQL database.

Experiment No. 4: Building a website.

Build a website for organizing an International Conference. The conference website must be able to collect the author's details and upload a file.

Targeted Application & Tools that can be used: **Xampp**
web server to be used to demonstrate PHP.

Project work/Assignment:

Assignments are given after completion of each module which the student need to submit within the stipulated deadline.

Textbook(s):

1] Robert. W. Sebesta, "*Programming the World Wide Web*", Pearson Education, 9th Edition, 2016.
2]Paul Deitel, Harvey Deitel, Abbey Deital,"Internet & World Wide Web How to Program", Fifth Edition, Pearson Education, 2021.

3]CSS Notes for Professionals, ebook available at https://books.goalkicker.com/CSSBook/ (Retrieved on Jan. 20, 2022)

4]Deitel, Deitel, Goldberg,"*Internet & World Wide Web How to Program*", Fifth Edition, Pearson Education, 2021.

Reference Book(s):

R1. Randy Connolly, Ricardo Hoar,"Fundamentals of Web Development", Pearson Education India, 1st. Edition.2016.

R2. Jeffrey C. Jackson,"Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition,2016.

Additional web-based resources

W1. W3schools.com
W2. Developer.mozilla.org/en-US/docs/Learn
W3. docs.microsoft.com
W4. informit.com/articles/ The Relationship Between Web 2.0 and Social Networking
https://presiuniv.knimbus.com/user#/home

Topics related to development of "FOUNDATION":

4. Web, WWW, Web browsers, Web servers, Internet.
5. CSS, PHP.
6. Designing the website for healthcare.

The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.

Course Code: CSE2260	**Course Title: Database Management Systems** **Type of Course: Theory only - PCC**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Foundational understanding of data types, data structures, basic programming knowledge, familiarity with operating systems and file management. Basic knowledge of set theory, logic, and discrete mathematics to understand relational algebra and query formulation.					
Anti-requisites	NIL					
Course Description	This course introduces the foundational principles of database management systems, including data models, schemas, and architectures. This course provides a solid foundation on the relational model of data and the use of relational algebra. It develops skills in SQL for data definition, manipulation, and control, enabling students to construct and execute complex queries. The course also introduces the concept of object oriented and object relational databases and modern database technologies like **NoSQL.** The also course allows the students to gain insights into data storage structures and indexing strategies for optimizing query performance.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain **Employability** through **Problem Solving** Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 5. Describe the fundamental elements of relational database management systems. [Understand] 6. Examine databases using SQL query processing and Optimization. [Apply] 7. Design simple database systems applying the normalization constraints and demonstrate the database transaction processing, recovery, and security. [Apply] 8. Interpret the concept of advanced databases and its applications. [Apply]					
Course Content:						
Module 1	**Introduction to Database Modelling and Relational Algebra(Understand)**	Assignment	**Problem Solving**	**10 Sessions**		
Topics: **Introduction to Database:** Schema, Instance, 3-shema architecture, physical and logical data independence, Data isolation problem in traditional file system, advantages of database over traditional file systems. Entity Relationship (ER) Model, ER Model to Relational Model, Examples on ER model. **Relational Algebra** with selection, projection, rename, set operations, Cartesian product, joins (inner and outer joins), and division operator. Examples on Relational Algebra Operations.						

Module 2	**Fundamentals of SQL and Query Optimization (Apply)**	Assignment	**Programming**	**11 Sessions**

Topics:
SQL Database Querying, DDL, DML, Constraints, Operators, Set Operators, Aggregate Functions, Joins, Views, Procedures, Functions and Triggers.
Database programming issues and techniques: Embedded SQL, Dynamic SQL; SQL / PSM and NoSQL.
Query Optimization: Purpose, transformation of relational expressions, estimating cost and statistics of expression, choosing evaluation plans, linear and bushy plans, dynamic programming algorithms.

Module 3	**Relational Database Design & Transaction Management (Apply)**	Assignment	**Problem Solving**	**12 Sessions**

Topics:
Relational database design: Problems in schema design, redundancy and anomalies, Normal Forms based on Primary Keys-(1NF,2NF, 3NF), Boyce-Codd Normal Form, Multi valued Dependency (Fourth Normal Form), Join Dependencies (Fifth Normal Form), lossy and lossless decompositions, Database De-normalization.
Transaction Management: The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; The write-ahead log protocol; Check pointing; Recovering from a System Crash; Media Recovery; Other approaches and interaction with concurrency control.

Module 4	**Advanced DBMS Topics (Apply)**	**Assignment**	**Case Study**	**12 Sessions**

Topics:
Advanced topics: Object oriented database management systems, Deductive database management systems, Spatial database management systems, Temporal database management systems, Constraint database management systems.
New database applications and architectures such as Data warehousing, Multimedia, Mobility, NoSQL, Native XML databases (NXD), Document-oriented databases, Statistical databases.

Targeted Application & Tools that can be used:
Application Area: Relational database systems for Business, Scientific and Engineering Applications.
Tools/Simulator used: MySQL DB for student practice.
Also demonstration of ORACLE DB on object-relational database creation and JDBC connection.

3. Problem Solving: Constructing ER-Diagrams for a given real time requirements, Normalizing the databases, querying the databases using relational algebra.
4. Programming: Implementation of any given scenario using MySQL.

Text Books:
T1. Elmasri R and Navathe S B, “Fundamentals of Database System”, Pearson Publication, 7th Edition, 2018.
T2. RamaKrishna & Gehrke, “Database Management Systems” 3rd Edition, 2018, McGraw-Hill Education.
T3. W. Lemahieu, S. vanden Broucke and B. Baesens, “Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data”, Cambridge University Press, 2018.

References
R1 Avi Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, McGraw-Hill ,7th Edition, 2019.
R2 M. Kleppmann, “Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems”, O’Reilly, 2017.

Topics relevant to development of "FOUNDATION SKILLS": S - Skill Development: Relational database design using ER- Relational mapping, Implementation of given database scenario using MYSQLDB. Topics relevant to development of Employability: Develop, test and implement computer databases, creatingsophisticated, interactive and secure database applications Topics relevant to "HUMAN VALUES &PROFESSIONAL ETHICS": Nil

urse Code: CSE2264	Course Title: Essentials of Artificial Intelligence Type of Course: Program Core Course -Theory	-P-C	3			3
sion No.						
urse Pre-requisites	NIL					
i-requisites						
urse Description	This course introduces the student to the basics of artificial intelligence. In this course, the student first learns the various search methods for problem-solving, followed by knowledge-based logic representations. After that, the student will learn about uncertainty in AI, as well as approaches to solve such challenges such as Naïve Bayes Classifier and Hidden Markov Models. Topics: Uninformed search, Heuristic search, Local search, Adversarial search, Constraint satisfaction, logic, First Order Resolution, Probability, Naïve Bayes Classifier, and Hidden Markov Model (HMM).					
urse Objectives	The objective of the course is EMPLOYBILITY of student by using EXPERIENTIAL LEARNING techniques.					
urse OutComes	On successful completion of this course the students shall be able to: 1. Explain different methods of searching, proving, and analysis in AI [Understand] 2. Implement various graphical and adversarial search algorithms. [Apply] 3. Prove, by resolution, different situations using First Order Logic [Apply] 4. Solve sequence labeling problems using HMM [Apply]					

Course Content:				
dule 1	rch Methods for Problem-Solving	blem-Solving Tests	TEL Assignments	No. of Sessions: 13
Introduction – History of AI, Agents and Environment, Types of AI and Learning. State Space Search; General Formulation of Search Problems; Data Structures used in Searching. **Uninformed Search Algorithms** – Breadth First Search, Depth First Search, Uniform Cost Search, Generalized Uniform Cost Search (a.k.a Dijkstra's Single-Source Shortest Path), Iterative Deepening Depth-First Search, Time and Space Complexity Analysis of Uninformed Search Algorithms. **Heuristic Search Algorithms** – Heuristics and Admissibility, Greedy Best-First Search, A* Search and weighted A* Search.				
dule 2	vanced Search Methods	blem-Solving Tests	TEL Assignments	No. of Sessions: 12
Local Search – Local Search, Hill Climbing, Genetic Algorithms, Gradient Descent. **Adversarial Search** –				

Minimax Search, Alpha-Beta Pruning, Ideal Ordering. **Constraint Satisfaction** – Constraint Satisfaction Problems Definitions and Examples – Map Colouring, N Queens, Cryptarithmetic, Generalized CSP; Back-tracking Heuristics; Arc Consistency and Path Consistency				
dule 3	owledge-Based Logic Representation	tomated Theorem Proving using FOL Resolution	TEL Assignments	No. of Sessions: 10
Propositional Logic – Syntax and Semantics of Propositional Logic. Logical connectives. Inference Rules. Conjunctive and Disjunctive Normal Forms. **First Order Logic** – Syntax and Semantics of Propositional Logic. Logical connectives. Inference Rules. Conjunctive and Disjunctive Normal Forms. **Resolution** – Resolution Principle. Propositional and First Order Resolution. Applications for solving story problems using Resolution				
dule 4	certainty in AI	presenting problems as HMM	TEL Assignments	No. of Sessions: 06
Probability – Probability Definitions. Conditional Probability. Bayes Theorem. Naïve Bayes Classifier. Using Naïve Bayes Classifier for Supervised Learning. **Hidden Markov Models** – Definition of HMM. Sequence Labeling and Markov Assumption. Sub-Problems in HMM and their solutions – Forward Probability and Viterbi Algorithm. Applications of Sequence Labeling in Natural Language Processing (Eg. Part-of-Speech Tagging). **Introduction to Deep Learning** – Artificial Neurons, Activation Functions, Multilayer Perceptron.				

Targeted Application & Tools that can be used:

1. Implementation of a shortest-path finder using different search algorithms.
2. Implementation of a sequence labeler using Viterbi Algorithm.

ject work/Assignment: Mention the Type of Project /Assignment proposed for this course

1. Group project on one of the topics mentioned above (Eg. Adversarial search).

tbook(s):

1. Stuart Russel and Peter Norvig. *Artificial Intelligence: A Modern Approach*. 4th Edition. Pearson Education. 2022.
2. Lavika Goel. *Artificial Intelligence: Concepts and Applications*. 1st Edition. Wiley. 2021.
3. Elaine Rich, Kevin Knight and Shivashankar B Nair. *Artificial Intelligence*. 4th Edition. MedTech Science Press. 2024.

erences:

1. Deepak Khemani. *A First Course in Artificial Intelligence*. 1st Edition. 6th Reprint, 2018.
2. Munesh Chandra Trivedi. *A Classical Approach to Artificial Intelligence*. 2nd Edition. Khanna Publishers. 2018.
3. George Luger. *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*. 6th Edition. Pearson Education. 2021.

eblinks

1. NPTEL Courses: Mausam (IIT Delhi), "An Introduction to Artificial Intelligence" Link: https://nptel.ac.in/courses/106102220.
2. Shyamanta M. Hazarika (IIT Guwahati), "Fundamentals of Artificial Intelligence". Link: https://nptel.ac.in/courses/112103280. Useful for the full course.
3. Deepak Khemani (IIT Madras), "Artificial Intelligence: Search Methods for Problem-Solving". Link: https://nptel.ac.in/courses/106106226. Useful for Module 1 and 2
4. Deepak Khemani (IIT Madras), "Artificial Intelligence: Knowledge Representation and Reasoning". Link: https://nptel.ac.in/courses/106106140. Useful for Module 3.

5. Deepak Khemani (IIT Madras), "AI: Constraint Satisfaction". Link: https://nptel.ac.in/courses/106106158. Useful for Module 2.

Catalogue prepared by	Dr. Sandeep Albert Mathias
Recommended by the Board of Studies on	BOS NO: SOCSE 2nd BOS held on 17/03/25
Date of Approval by the Academic Council	Academic Council Meeting No 21, Dated 17/03/25

urse Code: CSE2265	Course Title: Essentials of AI Lab e of Course: Program Core Course - Lab	-P-C	0			1
sion No.						
urse Pre-requisites	NIL					
i-requisites						
urse Description	This course introduces the student to the basics of artificial intelligence. In this course, the student first learns the various search methods for problem-solving, followed by knowledge-based logic representations. After that, the student will learn about uncertainty in AI, as well as approaches to solve such challenges such as Naïve Bayes Classifier and Hidden Markov Models. Topics: Uninformed search, Heuristic search, Local search, Adversarial search, Constraint satisfaction, logic, First Order Resolution, Probability, Naïve Bayes Classifier, and Hidden Markov Model (HMM).					
urse Objectives	The objective of the course is EMPLOYBILITY of student by using EXPERIENTIAL LEARNING techniques.					
urse OutComes	On successful completion of this course the students shall be able to: 1. Explain different methods of searching, proving, and analysis in AI [Understand] 2. Implement various graphical and adversarial search algorithms. [Apply] 3. Prove, by resolution, different situations using First Order Logic [Apply] 4. Solve sequence labeling problems using HMM [Apply]					
Course Content:					No. of Sessions: 15 (30 hours)	

Experiment No. 1: File Handling
Level 1: Read text files using Python
Level 2: Parse text files using Python

Experiment No. 2: Implementation of Graph Representations
Level 1: Implement graph representations by taking input from the console
Level 2: Implement graph representations by taking input from files.

Experiment No. 3 & 4: Implementation of Uninformed Search Algorithms
Level 1: Implement uninformed search algorithms – BFS and DFS – on unweighted graphs.
Level 2: Implement uninformed search algorithms – Uniform Cost Search and Dijkstra's SSSP – on weighted graphs

Experiment No. 5: Implementation of Heuristic Search Algorithms
Level 1: Calculate the upper-bounds of admissible heuristics using Dijkstra's SSSP.
Level 2: Implement Greedy Best-First Search and A* Search Algorithms.

Experiment No. 6 & 7: Implementation of Adversarial Search
Level 1: Implement a Game Tree
Level 2: Perform Alpha-Beta Pruning and Ideal Ordering

Experiment No. 8 & 9: Implementation of a CSP Solver
Level 1: Implement a CSP solver to solve a cryptarithmetic problem
Level 2: Implement a CSP solver for map colouring

Experiment No. 10: Using Python Packages for CSP
Level 1: Implement a CSP solver for Sudoku
Level 2: Implement a CSP solver for Addoku

Experiment No. 11: Implement a Family Tree Parser
Level 1: Perform logic programming using logpy.
Level 2: Implement a family tree parser

Experiment No. 12 & 13: Implement a Decision Maker
Level 1: Implement a Minesweeper solver
Level 2: Implement a Battleship solver

Experiment No. 14 & 15: Hidden Markov Model
Level 1: Implement a generic HMM
Level 2: Build a PoS Tagger using a HMM with the Brown Corpus and the Universal Dependencies Tagset.

Targeted Application & Tools that can be used:

3. Google Colab
4. Python IDEs like PyCharm

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

The course is a lab-based course with all the assessments centrally evaluated. Every experiment consists of **two sessions**. The first session involves exploring a solution to the problem. The second session involves solving a particular problem.

tbook(s): 1. Stuart Russel and Peter Norvig. *Artificial Intelligence: A Modern Approach*. 4th Edition. Pearson Education. 2022. 2. Prateek Joshi and Alberto Artasanchez. *Artificial Intelligence with Python*. 2nd Edition. Packt. 2020.	
erences: 1. Deepak Khemani. *A First Course in Artificial Intelligence*. 1st Edition. 6th Reprint, 2018. 2. Munesh Chandra Trivedi. *A Classical Approach to Artificial Intelligence*. 2nd Edition. Khanna Publishers. 2018.	
Catalogue prepared by	Dr. Sandeep Albert Mathias
Recommended by the Board of Studies on	BOS NO: SOCSE 2nd BOS held on 17/03/25
Date of Approval by the Academic Council	Academic Council Meeting No 21, Dated 17/03/25

Course Code: CSE2261	Course Title: Database Management Systems Laboratory Type of Course: 1) Laboratory - PCC	L-T-P-C	0	0	2	1
Version No.	1.0					
Course Pre-requisites	Foundational understanding of data types, basic programming knowledge, operating systems and file management.					
Anti-requisites	NIL					
Course Description	The Database Management Systems (DBMS) Laboratory is designed to provide students with hands-on experience in database design, implementation, and management using SQL and database management tools such as MySQL. The lab complements theoretical concepts learned in database courses by allowing students to practice database creation, querying, and optimization techniques. The DBMS Lab enables students to develop industry-relevant skills in database management, preparing them for careers in **software development, data engineering, and database administration**.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain **Employability** through **Problem Solving** Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 9. Demonstrate the database concepts, practice, and SQL queries. [Apply] 10. Design and implement database schemas while applying normalization techniques to optimize structure. [Apply]] 11. Develop and implement stored procedures, triggers, and views for automation and efficiency. [Apply] 12. To Design and build database applications for real world problems. [Apply]					

Course Content:

List of Laboratory Tasks:
Create Employee, Student, Banking and Library databases and populate them with required data. Do the following experiments of different lab sheets on those databases.

Labsheet-1 [3 Practical Sessions]
Experiment No 1: [1 Session]
1. To study and implement the different language of Structured Query Language.
Level 1: Perform operations using Data Definition Language and Data Manipulation Language commands including different variants of SELECT on Student DB.
Level 2: Identify the given requirements; valid attributes and data types and Perform DDL and DML operations on a given scenario. [Banking Databases]
Experiment No. 2: [2 Sessions]
2. To study and implement the concept of integrity constraints in SQL.
Level 1: Create tables on Banking database using PRIMARY KEY, NOT NULL, UNIQUE, FOREIGN KEY and demonstrate the working of relational, logical, pattern matching, BETWEEN, IS NULL, IN and NOT IN Special Operators on Student Database.
Level 2: Enforce different types of data and referential integrity constraints. Then try queries with special operators based on the student database. [Banking Database].

Labsheet-2 [3 Practical Sessions]
Experiment No. 3: [1 Session]
3. Implement complex queries in SQL.
Level 1: Implement the conjugate of GROUP BY, ORDER BY and aggregate functions on Banking Database.
Level 2: Implement MySQL DB queries on library database using appropriate clauses and aggregate functions. Also order the data either in ascending and descending order using corresponding clause. [Library databases].

Experiment No. 4: [2 Session]
4. To study and implement different types of Set and Join Operations [2 Slots]

Level 1: Demonstrate different types of Set Operations (UNION, UNION ALL, INTERSECT, MINUS) and Join Operations (INNER JOINs, OUTER JOINS, CROSS JOIN, NATURAL JOIN) on two or more tables of Airline Database. Level 2: Use Set and Join operations to retrieve the data from two or more relations(tables) as per the given
scenario. [Airline Database]

Labsheet-3 [2 Practical Sessions]
Experiment No. 5: [2 sessions]
5. To study and implement Views, and Procedures in MySQL DB.
Level 1: Implement MySQL Views, and Procedures in ORACLE DB on Employee database.
Level 2: Analyze the requirement and construct views, and Procedures on Mini Project Domain. [Banking Database]

Labsheet-4 [2 Practical Sessions]
Experiment No. 6: [2 Sessions]
6. To study and implement Functions, and Triggers in MySQL DB.
Level 1: Implement Oracle Functions and Triggers in Oracle on Employee database.
Level 2: Analyze the requirement and construct Functions and Triggers. [Supply chain Database]

Labsheet-5 [2 Practical Sessions]
Experiment No. 7: [2 Sessions]
7. To study and implement Functions, and Triggers in MySQL DB.
Level 1: Implement Oracle Functions and Triggers in Oracle on Employee database.
Level 2: Determine the requirement and construct Functions and Triggers. [Supply chain Database]

Labsheet-6 [4 Practical Sessions]
Experiment No. 8: [2 Sessions]
8. To implement the concept of forms and reports.
Level 1: Implement the concept of forms and reports.
Level 2: Examine the schema relationship.

Experiment No. 9: [2 Sessions]
9. Create the database using the given schema. (Flight Management)
Level 1: Implement a relational database based on the provided schema for the Flight Management system, including the creation of tables, relationships, and constraints.
Level 2: Demonstrate schema relationships by defining primary and foreign keys to ensure data integrity within the Flight Management database.

Labsheet-7 [4 Practical Sessions]
Experiment No. 10: [2 Sessions]
10. Create the database using the given schema. (Company database)
Level 1: Implement the database schema by defining tables, relationships, and constraints according to the given Company Database schema.
Level 2: Demonstrate the schema's relationships and data integrity by creating and linking tables as per the specified requirements.
Experiment No. 11: [2 Sessions]
11. Create the database using the given schema. (Student Library)
Level 1: Implement forms and reports based on the provided Student Library database schema, ensuring effective data entry and reporting mechanisms.
Level 2: Demonstrate the schema relationships within the Student Library database, demonstrating how these relationships influence the creation and functionality of forms and reports.

Labsheet-8 [1 Sessions]
12. Design a mini project based on the databases such as Inventory Management System, University Management System, Hospital Management System, etc.
Level 1: Implement the real time database.
Level 2: Analyze the working of database in real time.

Targeted Application & Tools that can be used:
Application Area: Relational database systems for Business, Scientific and Engineering Applications.
Tools/Simulator used: MySQL DB for student practice.
Also demonstration of ORACLE DB on object-relational database creation and JDBC connection.

Percentage of changes in this version: 50% of changes from earlier version. New topics are highlighted in italic.
5. Problem Solving: Constructing ER-Diagrams for a given real time requirements, Normalizing the databases, querying the databases using relational algebra. 6. Programming: Implementation of any given scenario using MySQL.
Text Books: T1. Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Publication, 7th Edition, 2018. T2. RamaKrishna & Gehrke, "Database Management Systems" 3rd Edition, 2018, McGraw-Hill Education. T3. W. Lemahieu, S. vanden Broucke and B. Baesens, "Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data", Cambridge University Press, 2018.
References R1 Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill ,7th Edition, 2019. R2 M. Kleppmann, "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems", O'Reilly, 2017.
Topics relevant to development of "FOUNDATION SKILLS": S - Skill Development: Relational database design using ER- Relational mapping, Implementation of given database scenario using MYSQLDB. Topics relevant to development of Employability: Develop, test and implement computer databases, creatingsophisticated, interactive and secure database applications Topics relevant to "HUMAN VALUES &PROFESSIONAL ETHICS": Nil

Course Code: CSE2269	**Course Title: Operating Systems** **Type of Course: Program Core and Theory Only**	**L-T- P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Nil					
Anti-requisites	**NIL**					
Course Description	This course introduces the concepts of operating system operations, operating system structure and its design and implementation. It covers the classical operating systems internal algorithms such as process scheduling, synchronization, deadlocks detection and recovery and memory management. The course also enhances the problem solving, systems programming ability and case studies.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Operating Systems and attain **Employability** through **Problem Solving** Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Describe the fundamental concepts of operating Systems and case studies. [**Knowledge**] 2] Demonstrate various CPU scheduling algorithms. .[**Application**] 3] Apply various tools to handle synchronization problems.[**Application**] 4] Demonstrate deadlock detection and recovery methods **[Application]** 5] Illustrate various memory management techniques.[**Application**]					

Course Content:				
Module 1	Introduction to Operating System	Assignment	Programming	**9 Hours**
Topics: Introduction to OS , Operating-System Operations, Operating System Services, , System Calls and its types, Operating System Structure, System Program and its types, Linkers and Loaders, Overview of OS design and implementation, Open-source operating system				
Module 2	Process Management	Assignment/Case Study	Programming/Simulation	**11 Hours**
Topics: Process Concept, Operations on Processes, Inter Process Communication, Communication in client-server systems (sockets, RPC, Pipes), Introduction to threads - Multithreading Models, Thread Libraries, Threading Issues, Process Scheduling– Basic concepts, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, SRTF, RR and Priority.				
Module 3	Process Synchronization and Deadlocks	Assignment	Programming	**11 Hours**
Topics: The Critical-Section Problem- Peterson's Solution, Synchronization hardware, Semaphores, Classic Problems of Synchronization with Semaphore Solution- Producer-Consumer Problem, Reader-Writer problems, Dining Philosopher's Problem, . Introduction to Deadlocks, Necessary conditions for deadlock, Resource allocation Graph, Methods for handling deadlock: Deadlock Prevention and Implementation, Deadlock Avoidance and Implementation, Deadlock detection & Recovery from Deadlock.				
Module 4	Memory Management	Assignment	Programming/Simulation	**10 Hours**
Topics: Introduction to Memory Management, Basic hardware-Base and Limit Registers, Memory Management Unit(MMU), Dynamic loading and linking, Swapping, Contiguous and Non-Contiguous Memory Allocation, Segmentation, Paging - Structure of the Page Table – Virtual Memory and Demand Paging – Page Faults and Page Replacement Algorithms, Copy-on-write, Allocation of Frames, Thrashing Introduction to File system management: File System Interface (access methods, directory structures), File system implementation.				
Targeted Application: **Application area is traffic management system, banking system, health care and many more systems where in there are resources and entities that use and manage the resources.** **Software Tools:** Oracle Virtual Box/VMWare Virtualization software [Virtual Machine Managers]. Used to install and work on multiple guest Operating Systems on top of a host OS. Intel Processor identification utility: This software is used to explain about multi-core processors. It helps to identify the specifications of your Intel processor, like no of cores, Chipset information, technologies supported by the processor etc.				
Project work/Assignment				
Demonstrate process concepts in LINUX OS. **Simulation of CPU scheduling algorithms.** **Develop program to demonstrate use of Semaphores in threads.** **Develop program to demonstrate use of deadlock avoidance algorithms.** **Develop program to demonstrate use of page replacement algorithms.** **Simulation of memory allocation strategies [first fit, best fit and worst fit].**				
Text Book Silberschatz A, Galvin P B and Gagne G , "Silberschatz's Operating System Concepts", Paperback, Global Edition Wiley, 2019				
References Silberschatz A, Galvin P B and Gagne G, "Operating System Concepts", 10th edition Wiley,				

2018.
William Stallings, "Operating Systems",Ninth Edition, By Pearson Paperback ,1 March 2018.
Sundaram RMD, Shriram K V, Abhishek S N, B Chella Prabha, " Cracking the Operating System skills", Dreamtech, paperback, 2020
Remzi H. Arpaci-Dusseau Andrea C. Arpaci-dusseau , "Operating Systems: Three Easy Pieces, Amazon digital Services", September 2018.

E-resources/Weblinks

https://www.os-book.com/OS9/
https://pages.cs.wisc.edu/~remzi/OSTEP/
https://codex.cs.yale.edu/avi/os-book/OS10/index.html

Course Code: **CSE7000**	**Course Title:** **Internship** **Type of Course:**	**L- T-P- C**	-	-	-	2
Version No.	**1.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems.						
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify the engineering problems related to local, regional, national or global needs. (Understand) 2. Apply appropriate techniques or modern tools for solving the intended problem. (Apply) 3. Design the experiments as per the standards and specifications. (Analyze) 4. Interpret the events and results for meaningful conclusions. (Evaluate)					
Catalogue prepared by	Mr. Md Ziaur Rahman					
Recommended by the Board of Studies on						
Date of Approval bythe Academic Council						

Course Code: CSE2271	Course Title: Software Design and Development Type of Course: School Core [Theory Only]	L-T- P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	**NIL**		
Anti-requisites	**NIL**		
Course Description	The objective of this course is to provide the fundamentals concepts of Software Engineering process and principles. The course covers software requirement engineering processes, system analysis, design, implementation and testing aspects of software system development. The course covers software quality, configuration management and maintenance.		
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Software Engineering and attain Skill Development through Participative Learning techniques.		
Course Out Comes	On successful completion of this course the students shall be able to: 1] Describe the Software Engineering principles, ethics and process models(Knowledge) 2] Identify the requirements, analysis and appropriate design models for a given application(Comprehension) 3] Understand the Agile Principles(Knowledge) 4] Apply an appropriate planning, scheduling, evaluation and maintenance principles involved in software(Application)		

Module 1	**Introduction to Software Engineering and Process Models (Knowledge level)**	Quiz		**10 Hours**
Introduction: Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Software Engineering Practice-Essence of Practice, General Principles Software Development Life Cycle **Models:** Waterfall Model – Classical Waterfall Model, Iterative Waterfall Model, Evolutionary model-Spiral, Prototype.				
Module 2	**Software Requirements, Analysis and Design (Comprehension level)**	Assignment	Development of SRS documents for a given scenario	**12 Hours**
Requirements Engineering: Eliciting requirements, Functional and non- Functional requirements, Software Requirements Specification (SRS), Requirement Analysis and validation. Requirements modelling- Introduction to Use Cases, Activity diagram and Swim lane diagram. CASE support in Software Life Cycle, Characteristics of CASE Tools, Architecture of a CASE Environment. **Design:** Design concepts, Architectural design, Component based design, User interface design.				
Module 3	**Agile Principles & Devops (Knowledge level)**	Quiz		**10 Hours**
Agile: Scrum Roles and activities, Sprint Agile software development methods - Scaling, User Stories, Agile estimation techniques, Product backlogs, Stake holder roles, Dynamic System Development Method. **Devops:** Introduction, definition, history, tools.				
Module 4	**Software Testing and Maintenance (Application Level)**	Assignment	Apply the testing concepts using Programing	**13 Hours**
Software Testing-verification and validation, Test Strategies - White Box Testing, Black box Testing. Automation Tools for Testing. **Software Quality Assurance**-Elements of software quality assurance, SQA Tasks, Goals and Metrics, Software configuration management- SCM process, SCM Tools (GitHub). **Maintenance-** Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models.				

Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools
Text Book 1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", VII Edition, McGraw-Hill, 2017.

2. Bob Hughes, Mike Cotterell, Rajib Mall, “Software Project Management”, VI Edition, McGraw-Hill, 2018.
References 1. Rajib Mall, “Fundamentals of Software Engineering”, VI Edition, PHI learning private limited, 2015. 2. Ian Sommerville, “Software Engineering”, IX Edition, Pearson Education Asia, 2011. 3. Agile Software Development Principles, Patterns and Practices.1st Edition, Wiley, 2002
Topics Relevant to “Skill Development: Balck box Testing, White box Testing, Automated Testing for Skill development through Participative Learning Techniques. This is attained through assessment mentioned in the course handout

urse Code: **:2274**	**urse Title:** Competitive Programming and Problem Solving **e of Course: Program Core**	-P-C	0	0		
sion No.						
urse Pre-requisites						
ti-requisites						
urse Description	The **Competitive Programming and Problem Solving** course equips students with efficient problem-solving skills for coding competitions and real-world challenges. Starting with brute-force solutions, students learn to optimize time and space complexity using advanced techniques like dynamic programming, greedy algorithms, and backtracking. Hands-on practice on platforms like CodeChef and Codeforces helps tackle problems involving number theory, data structures, and algorithmic paradigms. By understanding CP constraints and fostering a strategic mindset, students gain the confidence to excel in competitions, technical interviews, and practical applications.					
urse Out Comes	On successful completion of the course the students shall be able to: CO1 : Understanding the issues of online platforms and Competitive Programming (CP) and developing brute force coding for commonly asked CP problems. CO2 : Analyzing the space and time complexity of brute force solutions and designing efficient solutions. CO3 : Evaluating the applicability of suitable algorithmic approaches to solve relevant CP problems. CO4: Creating efficient solutions of CP problems using the learnt algorithmic approaches.					
urse Objective	The objective of the course is to familiarize the learners with the concepts of **Competitive Programming and Problem Solving** and attain **Skill Development** through **Experiential Learning** techniques.					
dule 1: Introduction to Competitive Programming erview of Efficient Coding for Problem Solving and CP: Introduction to competitive programming (CP); revisit of complexity analysis; introduction to online platforms such as codechef, codeforces etc and online submission; constraints during CP, online testing process and common errors such as TLE; use of STL						

dule 2: Number Theory for Problem-Solving

e of Number Theory for problem-solving: reducing time/space complexity of brute force coding solution of Sieve Method, Inverse Module, Euclidian Method of factorization; efficient coding for Permutation Combination; XORing based and pattern-based solutions.

dule 3: Optimizing Time & Space Using Sequential Storage

ding for Optimizing time and Space using Sequential Storage: two pointer approach; problem-solving using arrays and strings such as rotation on sorted arrays, duplicate removal, string matching algorithms; Kadane's algo, stacks, priority-queues and hashing based efficient coding; median based problems and alternate solutions.

dule 4: Non-Linear Data Structures

plying Non-Linear Data Structures for real-life problems: design of efficient solutions for problems such as finding loops in a linked list, memory efficient DLL, block reversal in LL; problem solving using trees and binary trees, Catalan numbers, applications of graphs, spanning tree and path algos for CP problems with reduced time/space complexity.

dule 5: Problem Solving using Advanced Topics

Problem Solving using Advanced Topics: concept of disjoint sets and their efficient representation, algorithmic approaches such as Greedy, Backtracking, Dynamic Programming and applying them for CP problems using bottom-up dynamic programming.

t of Laboratory Tasks:

1. You are given the finishing times of 'N' runners in a marathon. Write a program to find the runner who finished in the third position. **Focus:** Basic data structures (arrays), sorting algorithms (e.g., insertion sort, selection sort), and basic input/output.
2. In the same marathon, you are given the finishing times of 'N' runners and their bib numbers. Write a program to efficiently find the top 10 runners and their corresponding bib numbers. **Focus:** Efficient sorting algorithms (e.g., merge sort, quick sort), data structures like priority queues, and optimizing for large datasets.
3. A library maintains a list of books with their unique IDs. Write a program to check if a given book ID is present in the library. Focus: Searching algorithms (linear search), basic data structures (arrays or lists).
4. The library wants to implement a system to quickly find books by their titles. Suggest an efficient data structure (e.g., a hash table or a trie) and explain how to implement it to achieve fast book lookups. Focus: Understanding the trade-offs between different data structures, choosing the most appropriate data structure for a specific problem, and implementing efficient search operations.
5. An online store sells products with different prices. Write a program to calculate the total cost of a given list of products. **Focus:** Basic arithmetic operations, working with arrays or lists to store product prices.
6. The online store offers discounts based on the total purchase amount. Design an algorithm to efficiently calculate the final cost of an order, considering different discount rules (e.g., percentage discounts, fixed amount discounts, tiered discounts). Focus: Algorithmic design, conditional statements, handling complex scenarios with multiple rules, and potentially using dynamic programming techniques for optimization.
7. You are given two integers, 'a' and 'm'. Calculate 'a' raised to the power 'm' modulo a large prime number 'p'. **Focus:** Basic modular arithmetic operations (modular exponentiation), understanding the modulo operator.
8. In a secure communication system, you need to efficiently compute the modular exponentiation for very large values of 'm'. Implement and analyze the efficiency of the binary exponentiation algorithm for this task. **Focus:** Efficient algorithms for modular exponentiation (binary exponentiation), time complexity analysis, and understanding the importance of efficient algorithms in cryptography.

9. You have a deck of 'N' cards. Calculate the total number of possible hands of size 'K' that can be drawn from the deck. **Focus:** Basic combinatorics (combinations), factorial calculations.
10. In a card game, you need to calculate the probability of drawing certain combinations of cards (e.g., a pair, a three-of-a-kind) from a shuffled deck. Design an efficient algorithm to calculate these probabilities. **Focus:** Advanced combinatorics (permutations and combinations with repetitions), probability calculations, and optimizing calculations to avoid overflows.
11. You are given a network of devices represented as a graph. Determine if there is a path between two given devices in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search).
12. In a secure network, you need to detect and isolate compromised devices. Design an algorithm that efficiently identifies devices that exhibit anomalous behavior (e.g., unusual traffic patterns) using XOR-based techniques for data comparison and pattern matching. **Focus:** Applying XOR operations for data comparison and pattern recognition, understanding the properties of XOR (e.g., commutative, associative), and designing algorithms for network anomaly detection.
13. You are given an array representing the speeds of cars on a highway. Find the minimum time required for all cars to pass a certain point. **Focus:** Basic array traversal, finding the minimum element in an array.
14. In a more realistic scenario, cars have different lengths. Implement a two-pointer approach to simulate the movement of cars and determine the minimum time for all cars to pass a given point. **Focus:** Two-pointer technique, simulating real-world scenarios with arrays, optimizing time complexity.
15. Given a string, find the number of occurrences of a specific substring within the string. **Focus:** Basic string manipulation, string matching (brute-force approach).
16. Implement the KMP (Knuth-Morris-Pratt) string matching algorithm to efficiently find all occurrences of a given pattern within a large text document. **Focus:** Advanced string matching algorithms, understanding the concept of the "next" array in KMP, optimizing for large input sizes.
17. An online auction platform receives bids for different items. Implement a data structure (e.g., a priority queue) to efficiently track the highest bid for each item. **Focus:** Priority queues, insertion and extraction operations on priority queues, basic implementation of a priority queue using an array or a suitable library.
18. The auction platform needs to handle a large number of bids concurrently. Design and implement a system that efficiently processes bids, updates the highest bid for each item, and handles potential race conditions. **Focus:** Concurrent data structures and algorithms, thread safety, handling race conditions, optimizing for high-throughput scenarios.
19. A social network can be represented as a graph where users are nodes, and connections between users are edges. Write an algorithm to find if two given users are connected in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search), basic graph representation (adjacency list or adjacency matrix).
20. In a large social network, efficiently finding the shortest path between two users is crucial. Implement Dijkstra's algorithm to find the shortest paths between users in the network, considering edge weights (e.g., representing the strength of connections). **Focus:** Shortest path algorithms (Dijkstra's algorithm), graph algorithms with weighted edges, optimizing for large graphs.
21. A file system can be modeled as a tree structure. Implement a function to traverse the file system and print the names of all files and directories. **Focus:** Tree traversal algorithms (depth-first search or breadth-first search), basic tree representation (using nodes and pointers).
22. Design and implement a file system that supports efficient operations like creating directories, deleting files, and finding files based on their names or paths. Consider using a combination of tree structures and hash tables for efficient indexing and searching. **Focus:** Designing and implementing file system structures, using multiple data structures together, optimizing for common file system operations.

23. An online shopping cart can be represented as a tree, where each node represents an item or a category of items. Write an algorithm to calculate the total price of all items in the shopping cart. **Focus:** Tree traversal, calculating sums within a tree structure.
24. Implement a system that allows customers to apply discounts and coupons to their shopping carts. Consider using a combination of trees and other data structures (e.g., hash tables) to efficiently apply discounts and calculate the final price. **Focus:** Applying discounts and promotions to tree-like structures, efficient implementation of discount rules, optimizing for complex pricing scenarios.
25. In a social network, users can form groups. Given a list of friendships, determine if all users in a specific group are connected (directly or indirectly) through friendships. **Focus:** Disjoint set union (DSU) data structure, basic connectivity checks.
26. Design an efficient algorithm to find the minimum number of new friendships needed to connect all users in the social network into a single, connected component. **Focus:** Applying DSU for finding connected components, greedy algorithms, optimization for minimizing connections.
27. A treasure hunt involves a series of clues leading to the final treasure. Given a list of possible paths and their associated costs, find the cheapest path to reach the treasure. **Focus:** Greedy algorithms (e.g., Dijkstra's algorithm for shortest paths), basic graph representation.
28. In a more complex treasure hunt, there are time constraints associated with each path. Design an algorithm to find the fastest path to the treasure while considering both path costs and time constraints.

Focus: Combining greedy approaches with other techniques (e.g., priority queues), handling multiple constraints, optimizing for time-critical scenarios.

29. In a simplified chess game with only rooks, determine the minimum number of moves required for a rook to reach a specific target square on an empty board. **Focus:** Breadth-first search (BFS) on a graph (the chessboard), basic graph traversal.
30. In a more realistic chess game with multiple pieces and obstacles, implement a minimax algorithm with alpha-beta pruning to determine the best move for a player. **Focus:** Game tree search, minimax algorithm, optimization techniques like alpha-beta pruning, handling complex game states.

geted Application & Tools that can be used:

1. C or C++ Compiler (g++): The standard compiler for CP. Familiarize students with compilation flags (e.g., -O2 for optimization).
2. IDE (Integrated Development Environment): Code:: Blocks, Visual Studio, CLion, or similar IDEs. These provide debugging capabilities, code completion, and other helpful features.
3. Online Judges (CodeChef, Codeforces, LeetCode, HackerRank): Essential for practicing and submitting solutions.
4. Debugger (gdb): Crucial for understanding code execution and finding bugs. Origin, excel and Mat lab soft wares for programming and data analysis.
5. Number Theory Libraries: Some libraries provide pre-built functions for number theory operations (though often it's better to implement them yourself for learning).
6. Wolfram Alpha: A useful tool for verifying number theory calculations and exploring concepts.
7. **String Libraries:** Familiarize students with the string manipulation functions available in C++.
8. **Graph Visualization Tools:** Tools like Graphviz can be helpful for visualizing graphs and understanding graph algorithms.
9. **DP Debugging Techniques:** Practice debugging DP solutions, as they can be complex. Visualizing the DP table can be helpful.

t Books:

1 **Guide to Competitive Programming: Learning and Improving Algorithms Through Contests" (3rd Edition),** ***Antti Laaksonen, springer, 2024***

2 **"Data Structures and Algorithms in Java: A Project-Based Approach" –** ***Dan S. Myers, Cambridge University Press***

Reference Books:

1. **Data Structures and Algorithmic Thinking with Python/C++/Java", *Narasimha Karumanchi, 5th Edition, Career Monk, 2017.***
2. **Introduction to Algorithms, Thomas H. Cormen (Author), Charles E. Leiserson (Author), Ronald L. Rivest , fourth edition April 2022**

Web Resources

1. https://nptel.ac.in/courses/106106231
2.

ject work/Assignment: Mention the Type of Project /Assignment proposed for this course

Assessment Type

- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.)
- Quiz
- End Term Exam
- Self-Learning

Course Code: CSE 7100	**Course Title: Mini Project** **Type of Course:**	**L- T-P- C**	0	0	0	4
Version No.	**1.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.					

Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify the engineering problems related to local, regional, national or global needs. (Understand) 2. Apply appropriate techniques or modern tools for solving the intended problem. (Apply) 3. Design the experiments as per the standards and specifications. (Analyze) 4. Interpret the events and results for meaningful conclusions. (Evaluate) 5. Appraise project findings and communicate effectively through scholarly publications. (Create)
Catalogue prepared by	Dr. Sampath A K
Recommended by the Board of Studies on	
Date of Approval bythe Academic Council	

Course Code: **CSE 7300**	**Course Title:** **Capstone Project** **Type of Course:**	**L- T-P- C**	0	0	0	10
Version No.	**1.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to					

	pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify problems based on societal /research needs. (Understand) 2. Apply Knowledge and skill to solve societal problems in a group. (Apply) 3. Develop interpersonal skills to work as member of a group or leader. (Apply) 4. Analyze the inferences from available results through theoretical / Experimental / Simulations. (Analyze) 5. Analyze the impact of solutions in societal and environmental context for sustainable development. (Analyze) 6. Improve in written and oral communication. (Create) 7. Demonstrate capabilities of self-learning in a group, which leads to lifelong learning. (Understand)
Catalogue prepared by	Dr. Sampath A K
Recommended by the Board of Studies on	
Date of Approval bythe Academic Council	

Course Code: CSE3427	Course Title: .NET Full Stack Development	L- T-P- C	2-0-2-3
Version No.	1.0		
Course Pre-requisites	Nil		
Anti-requisites	CSE3151 Java Full Stack Development		
Course Description	This advanced level course enables students to perform full stack development using .NET, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using .NET and the related technologies/tools like C#, ASP.NET, Entity Framework Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.		
Course Objectives	The objective of the course is to familiarize the learners with the concepts of **DotNET FULL STACK Development** and attain **Employability Skills** through **Experiential Learning** techniques.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **1] Practice the use of C# for developing a small application [Application]** **2] Show web applications using Entity Framework. [Application]** **3]Solve simple web applications that use SQL and ASP.NET [Application]** **4] Apply concepts of ASP.NET to develop a Full Stack application. [Application]**		
Course Content:			

Module 1	C# Programming for Full Stack Development	Project	Programming	10 Sessions

Topics:
.NET Framework Fundamentals, Visual Studio IDE Fundamentals, C# Language Features, Working with arrays and collections, Working with variables, operators, and expressions, Decision and iteration statements, Managing program flow and events, Working with classes and methods, OOP concepts, Properties, Auto Implemented, Delegates, Anonymous Methods and Anonymous Types, Extension methods, Sealed Classes/Methods, Partial Classes/Methods, Asynchronous programming and threading, Data validation and working with data collections including LINQ, Handling errors and exceptions, Working with Files, Unit Testing – Nunit framework
Assignment: Develop a small application for managing library using C#.

Module 2	Entity Framework Core 2.0	Project	Programming	06 Sessions

Topics:
Entity Framework Core 2.0 Code First Approach; Introduction To Entity Framework and EDM; Querying the EDM; Working With Stored Procedures; Advanced Entity Framework - DbContext [EF6]; Advanced Operations; Performance Optimization; Data Access with ADO.NET
Assignment: Develop an application for managing HR policies of a department.

Module 3	ASP.NET	Project	Programming	06 Sessions

Topics:
ASP.NET Core, ASP.Net Core 3.1 MVC, ASP.NET Core Middleware and Request pipeline, Review

of SQL using MS SQL, Working With Data In Asp.Net, Razor View Engine, State Management In Asp. Net MVC & Layouts;

Assignment: Develop a web application to mark entry/exit of guests in a building.

Module 4	ASP.NET	Project	Programming	**08 Sessions**

Topics:
Introduction To Models, Validations In Asp.Net MVC, Authentication and Authorization In Asp.Net MVC, Advanced Asp. Net MVC - Ajax Action Link In MVC, Advanced Asp.Net MVC - Ajax Forms In MVC, Microsoft Testing Framework – Unit Testing the .NET Application
Assignment: Develop a software tool to do inventory management in a warehouse.

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: Visual Studio

Project work/Assignment:

1. **Problem Solving: Design of Algorithms and implementation of programs.**
2. **Programming: Implementation of given scenario using .NET.**
3. Assignment: Case study on Web sites development

Text Book:

T1. Fender, Young, "*Front-end Fundamentals",* Leanpub, 2015
T2. Valerio De Sanctis, *"ASP.NET Core 5 and Angular: Full-stack web development with .NET 5 and Angular 11"*, 4th Edition, Packt, 2021.

References

R1. Benjamin Perkins, Jon D. Reid, *"Beginning C# and .NET"*, Wiley, 2021 Reid, 2021.
R2. Piotr Gankiewicz, *"Full Stack .NET Web Development"*, Packt Publishing, 2017.
R3. Tamir Dresher, Amir Zuker, Shay Friedman, *"Hands-On Full-Stack Web Development with ASP.NET Core"*, Packt Publishing, 2018.
R4. Dustin Metzgar, *"Exploring .NET core with microservices, ASP.NET core, and Entity Framework Core"*, Manning, 2017.

Topics relevant to development of "Employability": C#, ASP.NET & SQL for developing Employability **Skill Development** through **Experiential Learning** techniques.. This is attained through assessment component mentioned in course handout.

Course Code: **CSE3428**	**Course Title:** **Java Full Stack Development**	**L- T-P- C**	2-0-2-3
Version No.	1.0		
Course Pre-requisites	**Nil**		
Anti-requisites	**CSE3152 .NET Full Stack Development**		

Course Description	This advanced level course enables students to perform full stack development using Java, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using Java, and the related technologies/tools like Java EE, Java Persistence, Hibernate, Maven, Spring Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.			
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.			
Course Outcomes	**On successful completion of the course the students shall be able to:** **1] Practice the use of Java for full stack development [Application]** **2] Show web applications using Java EE. [Application]** **3] Solve simple applications using Java Persistence and Hibernate [Application]** **4] Apply concepts of Spring to develop a Full Stack application. [Application]** **5] Employ automation tools like Maven, Selenium for Full Stack development. [Application]**			
Course Content:				
Module 1	Introduction	Project	Programming	**03 Sessions**
Topics: Review of Java; Advanced concepts of Java; Java generics; Java IO; New Features of Java. Unit Testing tools.				
Module 2	Java EE Web Applications	Project	Programming	**05 Sessions**
Topics: Introduction to Eclipse & Tomcat; JSP Fundamentals; Reading HTML form Data with JSP; State Management with JSP; JSP Standard Tag Library - Core & Function Tags; Servlet API Fundamentals; ServletContext, Session, Cookies; Request Redirection Techniques; Building MVC App with Servlets & JSP; Complete App - Integrating JDBC with MVC App **Assignment:** Develop an application for managing HR policies of a department.				
Module 3	Java Persistence using JPA and Hibernate	Project	Programming	**06 Sessions**
Topics: Fundamentals of Java Persistence with Hibernate; JPA for Object/Relational Mapping, Querying, Caching, Performance and Concurrency; First & Second Level Caching, Batch Fetching, Optimistic Locking & Versioning; Entity Relationships, Inheritance Mapping & Polymorphic Queries; Querying database using JPQL and Criteria API (JPA) **Assignment:** Design and develop a website that can actively keep track of entry-exit information of a housing society..				
Module 4	Spring Core	Project	Programming	**10 Sessions**
Topics: Spring Core, Spring MVC, Spring Boot REST API; Understanding Spring Framework; Using Spring MVC; Building a Database Web App with Spring and Hibernate o Spring AOP (Aspect Oriented Programming); Implementing Spring Security; Developing Spring REST API; Using Spring Boot for Rapid Development **Assignment:** Develop a software tool to do inventory management in a warehouse.				
Module 5	Automation tools	Project	Programming	**06 Sessions**
Topics:				

Introduction to Automation Tools; Apache Maven: Maven Fundamentals, Software Setup - Commandline and Eclipse, pom.xml and Directory Structure, Multi-Module Project Creation, Scopes, Dependency Management, Profiles; Functional/BDD Testing using Selenium, Selenium Fundamentals and IDE, Selenium WebDriver, Installation and Configuration, Locating WebElements, Driver Commands, WebElement Commands **Assignment:** Illustrate the use of automation tools in the development of a small software project.
Targeted Application & Tools that can be used: **Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.** **Professionally Used Software: Eclipse, NetBeans, Hibernate, Selenium, Maven, GIT.**
Project work/Assignment:
1. **Problem Solving: Design of Algorithms and implementation of programs.** 2. **Programming: Implementation of given scenario using Java.**
Text Book: T1. Fender, Young, "*Front-end Fundamentals",* Leanpub, 2015
References R1. Soni, Ravi Kant. *"Full Stack AngularJS for Java Developers: Build a Full-Featured Web Application from Scratch Using AngularJS with Spring RESTful."* , Apress, 2017. R2. Mardan, Azat. *"Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB."*, Apress, 2015

Course Code: **CSE3426**	**Course Title: Front-end Full Stack Development**		**L- T-P- C**	2-0-2-3
Version No.	1.0			
Course Pre-requisites	**Nil**			
Anti-requisites	**NIL**			
Course Description	This intermediate course enables students to perform front-end full stack development, with emphasis on employability skills. The course covers key technologies and architectures that enables the student to design and implement front-end. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.			
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.			
Course Outcomes	On successful completion of the course the students shall be able to: 1] Describe the fundamentals of DevOps and Front-end full stack development. [Comprehension] 2] Illustrate development of a responsive web. [Application] 3] Apply concepts of Angular.js to develop a web front-end. [Application] 4] Apply concepts of Angular.js to develop a web front-end. [Application]			
Course Content:				
Module 1	Fundamentals of DevOps and Web Development	Project	Programming	**04 Sessions**
Topics:				

Introduction to Agile Methodology; Scrum Fundamentals; Scrum Roles, Artifacts and Rituals; DevOps – Architecture, Lifecycle, Workflow & Principles; DevOps Tools Overview – Jenkins, Docker, Kubernetes.
Review of GIT source control. HTML5 – Syntax, Attributes, Events, Web Forms 2.0, Web Storage, Canvas, Web Sockets; CSS3 – Colors, Gradients, Text, Transform
Assignment: Develop a website for managing HR policies of a department.

Module 2	Responsive web design	Project	Programming	**03 Sessions**

Topics:
BootStrap for Responsive Web Design; JavaScript – Core syntax, HTML DOM, objects, classes, Async; Ajax and jQuery Introduction
Assignment: Design and develop a website that can actively keep track of entry-exit information of a housing society.

Module 3	Fundamentals of Angular.js	Project	Programming	**08 Sessions**

Topics:
Setting up Development & Build Environment: Node.js and NPM; Introduction to TypeScript; Working with OOP concepts with TypeScript; Angular Fundamentals; Angular CLI; Introduction to TypeScript; Debugging Angular applications; Components & Databinding in Depth; Angular Directives; Using Services & Dependency Injection; Angular Routing; Observables; Handling Forms in Angular Apps; Output transformation using Pipes; Making Http Requests; Authentication & Route Protection; Dynamic Components; Angular Modules & Optimizing Angular Apps; Deploying an Angular App; Angular Animations; Adding Offline Capabilities with Service Workers; Unit Testing in Angular Apps (Jasmine, Karma).
Assignment: Develop a software tool to do inventory management in a warehouse.

Module 4	Fundamentals of React.js	Project	Programming	**15 Sessions**

Topics:
Overview of React.js.; Reactive Programming; React Components; Render Method; Virtual DOM and Bandwidth Salvation; Two Distinct Ways of Initializing a React Class; States & Life Cycles; Component Mounting; Node.js & NPM; JSX Walkthrough; React Testing.
Assignment: Develop a web-based application to book movies/events (like bookmyshow).

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: GCC compiler.

Project work/Assignment:

1. **Problem Solving: Design of Algorithms and implementation of programs.**
2. **Programming: Implementation of given scenario using Java.**

Text Book:

T1. Fender, Young, "*Front-end Fundamentals",* Leanpub, 2015
T2. Northwood, Chris, "*The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer",* APress, 2018

References:

R1. Flanagan D S, *"Javascript : The Definitive Guide"* 7th Edition. 7th ed. O'Reilly Media; 2020.
R2. Alex Libby, Gaurav Gupta, and Asoj Talesra. *"Responsive Web Design with HTML5 and CSS3 Essentials",* Packt Publishing, 2016
R3. Duckett J Ruppert G Moore J. *"Javascript & Jquery : Interactive Front-End Web Development.";* Wiley; 2014.
R4. Greg Sidelnikov, *"React.js Book_ Learning React JavaScript Library"*, 1 edition, Scratch-River Tigris LLC 2016
R5. Web Reference: https://www.youtube.com/watch?v=JGNTYXkVCVY&list=PLd3UqWTnYXOkTSBCBNyyhxo_jxlY_uTWA&in

dex=2

urse Code: AT2301	Course Title: Calculus and Differential Equations Type of Course:BSC	T- P- C	3	1	0	4
rsion No.						
urse e-requisites	Basic Concepts of Limits, Differentiation, Integration (PU level)					
ti-requisites	**NIL**					
urse Description	Calculus and differential equations are used ubiquitously throughout mathematics, statistics and operations research. In this course, students can be able to build upon the foundations of calculus established to greatly enhance their repertoire of theory and practice in these areas. The application of calculus and differential equations in the description and modelling of real-world problems will also be considered. This unit will extend the problem-solving skills, range of knowledge and use of techniques in differential and integral calculus. The course focuses on the concepts of Calculus and Differential Equations with reference to specific engineering problems. The course is of both conceptual and analytical type in nature.					
urse Objective	The goal of the course Calculus and Differential Equations is to facilitate the students with a concrete foundation of differential calculus and to solve the first and higher-order ordinary differential equations enabling them to acquire the knowledge of these mathematical tools.					
urse Out Comes	On successful completion of the course the students shall be able to: 1) Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve. 2) Apply the principles of integral calculus to evaluate integrals. 3) Learn the notion of partial differentiation to calculate rate of change of multivariate functions and solve problems related to composite functions and Jacobian. 4) Solve first-order linear/nonlinear ordinary differential equations analytically using standard methods.					
urse Content:						
dule 1	**ferential Calculus**					
Polar Coordinates, polar curves, angle between radius vector and the tangent, angle between two curves, pedal equations, curvature and radius of curvature. Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.						
dule 2	**egral Calculus**					
Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.						
dule 3	**ltivariable Calculus**					
Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.						
dule 4	**ferential Equations**					
Definition, types of Differential Equations, Applications, Variable Separable, Homogeneous, Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. Linear differential equations of second and higher order with constant coefficients - Non-Homogeneous						

term of the type Q(x) = e^{ax}, Sin ax, Cosax, $e^{ax}v(x)$, $x^nv(x)$ - Method of variation of parameters.
geted Application & Tools that can be used: fferential calculus is used extensively in science and engineering. It can solve problems related to motion, velocity, acceleration, angles of incline or curve on a surface, etc. fferential Equations are used to model the behavior of electromagnetic fields, including in the design of antennas, microwave ovens, and other devices. Biology: PDEs are used to model biological processes, such as the spread of diseases and the development of biological tissues. ols Used: Python.
signment:
1. Select any one simple differential equation pertaining to the respective branch of engineering, identify the dependent and independent variable – Obtain the solution and compare the solution sets by varying the values of the dependent variable.
xt Book 1. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition 2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.
ferences: 1. Victor Henner, Tatyana Belozerova, Mickhail Khenner, Ordinary and Partial Differential Equations, CRC Press, Edition, 2013. 2. Walter Ledermann, Multiple integrals, Springer, 1st edition 3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002. 4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008. **E-resources/ Web links:** 1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_103205 2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_106839 3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_61605 4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_134719 5. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html 6. https://www.scu.edu.au/study-at-scu/units/math1005/2022/
pics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of calculus and differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving**.** This is attained through the assessment component mentioned in course handout.

urse Code: **Y2504**	**Course Title: Optoelectronics and Quantum Physics Lab** **pe of Course: BSC**	-P-C	0	0		
rsion No.						
urse Pre-requisites						
ti-requisites						
urse Description	The laboratory provides an opportunity to validate the concepts taught and enhances the ability to use the concepts for technological applications. The laboratory tasks aim to develop following skills: **An attitude of enquiry, confidence and ability to tackle new problems, ability to interpret events and results, observe and measure physical phenomena, select suitable equipment, instrument and materials, locate faults in systems.**					

urse Out Comes	On successful completion of the course the students shall be able to: CO1: To understand electrical and optical properties of materials CO2: Interpret the results of various experiments to verify the concepts used in optoelectronics and advanced devices.
urse Objective	The objective of the course is to familiarize the learners with the concepts of " Applied Physics for Computer Science Cluster "and attain **Skill Development** through **Experiential Learning** techniques

t of Laboratory Tasks:

Experiment No. 1: Experimental errors and uncertainty using excel

Level 1: Calculation of accuracy and precision of a given data

vel 2: propagation of errors in addition, subtraction, multiplication and division.

Experiment N0 2: To determine the wavelength of semiconductor diode Laser and to estimate the particle size of lycopodium powder using diffraction.

vel 1: Determination of Wavelength of Laser

vel 2: Finding the particle size of lycopodium powder.

periment No. 3: To determine the proportionality of Hall Voltage, magnetic flux density and the polarity of Charge carrier.

vel 1: To determine the proportionality of Hall Voltage and magnetic flux density

vel 2: To determine the polarity of Charge carrier.

Experiment No. 4: To study the I-V characteristics of a given zener diode in forward and reverse bias conditions.

vel 1: To study I –V characteristics of the given Zener diode in reverse bias and to determine break down voltage.

vel 2: To study I –V characteristics of the given Zener diode in forward bias and to determine knee voltage and forward resistance.

Experiment No. 5: To study input and output characteristics of a given Transistor.

vel 1: To determine the input resistance of a given transistor.

vel 2: To determine current transfer characteristics and transistor parameters of a given transistor.

Experiment No. 6: Determination of Fermi energy and Fermi temperature of a given metal and bimetallic wire.

Level 1: Determination of Fermi energy and Fermi temperature of given metal wire.

Level 2: Determination of Fermi energy and Fermi temperature of given bimetallic wire.

periment No. 7: To study the I-V characteristics and I-R characteristics of a solar cell as a function of the irradiance.

vel 1: To study the I-V characteristics

vel 2: I-R characteristics of a solar cell as a function of the irradiance.

periment No. 8: Calculate the numerical aperture and study the losses that occur in optical fiber cable. .

vel 1: Calculate the numerical aperture.

vel 2: study the losses that occur in optical fiber cable.

beriment No. 9: Plotting I-V characteristics in forward and reverse bias for LEDs d Determination of knee voltage. vel 1: Plotting I-V characteristics in forward and reverse bias for LEDs vel 2: Determination of knee voltage. beriment No. 10: Determination of Stefan's constant and verification of Stefan-Boltzmann Law. vel 1: Determination of Stefan's constant vel 2: Verification of Stefan-Boltzmann Law. beriment No. 11: Determination of dielectric constant of given materials. vel 1: Determination of Stefan's constant vel 2: compare the obtain results with other materials beriment No. 12: determine the wavelength of monochromatic light, such as sodium light, using Newton's rings. vel 1: Determination of wavelength vel 2: determine the radius of curvature of the Plano-convex lens.
rgeted Application & Tools that can be used: 1. Areas of application are optoelectronics industry, Solar panel technologies, quantum computing software, electronic devices using transistors and diodes, memory devices, endoscopy, SQUIDS in MRI, Advanced material characterizations using SEM and STM. 2. Origin, excel and Mat lab soft wares for programming and data analysis.
bject work/Assignment: Mention the Type of Project /Assignment proposed for this course
Assessment Type • Midterm exam • Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.) • Quiz • End Term Exam • Self-Learning 1. Prepare a comprehensive report on non-conventional energy resources in Karnataka and their pros and cons. 2. Write a report on importance of quantum entanglement in supercomputers.

urse Code: **Y2501**	**Course Title:** Optoelectronics and Quantum Physics **pe of Course: BSC**	-P-C	3	0		
rsion No.						
urse Pre-requisites						
ti-requisites						
urse Description	The purpose of this course is to enable the students to understand the fundamentals, working and applications of optoelectronic devices and to develop the basic abilities to appreciate the applications of advanced microscopy and quantum computers. The course develops the critical thinking and analytical skills.					

urse Out Comes	On successful completion of the course the students shall be able to: CO1: To understand the concepts of electrical conducting properties of metal, semiconductor and superconductivity. CO2: To understand the principles of quantum mechanics. CO3: Discuss the quantum concepts used in quantum computers. CO4: Explain the applications of lasers and optical fibers in various technological fields.			
urse Objective	The objective of the course is to familiarize the learners with the concepts of "Applied Physics for Computer Science Cluster "and to attain the basic knowledge related to quantum mechanics and computation.			
urse Content:				
dule 1	**ctrical Conductivity Of Solids And Semiconducting Devices**	ignment	a collection on efficiency of solar cells.	**Sessions**
Topics: Classification of materials based on bandgap, Fermi energy and Fermi level, Fermi level in semiconductors, Law of mass action, Electrical conductivity of a semiconductor, Hall effect, Superconductivity, p-n junctions, Zener diode, Solar cells, I-V characteristics, and LEDs				
dule 2	**antum Mechanics**	ignment		Sessions
Topics: Introduction, de-Broglie hypothesis, Heisenberg's uncertainty principle- statement and physical significance. Wave function-properties and physical significance. Schrodindger's time independent wave equation, Probability density and normalization of wave function. Wave Function in Ket Notation: Matrix form of wave function, Identity operator, Determination of I|0> and I|1>, Pauli Matrices and its operations on 0 and 1 states, Mention of Conjugate and Transpose, Unitary Matrix U, Examples: 2x2 Matrices and their multiplication (Inner Product), Probability, Orthogonality				
dule 3	**antum Computing**	m paper	minar on quantum computers.	Sessions
Topics: Introduction to quantum computing, Moore's law & its end, Differences between classical and quantum computing, Concept of Qubit and its properties, . Representation of qubit by Bloch sphere, Quantum Gates: Single Qubit Gates: Quantum Not Gate, Pauli Z Gate, Hadamard Gate, Phase Gate (or S Gate), T Gate. Multiple Qubit Gates: Controlled gate - CNOT Gate, (Discussion for 4 different input states). Representation of Swap gate, Controlled - Z gate, Toffoli gate. Problems.				
dule 4	**ers And Optical Fibers**	m paper	se study on medical applications of Lasers.	Sessions
Topics: Interactions of radiations with matter, expression for energy density of a system under thermal equilibrium in terms of Einstein's coefficients, conditions for LASER action using Einstein's coefficients, Characteristics of laser, conditions and requisites of laser, Principle of optical fibers, Numerical aperture and acceptance angle (Qualitative), Attenuation, Applications: Point to point communication with block diagram, application of optical fibers in endoscopy.				
geted Application & Tools that can be used: 1. Areas of application are optoelectronics industry, Solar panel technologies, quantum computing software, electronic devices using transistors and diodes, memory devices, endoscopy,				

SQUIDS in MRI, Advanced material characterizations using SEM and STM.

2. Origin, excel and Mat lab soft wares for programming and data analysis.

ject work/Assignment: Mention the Type of Project /Assignment proposed for this course

Assessment Type

- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.)
- Quiz
- End Term Exam
- Self-Learning

1. Prepare a comprehensive report on non-conventional energy resources in Karnataka and their pros and cons.
2. Write a report on importance of quantum entanglement in supercomputers.

t Book

1. Engineering Physics by Avadhanalu, Revised edition, S. Chand Publications,2024.
2. Quantum Computation and Quantum Information, Michael A. Nielsen & Isaac L. Chuang, Cambridge Universities Press, 2010 Edition

References:

1. Elementary Solid state Physics: Principles and Applications by M.A. Omar, 1st Edition, Pearson Publications, 2002.
2. Principles of Quantum Mechanics by R Shankar, 2nd edition, springer Publications, 2011.
3. Optoelectronics: An Introduction by John Wilson and John Hawkes, 3rd edition, Pearson Publications, 2017.
4. Engineering Physics by Gaur and Gupta, Dhanpat Rai Publications, 2012.
5. Introduction to Quantum Mechanics, David J Griffiths, Cambridge University Press, 2019

E-Resourses:

1. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=553045&site=ehost-live
2. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=833068&site=ehost-live
3. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=323988&site=ehost-live
4. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1530910&site=ehost-live
5. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=486032&site=ehost-live

Topics relevant to "SKILL DEVELOPMENT": Fundamentals of materials, Lasers and optical fibers.
for Skill Development through Participative Learning Techniques. This is attained through the Assignment/ Presentation as mentioned in the assessment component in course handout.

Course Code: MEC1006	**Course Title:** Engineering Graphics **Type of Course:** School Core & Theory Only	**L- T-P-C**	2	0	0	2
Version No.	1.2					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					

Course Description	**The course is designed with the objective of giving an overview of engineering graphics. It is introductory in nature and acquaints the students with the techniques used to create engineering drawings. The course emphasizes on projection of points, lines, planes and solids and isometric projections.**
Course Objective	**The objective of the course is to familiarize the learners with the concepts of "Engineering Graphics" and attain SKILL DEVELOPMENT through Problem solving methodologies.**
Course Outcomes	**On successful completion of this course the students shall be able to:** **(1) Demonstrate competency of Engineering Graphics as per BIS conventionsand standards.** **(2) Comprehend the theory of projection for drawing projections of Points, Lines and Planes under different conditions.** **(3) Prepare multiview orthographic projections of Solids by visualizing them in different positions.** **(4) Prepare pictorial drawings using the principles of isometric projections to visualize objects in three dimensions.**

Course Content:

Module 1	Introduction to Drawing	Assignment	Standard technical drawing	**02 Sessions**
Topics: **Introduction, drawing instruments and their uses, relevant BIS conventions and standards, Lettering, Line conventions, dimensioning, Selection of drawing sheet size and scale.** **[02 Hours: Comprehension Level]**				
Module 2	Orthographic projections of	Assignment	Projection methods Analysis	**10 Sessions**

	Points, Straight Lines and Plane Surfaces			
Topics: **Introduction, Definitions – Elements of projection and methods of projection, Planes of projection, reference line and conventions adopted. First angle and third angle projections. Projection of Points in all 4 quadrants.** **Projections of Straight Lines (located in first quadrant/first angle projection only): True and apparent lengths, true and apparent Inclinations to reference planes. (No application problems). Projection of Plane surfaces (First angle projection): Regular plane surfaces – triangle, square, rectangle, pentagon, hexagon and circle – in different positions inclined to both the planes using change of position method only.** **[10 Hours: Application Level]**				
Module 3	Orthographic Projections of Solids	Assignment	Multi-view drawing Analysis	**10 Sessions**
Topics: **Introduction, Projection of right regular prisms, pyramids, cone, hexahedron and tetrahedron in different positions (Problems resting on HP only and First angle projection).** **[10 Hours: Application Level]**				
Module 4	Isometric Projections of Solids (Using isometric scale only)	Assignment	Spatial Visualization	**8 Sessions**
Topics: **Introduction, Isometric scale, Isometric projections of right regular prisms, cylinders, pyramids, cones and their frustums, spheres and hemispheres, hexahedron (cube), and combination of 2 solids, conversion of orthographic view to isometric projection of simple objects.** **[8 Hours: Application Level]**				
Text Book: **1.N. D. Bhatt, "Engineering Drawing: Plane and Solid Geometry," Charotar Publishing House Pvt. Ltd.**				
References: **1. K.R. Gopalakrishna, "Engineering Graphics", Subhash Publishers, Bangalore.** **2. D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, "Engineering Graphics with AutoCAD," Prentice Hall.** **3. D. A. Jolhe, "Engineering Drawing with Introduction to AutoCAD," Tata McGraw Hill.** **Web resources:** **https://nptel.ac.in/courses/112103019**				
Topics relevant to "SKILL DEVELOPMENT": Projection in first and third angle for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout.				

ENG1900	**English for Technical Communication**	**L- T- P- C**	2	0	0
Version No.	1.0				
Course Pre-requisites					
Anti-requisites	**NIL**				
Course Description	This course enhances the technical communication skills of BTech students, focusing on clarity, precision, and conciseness in academic and professional settings. Students will learn to differentiate between general and technical communication, analyze technical content, develop structured writing skills, and deliver effective presentations. Through interactive activities such as TED Talk analyses, report writing, and presentation practice, the course provides hands-on experience for real-world applications. By the end, students will be equipped to communicate complex technical information effectively in various professional contexts.				
Course Outcomes	On successful completion of the course the students shall be able to: 1. Differentiate between general and technical communication. 2. Explain key reading comprehension techniques to enhance understanding of technical texts. 3. Write clear, concise, and well-structured technical reports and documents. 4. Deliver technical presentations and implement peer feedback for continuous improvement. 5. Explain ethical practices in digital communication for professional use.				

Course Content: Theory

Module 1	**Technical communication**	**Quiz**	**Listening**	**9 Hours**

Introduction to Communication

Technical vs. General Communication

Characteristics of technical communication

Importance of clarity, precision, and objectivity

Activity:

- Watching TED Talks/videos to identify differences in technical and general vocabulary

Module 2	**Technical Reading**	**Assignment**	**Reading**	**12 Hours**

Reading Comprehension

Note making & Notetaking

Content Analysis

Activity:

- Reading technical articles and answering comprehension questions
- Note making techniques

Module 3	Technical Writing	Assignment	Writing	12hours
Paragraph Writing Structure of a paragraph (topic sentence, supporting details, coherence) Report Writing Structure of technical and project reports (Introduction, Methods, Results, Discussion) **Activity:** • Writing a structured paragraph on a technical topic • Writing project reports				

Module 4	Professional Presentation	Presentation	Speaking	12Hours

Introduction to Presentation Skills

Preparing a Presentation

- Structuring content (Introduction, Body, Conclusion)
- Designing effective slides (Text. visual aids, readability, and impact)

Delivering a Presentation

- Engagement techniques, Storytelling, narration, pitching ideas handling Q&A
- Conviction, commitment, generating interest through enthusiasm

Demonstration & Practice

- Giving presentations on topics based on their academic interest
- Evaluating and providing peer feedback

Activity:

- Analyze a real-world engineering issue and present solutions using a structured approach.

Targeted Application & Tools that can be used: YouTube, Instagram, Quill Bot, Grammarly, & Padlet.

References:

Text books:

1. Gupta, R.C. *Technical Communication.* 2nd ed., Cambridge University Press, 2021.
2. Lannon, John M., and Laura J. Gurak. *Technical Communication.* 15th ed., Pearson, 2022.

Reference Books:

1. Gerson, Sharon J., and Steven M. Gerson. Technical Communication: Process and Product. 9th ed., Pearson, 2020.
2. Lannon, John M., and Laura J. Gurak. Technical Communication. 15th ed., Pearson, 2022.
3. Markel, Mike, and Stuart A. Selber. Technical Communication. 13th ed., Bedford/St. Martin's, 2020.

Web Resources:

1. https://owl.purdue.edu/owl/subject_specific_writing/technical_writing.
2. https://journals.ieeeauthorcenter.ieee.org/.
3. https://www.stc.org/.
4. https://ocw.mit.edu/.https://www.ted.com/talks.

Topics Relevant to "employability": Teamwork and Collaboration, Critical Thinking and Problem- Solving

Topics Relevant to "Human Values and Professional Ethics": Critical reasoning, Inclusivity and Fairness

urse Code: E2022	urse Title: Digital Design pe of Course: ESC	- T-P- C	2	)	0	2
rsion No.	)					

urse Pre-requisites	[1] Elements of Electronics/Electrical Engineering, 2] Basic concepts of number representation, Boolean Algebra
ti-requisites	-
urse Description	The purpose of this course is to enable the students to appreciate the fundamentals of digital logic circuits and Boolean algebra focusing on both combinational and sequential logic circuits. The course emphasizes on minimization techniques for making canonical and low-cost digital circuit implementations. This course deals with analysis and design of digital electronic circuits. The course also creates a foundation for future courses which includes Computer Architecture, Microprocessors, Microcontrollers, and Embedded Systems etc. The course enhances the Design, Implementation and Programming abilities through laboratory tasks. The associated laboratory provides an opportunity to verify the theoretical knowledge.
urse Objective	The objective of the course is to familiarize the learners with the concepts of Digital Design and attain the SKILL DEVELOPMENT through EXPERIENTIAL LEARNING.
urse Outcomes	On successful completion of this course the students shall be able to: i. Describe the concepts of number systems, Boolean algebra and logic gates. ii. Apply minimization techniques to simplify Boolean expressions. iii. Demonstrate the Combinational circuits for a given logic iv. Demonstrate the Sequential and programmable logic circuits
urse Content:	

dule 1	ndamentals of Number systems- Boolean algebra and digital logic	plication Assignment	ta Analysis task	06 classes
pics: Review of Number systems and logic gates, Number base conversions, Overview of Boolean functions and simplifications, two, three, four variable K-Maps- Don't care conditions- Both SOP and POS- Universal Gates (NAND & NOR) Implementations. Introduction to HDL.				
dule 2	Boolean function simplification	plication Assignment	ta Analysis task	08 Classes
pics: Introduction to Combinational circuits, Analysis, Design procedure, Binary Adder and Subtractor, Magnitude comparator, Parity generator and checker, Multiplexers-Demultiplexers, Decoders, Encoders and Priority Encoders, HDL Models of combinational circuits.				
dule 3	Combinational Logic circuits:	plication Assignment	ogramming Task & Data Analysis task	08 Classes
pics: Introduction to sequential circuits, Storage elements: latches and flip flops, Characteristic tables and equations, excitation table, Analysis of clocked sequential circuits, Mealy & Moore Models of finite state machines - Registers & Counters. HDL Models of Sequential circuits.				
rgeted Application & Tools that can be used: gital electronics is the foundation of all modern electronic devices such as cellular phones, MP3 players, laptop computers, digital cameras, high definition televisions, Home Automation, Communication in systems in industries Professionally Used Software: HDL/VHDL/Verilog HDL/ OOPS				
Text Book(s): 1. Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education, 6th edition 2. Thomas L. Floyd "DIGITAL LOGIC DESIGN" , Pearson Education, fourth edition.				
Reference(s): Reference Book(s):				

R1. Jain, R. P., *"Modern Digital Electronics",* McGraw Hill Education (India), 4th Edition

R2. Roth, Charles H., Jr and Kinney Larry L., *"Fundamentals of logic Design"*, Cengage Learning, 7th Edition

Online Resources (e-books, notes, ppts, video lectures etc.): Book Free Download (studymaterialz.in)

1. eBook1: Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education.
2. {[PDF] Digital Design By M. Morris Mano, Michael D Ciletti Book Free Download }
3. eBook2:Floyd "DIGITAL LOGIC DESIGN" fourth edition- ePub, eBook- [PDF] DIGITAL LOGIC DESIGN FOURTH EDITION FLOYD | abri.engenderhealth.org.
4. NPTEL Course- NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits
5. Digital Logic Design PPT Slide 1 (iare.ac.in)
6. Lab Tutorial: Multisim Tutorial for Digital Circuits - Bing video

CircuitVerse - Digital Circuit Simulator online

Learn Logisim➠ Beginners Tutorial | Easy Explanation! - Bing video

Digital Design 5: LOGISIM Tutorial & Demo

7. https://presiuniv.knimbus.com/user#/home

E-content:

1. Z. Xin-Li and W. Hong-Ying, "The Application of Digital Electronics in Networking Communication," 2016 Eighth International Conference on Measuring Technology and Mechatronics Automation (ICMTMA), 2016, pp. 684-687, doi: 10.1109/ICMTMA.2016.168.
2. An encoding technique for design and optimization of combinational logic circuit DipayanBhadra;Tanvir Ahmed Tarique;Sultan Uddin Ahmed;Md. Shahjahan;KazuyukiMurase2010 13th International Conference on Computer and Information Technology (ICCIT)
3. A. Matrosova and V. Provkin, "Applying Incompletely Specified Boolean Functions for Patch Circuit Generation," 2021 IEEE East-West Design & Test Symposium (EWDTS), 2021, pp. 1-4, doi: 10.1109/EWDTS52692.2021.9581029.
4. A. Matrosova, V. Provkin and E. Nikolaeva, "Masking Internal Node Faults and Trojan Circuits in Logical Circuits," *2019 IEEE East-West Design & Test Symposium (EWDTS)*, 2019, pp. 1-4, doi: 10.1109/EWDTS.2019.8884434.

Topics relevant to "SKILL DEVELOPMENT": Adders, Multiplexers, Decoders / Encoders; Flip-Flops, Counters and Registers for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. G. Muthupandi
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

urse Code: E2052	urse Title: Digital Design Lab pe of Course: Theory &Integrated Laboratory	- T-P- C	0	0	2	1
rsion No.	0					
urse Pre-requisites	1]Elements of Electronics/Electrical Engineering, 2] Basic concepts of number representation, Boolean Algebra					
ti-requisites	-					
urse Description	The purpose of this course is to enable the students to appreciate the fundamentals of digital logic circuits and Boolean algebra focusing on both combinational and sequential logic circuits. The course emphasizes on minimization techniques for making canonical and low-cost digital circuit implementations. This course deals with analysis and design of digital electronic circuits. The course also creates a foundation for future courses which includes Computer Architecture, Microprocessors, Microcontrollers, and Embedded Systems etc. The course enhances the Design, Implementation and Programming abilities through laboratory tasks. The associated laboratory provides an opportunity to verify the theoretical knowledge.					
urse Objective	The objective of the course is to familiarize the learners with the concepts of Digital Design and attain the SKILL DEVELOPMENT through EXPERIENTIAL LEARNING.					
urse Outcomes	On successful completion of this course the students shall be able to: i. Implement various universal gates and Boolean functions circuits using logic gates. ii. Implement various combinational and sequential logic circuits using logic gates.					
urse Content:						

t of Laboratory Tasks:
periment N0 1: Verify the Logic Gates truth table
vel 1: By using Digital Logic Trainer kit
vel 2: By using Analog devices like RPS, Volt meter, Resistors and ICs

periment No. 2: Verify the Boolean Function and Rules
vel 1: By using Digital Logic Trainer kit
vel 2: By using Analog devices like RPS, Volt meter, Resistors and ICs

periment No. 3: Design and Implementations of HA/FA
vel 1: By using basic logic gates and Trainer Kit
vel 2: By using Universal logic gates and Trainer Kit

periment No. 4: Design and Implementations of HS/FS
vel 1: By using basic logic gates and Trainer Kit
vel 2: By using Universal logic gates and Trainer Kit

periment No. 5: Design and Implementations of combinational logic circuit for specifications
vel 1: Specifications given in the form of Truth table
vel 2: Specification should be extracted from the given scenario

speriment No. 6: Study of Flip flops

periment No. 7: Design and Implementations of sequential logic circuit for specifications

vel 1: Specifications given in the form of Truth table
vel 2: Specification should be extracted from the given scenario

periment No.8: HDL coding for basic combinational logic circuits
vel 1: Gate level Modeling
vel 2: Behavioral Modeling

periment No.9: HDL coding for basic sequential logic circuit
vel 1: Gate level Modeling
vel 2: Behavioral Modeling

rgeted Application & Tools that can be used:

gital electronics is the foundation of all modern electronic devices such as cellular phones, MP3 players, laptop computers, digital cameras, high definition televisions, Home Automation, Communication in systems in industries

ofessionally Used Software: HDL/VHDL/Verilog HDL/ OOPS

Text Book(s):

3. Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education, 6th edition

4. Thomas L. Floyd "DIGITAL LOGIC DESIGN" , Pearson Education, fourth edition.

Reference(s):
Reference Book(s):

R1. Jain, R. P., *"Modern Digital Electronics",* McGraw Hill Education (India), 4th Edition

R2. Roth, Charles H., Jr and Kinney Larry L., *"Fundamentals of logic Design"*, Cengage Learning, 7th Edition

Online Resources (e-books, notes, ppts, video lectures etc.): Book Free Download (studymaterialz.in)

7. eBook1: Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education.
8. {[PDF] Digital Design By M. Morris Mano, Michael D Ciletti Book Free Download }
9. eBook2:Floyd "DIGITAL LOGIC DESIGN" fourth edition- ePub, eBook- [PDF] DIGITAL LOGIC DESIGN FOURTH EDITION FLOYD | abri.engenderhealth.org.
10. NPTEL Course- NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits
11. Digital Logic Design PPT Slide 1 (iare.ac.in)
12. Lab Tutorial: Multisim Tutorial for Digital Circuits - Bing video

CircuitVerse - Digital Circuit Simulator online
Learn Logisim➠ Beginners Tutorial | Easy Explanation! - Bing video
Digital Design 5: LOGISIM Tutorial & Demo
7. https://presiuniv.knimbus.com/user#/home

E-content:

5. Z. Xin-Li and W. Hong-Ying, "The Application of Digital Electronics in Networking Communication," 2016 Eighth International Conference on Measuring Technology and Mechatronics Automation (ICMTMA), 2016, pp. 684-687, doi: 10.1109/ICMTMA.2016.168.
6. An encoding technique for design and optimization of combinational logic circuit DipayanBhadra;Tanvir Ahmed Tarique;Sultan Uddin Ahmed;Md. Shahjahan;KazuyukiMurase2010 13th International Conference on Computer and Information Technology (ICCIT)
7. A. Matrosova and V. Provkin, "Applying Incompletely Specified Boolean Functions for Patch Circuit Generation," 2021 IEEE East-West Design & Test Symposium (EWDTS), 2021, pp. 1-4, doi: 10.1109/EWDTS52692.2021.9581029.

8. A. Matrosova, V. Provkin and E. Nikolaeva, "Masking Internal Node Faults and Trojan Circuits in Logical Circuits," *2019 IEEE East-West Design & Test Symposium (EWDTS)*, 2019, pp. 1-4, doi: 10.1109/EWDTS.2019.8884434.

Topics relevant to "SKILL DEVELOPMENT": Adders, Multiplexers, Decoders / Encoders; Flip-Flops, Counters and Registers for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: DES1146	**Course Title:** Introduction to Design Thinking **Type of Course:** Theory	**L-T-P-C**	1	0	0	1
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The course aims to introduce students to the fundamental principles and processes of Design Thinking and will learn to apply Design Thinking methodologies to real-world challenges. The course emphasizes empathy, creativity, and collaboration, equipping students with essential skills for successful engineering practice.					
Course Objective	This course is designed to develop and familiarize the learners with the concepts of creating thinking and attain Entrepreneurship by using Participative Learning techniques.					

<table>
<tr><td>Course Outcomes</td><td colspan="5">On successful completion of the course the students shall be able to:
1) Understand the concept and importance of Design Thinking.
2) Differentiate between traditional problem-solving and Design Thinking.
3) Identify the core stages of the Design Thinking process.</td></tr>
<tr><td>Course Content:</td><td colspan="5">All assignments and projects must be developed using the reference materials available from the PU e-resource database – JSTOR, EBSCO, Library OPAC, NPTEL Videos, etc.</td></tr>
<tr><td>Module 1</td><td>Introduction to Design Thinking</td><td>Visual journal, book of essays, context-specific assignment/project</td><td></td><td>Visual output generation, by Visual Journal and narrative development.</td><td>3 hours</td></tr>
<tr><td></td><td colspan="5">Topic
1) Definition and Introduction to Design Thinking
2) Understand the Design Thinking Process</td></tr>
<tr><td>Module 2</td><td>Design Thinking in Action</td><td>Visual journal, book of essays, context-specific assignment/project</td><td></td><td>Visual output generation, by visual journal and narrative development.</td><td>12 hours</td></tr>
<tr><td></td><td colspan="5">Topics:
1) Introduction to the steps of Design Thinking Process
2) Understand use cases of Design thinking
3) Design Thinking and Research Tools pertaining to Consumer Tech. , Home Tech. , Personal Tech. , Auto Tech. or Extended Reality.</td></tr>
<tr><td></td><td colspan="5">Targeted Application & Tools that can be used:
1) Design ideation tools like Miro , SCAMPER etc.
2) Research Tools for Human Centric Design using forecasting tools like WGSN
3) Feedback tools like Google Forms , etc.
4) Expert Lectures</td></tr>
<tr><td></td><td colspan="5">Text Book
Thinking Design by S Balaram. New Delhi [India]: Sage Publications Pvt. Ltd. 2010. eBook., Database: eBook Collection (EBSCOhost)
https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=6&sid=18ab1f43-1f92-4d02-ae2e-a9c06dc06d8c%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=354920&db=nlebk</td></tr>
</table>

References

Design Thinking by Clarke, Rachel Ivy. Series: Library Futures, Vol. 4. Chicago: ALA Neal-Schuman. 2020. eBook., Database: eBook Collection (EBSCOhost) https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=4&sid=c80a7d79-eda4-4b7e-a0d6-afafe437962b%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=2433506&db=nlebk

The Pocket Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions by Bruce Hanington; Bella Martin. Minneapolis: Rockport Publishers. 2017. eBook., Database: eBook Collection (EBSCOhost) https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=11&sid=f086b8c2-260e-4caa-8c48-d732c21a7724%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=1638693&db=nlebk

What Is Design Thinking and Why Is It Important? By Rim Razzouk and Valerie Shute - Review of Educational Research, Vol. 82, No. 3 (September 2012), pp. 330-348 (19 pages), Published by: American Educational Research Association https://puniversity.informaticsglobal.com:2054/stable/23260048?Search=yes&resultItemClick=true&searchText=design+thinking&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Ddesign%2Bthinking%26so%3Drel&ab_segments=0%2FSYC-6168%2Ftest&refreqid=fastly-default%3Acb1be24976e25734cb5fc13a8af6fdfb&seq=1#metadata_info_tab_contents

Abductive Thinking and Sensemaking: The Drivers of Design Synthesis by John Kolko, Design Issues, Vol. 26, No. 1 (Winter, 2010), pp. 15-28 (14 pages), Published by: The MIT Press https://puniversity.informaticsglobal.com:2054/stable/20627839?Search=yes&resultItemClick=true&searchText=design+thinking&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Ddesign%2Bthinking%26so%3Drel&ab_segments=0%2FSYC-6168%2Ftest&refreqid=fastly-default%3A0b89336ea274d63c010536b01316d7bb&seq=1#metadata_info_tab_contents

Designerly Ways of Knowing: Design Discipline versus Design Science by Nigel Cross, Design Issues, Vol. 17, No. 3 (Summer, 2001), pp. 49-55 (7 pages), Published by: The MIT Press https://puniversity.informaticsglobal.com:2054/stable/1511801?Search=yes&resultItemClick=true&searchText=design+thinking&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Ddesign%2Bthinking%26so%3Drel&ab_segments=0%2FSYC-6168%2Ftest&refreqid=fastly-default%3A0d5b607b163f60876ca973ed90e22b1c&seq=1#metadata_info_tab_contents

Course Code: **PPS 1025**	**Course Title: Industry Readiness Program – I (Audited Course)** Type of Course: Practical Only Course	L- T - P- C	0	0	2	0
Version No.	1.0					
Course Pre-requisites	• Students are expected to understand Basic English. • Students should have desire and enthusiasm to involve, participate and learn.					
Anti-requisites	NIL					
Course Description	This course is designed to enable students to set SMART goals, form professional & personal ethics for success and learn various email writing techniques. The course will benefit learners in presenting themselves effectively through various activities and learning methodologies.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Employability for Young Professionals" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.**					
Course Out Comes	**On successful completion of this course the students shall be able to:** CO 1 **Define** their career goals CO 2 **Practice ethical habits** for better career success CO3 **Demonstrate** effective email writing techniques					
Course Content						

Module 1	**Goal Setting & Grooming**	Classroom activities	**10 Hours**
Topics: SMART Goals, formal grooming through self-introduction activity **Activity:** Real world scenarios			
Module 2	**Habit Formation**	Role plays	**10 Hours**
Topics: Professional and Personal ethics for success and activity-based practice **Activity:** Students to present 2 min video on building professional ethics			
Module 3	**Email Etiquettes**	Individual and group presentation	**10 Hours**
Topics: Types of prompts to generate effective or desired results for email etiquettes **Activity:** Individual student presenting various search prompts			
Faculty: L&D			
Targeted Application & Tools that can be used: 1. TED Talks 2. You Tube Links 3. Activities			
Assignment proposed for this course Assignment 1: SMART Goal Assignment 2: AI tools for prompt search			
Continuous Individual Assessment Module 1: Presentation Module 2: Activity based assessment Module 3: Class assessment			

The topics related to skill development: Students acquire knowledge on SMART goals, implement grooming standards, practice ethical behavior in class and campus, acquire hands-on experience to use AI tools to get search prompts for desired email etiquettes.	
Catalogue prepared by	Faculty of L&D
Recommended by the Board of Studies on	**BOS held on**
Date of Approval by the Academic Council	**Academic Council Meeting held on**

Course Code: MAT2402	**Course Title: Probability and Statistics** **Type of Course:1] School Core**	**L-T- P- C**	**3**	**0**	**0**	**3**
Version No.	1.0					
Course Pre-requisites	MAT2301					
Anti-requisites	**NIL**					
Course Description	The course introduces the concepts of probability theory and statistical analysis, covering how to collect, organize, interpret, and draw inferences from data using mathematical models to understand randomness and uncertainty, with applications across various fields like science, engineering, economics, and social sciences.					
Course Objective	The objective of the course is to equip students with the foundational					

		knowledge of probability theory and statistical methods, enabling them to collect, analyze, interpret data, and make informed decisions based on the likelihood of events occurring in various situations, often applied across different fields like science, engineering, and business.	
Course Out Comes		On successful completion of the course the students shall be able to: CO1 - be able to compute conditional probabilities directly and using Bayes' theorem, and check for independence of events. CO2 - be able to set up and work with discrete & continuous random variables; in particular, to understand the Bernoulli, binomial, geometric, Poisson distributions, uniform, normal, and exponential distributions. CO3 - Identifying different types of data relationships (linear, polynomial, exponential, logarithmic). CO4 - be able to use specific significance tests, including z-test, t-test (one- and two-sample), and chi-squared test	
Course Content:			
Module 1	**Basic Probability**		**(6 Classes)**
Probability of an Event, multiplication rule, combinations, permutations, Addition Law, Multiplication Law, Conditional Probability, Bayes's Theorem and Problems.			
Module 2	**Random Variables and Bivariate Distributions**	**Assignment**	**(15 Classes)**
Random Variables (discrete and continuous), Probability Mass/Density Functions, Mathematical Expectations, discrete probability distributions - Binomial distribution, Poisson distribution, geometric distribution, Continuous uniform distribution - exponential distribution, normal distribution, gamma distribution. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.			
Module 3	**Curve Fitting & Statistical Methods**		**(13 Classes)**
Curve Fitting (Straight Line ($y = a + bx$), Parabola ($y = a + bx + cx^2$), Exponential Curves ($y = ae^{bx}$, $y = ab^x$ and $y = ax^b$) Measures of Central tendency, Moments, skewness and Kurtosis, Correlation - Karl Pearson's coefficient of correlation and rank correlation (with & Without repetition, Multiple Correlation - Problems. Regression analysis - lines of regression, Multiple regression - Problems.			
Module 4	**Joint Probability Distribution and Sampling Theory**	**Assignment**	**(15 Classes)**
Joint Probability distribution for two discrete random variables, expectation and covariance. Random sampling, sampling distributions, Standard Error, Type I & Type II errors, Testing of Hypothesis, Test of significance - Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations, Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.			
Targeted Application & Tools that can be used: The contents of this course has direct applications in most of the core engineering courses for problem formulations, Problem Solution and system Design. Tools Used: R software (Open Source)			
Assignment:			

Select any one simple differential equation pertaining to the respective branch of engineering, ıtify the dependent and independent variable + Obtain the solution and compare the solution sets by ying the values of the dependent variable.

Text Book

1. Ronald .E. Walpole, Raymond. H. Myers, Sharon. L Myers, and Keying E. Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Delhi-9th edition, 2012.
2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

References:

1. Miller and Freund, Probability and Statistics for Engineers, Pearson Education Ltd.
2. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition.
3. Douglas C. Montgomery & George Runger, Applied Statistics and Probability for Engineers, , Wiley Publications

E-resources/ Web links:

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&uni_id=EBSCO95_30102024_10427
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&uni_id=EBSCO95_30102024_100198
https://nptel.ac.in/courses/109104124
https://nptel.ac.in/courses/111106051
https://nptel.ac.in/courses/111102137
https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
https://www.scu.edu.au/study-at-scu/units/math1005/2022/
Presidency University's Knimbus library URL is: presiuniv.knimbus.com

Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of Vector calculus and Linear Algebra with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem Solving**.** This is attained through the assessment component mentioned in the course handout.

urse Code: CHE7601	vironmental Studies pe of Course: MOOC course	- P- C				
		ntact hours				
urse Pre-requisites	NIL					
ti-requisites	.					
urse Description	This course is designed to improve the learners' SKILL DEVELOPMENT by using PATICIPATIVE LEARNING techniques. This course aims to familiarize students with fundamental environmental concepts and their relevance to business operations, preparing them to address forthcoming sustainability challenges. It is designed to equip students with the knowledge and skills needed to make decisions that account for environmental consequences, fostering environmentally sensitive and responsible future managers. **This course is designed to cater to Environment and Sustainability**					
urse ective	The objective of the course is **'SKILL DEVELOPMENT'** of the student by using **'PARTICIPATIVE LEARNING'** techniques					
urse Outcomes	On successful completion of this course the students shall be able to: 1. Describe the issues related to natural resources, ecosystems and biodiversity 2. Identify environmental hazards affecting air, water and soil quality 3. Recognize the importance of healthy environment and finding the sustainable methods to protect the environment 4. Convert skills to address immediate environmental concerns through changes in environmental processes, policies, and decisions					
urse Content:						
dule 1	derstanding Environment, Natural Resources, and Sustainability					
pics:	ssification of natural resources, issues related to Population growth and their overutilization, and strategies for their conservation. Water, air, soil, mineral, energy and food source. Effect of human activities on natural resources. ncept of sustainability- Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs; Sustainable practices in managing resources, including deforestation, water conservation, Desalination – types, energy security, and food security issues, Life Cycle thinking and Circular Economy.					
dule 2	osystems, Biodiversity, and Sustainable Practices					
pics:	**Ecosystems and ecosystem services:** Various natural ecosystems, Major ecosystem types in India and their basic characteristics; forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance. The importance of biodiversity, Types of biodiversity, Biodiversity and Climate Change, the threats it faces, hotspots, and the methods used for its conservation. Strategies for in situ and ex situ conservation, mega diverse nation.					
dule 3	vironmental Pollution, Waste Management, and Sustainable Development					
pics:	Types of pollution- Chemical, - Biological, Biomedical, noise, air, water, soil, thermal, radioactive and marine pollution, and their impacts on society. Urbanization and Urban environmental problems; effects, and mitigation. Causes of pollution, such as global climate change, ozone layer depletion, the greenhouse effect, and acid rain, with a particular focus on pollution episodes in India. Importance of adopting cleaner technologies; Solid waste management;					

Sustainable Materials and Technologies: Biodegradable and compostable materials, Recycled and reclaimed materials (E-waste management), Sustainable manufacturing processes.

dule 4	cial Issues, Legislation, and Practical Applications			

pics:

Overview of key environmental legislation and the judiciary's role in environmental protection, including the Water (Prevention and Control of Pollution) Act of 1974, the Environment (Protection) Act of 1986, and the Air (Prevention and Control of Pollution) Act of 1981. Hazardous waste Rule 1989, Biomedical Waste handling 1998, Fly Ash Rule 1999, Municipal Solid Waste Rule 2000, Battery Rules 2001, E- Waste Rules 2011, Plastic waste management Rules 2016, Construction Demolition waste Rules 2016 National Biodiversity Action Plan (NBAP)

Major International Environmental Agreements: Convention on Biological Diversity (CBD), The Biological Diversity (Amendment) Act, 2023, United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement.

Major International organisations and initiatives: United Nations Environment Programme (UNEP), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC).

geted Application & Tools that can be used:

plication areas are Energy, Environment and sustainability

ols: Online Tools – NPTEL and Swayam.

ject work/Assignment:

sessment Type

- Online exams (MCQs) will be conducted by the department of Chemistry

line Link*:

1) Lecure by Dr. Samik Chowdhury, Dr. Sudha Goel, NPTEL course: Environmental Science, https://nptel.ac.in/courses/109105203, 2024.
2) Lecture by Dr. Padmavati, Dr Narendran Thiruthy, NPTEL Course: Biodiversity Protection, Farmers and Breeders Rights, https://nptel.ac.in/courses/129105008, 2024.

ther source links are available in below Resources link.

xt Book

1. G. Tyler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA
2. Poonia, M.P. Environmental Studies (3rd ed.), Khanna Book Publishing Co.
3. Bharucha, E. Textbook of Environmental Studies (3rd ed.) Orient Blackswan Private Ltd.
4. Dave, D., & Katewa, S. S. Text Book of Environmental Studies. Cengage Learning India Pvt Ltd.
5. Rajagopalan, R. Environmental studies: from crisis to cure (4th ed.). Oxford University Press.
6. Basu, M., & Xavier Savarimuthu, S. J. Fundamentals of environmental studies. Cambridge University Press.
7. Roy, M. G. Sustainable Development: Environment, Energy and Water Resources. Ane Books.
8. Pritwani, K. Sustainability of business in the context of environmental management. CRC Press.
9. Wright, R.T. & Boorse, D.F. Environmental Science: Toward A Sustainable Future (13th ed,). Pearson.

ference Books

1. Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022), Conservation through Sustainable Use: Lessons from India. Routledge.
2. William P. Cunningham and Mary Ann Cunningham (2020), Principles of Environmental Science: Inquiry & Applications, 9th Edition, McGraw-Hill Education, USA.
3. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.
4. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press.

https://doi.org/10.1201/9781003096238

5. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press

Resources:

1. https://nptel.ac.in/courses/109105203
2. https://archive.nptel.ac.in/courses/120/108/120108004/
3. https://nptel.ac.in/courses/127105018
4. https://onlinecourses.nptel.ac.in/noc23_lw06/preview
5. https://onlinecourses.swayam2.ac.in/ini25_bt02/preview
6. https://archive.nptel.ac.in/courses/120/108/120108002/
7. https://onlinecourses.swayam2.ac.in/ini25_bt02/preview
8. https://nptel.ac.in/courses/102104088
9. https://nptel.ac.in/courses/124107165
10. https://nptel.ac.in/courses/109106200
11. https://archive.nptel.ac.in/content/storage2/courses/120108004/module1/lecture1.pdf
12. https://onlinecourses.swayam2.ac.in/nou25_ge19/preview
13. https://onlinecourses.swayam2.ac.in/ini25_hs01/preview
14. http://kcl.digimat.in/nptel/courses/video/105105184/L32.html
15. https://nptel.ac.in/courses/105105169

Topics relevant to Skill Development:

1. An attitude of enquiry.
2. Write reports

e topics related to Environment and Sustainability :

topics in theory component are relevant to Environment and Sustainability.

Catalog prepared by	Faculty members of the Department of Chemistry
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

urse Code: '1200	**urse Title: Foundations of Integrated Engineering** **e of Course: Theory Only**	**L- T-P- C**	2	0	0	2
rsion No.						
urse Pre-requisites	**NIL**					
ti-requisites						
urse Description	This interdisciplinary course introduces first-year engineering students to foundational principles and practices across key engineering domains, emphasizing real-world problem-solving, sustainability, and ethical innovation. Students explore how civil, mechanical, electrical, and IT systems intersect with emerging technologies like IoT, AI, and geomatics to address global challenges. Through case studies, learners gain deeper understanding of smart infrastructure, prototyping mechanical/electronic systems, and securing IT solutions. Topics include bioinformatics for environmental monitoring, GIS-enabled urban planning, renewable energy integration, and cybersecurity fundamentals. The course cultivates a holistic understanding of engineering's role in sustainable development, safety, and ethical decision-making, preparing students to contribute meaningfully to multidisciplinary projects in a technology-driven world.					
urse Objective	The objective of the course is skill development of student by using Participative Learning techniques.					
urse Outcomes	On successful completion of this course the students shall be able to: 1] Recall key principles of Agile, DevOps, and bioinformatics used in interdisciplinary engineering contexts. 2] Explain the role of GIS, LiDAR, and sustainable materials in designing smart infrastructure and disaster management systems. 3] Describe core components of mechanical systems and their real-world applications. 4] Describe the functionality of IoT-enabled wearable devices, embedded systems, and renewable energy integration in smart grids. 5] List foundational IT concepts such as cloud computing architectures, cybersecurity threats, and blockchain applications.					
urse Content:						
dule 1	**ndations of Engineering Practice**	ignment	se studies		**essions**	
al-world problem-solving using data logic and practical applications, Collaboration and Innovation through multi-domain project, Engineering Ethics & Environmental Impact erging Fields: Automation, and Introduction to bioinformatics and its application tainability & Safety: Circular economy principles, carbon footprint analysis.						
dule 2	**il Engineering & Geomatics**	ignment	icle Review		**essions**	
art Infrastructure & Geomatics: GIS mapping, LiDAR, drone surveys for urban planning, Geospatial data analysis for disaster management. tainable Construction: 3D-printed structures, self-healing concrete, Digital twins for infrastructure monitoring. een Innovations: Net-zero energy buildings, rainwater harvesting systems.						
dule 3	**chanical Engineering in Action**	ignment & Quiz	ta Collection		**essions**	
vanced Manufacturing: Collaborative robots (cobots), additive manufacturing and 3D printing, Reverse engineering and prototyping. ergy Systems: Solar/wind energy harvesting, piezoelectric applications. mechanics: Prosthetics design, ergonomic product lifecycle.						
dule 4	**ctrical & Electronics Engineering**	ignment & Quiz	ta Collection and visualization		**essions**	

art Devices & Systems: Embedded systems, Wearable technology, Edge computing and hardware platforms
ergy Innovations: EV charging infrastructure, wireless power transfer, Smart grid integration with renewables.

dule 5	**ndamentals of IT**	ignment & Quiz	se studies	**5 Sessions**

re IT Topics: Networking basics, Cloud computing
bersecurity & Data: Encryption, phishing prevention, zero-trust models, Database management.
erging Tech: Blockchain for supply chains, AI/ML basics, IoT integration with cloud platforms

geted Application & Tools that can be used:

blication Areas include Interdisciplinary problem-solving, Smart city planning, disaster management, Robotics prototyping, renewable energy systems, Wearable health tech, smart grids, Secure cloud systems.
bls: 3D Printers, Autocad, Tinkercad, ArcGIS / QGIS, Arduino/Raspberry Pi

t Book:

1. William Oakes & Les Leone, "Engineering Your Future: An Introduction to Engineering", Oxford University Press, 9th Edition, 2021
2. Barry F. Kavanagh, “Introduction to Geomatics”, Pearson, 5th Edition, 2021
3. Ian Gibson, David Rosen, & Brent Stucker, “Additive Manufacturing Technologies”, Springer, 3rd Edition, 2021
4. Sudip Misra, "The Internet of Things: Enabling Technologies, Protocols, and Use Cases", Wiley, 2nd Edition, 2022
5. James Kurose & Keith Ross, “Computer Networking: A Top-Down Approach”, Pearson, 8th Edition, 2020

ferences

1. Supratim Choudhuri, “Bioinformatics for Beginners: Genes, Genomes, and Molecular Evolution", Academic Press, 1st Edition, 2023,
2. Robert McGinn, "The Ethical Engineer: Contemporary Concepts and Cases", Princeton University Press, 1st Edition, 2020
3. Charles J. Kibert, “Sustainable Construction: Green Building Design and Delivery”, Wiley, 5th Edition, 2022
4. Anthony M. Townsend, "Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia", W.W. Norton & Company, 1st Edition, 2020
5. David Buchla, "Renewable Energy Systems: A Smart Energy Systems Approach", Pearson, 2nd Edition, 2023
6. Charles Platt, "Make: Electronics: Learning Through Discovery", Make Community, 3rd Edition, 2021
7. Charles J. Brooks, Christopher Grow, & Philip Craig, “Cybersecurity Essentials", Wiley, 2nd Edition, 2021

eb-resources:

1. Post-parametric Automation in Design and Construction
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1155197&site=ehost-live
2. Smart Cities : Introducing Digital Innovation to Cities
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1993146&site=ehost-live
3. Innovation Energy: Trends and Perspectives or Challenges of Energy Innovation
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2323766&site=ehost-live
4. Additive Manufacturing: Opportunities, Challenges, Implications
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1134464&site=ehost-live

Catalogue prepared by	Dr. Nakul Ramanna, Dr. Rajiv Ranjan Singh, Mr. N. Gopalakrishnan, Mr. Ajay H A
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

urse Code: E2502	**Course Title: Chemistry of Smart Materials Lab (CSE and Allied)** **pe of Course: Laboratory course- Basic science course**	-P- C		0		1
rsion No.						
urse Pre-requisites	fore undertaking this Chemistry of Smart Materials Lab course, students are expected to possess foundational knowledge of chemistry, including an understanding of acids and bases, metals and metal ions, oxidizing and reducing agents, various types of instrumental analysis, and the proper use of laboratory glassware. Additionally, students should be familiar with handling chemicals and glassware safely and adhering to essential laboratory safety precautions.					
ti-requisites	.					
urse Description	The laboratory course aims to develop experimental skills and apply fundamental chemical principles to address chemistry-related problems in engineering. The experiments are carefully designed to complement the theoretical concepts covered in lectures, providing hands-on experience to deepen understanding and reinforce learning. This course is designed to cater to Environment and Sustainability.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Chemistry of Smart Materials Lab" and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques**.					
urse Outcomes (COs)	**On successful completion of the course, students shall be able to:** **CO1:** recognize the basic techniques and instrumentation used in chemistry laboratories for quantitative analysis. **CO2:** estimate the presence of acids and metal ions in domestic and industrial waste using laboratory techniques. **CO3:** review the experimental results and demonstrate improved experimental skills through hands-on laboratory experience. **CO4:** classify laboratory techniques such as experimental setups for synthesis, purification, recovery and analysis.					
urse Content:	**Total 30 sessions**					

periment 1	perimental	ta Collection	Analysis and Interpretation
termination of strength of strong acid in battery electrolyte using conductometric sensors.			
periment 2	perimental	ta Collection	Analysis and Interpretation
imation of iron from e-waste using Electrochemical sensors.			
periment 3	perimental	ta Collection	Analysis and Interpretation
termination of pKa of organic acid of battery electrolyte using pH sensor.			
periment 4	perimental	ta Collection	Analysis and Interpretation
Estimation of copper from PCBs by using colorimeter (Optical Sensor).			

periment 5	perimental	ta Collection	alysis and Interpretation
nductometric estimation of mixture of acids in Recycling process of E- waste.			
periment 6	perimental	ta Collection	alysis and Interpretation
termination of viscosity coefficient of a given organic liquid using Ostwald's Viscometer (viscoelastic property).			
periment 7	perimental	ta Collection	alysis and Interpretation
Recovery of valuable metals (copper) from e- waste by Iodometric titration.			
periment 8	perimental	ta Collection	alysis and Interpretation
imation of iron in electronic devices using Std. Potassium permanganate solution.			
periment 9	perimental	ta Collection	Analysis
me photometric estimation of sodium (Battery Recycling- Optical Sensor).			
periment 10	perimental	ta Collection	Analysis
thesis of conducting polyaniline for gas sensor applications (Demonstration experiment).			
periment 11	perimental	ta Collection	Analysis
een synthesis of nanomaterials (Demonstration experiment).			
periment 12	perimental	ta Collection	Analysis
Recovery of valuable metals from e- waste by eletroless method (Demonstration experiment).			
y 8 experiments will be conducted out of 12			

ntinuous Internal Assessment:

- Midterm exam
- Experimental Evaluation
- Viva-voce
- Endterm exam

xt Book

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S. Chand Publications, New Delhi (2022)
2. Vogel's text book of practical organic chemistry 5th edition
3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi

ferences

1. Engineering Chemistry Laboratory Manual (English, Paperback, Dr Manoj Kumar Solanki), Edu-creation Publishing

E-resources:

1. https://books-library.net/files/download-pdf-ebooks.org-kupd-679.pdf

Video Links:

1. https://www.youtube.com/watch?v=gd1YQr-74sw
2. https://www.youtube.com/watch?v=wVJ8WQax0rQ
3. https://www.youtube.com/watch?v=aWwEGCNtKwk
4. https://www.youtube.com/watch?v=JhBs_8DrPYo

5. https://www.youtube.com/watch?v=5bFAx2b_6A8
6. https://www.youtube.com/watch?v=_IVVZnAFfrM
7. https://www.youtube.com/watch?v=BBhuXOh9vOM
8. https://www.youtube.com/watch?v=j-nW3Jhc794

e topics related to Skill Development All the experiments are relevant to Skill Development through Experiential Learning Techniques. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Faculty members of Chemistry
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

urse Code: E2501	**urse Title: Chemistry of Smart Materials (CSE and Allied)** **e of Course: Theory only-Basic sciences course**	- P- C		0		3
sion No.						
urse Pre-requisites	Fundamental knowledge of organic and inorganic chemistry					
ti-requisites	.					
urse Description	The objective of the course is to introduce the students to concepts and applications of chemistry of smart materials. The course also aims to enhance the knowledge of smart materials associated with memory system, display devices, , sensors, energy devices and environment. It will also cultivate an ability to identify chemistry in each of smart engineered materials and interpret solutions for the challenges connected to memory, display, energy, smart, green and sustainable technologies. It targets to strengthen the fundamental concepts behind chemistry of smart materials and then builds an interface with their industrial applications. **This course is designed to cater to Environment and Sustainability**					
urse jective	The objective of the course is 'SKILL DEVELOPMENT' of the student by using Participative learning techniques.					
urse Outcomes	On successful completion of this course the students shall be able to: 1) Relate the knowledge of chemistry to computational approaches to identify materials functionalities and properties 2) Recognize and interpret solutions for the challenges connected to memory, display, smart, green and sustainable technologies. 3) Explain the quality parameters of engineering materials associated with environment and sensors. 4) Interpret the knowledge of sustainable chemistry for E- waste management. 5) Analyse the importance of various electrochemical sources in energy systems.					
urse Content:						
dule 1	**mputational Chemistry**	Assignment	ta Collection and analysis	**09 classes**		
pics: Fundamental particles of atom – their mass, charge and location – atomic number and mass number, Stabilizing interactions: Bonded and non-bonded interactions. Chemistry of weak interactions – van der Waals force and hydrogen bonding, Density functional theory. 3D co-ordinate generation for small molecules, geometry optimization by Molview. Chemical Databases: Chemoinformatics, MSDS ***f- learning topics:*** Scope, cost and efficiency of computational modeling.						
dule 2	**terials for Memory and Display Systems**	Assignment	ta Collection and analysis	**09 Classes**		
Topics: Memory Systems : Introduction, classification of electronic memory devices- Transistor, capacitor, charge -transfer and Resistor, types of materials - organic, polymeric and hybrid materials, and applications, manufacturing of semiconductor chips. **Display Systems:** photo and electroactive materials , materials for display -Principle, Properties and applications: Liquid crystals for LCD-Liquid crystals display, Basics of LED: OLED-organic light emitting diode and light emitting electrochemical cells. ***Self- learning topics:*** Green computing: Biocomposite based memory devices						
dule 3	**nomaterials based Smart Sensors and Devices**	Assignment	ta Collection and analysis	**09 Classes**		
pics: Nanomaterials- Introduction, classification based on dimensionality, quantum confinement. Size dependent						

properties, Synthesis, Properties of CNT and Graphene and their application as **Materials for data analysis and packaging** -RFID and IONT.

Sensors: Introduction, types, Principle and applications- electrochemical sensor: nanomaterials for sensing applications - Glucose, VOC sensing.

Self-learning topics: Fullerene, biomolecules in sensing, Strain sensors

dule 4	**Sustainable Materials and Development**	Quiz/Seminar	ta Collection and analysis	**09 Classes**

pics: E waste: Introduction, E waste Hazards, E- waste management, Recovery of precious metal- Cu by Hydrometallurgy.

Green Chemistry: Fundamentals and 12 principles with examples, Carbon footprint and sequestration

Sustainable Chemistry: -Introduction to Biomaterials- PLA , polymers in bio-compatible and bio-degradable materials - Poly(3-hydroxybutyrate-co-3-hydroxyvalerate) PHBV, synthesis and applications in drug delivery.

Self-learning topics: circular economy- case studies.

dule 5	**ergy Science**	Quiz/Seminar	ta Collection and analysis	**Classes**

pics: Battery technology: Fundamentals of electrochemistry, Introduction to electrochemical storage devices: battery (Lithium-ion battery- $LiMnO_2$, $LiCoO_2$, metal air batteries- LiO_2) and supercapacitors-Introduction, Principle, Types - EDLC, pseudo and asymmetric capacitor.

Photovoltaics: Solar cells - Construction and working principle; types- Inorganic, Organic and quantum dot sensitized (QDSSC's).

Self -learning topics: Battery technology for e-mobility, Green hydrogen

geted Application & Tools that can be used:

plication areas are Data storage and analysis, logistics, Biomedicine, Energy, Environment and sustainability

ols: Molview, chemdraw, excel etc

ject work/Assignment:

sessment Type

- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screenshot accessing the digital resource.)
- Quiz/Student Seminar
- End Term Exam
- Self-learning

t Book

10. Wiley, "Engineering Chemistry", Wiley.
11. G.A. Ozin and A.C. Arsenault, Nanochemistry: A chemical approach to nanomaterials, Royal Society of Chemistry, 2009

ference Books

1. Functional and smart materials, Chander Prakash, Sunpreet Singh, J. Paulo Davim, 2020, CRC Press, ISBN: 978-036-727-510-5.
2. E-waste recycling and management: present scenarios and environmental issues, Khan, Anish, and Abdullah M. Asiri. 2019, Springer, Vol. 33. ISBN: 978-3-030-14186-8.
Essentials of computational chemistry: theories and models, Christopher J Cramer, 2013, John Wiley & Sons. ISBN: 978-0-470-09182-1.
3. Energy storage and conversion devices: Supercapacitors, batteries and hydroelectric cells, Anurag Gaur, A. L. Sharma, Anil Arya. 2021, CRC press, 1st edition, ISBN: 978-1-003-14176-1.
4. Fundamentals of analytical chemistry: An introduction, Douglas A. Skooget etal., 2004 Thomson Asia pte Ltd., 8th, ISBN: 978-0-495-55828-6
5. Functional and smart materials, Chander Prakash, Sunpreet Singh, J. Paulo Davim, 2020, CRC Press, ISBN: 978-036-727-510-5.
6. Electrical and electronic devices, circuits and materials: Technological challenges and solutions. Tripathi, S. L., Alvi, P. A., & Subramaniam, U, 2021, John Wiley & Sons, ISBN: 978-0367564261.
7. F. Jensen, Introduction to Computational Chemistry, 3rd edition, Wiley, 2017.

E resources

1. https://presiuniv.knimbus.com/user#/searchresult?searchId=computational%20chemistry&_t=173805497014

2 2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_48504 3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_147967 4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_130301 5. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_87297 6. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_67006 7. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_137261 **8.** https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_86712
ll Sets topics in theory component are relevant to Environment and Sustainability.

Catalog prepared by	Faculties of Department of Chemistry
Recommended by the Board of Studies on	PU/SOE/CHE/BOS-0x/20xx-2x BOS held on 00/00/2x
Date of Approval by the Academic Council	th Academic council

G2501	**vanced English**	**T- P- C**	2	)	)	2
rsion No.						
urse Pre-requisites	G1900 - English for Technical Communication					
ti-requisites	L					
urse Description	This course is designed to equip students to enhance their communication abilities in Listening, Speaking, Reading, and Writing. The curriculum covers interpersonal communication principles, the art of speech writing and delivery (including impromptu speaking), strategic approaches to critical reading, the identification of logical fallacies, and persuasive writing. Furthermore, the course will introduce students to the potential of AI tools and the techniques of prompt engineering to elevate their communication skills in the digital age. Upon course completion, students will be well-prepared to communicate effectively and critically in both academic and professional environments.					
urse Out Come	On successful completion of the course the students shall be able to: 1. Recognize the elements of interpersonal and cross-cultural communication to address communication challenges effectively. 2. Demonstrate the ability to deliver structured and impromptu speeches using effective speaking techniques. 3. Interpret textual and visual materials using critical reading strategies to evaluate arguments, logic, and persuasion.					

	4. Produce persuasive and analytical essays using effective argumentation techniques and structured writing strategies.

Course Content:

dule 1	**undations of Effective Communication**	**se Studies/ Role play**	**oss-Cultural Competency**	**12 Classes**

pics:

- Fundamentals of Interpersonal Communication
- Verbal, Non-verbal, and Paraverbal communication.
- Cultural dimensions theory (Hofstede's Cultural Dimensions).
- Active Listening Techniques
- Common Errors in Communication

Activities:

- Instagram/YouTube Vocabulary Activity
- Charades with a Twist/Tone and Emotion Experiment/Mixed Messages Challenge/Role Reversal Conversations/Observation Exercise

dule 2	**stering Speech Delivery**	**M**	**blic Speaking Confidence**	**12 Classes**

pics:

- Introduction to Prompt Engineering
- Speech Preparation and Organization
- Techniques for Effective Impromptu Speaking
- Practice Speech Delivery

Activities:

- Speech Writing
- Impromptu Speech

dule 3	**itical Reading and Logical Analysis**	**rksheet**	**itical Thinking and Analysis**	**12 Classes**

Topics:

- Critical Reading Strategies: Contextualizing, Figurative Language, Evaluating Logic of an Argument, Recognizing Emotional Manipulation, Analysing Visuals
- Recognizing Logical Fallacies: Slippery Slope, False Dilemma, Post Hoc, Hasty Generalization, Ad Hominem, Straw Man, Bandwagon, No True Scotsman, Red Herring, Appeal to Authority, Sunk Cost, Appeal to ignorance

Activities:

- Critical Reading Worksheet/Identifying Bias in News Articles

dule 4	**iting Effective Arguments**	**signment**	**ear and Coherent Writing**	**lasses**

pics**:**

- Understanding Critical Writing
- Building Arguments (Pathos, Ethos, Logos)
- Techniques for Persuasion

Activities:

- Causes or Effects/Appeal Mash-Up/Debates on Controversial Topics
- Opinion Writing

rgeted Application & Tools that can be used: Quizziz, Chatgpt, Gemini, Youtube, Instagram, Quillbot, Grammarly, Padlet

ferences

1. Adler, R. B., Rodman, G., & DuPré, A. (2019). *Understanding human communication (14th ed.)*.

Oxford University Press.

2. Moore, B. N., & Parker, R. (2020). *Critical thinking* (13th ed.). McGraw-Hill Education.
3. Hamilton, C. (2020). *Communicating for success* (2nd ed.). Routledge.
4. Ting-Toomey, S., & Dorjee, T. (2018). Intercultural competence: A model for teaching and assessing cross-cultural communication. *Journal of Intercultural Communication, 47*(2), 213–229. https://doi.org/10.1016/j.jicc.2018.03.004
5. https://www.ted.com/

Topics Relevant to "employability": Teamwork and Collaboration, Critical Thinking and Problem-Solving **Topics Relevant to "Human Values and Professional Ethics":** Critical reasoning, Inclusivity and Fairness	
Catalogue prepared by	**Dr. Tychicus David, Dr. Jayalakshmi E**
Recommended by the Board of Studies on	**h BoS, 8th January 2025**
Date of Approval by the Academic Council	

Course Code: EEE1200	**urse Title: Basics of Electrical and Electronics Engineering.** **pe of Course: Professional Core - Theory**		**L-T-P-C**			3
rsion No.						
urse Pre-requisites	**NIL**					
ti-requisites						
urse Description	This is a fundamental Course which is designed to know the use of basics of electrical and electronics engineering principles occurs in various fields of Engineering. The course emphasises on the characteristics and applications of electrical and electronic devices. The course also emphasizes on the working, analysis and design of electrical circuits using both active & passive components. Additionally, this course creates a foundation for the future courses such as Electrical machines, power system, power electronics Linear Integrated Circuits, Analog Communication and Digital Communication etc.					
urse Objective	The objective of the course is to familiarize the learners with the concepts of Basics of Electrical and Electronics Engineering and attain **Skill Development** through **Participative Learning** techniques.					
urse Outcomes	**On successful completion of this course the students shall be able to:** 1. **Apply** basic laws of Electrical Engineering to compute voltage, currents and other parameters in the circuits. 2. **Discuss** various fundamental parameters appearing in the characteristics of semiconductor devices and their applications. 3. **Summarize** the operations of different biasing configurations of BJTs and amplifiers. 4. **Discuss** the performance characteristics and applications of various electrical Machines.					
urse Content:						
dule 1	**Introduction to Electrical Circuits**		ignment/ Quiz		merical solving Task	**0 Sessions**
DC Circuits: Concept of Circuit and Network, Types of elements, Network Reduction Techniques- Series and parallel connections of resistive networks, Star–to-Delta Transformations, Mesh Analysis, Nodal Analysis, Numerical examples. **AC Circuits:** Fundamentals of single phase circuits - Series RL, RC and R-L-C Circuits, Concept of active power, reactive power and Power factor, Numerical examples. Introduction to three phase system and relation between line and phase values in Star & Delta connection, Numerical examples.						
dule 2	**niconductor and Diode applications**		ignment/ Quiz		mory Recall based Quizzes	**Sessions**
Mass Action Law, Charge densities in a semiconductor, Types of SC, Junction diodes -Ideal and practical behaviour, Modelling the Diode Forward Characteristic, and Diode applications like rectifiers, Zener diode, characteristics and its applications like voltage regulator.						
dule 3	**nsistors and its Applications**		ignment/ Quiz		mory Recall-based Quizzes	**0 Sessions**
nsistor characteristics, Current components, BJT Configurations (CB, CC, CE configurations) and their current gains. Operating point, Biasing, Fixed Bias, and load line analysis. Single Stage amplifier. JFET (Construction, principal of Operation and Volt –Ampere characteristics). Pinch- off voltage, Comparison of BJT and FET. MOSFET (Construction, principal of Operation and symbol), MOSFET characteristics in Enhancement and Depletion modes.						
dule 4	**Fundamentals of ctrical Machines**		ignment/ Quiz		merical solving Task	**Sessions**
Electrical Machines: Single phase transformers: principle of operation and EMF equation, Numerical examples. DC Motor: principle of operation, Back EMF, torque equation, Numerical examples. AC Motor: Principle operation						

of Induction Motors and its Applications.

f-Learning Topics:

pping and clamping circuits, Stabilization Techniques, Voltage divider bias and its stability factor, Multistage amplifier, Darlington pair.

Special Machines: Introduction to special electrical machines and its applications.

rgeted Application & Tools that can be used:

Targeted Applications: Application Area includes all electrical and electronic circuits (power supply unit, regulator unit, embedded devices, hardware electronics etc.). The students will be able to join a profession which involves basics to high level of electronic circuit design.

Professionally Used Software: Multisim/ P Spice

ides these software tools hardware equipment such as Multimeters, Function Generators, Power Supplies, Oscilloscopes etc., can be used to perform component/circuit testing and analysis..

ject Work/ Assignment:

1. Article review: At the end, of course an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format.

2. Presentation: There will be a group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.

3. Case Study: - At the end of the course students will be given a 'real-world' application based circuits like Power Amplifier, Signal/Function Generator etc. as a case study. Students will be submitting a report which will include Circuit Diagrams, Design, Working Mechanism and Results etc. in appropriate format

t Book(s):

1. Kothari D. P. & Nagrath I. J., "Basic Electrical and Electronics Engineering", Tata McGraw-Hill
2. Education
3. Theraja B.L. and Theraja A.K., "A Textbook of Electrical Technology: Basic Electrical Engineering" in S.I. System of Units, 23rd ed., New Delhi: S. Chand, 2002.
4. A.P.Malvino, Electronic Principles,7thEdition, Tata McGraw Hill,2007
5. J. Millman, C. C. Halkias and C. D. Parikh, "Millman's Integrated Electronics", McGraw Hill Education, 2nd Edition.
6. Basics of Electrical & Electronics Laboratory Manual.

ference Book (s):

1. John Hiley, Keith Brown and Ian McKenzie Smith, "HUGHES Electrical and Electronic Technology", 10th Edition (Indian Edition published by Dorling Kindersley), Pearson,2011
2. Samarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, Prentice Hall India, 2007.
3. K Uma Rao, A Jaya Lakshmi, "Basic Electrical engineering" IK International publishing house Pvt. Ltd
4. R. L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education India 7th Edition.
5. A K. Maini, V. Agrawal, "Electronic Devices & Circuits", Wiley, 2nd Edition
6. A.S Sedra, K. C. Smith, "Microelectronic Circuits", Oxford University Press, 6th Edition

Online Resources (e-books, notes, ppts, video lectures etc.):

1. https://presidencyuniversity.linways.com
2. https://www.digimat.in/nptel/courses/video/108105112/L01 "Fundamentals of Electrical Engineering-Basic Concepts, Examples"
3. Seminar Topic: https://nptel.ac.in/courses/108/105/108105153/ "Electrical Measurements"
4. Video lectures on "Electronic Devices" by Prof. Dr. A. N. Chandorkar, IIT Bombay http://www.satishkashyap.com/2013/03/video-lectures-on-electron-devices-by.html
5. Video lectures on "Analog Electronics" by Prof. S.C. Dutta Roy, IIT Delhi

https://nptel.ac.in/courses/108/102/108102095/

6. Video lectures on “Diodes”, by Prof. Chitralekha Mahanta, IIT Guwahati, https://nptel.ac.in/courses/117/103/117103063/

E-content:

1. “Introduction to Electrical Machines https://nptel.ac.in/courses/108/102/108102146/”

M. -Y. Kao, H. Kam and C. Hu, "Deep-Learning-Assisted Physics-Driven MOSFET Current Voltage Modeling," in IEEE Electron Device Letters, vol. 43, no. 6, pp. 974-977, June 2022, doi: 10.1109/LED.2022.3168243 https://ieeexplore-ieee-org-resiuniv.knimbus.com/document/9758727

2. F. Bonet, O. Aviñó-Salvadó, M. Vellvehi, X. Jordà, P. Godignon and X. Perpiñà, "Carrier Concentration Analysis in 1.2 kV SiC Schottky Diodes Under Current Crowding," in IEEE Electron Device Letters, vol. 43, no. 6, pp. 938-941, June 2022, doi: 10.1109/LED.2022.3171112. https://ieeexplore-ieeeorg-presiuniv.knimbus.com/document/9764749

3. M. Chanda, S. Jain, S. De and C. K. Sarkar, "Implementation of Subthreshold Adiabatic Logic for Ultralow-Power Application," in IEEE Transactions on Very Large Scale Integration (VLSI) Systems, vol. .23, no. 12, pp. 2782-2790, Dec. 2015. https://ieeexplore.ieee.org/document/7018053

4. R. Raut and O. Ghasemi, "A power efficient wide band trans-impedance amplifier in submicron CMOS integrated circuit technology," 2008 Joint 6th International IEEE Northeast Workshop on Circuits and Systems and TAISA Conference, 2008, pp. 113-116, doi: 0.1109/NEWCAS.2008.4606334. https://ieeexplore.ieee.org/document/4606334

Topics relevant to “SKILL DEVELOPMENT”: Performing suitable experiments to compute the electric circuit parameters, performance operation of machines, and operation of semiconductor devices for **Skill Development** through **Participative Learning techniques.** This is attained through assessment component mentioned in course plan.

Catalogue prepared by	Dr. Ajay Kumar Maurya
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

urse Code EEE1250	**Course Title: Basics of Electrical and Electronics Engineering Laboratory** **Type of Course: Professional Core - Laboratory**	-T- P- C	0	0	2	1
rsion No.						
urse Pre-requisites						
ti-requisites						
urse Description	This fundamental laboratory provides an opportunity to validate the concepts taught in the basics of electrical and electronics engineering and enhances the ability to visualize real system performance, using both hardware and simulation tools.					
urse Objective	The objective of the course is to familiarize the learners with the concepts of Basics of Electrical and Electronics Engineering and attain Skill Development through Experiential Learning techniques.					
sic skill sets required for the laboratory:						
	The students shall be able to develop: **1) An attitude of enquiry.** **2) Confidence and ability to tackle new problems.** **3) Ability to interpret events and results.** **4) Ability to work as a leader and as a member of team.** 5) Assess errors and eliminate them. **6) Observe and measure physical phenomenon.** **7) Write Reports.** **8) Select suitable equipment, instrument and materials.** 9) Locate faults in systems. 10) Manipulative skills for setting and handling equipment. **11) The ability to follow standard test procedures.** **12) An awareness of the need to observe safety precautions.** 13) To judge magnitudes without actual measurement.					
urse Out Comes	**On successful completion of the course the students shall be able to:** 1. Apply basic laws of Electrical Engineering to compute voltage, currents, and other parameters in the circuits. 2. Demonstrate the working of electrical machines to observe performance characteristics. 3. Demonstrate the working of electronic circuits to obtain the V-I Characteristics of various semiconductor devices. 4. Sketch the characteristics and waveforms relevant to standard electrical and electronic circuits					
urse Content:						
	t of Laboratory Tasks: **Experiment No 1:** Verification of KVL and KCL for a given DC circuit. **Level 1:** Study and Verify KVL and KCL for the given electrical Circuit. **Level 2:** For the same circuit considered in level 1, perform the simulation using NI LabVIEW/Multisim/MATLAB. **Experiment No 2:** Analyse AC series circuits – RL, RC and RLC . **Level 1:** Conduct an experiment to perform and verify the impedance, current and power of Series RL and RC circuits **Level 2:** Conduct an experiment to perform and verify the impedance and current of RLC series circuits.					

	Experiment No 3: Calculation of power and power factor of the given AC Circuit. **Level 1:** Conduct an experiment to measure the power and power factor for given resistive load. **Level 2:** Conduct an experiment to measure the power and power factor for given inductive load. **Experiment No 4:** Perform the experiments on given Transformer. **Level 1:** Verify the EMF equation of a transformer and compute the voltage transformation ratio. **Level 2:** Study the effect of load on the secondary side of the transformer and verify the EMF equation under load conditions. **Experiment No 5:** Load test on DC shunt motor **Level 1:** Conduct load test on DC shunt motor and find its efficiency at different loads **Level 2:** Conduct load test on DC shunt motor and plot the performance characteristics. **periment 6:** Study of PN-Junction Diode Characteristics in Forward and Reverse Bias Conditions. **vel 1:** Carry out an experiment to plot VI Characteristics and hence find the cut-in voltage on forward characteristics for the Silicon P-N Junction diode. **vel 2:** Carry out an experiment to plot VI Characteristics of Zener diode and hence find the zener voltage on reverse characteristics for the Silicon P-N Junction zener diode. **periment No. 7:** To observe the output waveform of half wave and full wave rectifier circuit and compute ripple factor and efficiency **vel 1:** Identify the components required for a rectifier circuit, rig up the circuit, and sketch the output waveforms without filter. **vel 2:** Rig up the rectifier circuit with RC filter, observe the output waveforms, determine the efficiency and ripple factor. **periment 8:** To construct clipping and clamping circuits for different reference voltages and to verify the responses. **vel 1:**Identify the components required for building a Clipper / Clamper circuit. Rig up the circuit according to the circuit diagram given and sketch the output waveform. **vel 2:** Given a sinusoidal input of 10 V p-p, implement a positive / negative clipper with output clipped at 2 V. **periment 9:** To calculate various parameters of emitter follower circuit using BJT **vel 1:** Identify the components required to implement an emitter follower circuit. Rig up the circuit and observe the variations in output waveform with respect to the variations in input waveform. **vel 2:** Determine the values of Z_{in} input impedance and Z_{out} output impedance for Emitter Follower. **periment 10:** To Implement RC Coupled amplifier using a BJT and sketch the frequency response. **vel 1**: Identify the components required to implement an RC coupled amplifier circuit. Rig up the circuit and sketch the frequency response. **Level 2**: From the frequency response curve determine the value of the mid band gain and the bandwidth.

rgeted Application & Tools that can be used:

Targeted Applications: Application Area includes all electrical and electronic circuits (power supply unit, regulator unit, embedded devices, hardware electronics etc.). The students will be able to join a profession which involves basics to high level of electronic circuit design.

Professionally Used Software: Multisim/ P Spice

sides these software tools hardware equipment such as Multimeters, Function Generators, Power pplies, Oscilloscopes etc., can be used to perform component/circuit testing and analysis.

urse Material

1. Basics of Electrical and Electronics Engineering Laboratory Manual, Presidency University, Bengaluru.

xt Book:

2. Kothari D. P. & Nagrath I. J., "Basic Electrical and Electronics Engineering", Tata McGraw-Hill

Reference Books:

3. John Hiley, Keith Brown and Ian McKenzie Smith, "HUGHES Electrical and Electronic Technology", 10th Edition (Indian Edition published by Dorling Kindersley), Pearson,2011
4. Samarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, Prentice Hall India, 2007.
5. K Uma Rao, A Jaya Lakshmi, "Basic Electrical engineering" IK International publishing house Pvt. Ltd
6. R. L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education India 7th Edition.
7. A K. Maini, V. Agrawal, "Electronic Devices & Circuits", Wiley, 2nd Edition
8. A.S Sedra, K. C. Smith, "Microelectronic Circuits", Oxford University Press, 6th Edition

Online Learning Resources:

9. https://presidencyuniversity.linways.com
10. https://www.digimat.in/nptel/courses/video/108105112/L01 "Fundamentals of Electrical Engineering-Basic Concepts, Examples"
11. Video lectures on "Diodes", by Prof. Chitralekha Mahanta, IIT Guwahati, https://nptel.ac.in/courses/117/103/117103063/

Topics relevant to "SKILL DEVELOPMENT": All the experiments which are listed are for **Skill Development** through **Experiential Learning Techniques**. This is attained through the assessment component mentioned in course handout.

Catalogue prepared by	Dr. Ajay Kumar Maurya
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: LAW1007	**Course Title: Indian Constitution and Professional Ethics for Engineers** **Type of Course: Theory**	**L-T-P-C**	1	0	0	0
Version No.						
Course Prerequisites						
Anti-requisites	NIL					
Course Description	The purpose of this course is to introduce the students to the theory, concepts and practice of Constitution of India which is the law of the land. Further, the course aims at acquainting the students with basic approaches and methodologies to analyse and decide on the ethical dilemma in the field of engineering. The course is both conceptual and analytical. The course develops critical thinking skills by augmenting the student's ability to comprehend the conceptual and legal framework of Constitution of India. Ethics and values are very beautifully weaved into the tapestry of the Indian Constitution. Therefore, the course provides an introduction to the essential theoretical basis of engineering ethics and its application through a range of industry relevant such as engineers' responsibility for safety and risks, responsibility of employers, rights of engineers etc.					
Course Objective	1. To introduce the students to the conceptual framework of Constitution of India and engineering ethics. 2. To enhance the practical knowledge on responsibility of engineering professionals as citizens of India. 3. To acquaint the student with the relevant contemporary issues surrounding constitutional values and professional ethics. 4. To orient the students about the ethical concepts and frameworks enabling them to identify the codes and moral values relevant to the professional world.					

Course Outcomes	**On successful completion of this course the students shall be able:** 1. To understand foundational Indian constitutional law concepts and values. 2. To identify the different pillars of democracy and their functions. 3. To analyse the role of the engineers' responsibility in ensuring safety of the society and the employer.

Module 1	**Introduction to the Indian Constitution**	Knowledge	Quiz	**5 Classes**
Course Content:				

Meaning of Constitution, Constitutional Law and Constitutionalism, India before and after adoption of Constitution, Preamble, Salient Features, Concept and Relevance of Fundamental Rights, Fundamental Duties and Directive Principles of State Policy in brief.

Module 2	**Pillars of Democracy: Legislature Executive and Judiciary**	Knowledge	Short Essay	**5 Classes**

Federalism, Union and State Executive, Parliament and State Legislature, Union and State Judiciary, Amendment of the Constitution

Module 3	**Engineering Ethics**	Analysis	Presentation on conceptual understanding and problem based scenarios	**5 Classes**

Scope & Aims of Engineering & Professional Ethics, Code of Ethics as defined in the website of Institution of Engineers (India), Profession, Professionalism, and Professional Responsibility, Conflicts of Interest, Engineering Standards, the impediments to Responsibility, IPRs (Intellectual Property Rights), Necessity of responsible experimentation ,Case Studies on Challenger, Chernobyl, and Boeing.

Project work/Assignment: Quiz on Fundamental Rights, Short Essay on Judicial Activism in India, Problem based assignments of engineering ethics.

Resources:

1. M.P. Jain, Indian Constitutional Law, 8th Edition, Lexis Nexis, 2022.
2. M.W.Martin and R. Schinzinger, Ethics in Engineering, 4thEdition, McGraw Hill Education, 2015.

References:

1. Durga Das Basu, Commentary on the Constitution of India, 9th Edition, Lexis Nexis, 2019.
2. Rowan, John, and Zinaich Jr., Ethics for the Professions, Wadsworth, 2003.
3. R.C. Sekhar, Ethical Choices in Business, Response Books, Sage Publications, 1997.

Catalogue prepared by	School of Law
Recommended by the Board of Studies on	

Date of Approval by the Academic Council	

Course Code: **PPS 1026**	**Course Title: Industry Readiness Program – II (Audited Course)** Type of Course: Practical Only Course	L- T - P- C	0	0	2	0
Version No.	1.0					
Course Pre-requisites	• Students are expected to understand Basic English. • Students should have desire and enthusiasm to involve, participate and learn.					
Anti-requisites	NIL					
Course Description	This course is designed to enable students learn styles of communication, team building and use empathy in leadership. The course will benefit learners in preparing themselves effectively through various activities and learning methodologies.					

Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Industry Readiness for Young Professionals" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.**
Course Out Comes	**On successful completion of this course the students shall be able to:** CO 1 **Apply** different communication skills for success in workplace CO 2 **Practice team building skills** for career success CO3 **Demonstrate** ethical leadership skills in workplace
Course Content	

Module 1	**Effective Communication**	Classroom activities	**10 Hours**
Topics: Practice effective communication skills (Verbal, Non-verbal, Written and Visual) **Activity:** Use social media prompts to prepare self-introduction videos			
Module 2	**Team Building**	Group Activity	**10 Hours**
Topics: Skills of an effective team player **Activity:** Student group activity to build class networking			
Module 3	**Leadership**	Case study	**10 Hours**
Topics: Types of leadership, using empathy in leadership **Activity:** Individual presentation by students on corporate leaders.			
Faculty : L&D			
Targeted Application & Tools that can be used: 4. TED Talks 5. You Tube Links 6. Activities			
Assignment proposed for this course Assignment 1: One minute reel Assignment 2: Team building assignment			
Continuous Individual Assessment Module 1: L-S-R-W class assessment Module 2: Team Presentation Module 3: Individual Assessment			

The topics related to skill development: Students acquire knowledge on effective communication skills, team building skills and how to prepare themselves to be leaders in workplace using empathy and implement various skill sets during the course of their time in the university.	
Catalogue prepared by	Faculty of L&D
Recommended by the Board of Studies on	**BOS held on**
Date of Approval by the Academic Council	**Academic Council Meeting held on**

urse Code: ECE1511	**urse Title: Design Workshop**	**T-P- C**	1	0	2	2
rsion No.						
urse Pre-requisites	NIL					
ti-requisites	L					
urse Description	This course is designed to provide an in-depth understanding of Arduino, microcontrollers Raspberry pi and their application in various real time projects involving sensors. Throughout the course, students will learn the fundamentals of Arduino and Raspberry Pi programming and gain hands-on experience with a wide range of sensors. Students will explore how to connect and interface sensors with Arduino and Raspberry Pi boards, read sensor data, and use it to control various output devices This course is suitable for beginners who are interested in exploring the world of electronics and developing practical applications using Arduino, Raspberry Pi and sensors.					
urse Objective	The objective of the course is **Employability Skills** of student by using **PARTICIPATIVE LEARNING** techniques.					

urse Outcomes	**On successful completion of the course the students shall be able to** 1) Explain the main features of the Arduino & the Raspberry Pi prototype board. 2) Demonstrate the hardware interfacing of the peripherals to Arduino and Raspberry Pi system. 3) Understand the types of sensors and its functions 4) Demonstrate the functioning of live projects carried out using Arduino and Raspberry Pi system.
urse Content:	

dule 1	**Basic concepts of Microcontrollers**	Hands-on	Interfacing Task and Analysis	**3 Sessions**

pics:
Introduction to Arduino, ESP and Node MCU Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, API's , Introduction to Embedded C and Arduino platform, Arduino Datatypes and variables, Arduino i/o Functions, Arduino Communications, Arduino IDE, Various Cloud Platforms.

dule 2	**nsory Devices**	nds-on	erfacing Task and Analysis	**essions**

duino Sensors: Humidity Sensor, Temperature Sensor, Water Detector / Sensor, PIR Sensor, Ultrasonic Sensor, Connecting Switches and actuators, sensor interface with Arduino.
roduction to 3D Printer: 3D Printer technology and its working Principles, Applications. Introduction to online Simulators: Working with AutoCAD/Fusion 360 Simulator.

dule 3	**roduction to Micro python**	nds-on	erfacing Task and Analysis	**Sessions**

pics:
roduction to MicroPython, Comparison with other programming languages, Setting up the MicroPython development environment, Basics of MicroPython syntax and structure.

dule 4	**rking with Raspberry-pi**	nds-on	erfacing Task and Analysis	**essions**

roduction to raspberry pi boards, pin-diagram, different types of raspberry pi boards and its application, LED and switch control. Mastering Modules, Setup Raspberry - PuTTY SSH,VNC Viewer to interface with more complicated sensors and actuators. Various Libraries and its functions.

b: Name of the Experiments:

1. **Introduction Lab 1:**

Level 1: Overview on Arduino based Micro-controller, and sensors.
Level 2: Interfacing of Arduino and ESP boards with sensors and other components.

2. **Lab 2: Smart Plant Monitoring**

Level 1- Push button-controlled LED.
Level 2- Automatic Irrigation and monitoring System using Arduino

3. **Lab 3: Robotics with Arduino**.

Level 1- Servo Motor control using Arduino

Level 2: DC Motor Control Using Arduino for Robotics.

4. **Lab 4: Environmental pollution using ESP.**

Level 1 - IoT based air Pollution Monitoring System.

Level 2- IoT Based water pollution system

5. **Introduction Lab for raspberry pi:**

Level 1: Overview on Different Raspberry Pi Boards, and sensors.

Level 2: Configuring the Raspberry Pi and Interfacing with sensors and other components.

6. **Lab 7:** Raspberry Pi based Object Detection using TensorFlow and OpenCV.
7. **Lab 8:** Speech Recognition on Raspberry Pi for Voice Controlled Home Automation.
8. **Lab 9:** Design the website using HTML and CSS, and host the website on Raspberry Pi.
9. **Introduction Lab for 3D printing:**

Overview of 3D printing. Design of 3D structure using the CAD. Understand the steps of fabrication of simple rectangular box using 3D printer.

10. **Lab 10:** Design and print of Hollow Cylindrical structure using 3D CAD and 3D printer.
11. **Lab 11** Demonstration of Jetson nano board and its capability. **(OPTIONAL)**
12. **Lab 12:** Revision
13. **Lab 13:** Revision
14. **Lab 14:** Mini Project
15. **Lab 15:** Mini Project Evaluation.

Topics: Types of Arduino boards, Thonny Python, Python IDLE, **sensors, 3D Printer**

rgeted Application & Tools that can be used:

plication Area:

me Automation, Environmental Monitoring, Agriculture and Farming, Industrial Automation, Internet of Things (IoT), Robotics, Wearable Devices, Security Systems, Education and Learning. These are just a few examples of the many application areas where Arduino, Raspberry Pi and sensors can be applied. The flexibility and affordability of Arduino, and Raspberry Pi combined with the wide range of sensors available, allow for endless possibilities in creating innovative projects.

fessionally Used Software: Students can use open SOURCE Software's Arduino IDE and Tincker CAD, Thonny Python, Python IDLE etc.

ject work/Assignment:

1. Projects: At the end of the course students will be completing the project work on solving many real time issues.

2. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link .

Presentation: There will be a presentation from interdisciplinary students group, where the students will be given a project on they have to demonstrate the working and discuss the applications for the same

xtbook(s):

1. **Monk Simon "Programming Arduino: Getting Started with Sketches", Mc Graw Hill Publications Second Edition**
2. **Monk Simon "Raspberry Pi Cookbook: Software and Hardware Problems and Solutions", Publisher(s): O'Reilly Media, Inc. ISBN: 9781098130923 fourth Edition.**

ferences

ference Book(s)

1. **Neerparaj Rai "Arduino Projects for Engineers" BPB publishers,first edition, 2016.**
2. Ryan Turner "Arduino Programming " Nelly B.L. International Consulting Ltd. first edition,2019.
3. **Charles Bell Micro Python for the Internet of Things: A Beginner's Guide to Programming with Python on Microcontrollers" by" Edition 1, 2017, ISBN 978-1-4842-3123-4**
4. Stewart Watkiss "Learn Electronics with Raspberry Pi " Apress Berkeley, CA . second edition,2020. ISBN978-1-4842-6348-8
5. Jo Prusa, "Basic of 3D printing", Prusa Research, 3rd edition.
6. Volker Ziemann, "**A Hands-On Course in Sensors Using the Arduino and Raspberry Pi (Series in Sensors)**", CRC Press, 1st Edition. 2018.

line Resources (e-books, notes, ppts, video lectures etc.):

1. Arduino trending Projects < https://www. https://projecthub.arduino.cc/>
2. Introduction to Arduino < https://onlinecourses.swayam2.ac.in/aic20_sp04/preview>
3. Case studies on Wearable technology< https://www.htciitm.org/wearables>
4. Raspberry-pi Projects < https://magpi.raspberrypi.com/articles/category/tutorials/>
5. Introduction to internet of things< https://nptel.ac.in/courses/106105166>

ontent:

1. **Cattle Health Monitoring System Using Arduino and IOT (April 2021| IJIRT | Volume 7 Issue 11 | ISSN: 2349-6002)**
2. **M H Hemanth Kumar, Ravi Pratap Singh, Nishu Sharma, Pragya Singh" IOT BASED SMART SECURITY SYSTEM USING ARDUINO" 2021 JETIR August 2021, Volume 8, Issue 8.**
3. **R. Maheswar, P. Jayarajan, S. Vimalraj, G. Sivagnanam, V. Sivasankaran and I. S. Amiri, "Energy Efficient Real Time Environmental Monitoring System Using Buffer Management Protocol," 2018, pp. 1-5, doi: 10.1109/ICCCNT.2018.8494144. https://ieeexplore.ieee.org/document/8494144.**
4. **Yaser S Shaheen,Hussam., " Arduino Mega Based Smart Traffic Control System ," December 2021 Asian Journal of Advanced Research and Reports 15(12): 43-52, 2021(15(12): 43-52, 2021):15(12): 43-52, 2021.**
5. **Basil, Eliza Sawant, S.D. "IoT based traffic light control system using Raspberry Pi " DOI 10.1109/ICECDS.2017.8389604**
6. **Supriya S, 2Dr. Aravinda " Green leaf disease detection and identification using Raspberry Pi https://www.irjet.net/archives/V9/i8/IRJET-V9I847.**
7. **Dr. E.N. Ganesh., "Health Monitoring System using Raspberry Pi and IOT" DOI : http://dx.doi.org/10.13005/ojcst12.01.03**

pics relevant to development of "SKILL": System design for achieving Sustainable Development Goals.

Catalogue prepared by	Dr Ashutosh Anand

Recommended by the Board of Studies on	)S NO:
Date of Approval by the Academic Council	ademic Council Meeting No. ___ dated on _____

Course Code: MAT2303	**Course Title: Linear Algebra & Vector Calculus** **Type of Course:1] School Core**	**L-T- P- C**	**3**	**1**	**0**	**4**

Version No.		1.0
Course Pre-requisites		Basic Concepts of Limits, Differentiation, Integration, Matrices (PU Level)
Anti-requisites		**NIL**
Course Description		This course explores the fundamental concepts of vectors, matrices, and their operations within the context of calculus, including vector differentiation and integration, while applying these tools to solve problems related to linear systems, transformations, and geometric interpretations in higher dimensions, often with applications in fields like physics, engineering, and computer graphics; key topics include vector algebra, matrix operations, determinants, eigenvalues, eigenvectors, gradients, divergence, curl, line integrals, surface integrals, and the fundamental theorems of vector calculus like Green's Theorem, Stokes' Theorem, and the Divergence Theorem.
Course Objective		The course is intended to develop computational proficiency involving procedures in Matrices, Linear Algebra and Vector Calculus which are useful to all engineering disciplines. This course is to equip students with the ability to understand and manipulate vectors in multidimensional space, apply matrix operations to solve systems of linear equations, and utilize concepts like gradients, divergence, and curl to analyze physical phenomena, all while developing a strong foundation for applying these tools in various scientific and engineering fields like physics, mechanics, and computer graphics.
Course Out Comes		On successful completion of the course the students shall be able to: CO1 - Use matrix methods and certain techniques to solve the system of linear equations and to find eigen values, eigen vectors of a matrix to check whether it is diagonalizable. CO2 - Understand the abstract notions of vector space and dimensionality of it. CO3 - find the matrix representation of a linear transformation given bases of the relevant vector spaces. CO4 - Learn different notions of vector and scalar fields with their properties. Understanding the major theorems (Green's, Stokes', Gauss') and some applications of these theorems.
Course Content:		

Module 1	**Systems of Linear Equations**		6. ***Classes)***
Systems of Linear Equations, Matrices and Elementary Row Operations, Echelon forms, Matrix operations, invertible matrices, Determinants and their properties, Cramer's Rule, LU-decomposition, Applications of Systems of Linear Equations.			
Module 2	**Vector Space**	**Assignment**	***(9Classes)***
Linear Combinations and Linear Independence, Vectors in n R^n, Linear Combinations, Linear Independence Vector Spaces, Definition of a Vector Space, Subspaces, Basis and Dimension, Coordinates and Change of Basis, Orthogonal bases and orthogonal projections.			
Module 3	**Linear Transformations**		***(15 lectures)***

Linear Transformations, Algebra of transformations, The Null Space and Range, Isomorphisms, Matrix Representation of Linear Transformations, Similarity Eigenvalues and Eigenvectors, Eigen values and Eigen vectors, Diagonalization.
Inner Product Spaces, The Dot Product on R^n and Inner Product Spaces, Orthonormal Bases, Orthogonal Complements, Application: Least Squares Approximation, Diagonalization of Symmetric Matrices,
Application: Quadratic Forms.
Singular Value Decomposition: Singular values, computing singular value decomposition, and Introduction to principal component analysis.

Module 4	**Vector Calculus**	**Assignment**	***(15 lectures)***

Vector & Scalar Functions and Fields, Derivatives, Curve, Arc length, Curvature & Torsion, Gradient of Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field, Physical interpretation, solenoidal and irrotational vector fields. Problems.
Line Integrals, Path Independence of Line Integrals, Green`s Theorem in the plane, Surface Integrals, Divergence Theorem of Gauss, Stokes`s Theorem.

Targeted Application & Tools that can be used:

- Solve systems of linear equations using various methods including Gaussian and Gauss Jordan elimination and inverse matrices.
- Perform matrix algebra, invertibility, and the transpose and understand vector algebra in R^n.
- Determine relationship between coefficient matrix invertibility and solutions to a system of linear equations and the inverse matrices.
- Find eigenvalues and eigenvectors and use them in applications.
- Find the dimension of spaces such as those associated with matrices and linear transformations.
- Understand real vector spaces and subspaces and apply their properties.
- Compute inner products in a real vector space and compute angle and orthogonality in inner product spaces.
- Create orthogonal and orthonormal bases: Gram-Schmidt process and use bases and orthonormal bases to solve application problems.
- Prove basic results in linear algebra using appropriate proof-writing techniques such as linear independence of vectors; properties of subspaces; linearity, injectivity and subjectivity of functions; and properties of eigenvectors and eigenvalues.

Assignment:

Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding applications of Linear Algebra and Vector Calculus to engineering applications – The faculty will allocate chapters/ parts hapters to groups of students so that the entire syllabus of Linear Algebra and Vector Calculus is covered.

Text Book

1. Gilbert Strang, Linear Algebra and its applications, Wellesley-Cambridge Press,U.S.; 6th edition.
2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

References:

1. Introduction to Linear Algebra with Application, Jim Defranza, Daniel Gagliardi, Tata McGraw-Hill
2. Elementary Linear Algebra, Applications version, Anton and Rorres, Wiley India Edition.
3. Advanced Engineering Mathematics, Erwin Kreysig, Wiley Publication.
4. Elementary Linear Algebra, Ron Larson, Cengage Learning .
5. Linear Algebra and its Applications, David C. Lay, Pearson Education.

E-resources/ Web links:

1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_9607
2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_143156
3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_EBSCO_29052023_270975
4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_94555
5. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_243864
6. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_224531
7. NPTEL Video Lectures Matrices and Linear Algebra:

8.	https://nptel.ac.in/courses/111106051/
9.	NPTEL Video Lectures Differential Equations:
10.	https://nptel.ac.in/courses/111106100/
11.	NPTEL Vector Calculus:
12.	https://nptel.ac.in/courses/111/105/111105122/
13.	https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
14.	https://www.scu.edu.au/study-at-scu/units/math1005/2022/

Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of Vector calculus and Linear Algebra with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem Solving**.** This is attained through the assessment component mentioned in the course handout.

Course Code: MAT2404	**Course Title: Discrete Mathematics Type of Course:1] School Core**	**L-T- P- C**	**3**	**1**	**0**	**4**
Version No.	1.0					
Course Pre-requisites	MAT2302					
Anti-requisites	**NIL**					
Course Description	The course explores the study of mathematical structures that are fundamentally discrete (not continuous), focusing on concepts like set theory, logic, graph theory, combinatorics, and number theory, with applications primarily in computer science fields like algorithms, software development, and cryptography; it covers topics such as propositional logic, proof techniques, relations, functions, counting principles, and basic graph algorithms, providing a foundation for analyzing discrete problems and structures within computer science.					
Course Objective	The main objective of the course is that students should learn a particular set of mathematical facts and how to apply them. It teaches students how to think logically and mathematically through five important themes: mathematical reasoning, combinatorial analysis, discrete structures, algorithmic thinking, and applications and modeling. A successful discrete mathematics course should carefully blend and balance all five themes.					
Course Outcomes	On successful completion of the course the students shall be able to: CO1 - Explain logical sentences through predicates, quantifiers and logical connectives. CO2 - Deploy the counting techniques to tackle combinatorial problems CO3 - Comprehend the basic principles of set theory and different types of relations. CO4 - Apply different types of structures of trees for developing programming skills					
Course Content:						
Module 1	**Fundamentals of Logic**					**(10 Classes)**
Basic Connectives and Truth Tables, Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.						
Module 2	**Principle of Counting**	**Assignment**				**(15 Classes)**
The Well Ordering Principle – Mathematical Induction The Basics of Counting, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Generating Permutations and Combinations Advanced Principle Counting: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.						
Module 3	**Relations and Functions**					**(10 Classes)**
Cartesian Products and Relations, Functions, One-to-One, Onto Functions. The Pigeon-hole Principle, Function						

Composition and Inverse Functions.
Relations, Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders, Lattice, Hasse Diagrams, Equivalence Relations and Partitions.

Module 4	**Recurrence Relations and Generating Functions**		**(10 Classes)**

Homogeneous and inhomogeneous recurrences and their solutions - solving recurrences using generating functions - Repertoire method - Perturbation method - Convolutions - simple manipulations and tricks.

Module 5	**Graph Theory & Algorithms on Networks**	**Assignment**	**(15 Classes)**

Definitions and basic results - Representation of a graph by a matrix and adjacency list - Trees - Cycles - Properties - Paths and connectedness - Sub graphs - Graph Isomorphism - Operations on graphs - Vertex and edge cuts - Vertex and edge connectivity, Euler and Hamilton Paths, Shortest-Paths.
Tree - Definitions, Properties, and Examples, Routed Trees, Binary search tree, Decision tree, spanning tree: BFS, DFS.
Algorithms on Networks - Shortest path algorithm- Dijikstra's algorithm, Minimal spanning tree- Kruskal algorithm and Prim's algorithm.

Targeted Application & Tools that can be used:
Discrete mathematics provides the mathematical foundations for many computer science courses including data structures, algorithms, database theory, automata theory, formal languages, compiler theory, computer security, and operating systems.

Assignment:

Assignment 1: Logic Equivalences and Predicate calculus.
Assignment 2: Equivalence Relations and Lattices
Assignment 3: Recurrence Relations

Text Book

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", McGraw-Hill,s 8th Edition,2019.
2. Harary – Graph Theory, Addison-Wesley Publishing Company.

References:

1. Arthur Gill, "Applied Algebra for Computer Science", Prentice Hall.
2. K.D. Joshi, "Discrete Mathematics", Wiley Eastern Ltd.
3. Ralph. P. Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia.

E-resources/ Web links:

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO30102024_54588
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO30102024_375
https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
https://www.scu.edu.au/study-at-scu/units/math1005/2022/

Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of calculus and differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving**.** This is attained through the assessment component mentioned in course handout.

urse Code: AT2301	**Course Title: Calculus and Differential Equations** **Type of Course : BSC**	**T- P- C**	**3**	**1**	**0**	**4**
rsion No.						
urse Pre-requisites						
ti-requisites	**L**					
urse Description	Calculus and differential equations are used ubiquitously throughout mathematics, statistics and operations research. In this course, students can be able to build upon the foundations of calculus established to greatly enhance their repertoire of theory and practice in these areas. The application of calculus and differential equations in the description and modelling of real-world problems will also be considered. This unit					

	will extend the problem-solving skills, range of knowledge and use of techniques in differential and integral calculus. The course focuses on the concepts of Calculus and Differential Equations with reference to specific engineering problems. The course is of both conceptual and analytical type in nature.
urse Objective	The goal of the course Calculus and Differential Equations is to facilitate the students with a concrete foundation of differential calculus and to solve the first and higher-order ordinary differential equations enabling them to acquire the knowledge of these mathematical tools.
urse Out Comes	On successful completion of the course the students shall be able to: 1. Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve. 2. Apply the principles of integral calculus to evaluate integrals. 3. Learn the notion of partial differentiation to calculate rate of change of multivariate functions and solve problems related to composite functions and Jacobian. 4. Solve first-order linear/nonlinear ordinary differential equations analytically using standard methods.
urse Content:	

dule 1	**ferential Calculus**		**(10 Classes)**
Polar Coordinates, polar curves, angle between radius vector and the tangent, angle between two curves, pedal equations, curvature and radius of curvature. Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.			
dule 2	**egral Calculus**	**Assignment**	**(10 Classes)**
Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.			
dule 3	**ltivariable Calculus**		**(10 lectures)**
Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.			
dule 4	**ferential Equations**	**Assignment**	**(15 lectures)**
Definition, types of Differential Equations, Applications, Variable Separable, Homogeneous, Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. Linear differential equations of second and higher order with constant coefficients - Non-Homogeneous term of the type $Q(x) = e^{ax}$, Sin ax, Cosax, $e^{ax}v(x)$, $x^n v(x)$ - Method of variation of parameters.			

geted Application & Tools that can be used:

fferential calculus is used extensively in science and engineering. It can solve problems related to motion, velocity, acceleration, angles of incline or curve on a surface, etc.

fferential Equations are used to model the behavior of electromagnetic fields, including in the design of antennas, microwave ovens, and other devices. Biology: PDEs are used to model biological processes, such as the spread of diseases and the development of biological tissues.

ols Used: Python.

signment:

Select any one simple differential equation pertaining to the respective branch of engineering, identify the dependent and independent variable – Obtain the solution and compare the solution sets by varying the values of the dependent variable.

xt Book

3. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition
4. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

ferences:

5. Victor Henner, Tatyana Belozerova, Mickhail Khenner, Ordinary and Partial Differential Equations, CRC Press, Edition, 2013.
6. Walter Ledermann, Multiple integrals, Springer, 1st edition
7. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
8. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

E-resources/ Web links:

7. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_103205
8. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_106839
9. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_61605
10. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_134719
11. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
12. https://www.scu.edu.au/study-at-scu/units/math1005/2022/

pics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of calculus and differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving**.** This is attained through the assessment component mentioned in course handout.

urse Code: Y2504	Course Title: Optoelectronics and Quantum Physics Lab pe of Course: BSC	-P-C				
rsion No.						
urse Pre-requisites						
ti-requisites						
urse Description	The laboratory provides an opportunity to validate the concepts taught and enhances the ability to use the concepts for technological applications. The laboratory tasks aim to develop following skills: **An attitude of enquiry, confidence and ability to tackle new problems, ability to interpret events and results, observe and measure physical phenomena, select suitable equipment, instrument and materials, locate faults in systems.**					
urse Out Comes	On successful completion of the course the students shall be able to: CO1: To understand electrical and optical properties of materials CO2: Interpret the results of various experiments to verify the concepts used in optoelectronics and advanced devices.					
urse Objective	The objective of the course is to familiarize the learners with the concepts of " Applied Physics for Computer Science Cluster "and attain **Skill Development** through **Experiential Learning** techniques					

t of Laboratory Tasks:

Experiment No. 1: Experimental errors and uncertainty using excel

Level 1: Calculation of accuracy and precision of a given data

vel 2: propagation of errors in addition, subtraction, multiplication and division.

Experiment N0 2: To determine the wavelength of semiconductor diode Laser and to estimate the particle size of lycopodium powder using diffraction.

vel 1: Determination of Wavelength of Laser

vel 2: Finding the particle size of lycopodium powder.

periment No. 3: To determine the proportionality of Hall Voltage, magnetic flux density and the polarity of Charge carrier.

vel 1: To determine the proportionality of Hall Voltage and magnetic flux density

vel 2: To determine the polarity of Charge carrier.

Experiment No. 4: To study the I-V characteristics of a given zener diode in forward and reverse bias conditions.

vel 1: To study I –V characteristics of the given Zener diode in reverse bias and to determine break down voltage.

vel 2: To study I –V characteristics of the given Zener diode in forward bias and to determine knee voltage and forward resistance.

Experiment No. 5: To study input and output characteristics of a given Transistor.

vel 1: To determine the input resistance of a given transistor.

vel 2: To determine current transfer characteristics and transistor parameters of a given transistor.

Experiment No. 6: Determination of Fermi energy and Fermi temperature of a given metal and bimetallic wire.
Level 1: Determination of Fermi energy and Fermi temperature of given metal wire.
Level 2: Determination of Fermi energy and Fermi temperature of given bimetallic wire.

periment No. 7: To study the I-V characteristics and I-R characteristics of a solar cell as a function of the irradiance.
vel 1: To study the I-V characteristics
vel 2: I-R characteristics of a solar cell as a function of the irradiance.

periment No. 8: Calculate the numerical aperture and study the losses that occur in optical fiber cable. .
vel 1: Calculate the numerical aperture.
vel 2: study the losses that occur in optical fiber cable.

periment No. 9: Plotting I-V characteristics in forward and reverse bias for LEDs
d Determination of knee voltage.
vel 1: Plotting I-V characteristics in forward and reverse bias for LEDs
vel 2: Determination of knee voltage.

periment No. 10: Determination of Stefan's constant and verification of Stefan-Boltzmann Law.
vel 1: Determination of Stefan's constant
vel 2: Verification of Stefan-Boltzmann Law.

periment No. 11: Determination of dielectric constant of given materials.
vel 1: Determination of Stefan's constant
vel 2: compare the obtain results with other materials

periment No. 12: determine the wavelength of monochromatic light, such as sodium light, using Newton's rings.
vel 1: Determination of wavelength
vel 2: determine the radius of curvature of the Plano-convex lens.

rgeted Application & Tools that can be used:

3. Areas of application are optoelectronics industry, Solar panel technologies, quantum computing software, electronic devices using transistors and diodes, memory devices, endoscopy, SQUIDS in MRI, Advanced material characterizations using SEM and STM.
4. Origin, excel and Mat lab soft wares for programming and data analysis.

bject work/Assignment: Mention the Type of Project /Assignment proposed for this course

Assessment Type

- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.)
- Quiz
- End Term Exam
- Self-Learning

Prepare a comprehensive report on non-conventional energy resources in Karnataka and their pros and cons.
Write a report on importance of quantum entanglement in supercomputers.

urse Code: Y2501	**Course Title:** Optoelectronics and Quantum Physics **pe of Course: BSC**	**.-T-P-C**	**3**	**0**	**0**	**3**
rsion No.						
urse Pre-requisites						
ti-requisites	.					
urse Description	The purpose of this course is to enable the students to understand the fundamentals, working and applications of optoelectronic devices and to develop the basic abilities to appreciate the applications of advanced microscopy and quantum computers. The course develops the critical thinking and analytical skills.					
urse Out Comes	On successful completion of the course the students shall be able to: CO1: To understand the concepts of electrical conducting properties of metal, semiconductor and superconductivity. CO2: To understand the principles of quantum mechanics. CO3: Discuss the quantum concepts used in quantum computers. CO4: Explain the applications of lasers and optical fibers in various technological fields.					
urse Objective	The objective of the course is to familiarize the learners with the concepts of "Applied Physics for Computer Science Cluster "and to attain the basic knowledge related to quantum mechanics and computation.					
urse Content:						
dule 1	**ctrical Conductivity of Solids and Semiconducting Devices**	ignment	a collection on efficiency of solar cells.		**Sessions**	
Topics: Classification of materials based on bandgap, Fermi energy and Fermi level, Fermi level in semiconductors, Law of mass action, Electrical conductivity of a semiconductor, Hall effect, Superconductivity, p-n junctions, Zener diode, Solar cells, I-V characteristics, and LEDs						
dule 2	**antum Mechanics**	ignment			Sessions	
Topics: Introduction, de-Broglie hypothesis, Heisenberg's uncertainty principle- statement and physical significance. Wave function-properties and physical significance. Schrodindger's time independent wave equation, Probability density and normalization of wave function. Wave Function in Ket Notation: Matrix form of wave function, Identity operator, Determination of I|0> and I|1>, Pauli Matrices and its operations on 0 and 1 states, Mention of Conjugate and Transpose, Unitary Matrix U, Examples: 2x2 Matrices and their multiplication (Inner Product), Probability, Orthogonality						
dule 3	**antum Computing**	m paper	ninar on quantum computers.		Sessions	
Topics: Introduction to quantum computing, Moore's law & its end, Differences between classical and quantum computing, Concept of Qubit and its properties, . Representation of qubit by Bloch sphere, Quantum Gates: Single Qubit Gates: Quantum Not Gate, Pauli Z Gate, Hadamard Gate, Phase Gate (or S Gate), T Gate. Multiple Qubit Gates: Controlled gate - CNOT Gate, (Discussion for 4 different input states). Representation of Swap gate, Controlled - Z gate, Toffoli gate. Problems.						
dule 4	**ers And Optical Fibers**	m paper	e study on medical applications of Lasers.		Sessions	

Topics: Interactions of radiations with matter, expression for energy density of a system under thermal equilibrium in terms of Einstein's coefficients, conditions for LASER action using Einstein's coefficients, Characteristics of laser, conditions and requisites of laser, Principle of optical fibers, Numerical aperture and acceptance angle (Qualitative), Attenuation, Applications: Point to point communication with block diagram, application of optical fibers in endoscopy.

geted Application & Tools that can be used:

5. Areas of application are optoelectronics industry, Solar panel technologies, quantum computing software, electronic devices using transistors and diodes, memory devices, endoscopy, SQUIDS in MRI, Advanced material characterizations using SEM and STM.
6. Origin, excel and Mat lab soft wares for programming and data analysis.

ject work/Assignment: Mention the Type of Project /Assignment proposed for this course

Assessment Type

- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.)
- Quiz
- End Term Exam
- Self-Learning

Prepare a comprehensive report on non-conventional energy resources in Karnataka and their pros and cons.

Write a report on importance of quantum entanglement in supercomputers.

xt Book

3. Engineering Physics by Avadhanalu, Revised edition, S. Chand Publications,2024.
4. Quantum Computation and Quantum Information, Michael A. Nielsen & Isaac L. Chuang, Cambridge Universities Press, 2010 Edition

References:

1. Elementary Solid state Physics: Principles and Applications by M.A. Omar, 1st Edition, Pearson Publications, 2002.
6. Principles of Quantum Mechanics by R Shankar, 2nd edition, springer Publications, 2011.
7. Optoelectronics: An Introduction by John Wilson and John Hawkes, 3rd edition, Pearson Publications, 2017.
8. Engineering Physics by Gaur and Gupta, Dhanpat Rai Publications, 2012.
9. Introduction to Quantum Mechanics, David J Griffiths, Cambridge University Press, 2019

E-Resourses:

6. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=553045&site=ehost-live
7. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=833068&site=ehost-live
8. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=323988&site=ehost-live
9. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1530910&site=ehost-live
10. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=486032&site=ehost-live

Topics relevant to "SKILL DEVELOPMENT": Fundamentals of materials, Lasers and optical fibers.
for Skill Development through Participative Learning Techniques. This is attained through the Assignment/ Presentation as mentioned in the assessment component in course handout.

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Course Code: MEC1006	**Course Title:** Engineering Graphics **Type of Course:** School Core & Theory Only	**L- T-P- C**	2	0	0	2
Version No.	1.2					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	The course is designed with the objective of giving an overview of engineering graphics. It is introductory in nature and acquaints the students with the techniques used to create engineering drawings. The course emphasizes on projection of points, lines, planes and solids and isometric projections.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of "Engineering Graphics" and attain SKILL DEVELOPMENT through Problem solving methodologies.					
Course Outcomes	On successful completion of this course the students shall be able to: 1. Demonstrate competency of Engineering Graphics as per BIS conventions and standards. 2. Comprehend the theory of projection for drawing projections of Points, Lines andPlanes under different conditions. 3. Prepare multiview orthographic projections of Solids by visualizing them in different positions. 4. Prepare pictorial drawings using the principles of isometric projections to visualizeobjects in three dimensions.					

Course Content:

Module 1	Introduction to Drawing	Assignment	Standard technical drawing	**02 Sessions**
Topics: Introduction, drawing instruments and their uses, relevant BIS conventions and standards, Lettering, Lineconventions, dimensioning, Selection of drawing sheet size and scale.				
Module 2	Orthographic projections of Points, Straight Lines and Plane Surfaces	Assignment	Projection methods Analysis	**10 Sessions**
Topics: Introduction, Definitions – Elements of projection and methods of projection, Planes of projection, reference line and conventions adopted. First angle and third angle projections. Projection of Points inall 4 quadrants. Projections of Straight Lines (located in first quadrant/first angle projection only): True and apparent lengths, true and apparent Inclinations to reference planes. (No application problems). Projection of Plane surfaces (First angle projection): Regular plane surfaces – triangle, square, rectangle, pentagon, hexagon and circle – in different positions inclined to both the planes using change of position method only.				

Module 3	Orthographic Projections of Solids	Assignment	Multi-view drawing Analysis	**10 Sessions**
Topics: **Introduction, Projection of right regular prisms, pyramids, cone, hexahedron and tetrahedron in different positions (Problems resting on HP only and First angle projection).**				
Module 4	Isometric Projections of Solids (Using isometric scale only)	Assignment	Spatial Visualization	**8 Sessions**
Topics: **Introduction, Isometric scale, Isometric projections of right regular prisms, cylinders, pyramids, cones and their frustums, spheres and hemispheres, hexahedron (cube), and combination of 2 solids, conversion of orthographic view to isometric projection of simple objects.** **[8 Hours: Application Level]**				
Text Book: **1.N. D. Bhatt, "Engineering Drawing: Plane and Solid Geometry," Charotar Publishing House Pvt. Ltd.**				
References: **4. K.R. Gopalakrishna, "Engineering Graphics", Subhash Publishers, Bangalore.** **5. D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, "Engineering Graphics with AutoCAD," Prentice Hall.** **6. D. A. Jolhe, "Engineering Drawing with Introduction to AutoCAD," Tata McGraw Hill.** **Web resources:** **https://nptel.ac.in/courses/112103019**				
Topics relevant to "SKILL DEVELOPMENT": Projection in first and third angle for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout.				

Catalogue prepared by	Dr Yuvaraja Naik
Recommended by the Board of Studies on	BOS NO: 19thBOS held on 5th July 2024
Date of Approval by the Academic Council	24th Academic Council Meeting held on 03/08/2024

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ENG1900	**English for Technical Communication**	**L- T- P- C**	2	0	0	2
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	**NIL**					
Course Description	This course enhances the technical communication skills of BTech students, focusing on clarity, precision, and conciseness in academic and professional settings. Students will learn to differentiate between general and technical communication, analyze technical content, develop structured writing skills, and deliver effective presentations. Through interactive activities such as TED Talk analyses, report writing, and presentation practice, the course provides hands-on experience for real-world applications. By the end, students will be equipped to communicate complex technical information effectively in various professional contexts.					
Course Outcomes	On successful completion of the course the students shall be able to: 6. Differentiate between general and technical communication. 7. Explain key reading comprehension techniques to enhance understanding of technical texts. 8. Write clear, concise, and well-structured technical reports and documents. 9. Deliver technical presentations and implement peer feedback for continuous improvement. 10. Explain ethical practices in digital communication for professional use.					

Course Content: Theory

Module 1	**Technical communication**	**Quiz**	**Listening**	**9 Hours**

Introduction to Communication
Technical vs. General Communication
Characteristics of technical communication
Importance of clarity, precision, and objectivity

Activity:

- Watching TED Talks/videos to identify differences in technical and general vocabulary

Module 2	**Technical Reading**	**Assignment**	**Reading**	**12 Hours**

Reading Comprehension
Note making & Notetaking

Content Analysis

Activity:

- Reading technical articles and answering comprehension questions
- Note making techniques

Module 3	**Technical Writing**	**Assignment**	**Writing**	**12hours**

Paragraph Writing

Structure of a paragraph (topic sentence, supporting details, coherence)

Report Writing

Structure of technical and project reports (Introduction, Methods, Results, Discussion)

Activity:

- Writing a structured paragraph on a technical topic
- Writing project reports

Module 4	Professional Presentation	Presentation	Speaking	12Hours

Introduction to Presentation Skills

Preparing a Presentation

- Structuring content (Introduction, Body, Conclusion)
- Designing effective slides (Text. visual aids, readability, and impact)

Delivering a Presentation

- Engagement techniques, Storytelling, narration, pitching ideas handling Q&A
- Conviction, commitment, generating interest through enthusiasm

Demonstration & Practice

- Giving presentations on topics based on their academic interest
- Evaluating and providing peer feedback

Activity:

- Analyze a real-world engineering issue and present solutions using a structured approach.

Targeted Application & Tools that can be used: YouTube, Instagram, Quill Bot, Grammarly, & Padlet.

References:

Text books:

3. Gupta, R.C. *Technical Communication.* 2nd ed., Cambridge University Press, 2021.
4. Lannon, John M., and Laura J. Gurak. *Technical Communication.* 15th ed., Pearson, 2022.

Reference Books:

4. Gerson, Sharon J., and Steven M. Gerson. Technical Communication: Process and Product. 9th ed., Pearson, 2020.
5. Lannon, John M., and Laura J. Gurak. Technical Communication. 15th ed., Pearson, 2022.
6. Markel, Mike, and Stuart A. Selber. Technical Communication. 13th ed., Bedford/St. Martin's, 2020.

Web Resources:

5. https://owl.purdue.edu/owl/subject_specific_writing/technical_writing.
6. https://journals.ieeeauthorcenter.ieee.org/.
7. https://www.stc.org/.
8. https://ocw.mit.edu/.https://www.ted.com/talks.

Topics Relevant to "employability": Teamwork and Collaboration, Critical Thinking and Problem- Solving

Topics Relevant to "Human Values and Professional Ethics": Critical reasoning, Inclusivity and Fairness

urse Code: E1500	**urse Title: Computational Thinking using Python** **pe of Course: ESC**	**T-P-C**	2	0	2	3
rsion No.						
urse Pre-requisites						
ti-requisites	L					
urse Description	The course efficiently introduces fundamental ideas including conditionals, loops, functions, lists, strings, and tuples through some inspiring examples. It then discusses dynamic programming like handling exceptions and file usage. In terms of data structures, the course covers Python dictionaries, classes, and objects for constructing user-defined datatypes like linear and binary search.					
urse Object	The objective of the course is to familiarize the learners with the concepts of **Computational Thinking using Python** and attain **Skill Development** through **Participative Learning** techniques.					
urse Out Comes	On successful completion of the course the students shall be able to: 10) Describe algorithmic solutions for basic computing issues.. (Understand) 11) Explain data types and operators. (Understand) 12) Demonstrate control structures and Functions. (Apply) 13) Apply the data structures for the given data. (Apply) 14) Demonstrate the file operations. (Apply)					
urse Content:						
dule 1	**Computational Thinking And Problem Solving**	signment		ogramming	**6 Sessions**	
Topics: Fundamentals of Computing– Identification of Computational Problems Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi						
dule 2	**tatypes, Expressions, Statements**	signment		ogramming	**essions**	
Topics: Python interpreter and interactive mode,debugging; values and types: int, float, boolean, string , and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.						
dule 3	**ntrol flow, Functions, Strings**	signment		ogramming	**essions**	
Topics: Conditionals:Boolean values and operators, conditional (if), alternative (if else),chained conditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values,parameters, local and global scope, function composition, recursion; Strings: string slices,immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.						
dule 4	**sts, Tuples, Dictionaries**	signment		ogramming	**essions**	

pics:

ts: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing- list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

dule 5	**es**	signment		gramming	**essions**

es and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

ject work/Assignment:

3. **Assignment 1 on (Module 1 and Module 2)**
4. **Assignment 2 on (Module 3 and Module 4 & 5)**

Text Book

3. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021
4. Eric Matthes, Python Crash Course,: A Hands-On, Project-Based Introduction to Programming, 3rd Edition, 2023

References

3. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
4. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

Web Resources

W2. https://onlinecourses.nptel.ac.in/noc20_cs70/preview

Topics relevant to development of "Employability": Data structures using python.

Topics relevant to "PROFESSIONAL ETHICS": Naming and coding convention for simple programs using python.

urse Code: E2022	**urse Title:** Digital Design **pe of Course:** ESC	**-** **T-P- C**	2	0	0	2
rsion No.	0					
urse Pre-requisites	[1] Elements of Electronics/Electrical Engineering, 2] Basic concepts of number representation, Boolean Algebra					
ti-requisites	-					
urse Description	The purpose of this course is to enable the students to appreciate the fundamentals of digital logic circuits and Boolean algebra focusing on both combinational and sequential logic circuits. The course emphasizes on minimization techniques for making canonical and low-cost digital circuit implementations. This course deals with analysis and design of digital electronic circuits. The course also creates a foundation for future courses which includes Computer Architecture, Microprocessors, Microcontrollers, and Embedded Systems etc. The course enhances the Design, Implementation and Programming abilities through laboratory tasks. The associated laboratory provides an opportunity to verify the theoretical knowledge.					
urse Objective	The objective of the course is to familiarize the learners with the concepts of Digital Design and attain the SKILL DEVELOPMENT through EXPERIENTIAL LEARNING.					
urse Outcomes	On successful completion of this course the students shall be able to: v. Describe the concepts of number systems, Boolean algebra and logic gates. vi. Apply minimization techniques to simplify Boolean expressions. vii. Demonstrate the Combinational circuits for a given logic viii. Demonstrate the Sequential and programmable logic circuits					
urse Content:						
dule 1	ndamentals of Number systems- Boolean algebra and digital logic	plication Assignment	ta Analysis task		06 classes	
pics: Review of Number systems and logic gates, Number base conversions, Overview of Boolean functions and simplifications, two, three, four variable K-Maps- Don't care conditions- Both SOP and POS- Universal Gates (NAND & NOR) Implementations. Introduction to HDL.						
dule 2	Boolean function simplification	plication Assignment	ta Analysis task		08 Classes	
pics: Introduction to Combinational circuits, Analysis, Design procedure, Binary Adder and Subtractor, Magnitude comparator, Parity generator and checker, Multiplexers-Demultiplexers, Decoders, Encoders and Priority Encoders, HDL Models of combinational circuits.						
dule 3	Combinational Logic circuits:	plication Assignment	ogramming Task & Data Analysis task		08 Classes	
pics: Introduction to sequential circuits, Storage elements: latches and flip flops, Characteristic tables and equations, excitation table, Analysis of clocked sequential circuits, Mealy & Moore Models of finite state machines - Registers & Counters. HDL Models of Sequential circuits.						
rgeted Application & Tools that can be used: gital electronics is the foundation of all modern electronic devices such as cellular phones, MP3 players, laptop computers, digital cameras, high definition televisions, Home Automation, Communication in systems in industries Professionally Used Software: HDL/VHDL/Verilog HDL/ OOPS						
Text Book(s):						

5. Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education, 6th edition

6. Thomas L. Floyd "DIGITAL LOGIC DESIGN" , Pearson Education, fourth edition.

Reference(s):
Reference Book(s):
R1. Jain, R. P., *"Modern Digital Electronics",* McGraw Hill Education (India), 4th Edition

R2. Roth, Charles H., Jr and Kinney Larry L., *"Fundamentals of logic Design"*, Cengage Learning, 7th
Edition

Online Resources (e-books, notes, ppts, video lectures etc.): Book Free Download (studymaterialz.in)
13. eBook1: Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education.
14. {[PDF] Digital Design By M. Morris Mano, Michael D Ciletti Book Free Download }
15. eBook2:Floyd "DIGITAL LOGIC DESIGN" fourth edition- ePub, eBook- [PDF] DIGITAL LOGIC DESIGN FOURTH EDITION FLOYD | abri.engenderhealth.org.
16. NPTEL Course- NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits
17. Digital Logic Design PPT Slide 1 (iare.ac.in)
18. Lab Tutorial: Multisim Tutorial for Digital Circuits - Bing video
CircuitVerse - Digital Circuit Simulator online
Learn Logisim➠ Beginners Tutorial | Easy Explanation! - Bing video
Digital Design 5: LOGISIM Tutorial & Demo
19. https://presiuniv.knimbus.com/user#/home
E-content:

9. Z. Xin-Li and W. Hong-Ying, "The Application of Digital Electronics in Networking Communication," 2016 Eighth International Conference on Measuring Technology and Mechatronics Automation (ICMTMA), 2016, pp. 684-687, doi: 10.1109/ICMTMA.2016.168.
10. An encoding technique for design and optimization of combinational logic circuit DipayanBhadra;Tanvir Ahmed Tarique;Sultan Uddin Ahmed;Md. Shahjahan;KazuyukiMurase2010 13th International Conference on Computer and Information Technology (ICCIT)
11. A. Matrosova and V. Provkin, "Applying Incompletely Specified Boolean Functions for Patch Circuit Generation," 2021 IEEE East-West Design & Test Symposium (EWDTS), 2021, pp. 1-4, doi: 10.1109/EWDTS52692.2021.9581029.
12. A. Matrosova, V. Provkin and E. Nikolaeva, "Masking Internal Node Faults and Trojan Circuits in Logical Circuits," *2019 IEEE East-West Design & Test Symposium (EWDTS)*, 2019, pp. 1-4, doi: 10.1109/EWDTS.2019.8884434.

Topics relevant to "SKILL DEVELOPMENT": Adders, Multiplexers, Decoders / Encoders; Flip-Flops, Counters and Registers for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: DES1146	**Course Title:** Introduction to Design Thinking **Type of Course:** Theory		**L-T-P- C**	1	0	0	1
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The course aims to introduce students to the fundamental principles and processes of Design Thinking and will learn to apply Design Thinking methodologies to real-world challenges. The course emphasizes empathy, creativity, and collaboration, equipping students with essential skills for successful engineering practice.					
Course Objective	This course is designed to develop and familiarize the learners with the concepts of creating thinking and attain Entrepreneurship by using Participative Learning techniques.					
Course Outcomes	On successful completion of the course the students shall be able to: 4) Understand the concept and importance of Design Thinking. 5) Differentiate between traditional problem-solving and Design Thinking. 6) Identify the core stages of the Design Thinking process.					
Course Content:	All assignments and projects must be developed using the reference materials available from the PU e-resource database – JSTOR, EBSCO, Library OPAC, NPTEL Videos, etc.					
Module 1	Introduction to Design Thinking	Visual journal, book of essays, context-specific assignment/project	Visual output generation, by Visual Journal and narrative development.	**3 hours**		
Topic 3) Definition and Introduction to Design Thinking 4) Understand the Design Thinking Process						
Module 2	Design Thinking in Action	Visual journal, book of essays, context-specific assignment/project	Visual output generation, by visual journal and narrative development.	**12 hours**		
Topics: 4) Introduction to the steps of Design Thinking Process 5) Understand use cases of Design thinking 6) Design Thinking and Research Tools pertaining to Consumer Tech. , Home Tech. , Personal Tech. , Auto Tech. or Extended Reality.						
Targeted Application & Tools that can be used: 5) Design ideation tools like Miro , SCAMPER etc. 6) Research Tools for Human Centric Design using forecasting tools like WGSN 7) Feedback tools like Google Forms , etc. 8) Expert Lectures						
1. **Text Book** 2. Thinking Design by S Balaram. New Delhi [India]: Sage Publications Pvt. Ltd. 2010. eBook., Database: eBook Collection (EBSCOhost)						

3. https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=6&sid=18ab1f43-1f92-4d02-ae2e-a9c06dc06d8c%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=354920&db=nlebk

References

1. Design Thinking by Clarke, Rachel Ivy. Series: Library Futures, Vol. 4. Chicago: ALA Neal-Schuman. 2020. eBook., Database: eBook Collection (EBSCOhost)
2. https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=4&sid=c80a7d79-eda4-4b7e-a0d6-afafe437962b%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=2433506&db=nlebk
3. The Pocket Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions by Bruce Hanington; Bella Martin. Minneapolis: Rockport Publishers. 2017. eBook., Database: eBook Collection (EBSCOhost)

https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=11&sid=f086b8c2-260e-4caa-8c48-d732c21a7724%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=1638693&db=nlebk

4. What Is Design Thinking and Why Is It Important? By Rim Razzouk and Valerie Shute - Review of Educational Research, Vol. 82, No. 3 (September 2012), pp. 330-348 (19 pages), Published by: American Educational Research Association

https://puniversity.informaticsglobal.com:2054/stable/23260048?Search=yes&resultItemClick=true&searchText=design+thinking&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Ddesign%2Bthinking%26so%3Drel&ab_segments=0%2FSYC-6168%2Ftest&refreqid=fastly-default%3Acb1be24976e25734cb5fc13a8af6fdfb&seq=1#metadata_info_tab_contents

5. Abductive Thinking and Sensemaking: The Drivers of Design Synthesis by John Kolko, Design Issues, Vol. 26, No. 1 (Winter, 2010), pp. 15-28 (14 pages), Published by: The MIT Press

https://puniversity.informaticsglobal.com:2054/stable/20627839?Search=yes&resultItemClick=true&searchText=design+thinking&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Ddesign%2Bthinking%26so%3Drel&ab_segments=0%2FSYC-6168%2Ftest&refreqid=fastly-default%3A0b89336ea274d63c010536b01316d7bb&seq=1#metadata_info_tab_contents

6. Designerly Ways of Knowing: Design Discipline versus Design Science by Nigel Cross, Design Issues, Vol. 17, No. 3 (Summer, 2001), pp. 49-55 (7 pages), Published by: The MIT Press

https://puniversity.informaticsglobal.com:2054/stable/1511801?Search=yes&resultItemClick=true&searchText=design+thinking&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Ddesign%2Bthinking%26so%3Drel&ab_segments=0%2FSYC-6168%2Ftest&refreqid=fastly-default%3A0d5b607b163f60876ca973ed90e22b1c&seq=1#metadata_info_tab_contents

Course Code: PPS 1025	**Course Title: Industry Readiness Program – I (Audited Course)** **Type of Course: HSMC**	**L- T - P- C**	0	0	2	0
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course is designed to enable students to set SMART goals, form Professional & personal ethics for success and learn various email writing techniques. The course will benefit learners in presenting themselves effectively through various activities and learning methodologies.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Employability for Young Professionals" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.**					
Course Out Comes	**On successful completion of this course the students shall be able to:** CO 1 **Define** their career goals CO 2 **Practice ethical habits** for better career success CO3 **Demonstrate** effective email writing techniques					
Course Content						

Module 1	**Goal Setting & Grooming**	Classroom activities	**10 Hours**
Topics: SMART Goals, formal grooming through self-introduction activity **Activity:** Real world scenarios			
Module 2	**Habit Formation**	Role plays	**10 Hours**
Topics: Professional and Personal ethics for success and activity-based practice **Activity:** Students to present 2 min video on building professional ethics			
Module 3	**Email Etiquettes**	Individual and group presentation	**10 Hours**
Topics: Types of prompts to generate effective or desired results for email etiquettes **Activity:** Individual student presenting various search prompts			
Faculty: L&D			

Targeted Application & Tools that can be used: 7. TED Talks 8. You Tube Links 9. Activities
Assignment proposed for this course Assignment 1: SMART Goal Assignment 2: AI tools for prompt search
Continuous Individual Assessment Module 1: Presentation Module 2: Activity based assessment Module 3: Class assessment
The topics related to skill development: Students acquire knowledge on SMART goals, implement grooming standards, practice ethical behavior in class and campus, acquire hands-on experience to use AI tools to get search prompts for desired email etiquettes.

Course Code: MAT2402	Course Title: Probability and Statistics Type of Course: BSC	L-T- P- C	3	0	0	3
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	NIL					
Course Description	The course introduces the concepts of probability theory and statistical analysis, covering how to collect, organize, interpret, and draw inferences from data using mathematical models to understand randomness and uncertainty, with applications across various fields like science, engineering, economics, and social sciences.					
Course Objective	The objective of the course is to equip students with the foundational knowledge of probability theory and statistical methods, enabling them to collect, analyze, interpret data, and make informed decisions based on the likelihood of events occurring in various situations, often applied across different fields like science, engineering, and business.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Be able to compute conditional probabilities directly and using Bayes' theorem, and check for independence of events. 2. Be able to set up and work with discrete & continuous random variables; in particular, to understand the Bernoulli, binomial, geometric, Poisson distributions, uniform, normal, and exponential distributions. 3. Identifying different types of data relationships (linear, polynomial, exponential, logarithmic). 4. Be able to use specific significance tests, including z-test, t-test (one- and two-sample), and chi-squared test					

Course Content:

Module 1	Basic Probability		(6 Classes)
Probability of an Event, multiplication rule, combinations, permutations, Addition Law, Multiplication Law, Conditional Probability, Bayes's Theorem and Problems.			
Module 2	Random Variables and Bivariate Distributions	Assignment	(15 Classes)
Random Variables (discrete and continuous), Probability Mass/Density Functions, Mathematical Expectations, discrete probability distributions - Binomial distribution, Poisson distribution, geometric distribution, Continuous uniform distribution - exponential distribution, normal distribution, gamma distribution. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.			
Module 3	Curve Fitting & Statistical Methods		(13 Classes)
Curve Fitting (Straight Line ($y = a + bx$), Parabola ($y = a + bx + cx^2$), Exponential Curves ($y = ae^{bx}$, $y = ab^x$ and $y = ax^b$) Measures of Central tendency, Moments, skewness and Kurtosis, Correlation - Karl Pearson's coefficient of correlation and rank correlation (with & Without repetition, Multiple Correlation - Problems. Regression analysis - lines of regression, Multiple regression - Problems.			
Module 4	Joint Probability Distribution and Sampling Theory	Assignment	(15 Classes)

Joint Probability distribution for two discrete random variables, expectation and covariance.
Random sampling, sampling distributions, Standard Error, Type I & Type II errors, Testing of Hypothesis, Test of significance - Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations, Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Targeted Application & Tools that can be used:

The contents of this course has direct applications in most of the core engineering courses for problem formulations, Problem Solution and system Design.
Tools Used: R software (Open Source)

Assignment:

2. Select any one simple differential equation pertaining to the respective branch of engineering, identify the dependent and independent variable – Obtain the solution and compare the solution sets by varying the values of the dependent variable.

Text Book

1. Ronald .E. Walpole, Raymond. H. Myers, Sharon. L Myers, and Keying E. Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Delhi-9th edition, 2012.
2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

References:

1. Miller and Freund, Probability and Statistics for Engineers, Pearson Education Ltd.
2. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition.
3. Douglas C. Montgomery & George Runger, Applied Statistics and Probability for Engineers, , Wiley Publications

E-resources/ Web links:

1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_10427
2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_100198
3. https://nptel.ac.in/courses/109104124
4. https://nptel.ac.in/courses/111106051
5. https://nptel.ac.in/courses/111102137
6. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
7. https://www.scu.edu.au/study-at-scu/units/math1005/2022/

8. Presidency University's Knimbus library URL is: presiuniv.knimbus.com
Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of Vector calculus and Linear Algebra with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem Solving**.** This is attained through the assessment component mentioned in the course handout.

urse Code: IE7601	vironmental Studies pe of Course: MOOC course	T- P- C				
		ntact hours				
urse Pre-requisites	NIL					
ti-requisites	L					
urse Description	This course is designed to improve the learners' SKILL DEVELOPMENT by using PATICIPATIVE LEARNING techniques. This course aims to familiarize students with fundamental environmental concepts and their relevance to business operations, preparing them to address forthcoming sustainability challenges. It is designed to equip students with the knowledge and skills needed to make decisions that account for environmental consequences, fostering environmentally sensitive and responsible future managers. **This course is designed to cater to Environment and Sustainability**					
urse jective	The objective of the course is **'SKILL DEVELOPMENT'** of the student by using **'PARTICIPATIVE LEARNING'** techniques					
urse Outcomes	On successful completion of this course the students shall be able to: 5. Describe the issues related to natural resources, ecosystems and biodiversity 6. Identify environmental hazards affecting air, water and soil quality 7. Recognize the importance of healthy environment and finding the sustainable methods to protect the environment 8. Convert skills to address immediate environmental concerns through changes in environmental processes, policies, and decisions					
urse Content:						
dule 1	**derstanding Environment, Natural Resources, and Sustainability**					
pics: ssification of natural resources, issues related to Population growth and their overutilization, and strategies for their conservation. Water, air, soil, mineral, energy and food source. Effect of human activities on natural resources. ncept of sustainability- Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs; Sustainable practices in managing resources, including deforestation, water conservation, Desalination – types, energy security, and food security issues, Life Cycle thinking and Circular Economy.						
dule 2	**osystems, Biodiversity, and Sustainable Practices**					
pics: **Ecosystems and ecosystem services:** Various natural ecosystems, Major ecosystem types in India and their basic characteristics; forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services-classification and their significance. The importance of biodiversity, Types of biodiversity, Biodiversity and Climate Change, the threats it faces, hotspots, and the methods used for its conservation. Strategies for in situ and ex situ conservation, mega diverse nation.						
dule 3	**vironmental Pollution, Waste Management, and Sustainable Development**					
pics:						

Types of pollution- Chemical, - Biological, Biomedical, noise, air, water, soil, thermal, radioactive and marine pollution, and their impacts on society. Urbanization and Urban environmental problems; effects, and mitigation.
Causes of pollution, such as global climate change, ozone layer depletion, the greenhouse effect, and acid rain, with a particular focus on pollution episodes in India. Importance of adopting cleaner technologies; Solid waste management;

Sustainable Materials and Technologies: Biodegradable and compostable materials, Recycled and reclaimed materials (E-waste management), Sustainable manufacturing processes.

dule 4	**cial Issues, Legislation, and Practical Applications**			

pics:

Overview of key environmental legislation and the judiciary's role in environmental protection, including the Water (Prevention and Control of Pollution) Act of 1974, the Environment (Protection) Act of 1986, and the Air (Prevention and Control of Pollution) Act of 1981. Hazardous waste Rule 1989, Biomedical Waste handling 1998, Fly Ash Rule 1999, Municipal Solid Waste Rule 2000, Battery Rules 2001, E- Waste Rules 2011, Plastic waste management Rules 2016, Construction Demolition waste Rules 2016 National Biodiversity Action Plan (NBAP)

Major International Environmental Agreements: Convention on Biological Diversity (CBD), The Biological Diversity (Amendment) Act, 2023, United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement.

Major International organisations and initiatives: United Nations Environment Programme (UNEP), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC).

rgeted Application & Tools that can be used:

plication areas are Energy, Environment and sustainability

ols: Online Tools – NPTEL and Swayam.

oject work/Assignment:

ssessment Type

- Online exams (MCQs) will be conducted by the department of Chemistry

line Link*:

3) Lecure by Dr. Samik Chowdhury, Dr. Sudha Goel, NPTEL course: Environmental Science, https://nptel.ac.in/courses/109105203, 2024.
4) Lecture by Dr. Padmavati, Dr Narendran Thiruthy, NPTEL Course: Biodiversity Protection, Farmers and Breeders Rights, https://nptel.ac.in/courses/129105008, 2024.

ther source links are available in below Resources link.

xt Book

12. G. Tyler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA
13. Poonia, M.P. Environmental Studies (3rd ed.), Khanna Book Publishing Co.
14. Bharucha, E. Textbook of Environmental Studies (3rd ed.) Orient Blackswan Private Ltd.
15. Dave, D., & Katewa, S. S. Text Book of Environmental Studies. Cengage Learning India Pvt Ltd.
16. Rajagopalan, R. Environmental studies: from crisis to cure (4th ed.). Oxford University Press.
17. Basu, M., & Xavier Savarimuthu, S. J. Fundamentals of environmental studies. Cambridge University Press.
18. Roy, M. G. Sustainable Development: Environment, Energy and Water Resources. Ane Books.
19. Pritwani, K. Sustainability of business in the context of environmental management. CRC Press.
20. Wright, R.T. & Boorse, D.F. Environmental Science: Toward A Sustainable Future (13th ed,). Pearson.

ference Books

6. Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022), Conservation through Sustainable Use: Lessons from India. Routledge.
7. William P. Cunningham and Mary Ann Cunningham (2020), Principles of Environmental Science: Inquiry & Applications, 9th Edition, McGraw-Hill Education, USA.
8. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.
9. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press. https://doi.org/10.1201/9781003096238
10. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press

Resources:

16. https://nptel.ac.in/courses/109105203
17. https://archive.nptel.ac.in/courses/120/108/120108004/
18. https://nptel.ac.in/courses/127105018
19. https://onlinecourses.nptel.ac.in/noc23_lw06/preview
20. https://onlinecourses.swayam2.ac.in/ini25_bt02/preview
21. https://archive.nptel.ac.in/courses/120/108/120108002/
22. https://onlinecourses.swayam2.ac.in/ini25_bt02/preview
23. https://nptel.ac.in/courses/102104088
24. https://nptel.ac.in/courses/124107165
25. https://nptel.ac.in/courses/109106200
26. https://archive.nptel.ac.in/content/storage2/courses/120108004/module1/lecture1.pdf
27. https://onlinecourses.swayam2.ac.in/nou25_ge19/preview
28. https://onlinecourses.swayam2.ac.in/ini25_hs01/preview
29. http://kcl.digimat.in/nptel/courses/video/105105184/L32.html
30. https://nptel.ac.in/courses/105105169

Topics relevant to Skill Development:

3. An attitude of enquiry.
4. Write reports

e topics related to Environment and Sustainability :

topics in theory component are relevant to Environment and Sustainability.

urse Code: '1200	**urse Title: Foundations of Integrated Engineering** **e of Course: ESC**	**L- T-P- C**	2	0	0	2
rsion No.						
urse Pre-requisites	**NIL**					
ti-requisites	.					
urse Description	This interdisciplinary course introduces first-year engineering students to foundational principles and practices across key engineering domains, emphasizing real-world problem-solving, sustainability, and ethical innovation. Students explore how civil, mechanical, electrical, and IT systems intersect with emerging technologies like IoT, AI, and geomatics to address global challenges. Through case studies, learners gain deeper understanding of smart infrastructure, prototyping mechanical/electronic systems, and securing IT solutions. Topics include bioinformatics for environmental monitoring, GIS-enabled urban planning, renewable energy integration, and cybersecurity fundamentals. The course cultivates a holistic understanding of engineering's role in sustainable development, safety, and ethical decision-making, preparing students to contribute meaningfully to multidisciplinary projects in a technology-driven world.					
urse Objective	The objective of the course is skill development of student by using Participative Learning techniques.					
urse Outcomes	On successful completion of this course the students shall be able to: 1] Recall key principles of Agile, DevOps, and bioinformatics used in interdisciplinary engineering contexts. 2] Explain the role of GIS, LiDAR, and sustainable materials in designing smart infrastructure and disaster management systems. 3] Describe core components of mechanical systems and their real-world applications. 4] Describe the functionality of IoT-enabled wearable devices, embedded systems, and renewable energy integration in smart grids. 5] List foundational IT concepts such as cloud computing architectures, cybersecurity threats, and blockchain applications.					
urse Content:						
dule 1	**ndations of Engineering Practice**	ignment	e studies		**essions**	
l-world problem-solving using data logic and practical applications, Collaboration and Innovation through multi-domain project, Engineering Ethics & Environmental Impact erging Fields: Automation, and Introduction to bioinformatics and its application tainability & Safety: Circular economy principles, carbon footprint analysis.						
dule 2	**il Engineering & Geomatics**	ignment	icle Review		**essions**	
art Infrastructure & Geomatics: GIS mapping, LiDAR, drone surveys for urban planning, Geospatial data analysis for disaster management. tainable Construction: 3D-printed structures, self-healing concrete, Digital twins for infrastructure monitoring. een Innovations: Net-zero energy buildings, rainwater harvesting systems.						
dule 3	**chanical Engineering in Action**	ignment & Quiz	a Collection		**essions**	
vanced Manufacturing: Collaborative robots (cobots), additive manufacturing and 3D printing, Reverse engineering and prototyping. rgy Systems: Solar/wind energy harvesting, piezoelectric applications. mechanics: Prosthetics design, ergonomic product lifecycle.						
dule 4	**ctrical & Electronics Engineering**	ignment & Quiz	a Collection and visualization		**essions**	

art Devices & Systems: Embedded systems, Wearable technology, Edge computing and hardware platforms
ergy Innovations: EV charging infrastructure, wireless power transfer, Smart grid integration with renewables.

dule 5	**ndamentals of IT**	ignment & Quiz	se studies	**5 Sessions**

re IT Topics: Networking basics, Cloud computing
bersecurity & Data: Encryption, phishing prevention, zero-trust models, Database management.
erging Tech: Blockchain for supply chains, AI/ML basics, IoT integration with cloud platforms

geted Application & Tools that can be used:

blication Areas include Interdisciplinary problem-solving, Smart city planning, disaster management, Robotics prototyping, renewable energy systems, Wearable health tech, smart grids, Secure cloud systems.
bls: 3D Printers, Autocad, Tinkercad, ArcGIS / QGIS, Arduino/Raspberry Pi

t Book:

6. William Oakes & Les Leone, "Engineering Your Future: An Introduction to Engineering", Oxford University Press, 9th Edition, 2021
7. Barry F. Kavanagh, “Introduction to Geomatics”, Pearson, 5th Edition, 2021
8. Ian Gibson, David Rosen, & Brent Stucker, “Additive Manufacturing Technologies”, Springer, 3rd Edition, 2021
9. Sudip Misra, "The Internet of Things: Enabling Technologies, Protocols, and Use Cases", Wiley, 2nd Edition, 2022
10. James Kurose & Keith Ross, “Computer Networking: A Top-Down Approach”, Pearson, 8th Edition, 2020

ferences

8. Supratim Choudhuri, “Bioinformatics for Beginners: Genes, Genomes, and Molecular Evolution", Academic Press, 1st Edition, 2023,
9. Robert McGinn, "The Ethical Engineer: Contemporary Concepts and Cases", Princeton University Press, 1st Edition, 2020
10. Charles J. Kibert, “Sustainable Construction: Green Building Design and Delivery”, Wiley, 5th Edition, 2022
11. Anthony M. Townsend, "Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia", W.W. Norton & Company, 1st Edition, 2020
12. David Buchla, "Renewable Energy Systems: A Smart Energy Systems Approach", Pearson, 2nd Edition, 2023
13. Charles Platt, "Make: Electronics: Learning Through Discovery", Make Community, 3rd Edition, 2021
14. Charles J. Brooks, Christopher Grow, & Philip Craig, “Cybersecurity Essentials", Wiley, 2nd Edition, 2021

eb-resources:

5. Post-parametric Automation in Design and Construction
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1155197&site=ehost-live
6. Smart Cities : Introducing Digital Innovation to Cities
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1993146&site=ehost-live
7. Innovation Energy: Trends and Perspectives or Challenges of Energy Innovation
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2323766&site=ehost-live
8. Additive Manufacturing: Opportunities, Challenges, Implications
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1134464&site=ehost-live

urse Code: E2501	**urse Title: Chemistry of Smart Materials** **pe of Course: Theory - BSC**	**L-T- P- C**		0		3
rsion No.						
urse Pre-requisites						
ti-requisites	-					
urse Description	The objective of the course is to introduce the students to concepts and applications of chemistry of smart materials. The course also aims to enhance the knowledge of smart materials associated with memory system, display devices, , sensors, energy devices and environment. It will also cultivate an ability to identify chemistry in each of smart engineered materials and interpret solutions for the challenges connected to memory, display, energy, smart, green and sustainable technologies. It targets to strengthen the fundamental concepts behind chemistry of smart materials and then builds an interface with their industrial applications. **This course is designed to cater to Environment and Sustainability**					
urse jective	The objective of the course is 'SKILL DEVELOPMENT' of the student by using Participative learning techniques.					
urse Outcomes	On successful completion of this course the students shall be able to: **1.** Relate the knowledge of chemistry to computational approaches to identify materials functionalities and properties **2.** Recognize and interpret solutions for the challenges connected to memory, display, smart, green and sustainable technologies. **3.** Explain the quality parameters of engineering materials associated with environment and sensors. 4. Interpret the knowledge of sustainable chemistry for E- waste management. 5. Analyse the importance of various electrochemical sources in energy systems.					
urse Content:						
odule 1	**mputational Chemistry**	Assignment	ata Collection and analysis		**09 classes**	
pics: Fundamental particles of atom – their mass, charge and location – atomic number and mass number, Stabilizing interactions: Bonded and non-bonded interactions. Chemistry of weak interactions – van der Waals force and hydrogen bonding, Density functional theory. 3D co-ordinate generation for small molecules, geometry optimization by Molview. Chemical Databases: Chemoinformatics, MSDS ***f- learning topics:*** Scope, cost and efficiency of computational modeling.						
odule 2	**terials for Memory and Display Systems**	Assignment	ata Collection and analysis		**09 Classes**	
Topics: Memory Systems : Introduction, classification of electronic memory devices- Transistor, capacitor, charge -transfer and Resistor, types of materials - organic, polymeric and hybrid materials, and applications, manufacturing of semiconductor chips. **Display Systems:** photo and electroactive materials , materials for display -Principle, Properties and applications: Liquid crystals for LCD-Liquid crystals display, Basics of LED: OLED-organic light emitting diode and light emitting electrochemical cells. ***Self- learning topics:*** Green computing: Biocomposite based memory devices						

odule 3	**nomaterials based Smart Sensors and Devices**	Assignment	ata Collection and analysis	**09 Classes**
pics: Nanomaterials- Introduction, classification based on dimensionality, quantum confinement. Size dependent properties, Synthesis, Properties of CNT and Graphene and their application as **Materials for data analysis and packaging** -RFID and IONT. **Sensors:** Introduction, types, Principle and applications- electrochemical sensor: nanomaterials for sensing applications - Glucose, VOC sensing. **Self-learning topics:** Fullerene, biomolecules in sensing, Strain sensors				
odule 4	**Sustainable Materials and Development**	Quiz/Seminar	ata Collection and analysis	**09 Classes**
pics: E waste: Introduction, E waste Hazards, E- waste management, Recovery of precious metal- Cu by Hydrometallurgy. **Green Chemistry**: Fundamentals and 12 principles with examples, Carbon footprint and sequestration **Sustainable Chemistry:** -Introduction to Biomaterials- PLA , polymers in bio-compatible and bio-degradable materials - Poly(3-hydroxybutyrate-co-3-hydroxyvalerate) PHBV, synthesis and applications in drug delivery. ***Self-learning topics:*** circular economy- case studies.				
odule 5	**ergy Science**	Quiz/Seminar	ata Collection and analysis	**Classes**
pics: Battery technology: Fundamentals of electrochemistry, Introduction to electrochemical storage devices: battery (Lithium-ion battery- $LiMnO_2$, $LiCoO_2$, metal air batteries- LiO_2) and supercapacitors- Introduction, Principle, Types - EDLC, pseudo and asymmetric capacitor. **Photovoltaics:** Solar cells - Construction and working principle; types- Inorganic, Organic and quantum dot sensitized (QDSSC's). ***Self -learning topics:*** Battery technology for e-mobility, Green hydrogen				
rgeted Application & Tools that can be used: plication areas are Data storage and analysis, logistics, Biomedicine, Energy, Environment and sustainability **ols:** Molview, chemdraw, excel etc				
oject work/Assignment:				
sessment Type • Midterm exam • Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screenshot accessing the digital resource.) • Quiz/Student Seminar • End Term Exam • Self-learning				
xt Book 21. Wiley, "Engineering Chemistry", Wiley. 22. G.A. Ozin and A.C. Arsenault, Nanochemistry: A chemical approach to nanomaterials, Royal Society of Chemistry, 2009				
ference Books 1. Functional and smart materials, Chander Prakash, Sunpreet Singh, J. Paulo Davim, 2020, CRC Press, 2. ISBN: 978-036-727-510-5. 3. E-waste recycling and management: present scenarios and environmental issues, Khan, Anish, and 4. Abdullah M. Asiri. 2019, Springer, Vol. 33. ISBN: 978-3-030-14186-8. 5. Essentials of computational chemistry: theories and models, Christopher J Cramer, 2013, John Wiley & 6. Sons. ISBN: 978-0-470-09182-1. 7. Energy storage and conversion devices: Supercapacitors, batteries and hydroelectric cells, Anurag Gaur,				

8. L. Sharma, Anil Arya. 2021, CRC press, 1st edition, ISBN: 978-1-003-14176-1.
9. Fundamentals of analytical chemistry: An introduction, Douglas A. Skooget etal., 2004 Thomson Asia pte
10. Ltd., 8th, ISBN: 978-0-495-55828-6
11. Functional and smart materials, Chander Prakash, Sunpreet Singh, J. Paulo Davim, 2020, CRC Press,
12. ISBN: 978-036-727-510-5.
13. Electrical and electronic devices, circuits and materials: Technological challenges and solutions. Tripathi,
14. L., Alvi, P. A., & Subramaniam, U, 2021, John Wiley & Sons, ISBN: 978-0367564261.
15. F. Jensen, Introduction to Computational Chemistry, 3rd edition, Wiley, 2017.

E resources

1. https://presiuniv.knimbus.com/user#/searchresult?searchId=computational%20chemistry&_t=1738054970142
2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_48504
3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_147967
4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_130301
5. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_87297
6. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_67006
7. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_137261
8. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_86712

II Sets

topics in theory component are relevant to Environment and Sustainability.

Course Code: CSE2200	**Course Title: Program Solving Using C Type of Course: Theory - PCC**	**L- T-P-C**	2	0	0	2
Version No.	1.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. ACAlso by learning the basic programming constructs they can easily switch over to any other language in future.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Problem SolvingUsing C and attain Employability through Problem Solving Methodologies.					
Course Outcomes	**On successful completion of this course the students shall be able to:** 1. Write algorithms and to draw flowcharts for solving problems 2. Demonstrate knowledge and develop simple applications in C programmingconstructs 3. Develop and implement applications using arrays and strings 4. Decompose a problem into functions and develop modular reusable code 5. Solve applications in C using structures and Union 6. Design applications using Sequential and Random Access File Processing.					
Course Content:						
Module 1	Introduction to C Language	Quiz	Problem Solving	**6 Sessions**		
Topics: Introduction to Programming – Algorithms – Pseudo Code - Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.						
Module 2	Introduction to Arrays and Strings	Quiz	Problem Solving	**6 Sessions**		
Topics: **Arrays:** Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs – Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs – Matrix operations. **Strings:** Introduction – Declaring and Initializing String Variables – Reading Strings from Terminal – Writing String to Screen – String Handling Functions.						
Module 3	Functions and Pointers	Quiz	Problem Solving	**6 Sessions**		
Topics: **Functions:** Introduction – Need for User-defined functions – Elements of User-Defined Functions: declaration, definition and function call–Categories of Functions – Recursion. **Pointers:** Introduction – Declaring Pointer Variables – Initialization of Variables – Pointer Operators – Pointer Arithmetic – Arrays and Pointers – Parameter Passing: Pass by Value, Pass by Reference.						

Module 4	Structures and Union	Quiz	Problem Solving	**6 Sessions**
Topics: **Structures:** Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Members – Array of Structures – Arrays within Structures – **Union:** Introduction – Defining and Declaring Union – Difference Between Union and Structure.				
Module 5	File handling	Case Study	Problem Solving	**6 Sessions**
Topics: Files: Defining and Opening a File – Closing a File – Input / Output Operations on File – Random Access Files				
Text Book(s): **1. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316- 513-0.**				
Reference Book(s): 6. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020. 7. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016. 8. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015 9. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014. 10. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.				
Web Links and Video Lectures: **1. https://nptel.ac.in/courses/106/105/106105171/** **2. https://archive.nptel.ac.in/courses/106/104/106104128/**				

Course Code: CSE2201	**Course Title: Program Solving Using C Lab** **Type of Course: Lab - PCC**	**L- T-P-C**	0	0	4	2
Version No.	1.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. ACAlso by learning the basic programming constructs they can easily switch over to any other language in future.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Problem SolvingUsing C and attain Employability through Problem Solving Methodologies.					
Course Outcomes	**On successful completion of this course the students shall be able to:** 7. Write algorithms and to draw flowcharts for solving problems 8. Demonstrate knowledge and develop simple applications in C programmingconstructs 9. Develop and implement applications using arrays and strings 10. Decompose a problem into functions and develop modular reusable code 11. Solve applications in C using structures and Union 12. Design applications using Sequential and Random Access File Processing.					
Course Content:						

List of Practicals:
Lab Sheet 1: 10 Sessions

Program 1: Sum of Two Numbers
Program 2: Find the Greatest of Three Numbers
Program 3: Check Even or Odd using Conditional Operator
Program 4: Print Multiplication Table using Loop
Program 5: Count Digits in a Number using While Loop
Program 6: Demonstration of Preprocessor Directives
Program 7: Simple Calculator using Switch Case

Lab Sheet 2: 10 Sessions
Program 1: Check Whether a Number is Positive, Negative or Zero
Program 2: Find the Sum of First N Natural Numbers
Program 3: Check Whether a Number is Prime or Not
Program 4: Find Factorial of a Number
Program 5: Reverse a Number
Program 6: Simple Number Guessing Game

Lab Sheet 3: 10 Sessions
Program 1: Linear Search in a One-Dimensional Array
Program 2: Bubble Sort on an Integer Array
Program 3: Matrix Addition (2D Arrays)
Program 4: Count Vowels in a String
Program 6: Selection Sort on an Array

Lab Sheet 4: 10 Sessions
Program 1: Sum of Two Numbers Using User-Defined Function
Program 2: Factorial Using Recursion
Program 3: Swap Two Numbers Using Call by Value (No Swap)
Program 4: Swap Two Numbers Using Call by Reference (With Swap)
Program 5: Pointer Basics - Access and Modify Variable via Pointer
Program 6: Accessing Array Elements Using Pointers

Lab Sheet 5: 10 Sessions
Program 1: Basic Structure Usage
Program 2: Input and Display Array of Structures
Program 3: Array Inside Structure (Student Marks)
Program 4: Structure with Nested Structures (Date of Birth)
Program 5: Union Example and Member Access

Lab Sheet 6: 10 Sessions
Program 1: Write to a File (Text Mode)
Program 2: Read from a File (Text Mode)
Program 3: Append Data to a File
Program 4: Count Characters, Words and Lines in a File
Program 5: Write and Read Structure to/from a Binary File
Program 6: Random Access in File (Update a Record)

Text Book(s):

1. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316- 513-0.

Reference Book(s):

11. **Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.**
12. **ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.**
13. **Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015**
14. **Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.**
15. **Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.**

Web Links and Video Lectures:

3. https://nptel.ac.in/courses/106/105/106105171/
4. https://archive.nptel.ac.in/courses/106/104/106104128/

G2501	**lvanced English**	**T- P- C**	2	)	)	2
rsion No.	)					
urse Pre-requisites	G1900 - English for Technical Communication					
ti-requisites	**L**					
urse Description	This course is designed to equip students to enhance their communication abilities in Listening, Speaking, Reading, and Writing. The curriculum covers interpersonal communication principles, the art of speech writing and delivery (including impromptu speaking), strategic approaches to critical reading, the identification of logical fallacies, and persuasive writing. Furthermore, the course will introduce students to the potential of AI tools and the techniques of prompt engineering to elevate their communication skills in the digital age. Upon course completion, students will be well-prepared to communicate effectively and critically in both academic and professional environments.					
urse Out Come	On successful completion of the course the students shall be able to: 5. Recognize the elements of interpersonal and cross-cultural communication to address communication challenges effectively. 6. Demonstrate the ability to deliver structured and impromptu speeches using effective speaking techniques. 7. Interpret textual and visual materials using critical reading strategies to evaluate arguments, logic, and persuasion. 8. Produce persuasive and analytical essays using effective argumentation techniques and structured writing strategies.					

Course Content:

dule 1	**undations of Effective Communication**	**se Studies/ Role play**	**oss-Cultural Competency**	**12 Classes**

pics:

- Fundamentals of Interpersonal Communication
- Verbal, Non-verbal, and Paraverbal communication.
- Cultural dimensions theory (Hofstede's Cultural Dimensions).
- Active Listening Techniques
- Common Errors in Communication

Activities:

- Instagram/YouTube Vocabulary Activity
- Charades with a Twist/Tone and Emotion Experiment/Mixed Messages Challenge/Role Reversal Conversations/Observation Exercise

dule 2	**astering Speech Delivery**	**M**	**blic Speaking Confidence**	**12 Classes**

pics:

- Introduction to Prompt Engineering
- Speech Preparation and Organization
- Techniques for Effective Impromptu Speaking
- Practice Speech Delivery

Activities:

- Speech Writing
- Impromptu Speech

ɔdule 3	**itical Reading and Logical Analysis**	**ɔrksheet**	**itical Thinking and Analysis**	**12 Classes**

Topics:

- Critical Reading Strategies: Contextualizing, Figurative Language, Evaluating Logic of an Argument, Recognizing Emotional Manipulation, Analysing Visuals
- Recognizing Logical Fallacies: Slippery Slope, False Dilemma, Post Hoc, Hasty Generalization, Ad Hominem, Straw Man, Bandwagon, No True Scotsman, Red Herring, Appeal to Authority, Sunk Cost, Appeal to ignorance

Activities:

- Critical Reading Worksheet/Identifying Bias in News Articles

ɔdule 4	**riting Effective Arguments**	**signment**	**ear and Coherent Writing**	**Classes**

pics**:**

- Understanding Critical Writing
- Building Arguments (Pathos, Ethos, Logos)
- Techniques for Persuasion

Activities:

- Causes or Effects/Appeal Mash-Up/Debates on Controversial Topics
- Opinion Writing

rgeted Application & Tools that can be used: Quizziz, Chatgpt, Gemini, Youtube, Instagram, Quillbot, Grammarly, Padlet

ferences

6. Adler, R. B., Rodman, G., & DuPré, A. (2019). *Understanding human communication (14th ed.)*. Oxford University Press.
7. Moore, B. N., & Parker, R. (2020). *Critical thinking* (13th ed.). McGraw-Hill Education.
8. Hamilton, C. (2020). *Communicating for success* (2nd ed.). Routledge.
9. Ting-Toomey, S., & Dorjee, T. (2018). Intercultural competence: A model for teaching and assessing cross-cultural communication. *Journal of Intercultural Communication, 47*(2), 213–229. https://doi.org/10.1016/j.jicc.2018.03.004
10. https://www.ted.com/

Topics Relevant to "employability": Teamwork and Collaboration, Critical Thinking and Problem-Solving

Topics Relevant to "Human Values and Professional Ethics": Critical reasoning, Inclusivity and Fairness

ırse Code: :E1200	**ırse Title: Basics of Electrical and Electronics Engineering.** **ɒe of Course: Theory - ESC**		**L-T-P-C**			3
rsion No.						
ırse Pre-requisites	**NIL**					
ti-requisites						
ırse Description	This is a fundamental Course which is designed to know the use of basics of electrical and electronics engineering principles occurs in various fields of Engineering. The course emphasises on the characteristics and applications of electrical and electronic devices. The course also emphasizes on the working, analysis and design of electrical circuits using both active & passive components. Additionally, this course creates a foundation for the future courses such as Electrical machines, power system, power electronics Linear Integrated Circuits, Analog Communication and Digital Communication etc.					
ırse Objective	The objective of the course is to familiarize the learners with the concepts of Basics of Electrical and Electronics Engineering and attain **Skill Development** through **Participative Learning** techniques.					
ırse Outcomes	**On successful completion of this course the students shall be able to:** 5. **Apply** basic laws of Electrical Engineering to compute voltage, currents and other parameters in the circuits. 6. **Discuss** various fundamental parameters appearing in the characteristics of semiconductor devices and their applications. 7. **Summarize** the operations of different biasing configurations of BJTs and amplifiers. 8. **Discuss** the performance characteristics and applications of various electrical Machines.					
ırse Content:						
dule 1	**Introduction to Electrical Circuits**		ignment/ Quiz		merical solving Task	**0 Sessions**
DC Circuits: Concept of Circuit and Network, Types of elements, Network Reduction Techniques- Series and parallel connections of resistive networks, Star–to-Delta Transformations, Mesh Analysis, Nodal Analysis, Numerical examples. **AC Circuits:** Fundamentals of single phase circuits - Series RL, RC and R-L-C Circuits, Concept of active power, reactive power and Power factor, Numerical examples. Introduction to three phase system and relation between line and phase values in Star & Delta connection, Numerical examples.						
dule 2	**niconductor and Diode applications**		ignment/ Quiz		mory Recall based Quizzes	**Sessions**
Mass Action Law, Charge densities in a semiconductor, Types of SC, Junction diodes -Ideal and practical behaviour, Modelling the Diode Forward Characteristic, and Diode applications like rectifiers, Zener diode, characteristics and its applications like voltage regulator.						
dule 3	**nsistors and its Applications**		ignment/ Quiz		mory Recall-based Quizzes	**0 Sessions**
nsistor characteristics, Current components, BJT Configurations (CB, CC, CE configurations) and their current gains. Operating point, Biasing, Fixed Bias, and load line analysis. Single Stage amplifier. JFET (Construction, principal of Operation and Volt –Ampere characteristics). Pinch- off voltage, Comparison of BJT and FET. MOSFET (Construction, principal of Operation and symbol), MOSFET characteristics in Enhancement and Depletion modes.						
dule 4	**Fundamentals of ctrical Machines**		ignment/ Quiz		merical solving Task	**Sessions**
Electrical Machines: Single phase transformers: principle of operation and EMF equation, Numerical examples.						

DC Motor: principle of operation, Back EMF, torque equation, Numerical examples. AC Motor: Principle operation of Induction Motors and its Applications.

f-Learning Topics:

ɔping and clamping circuits, Stabilization Techniques, Voltage divider bias and its stability factor, Multistage amplifier, Darlington pair.

Special Machines: Introduction to special electrical machines and its applications.

ɾgeted Application & Tools that can be used:

Targeted Applications: Application Area includes all electrical and electronic circuits (power supply unit, regulator unit, embedded devices, hardware electronics etc.). The students will be able to join a profession which involves basics to high level of electronic circuit design.

Professionally Used Software: Multisim/ P Spice

ɨides these software tools hardware equipment such as Multimeters, Function Generators, Power Supplies, Oscilloscopes etc., can be used to perform component/circuit testing and analysis..

ɟject Work/ Assignment:

1. Article review: At the end, of course an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format.

2. Presentation: There will be a group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.

3. Case Study: - At the end of the course students will be given a 'real-world' application based circuits like Power Amplifier, Signal/Function Generator etc. as a case study. Students will be submitting a report which will include Circuit Diagrams, Design, Working Mechanism and Results etc. in appropriate format

ɪt Book(s):

7. Kothari D. P. & Nagrath I. J., "Basic Electrical and Electronics Engineering", Tata McGraw-Hill
8. Education
9. Theraja B.L. and Theraja A.K., "A Textbook of Electrical Technology: Basic Electrical Engineering" in S.I. System of Units, 23rd ed., New Delhi: S. Chand, 2002.
10. A.P.Malvino, Electronic Principles,7thEdition, Tata McGraw Hill,2007
11. J. Millman, C. C. Halkias and C. D. Parikh, "Millman's Integrated Electronics", McGraw Hill Education, 2nd Edition.
12. Basics of Electrical & Electronics Laboratory Manual.

ɟerence Book (s):

7. John Hiley, Keith Brown and Ian McKenzie Smith, "HUGHES Electrical and Electronic Technology", 10th Edition (Indian Edition published by Dorling Kindersley), Pearson,2011
8. Samarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, Prentice Hall India, 2007.
9. K Uma Rao, A Jaya Lakshmi, "Basic Electrical engineering" IK International publishing house Pvt. Ltd
10. R. L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education India 7th Edition.
11. A K. Maini, V. Agrawal, "Electronic Devices & Circuits", Wiley, 2nd Edition
12. A.S Sedra, K. C. Smith, "Microelectronic Circuits", Oxford University Press, 6th Edition

Online Resources (e-books, notes, ppts, video lectures etc.):

7. https://presidencyuniversity.linways.com
8. https://www.digimat.in/nptel/courses/video/108105112/L01 "Fundamentals of Electrical Engineering-Basic Concepts, Examples"
9. Seminar Topic: https://nptel.ac.in/courses/108/105/108105153/ "Electrical Measurements"
10. Video lectures on "Electronic Devices" by Prof. Dr. A. N. Chandorkar, IIT Bombay http://www.satishkashyap.com/2013/03/video-lectures-on-electron-devices-by.html

11. Video lectures on "Analog Electronics" by Prof. S.C. Dutta Roy, IIT Delhi https://nptel.ac.in/courses/108/102/108102095/
12. Video lectures on "Diodes", by Prof. Chitralekha Mahanta, IIT Guwahati, https://nptel.ac.in/courses/117/103/117103063/

E-content:

5. "Introduction to Electrical Machines https://nptel.ac.in/courses/108/102/108102146/"
M. -Y. Kao, H. Kam and C. Hu, "Deep-Learning-Assisted Physics-Driven MOSFET Current Voltage Modeling," in IEEE Electron Device Letters, vol. 43, no. 6, pp. 974-977, June 2022, doi: 10.1109/LED.2022.3168243 https://ieeexplore-ieee-org-resiuniv.knimbus.com/document/9758727
6. F. Bonet, O. Aviñó-Salvadó, M. Vellvehi, X. Jordà, P. Godignon and X. Perpiñà, "Carrier Concentration Analysis in 1.2 kV SiC Schottky Diodes Under Current Crowding," in IEEE Electron Device Letters, vol. 43, no. 6, pp. 938-941, June 2022, doi: 10.1109/LED.2022.3171112. https://ieeexplore-ieeeorg-presiuniv.knimbus.com/document/9764749
7. M. Chanda, S. Jain, S. De and C. K. Sarkar, "Implementation of Subthreshold Adiabatic Logic for Ultralow-Power Application," in IEEE Transactions on Very Large Scale Integration (VLSI) Systems, vol. .23, no. 12, pp. 2782-2790, Dec. 2015. https://ieeexplore.ieee.org/document/7018053
8. R. Raut and O. Ghasemi, "A power efficient wide band trans-impedance amplifier in submicron CMOS integrated circuit technology," 2008 Joint 6th International IEEE Northeast Workshop on Circuits and Systems and TAISA Conference, 2008, pp. 113-116, doi: 0.1109/NEWCAS.2008.4606334. https://ieeexplore.ieee.org/document/4606334

Topics relevant to "SKILL DEVELOPMENT": Performing suitable experiments to compute the electric circuit parameters, performance operation of machines, and operation of semiconductor devices for **Skill Development** through **Participative Learning techniques.** This is attained through assessment component mentioned in course plan.

urse Code EEE1250	**urse Title: Basics of Electrical and Electronics Engineering Laboratory**	**-T- P- C**	0	0	2	1
	pe of Course: Laboratory - ESC					

rsion No.	
urse Pre-requisites	
ti-requisites	
urse Description	This fundamental laboratory provides an opportunity to validate the concepts taught in the basics of electrical and electronics engineering and enhances the ability to visualize real system performance, using both hardware and simulation tools.
urse Objective	The objective of the course is to familiarize the learners with the concepts of Basics of Electrical and Electronics Engineering and attain Skill Development through Experiential Learning techniques.
sic skill sets required for the laboratory:	
	The students shall be able to develop: **14) An attitude of enquiry.** **15) Confidence and ability to tackle new problems.** **16) Ability to interpret events and results.** **17) Ability to work as a leader and as a member of team.** 18) Assess errors and eliminate them. **19) Observe and measure physical phenomenon.** **20) Write Reports.** **21) Select suitable equipment, instrument and materials.** 22) Locate faults in systems. 23) Manipulative skills for setting and handling equipment. **24) The ability to follow standard test procedures.** **25) An awareness of the need to observe safety precautions.** 26) To judge magnitudes without actual measurement.
urse Out Comes	**On successful completion of the course the students shall be able to:** 5. Apply basic laws of Electrical Engineering to compute voltage, currents, and other parameters in the circuits. 6. Demonstrate the working of electrical machines to observe performance characteristics. 7. Demonstrate the working of electronic circuits to obtain the V-I Characteristics of various semiconductor devices. 8. Sketch the characteristics and waveforms relevant to standard electrical and electronic circuits
urse Content:	
	t of Laboratory Tasks: **Experiment No 1:** Verification of KVL and KCL for a given DC circuit. **Level 1:** Study and Verify KVL and KCL for the given electrical Circuit. **Level 2:** For the same circuit considered in level 1, perform the simulation using NI LabVIEW/Multisim/MATLAB. **Experiment No 2:** Analyse AC series circuits – RL, RC and RLC . **Level 1:** Conduct an experiment to perform and verify the impedance, current and power of Series RL and RC circuits

	Level 2: Conduct an experiment to perform and verify the impedance and current of RLC series circuits. **Experiment No 3:** Calculation of power and power factor of the given AC Circuit. **Level 1:** Conduct an experiment to measure the power and power factor for given resistive load. **Level 2:** Conduct an experiment to measure the power and power factor for given inductive load. **Experiment No 4:** Perform the experiments on given Transformer. **Level 1:** Verify the EMF equation of a transformer and compute the voltage transformation ratio. **Level 2:** Study the effect of load on the secondary side of the transformer and verify the EMF equation under load conditions. **Experiment No 5:** Load test on DC shunt motor **Level 1:** Conduct load test on DC shunt motor and find its efficiency at different loads **Level 2:** Conduct load test on DC shunt motor and plot the performance characteristics. **periment 6:** Study of PN-Junction Diode Characteristics in Forward and Reverse Bias Conditions. **vel 1:** Carry out an experiment to plot VI Characteristics and hence find the cut-in voltage on forward characteristics for the Silicon P-N Junction diode. **vel 2:** Carry out an experiment to plot VI Characteristics of Zener diode and hence find the zener voltage on reverse characteristics for the Silicon P-N Junction zener diode. **periment No. 7:** To observe the output waveform of half wave and full wave rectifier circuit and compute ripple factor and efficiency **vel 1:** Identify the components required for a rectifier circuit, rig up the circuit, and sketch the output waveforms without filter. **vel 2:** Rig up the rectifier circuit with RC filter, observe the output waveforms, determine the efficiency and ripple factor. **periment 8:** To construct clipping and clamping circuits for different reference voltages and to verify the responses. **vel 1:**Identify the components required for building a Clipper / Clamper circuit. Rig up the circuit according to the circuit diagram given and sketch the output waveform. **vel 2:** Given a sinusoidal input of 10 V p-p, implement a positive / negative clipper with output clipped at 2 V. **periment 9:** To calculate various parameters of emitter follower circuit using BJT **vel 1:** Identify the components required to implement an emitter follower circuit. Rig up the circuit and observe the variations in output waveform with respect to the variations in input waveform. **vel 2:** Determine the values of Z_{in} input impedance and Z_{out} output impedance for Emitter Follower. **periment 10:** To Implement RC Coupled amplifier using a BJT and sketch the frequency response. **vel 1**: Identify the components required to implement an RC coupled amplifier circuit. Rig up the circuit and sketch the frequency response. **Level 2**: From the frequency response curve determine the value of the mid band

	gain and the bandwidth.

Targeted Application & Tools that can be used:

Targeted Applications: Application Area includes all electrical and electronic circuits (power supply unit, regulator unit, embedded devices, hardware electronics etc.). The students will be able to join a profession which involves basics to high level of electronic circuit design.

Professionally Used Software: Multisim/ P Spice

sides these software tools hardware equipment such as Multimeters, Function Generators, Power Supplies, Oscilloscopes etc., can be used to perform component/circuit testing and analysis.

Course Material

12. Basics of Electrical and Electronics Engineering Laboratory Manual, Presidency University, Bengaluru.

Text Book:

13. Kothari D. P. & Nagrath I. J., "Basic Electrical and Electronics Engineering", Tata McGraw-Hill

Reference Books:

14. John Hiley, Keith Brown and Ian McKenzie Smith, "HUGHES Electrical and Electronic Technology", 10th Edition (Indian Edition published by Dorling Kindersley), Pearson,2011
15. Samarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, Prentice Hall India, 2007.
16. K Uma Rao, A Jaya Lakshmi, "Basic Electrical engineering" IK International publishing house Pvt. Ltd
17. R. L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education India 7th Edition.
18. A K. Maini, V. Agrawal, "Electronic Devices & Circuits", Wiley, 2nd Edition
19. A.S Sedra, K. C. Smith, "Microelectronic Circuits", Oxford University Press, 6th Edition

Online Learning Resources:

20. https://presidencyuniversity.linways.com
21. https://www.digimat.in/nptel/courses/video/108105112/L01 "Fundamentals of Electrical Engineering-Basic Concepts, Examples"
22. Video lectures on "Diodes", by Prof. Chitralekha Mahanta, IIT Guwahati, https://nptel.ac.in/courses/117/103/117103063/

Topics relevant to "SKILL DEVELOPMENT": All the experiments which are listed are for **Skill Development** through **Experiential Learning Techniques**. This is attained through the assessment component mentioned in course handout.

urse Code: **LAW7601**	**ian Constitution** **pe of Course: MOOC course**	**- P- C**				
		ntact hours				
urse Pre-requisites	NIL					
ti-requisites						
urse Description	This course is designed to improve the learners' SKILL DEVELOPMENT by using PATICIPATIVE LEARNING techniques. This course aims to familiarize students with fundamentals of Indian Constitution concepts and their relevance to 75+ Years of Republic of India (https://constitution75.com/) as well as **#AzaadiKaAmrutMahotsav / Azadi Ka Amrit Mahotsav** (https://amritmahotsav.nic.in). It is designed to equip students with the knowledge about the Constitution of India. This course aims to introduce the constitutional law of India to students from all walks of life and help them understand the constitutional principles as applied and understood in everyday life. The objective of making the Constitution of India, familiar to all students, and not only to law students, this course aims and objectifies legal understanding in the simplest of forms. **This course is designed to cater to Constitutional Studies.**					
urse jective	The objective of the course is **'SKILL DEVELOPMENT'** of the student by using **'PARTICIPATIVE LEARNING'** techniques					
urse Outcomes	On successful completion of this course the students shall be able to: 1. Describe the basic understanding of the Indian Constitution and the concepts and issues relevant to day-to-day life of the nation and to equip the Citizen with the zeal of capacity building. Recognizing and identify the values of the Constitution of India. 2. Enabling the Citizen-centric Awareness of Rights and Responsibilities of the State 3. Explain the role of the State actors in building India. 4. Understanding the Gandhian vision over the power of the LSG (Local Self-Governance)					
urse Content:						
dule 1	**derstanding the Making of the Constitution: The Constituent Assembly & The Constitution of India**					
pics: Historical Context of Constituent Assembly - Compositions & Functions of Constituent Assembly What is a Constitution? – Why have a Constitution? – Constitutional Change - Features of Indian Constitution – Preamble of Indian Constitution						
dule 2	**zen's Fundamental Rights and State's Responsibilities (Directive Principles)**					
pics: Introduction to Fundamental Rights - Right to Equality – Facets of Right to Equality - Right to Freedom - Constitutional Position of Some Democratic Rights - Right Against Exploitation - Right to Freedom of Religion - Right to Constitutional Remedies Directive Principles of the State Policy						
dule 3	**gans Of the Government**					
pics: **Executive**: The President of India - Powers and Functions of President of India - Emergency Powers and the Position of the President **Legislature**: Union Council of Ministers - Prime Minister - The Rajya Sabha - The Lok Sabha - Relation between the Lok Sabha & Rajya Sabha - Office of the Speaker – Important Parliamentary Committees **Judiciary**: The Structure and Organization of the Judiciary & the High Court - The Supreme Court - Role of The Supreme Court - Judicial Activism in India - Basic Structure Doctrine & PIL						
dule 4	**leralism & Decentralization**					

ɔics:

What is Federalism? - Centre-State Legislative Relations - Centre-State Administrative Relations - Centre-State Financial Relations

The 5th & 6th Schedules - Municipality- (History of Indian Municipality, Organization & Functions) – Panchayat 1 (Idea of Panchayat, Organization and Powers of Panchayats in India)

geted Application & Tools that can be used:

ɔlication areas to familiarize students with fundamentals of Indian Constitutional concepts.

ɔls: Online Tools – NPTEL and Swayam.

ɔject work/Assignment:

sessment Type

- Online end term exam will be conducted as notified by the Presidency University.

line Link*:

1) Prof. Amitabha Ray, SWAYAM Course: "Constitutional Government & Democracy in India"
https://onlinecourses.swayam2.ac.in/cec19_hs13/preview

* Other source links are available in below Resources link.

t Book

1. Durga Das Basu --- Introduction to the Constitution of India, 23rd Edition (Gurgaon; LexisNexis, 2018).
2. MP Jain's Constitutional Law of India, Lexis Nexis
3. V.N Shukla's Indian Constitutional Law, M.P Singh 13th Edition
4. MV Pylee's Constitution of India
5. J.C.Johari -- The Constitution of India: A Politico-Legal Study (Greater Noida: Sterling Publishers Pvt. Ltd. 2013).
6. Himangshu Roy and M.P.Singh – Indian Political System, 4th Edition (Bengaluru; Pearson Education, 2018)
7. Vidya Bhushan & Vishnoo Bhagwan--- Indian Administration (S. Chand, 2011)
8. S.R.Maheswari --- Indian Administration (Orient Blackswan, 2001)
9. Dr. A.Avasthi & A.P. Avasthi --- Indian Administration (L.N. Agarwal Educational Publishing, 2017).
10. B. L. Fadia --- Indian Government and Politics (Sahitya a. Bhawan, 13th Revised Edition, 2017).
11. P.M.Bakshi – The Constitution of India (Prayagraj, UP; a. Universal Law Publishing, January, 2018)

ference Books

1. HM Seervai, Constitutional Law of India, 4th Ed. Vol I, II, & III
2. Uday Raj Rai, Constitutional Law-I
3. Democracy and Constitutionalism in India, Oxford University Press 2009

Resources:

1. https://onlinecourses.nptel.ac.in/noc20_lw03/course?&force_user=true
2. https://onlinecourses.swayam2.ac.in/cec19_hs13/course?&force_user=true
3. https://nptel.ac.in/courses/129106003
4. https://nptel.ac.in/courses/129106411
5. https://nptel.ac.in/courses/129105608
6. https://nptel.ac.in/courses/129106002

Topics relevant to Skill Development:

1. An attitude of inquiry.
2. Write reports

e topics related to Constitutional Studies and its application :

topics in theory component are relevant to Indian Constitution.

Course Code: PPS1026	**Course Title: Industry Readiness Program – II (Audited Course)** Type of Course: Practical Only Course	L- T - P- C	0	0	2	0
Version No.	1.0					

Course Pre-requisites	
Anti-requisites	NIL
Course Description	This course is designed to enable students learn styles of communication, team building and use empathy in leadership. The course will benefit learners in preparing themselves effectively through various activities and learning methodologies.
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Industry Readiness for Young Professionals" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.**
Course Out Comes	**On successful completion of this course the students shall be able to:** CO 1 **Apply** different communication skills for success in workplace CO 2 **Practice team building skills** for career success CO3 **Demonstrate** ethical leadership skills in workplace
Course Content	

Module 1	**Effective Communication**	Classroom activities	**10 Hours**
Topics: Practice effective communication skills (Verbal, Non-verbal, Written and Visual) **Activity:** Use social media prompts to prepare self-introduction videos			
Module 2	**Team Building**	Group Activity	**10 Hours**
Topics: Skills of an effective team player **Activity:** Student group activity to build class networking			
Module 3	**Leadership**	Case study	**10 Hours**
Topics: Types of leadership, using empathy in leadership **Activity:** Individual presentation by students on corporate leaders.			
Faculty : L&D			
Targeted Application & Tools that can be used: 10. TED Talks 11. You Tube Links 12. Activities			
Assignment proposed for this course Assignment 1: One minute reel Assignment 2: Team building assignment			

Continuous Individual Assessment Module 1: L-S-R-W class assessment Module 2: Team Presentation Module 3: Individual Assessment
The topics related to skill development: Students acquire knowledge on effective communication skills, team building skills and how to prepare themselves to be leaders in workplace using empathy and implement various skill sets during the course of their time in the university.

urse Code: ECE1511	**urse Title: Design Workshop** **urse Type : ESC**	**T-P- C**	1	0	2	2
rsion No.						
urse Pre-requisites	NIL					
ti-requisites	L					
urse Description	This course is designed to provide an in-depth understanding of Arduino, microcontrollers Raspberry pi and their application in various real time projects involving sensors. Throughout the course, students will learn the fundamentals of Arduino and Raspberry Pi programming and gain hands-on experience with a wide range of sensors. Students will explore how to connect and interface sensors with Arduino and Raspberry Pi boards, read sensor data, and use it to control various output devices This course is suitable for beginners who are interested in exploring the world of electronics and developing practical applications using Arduino, Raspberry Pi and sensors.					
urse Objective	The objective of the course is **Employability Skills** of student by using **PARTICIPATIVE LEARNING** techniques.					
urse Outcomes	**On successful completion of the course the students shall be able to** 1. Explain the main features of the Arduino & the Raspberry Pi prototype board. 2. Demonstrate the hardware interfacing of the peripherals to Arduino and Raspberry Pi system. 3. Understand the types of sensors and its functions 4. Demonstrate the functioning of live projects carried out using Arduino and Raspberry Pi system.					
urse Content:						

dule 1	**Basic concepts of Microcontrollers**	Hands-on	Interfacing Task and Analysis	**3 Sessions**

pics:
Introduction to Arduino, ESP and Node MCU Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, API's , Introduction to Embedded C and Arduino platform, Arduino Datatypes and variables, Arduino i/o Functions, Arduino Communications, Arduino IDE, Various Cloud Platforms.

dule 2	**sory Devices**	nds-on	erfacing Task and Analysis	**essions**

duino Sensors: Humidity Sensor, Temperature Sensor, Water Detector / Sensor, PIR Sensor, Ultrasonic Sensor, Connecting Switches and actuators, sensor interface with Arduino.
roduction to 3D Printer: 3D Printer technology and its working Principles, Applications. Introduction to online Simulators: Working with AutoCAD/Fusion 360 Simulator.

dule 3	**roduction to Micro python**	nds-on	erfacing Task and Analysis	**Sessions**

pics:
roduction to MicroPython, Comparison with other programming languages, Setting up the MicroPython development environment, Basics of MicroPython syntax and structure.

dule 4	**rking with Raspberry-pi**	nds-on	erfacing Task and Analysis	**essions**

roduction to raspberry pi boards, pin-diagram, different types of raspberry pi boards and its application, LED and switch control. Mastering Modules, Setup Raspberry - PuTTY SSH,VNC Viewer to interface with more

complicated sensors and actuators. Various Libraries and its functions.

ɔ: Name of the Experiments:

16. **Introduction Lab 1:**

Level 1: Overview on Arduino based Micro-controller, and sensors.

Level 2: Interfacing of Arduino and ESP boards with sensors and other components.

17. **Lab 2: Smart Plant Monitoring**

Level 1- Push button-controlled LED.

Level 2- Automatic Irrigation and monitoring System using Arduino

18. **Lab 3: Robotics with Arduino**.

Level 1- Servo Motor control using Arduino

Level 2: DC Motor Control Using Arduino for Robotics.

19. **Lab 4: Environmental pollution using ESP.**

Level 1 - IoT based air Pollution Monitoring System.

Level 2- IoT Based water pollution system

20. **Introduction Lab for raspberry pi:**

Level 1: Overview on Different Raspberry Pi Boards, and sensors.

Level 2: Configuring the Raspberry Pi and Interfacing with sensors and other components.

21. **Lab 7:** Raspberry Pi based Object Detection using TensorFlow and OpenCV.
22. **Lab 8:** Speech Recognition on Raspberry Pi for Voice Controlled Home Automation.
23. **Lab 9:** Design the website using HTML and CSS, and host the website on Raspberry Pi.
24. **Introduction Lab for 3D printing:**

Overview of 3D printing. Design of 3D structure using the CAD. Understand the steps of fabrication of simple rectangular box using 3D printer.

25. **Lab 10:** Design and print of Hollow Cylindrical structure using 3D CAD and 3D printer.
26. **Lab 11** Demonstration of Jetson nano board and its capability. **(OPTIONAL)**
27. **Lab 12:** Revision
28. **Lab 13:** Revision
29. **Lab 14:** Mini Project
30. **Lab 15:** Mini Project Evaluation.

Topics: Types of Arduino boards, Thonny Python, Python IDLE, **sensors, 3D Printer**

rgeted Application & Tools that can be used:

plication Area:

me Automation, Environmental Monitoring, Agriculture and Farming, Industrial Automation, Internet of Things (IoT), Robotics, Wearable Devices, Security Systems, Education and Learning. These are just a few examples of the many application areas where Arduino, Raspberry Pi and sensors can be applied. The flexibility and affordability of Arduino, and Raspberry Pi combined with the wide range of sensors available, allow for endless possibilities in creating innovative projects.

ɔfessionally Used Software: Students can use open SOURCE Software's Arduino IDE and Tincker CAD, Thonny Python, Python IDLE etc.

ɔject work/Assignment:

1. Projects: At the end of the course students will be completing the project work on solving many real time issues.

2. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link .

Presentation: There will be a presentation from interdisciplinary students group, where the students will be given a project on they have to demonstrate the working and discuss the applications for the same

xtbook(s):

3. **Monk Simon "Programming Arduino: Getting Started with Sketches", Mc Graw Hill Publications Second Edition**
4. **Monk Simon "Raspberry Pi Cookbook: Software and Hardware Problems and Solutions", Publisher(s): O'Reilly Media, Inc. ISBN: 9781098130923 fourth Edition.**

ferences

ference Book(s)

1. **Neerparaj Rai "Arduino Projects for Engineers" BPB publishers,first edition, 2016.**
2. Ryan Turner "Arduino Programming " Nelly B.L. International Consulting Ltd. first edition,2019.
3. **Charles Bell Micro Python for the Internet of Things: A Beginner's Guide to Programming with Python on Microcontrollers" by" Edition 1, 2017, ISBN 978-1-4842-3123-4**
4. Stewart Watkiss "Learn Electronics with Raspberry Pi " Apress Berkeley, CA . second edition,2020. ISBN978-1-4842-6348-8
5. Jo Prusa, "Basic of 3D printing", Prusa Research, 3rd edition.
6. Volker Ziemann, "**A Hands-On Course in Sensors Using the Arduino and Raspberry Pi (Series in Sensors)**", CRC Press, 1st Edition. 2018.

line Resources (e-books, notes, ppts, video lectures etc.):

6. Arduino trending Projects < https://www. https://projecthub.arduino.cc/>
7. Introduction to Arduino < https://onlinecourses.swayam2.ac.in/aic20_sp04/preview>
8. Case studies on Wearable technology< https://www.hticiitm.org/wearables>
9. Raspberry-pi Projects < https://magpi.raspberrypi.com/articles/category/tutorials/>
10. Introduction to internet of things< https://nptel.ac.in/courses/106105166>

ontent:

8. Cattle Health Monitoring System Using Arduino and IOT (April 2021| IJIRT | Volume 7 Issue 11 | ISSN: 2349-6002)
9. M H Hemanth Kumar, Ravi Pratap Singh, Nishu Sharma, Pragya Singh" IOT BASED SMART SECURITY SYSTEM USING ARDUINO" 2021 JETIR August 2021, Volume 8, Issue 8,
10. R. Maheswar, P. Jayarajan, S. Vimalraj, G. Sivagnanam, V. Sivasankaran and I. S. Amiri, "Energy Efficient Real Time Environmental Monitoring System Using Buffer Management Protocol," 2018, pp. 1-5, doi: 10.1109/ICCCNT.2018.8494144. **https://ieeexplore.ieee.org/document/8494144**.
11. Yaser S Shaheen,Hussam., " Arduino Mega Based Smart Traffic Control System ," December 2021 Asian Journal of Advanced Research and Reports 15(12): 43-52, 2021(15(12): 43-52, 2021):15(12): 43-52, 2021.
12. Basil, Eliza Sawant, S.D. "IoT based traffic light control system using Raspberry Pi " DOI 10.1109/ICECDS.2017.8389604
13. Supriya S, 2Dr. Aravinda " Green leaf disease detection and identification using Raspberry Pi https://www.irjet.net/archives/V9/i8/IRJET-V9I847.
14. Dr. E.N. Ganesh., "Health Monitoring System using Raspberry Pi and IOT" DOI : http://dx.doi.org/10.13005/ojcst12.01.03

pics relevant to development of "SKILL": System design for achieving Sustainable Development Goals.

Course Code: MAT2303	**Course Title: Linear Algebra & Vector Calculus** **Type of Course:BSC**	**L-T- P- C**	**3**	**1**	**0**	**4**

Version No.		1.0
Course Pre-requisites		Basic Concepts of Limits, Differentiation, Integration, Matrices (PU Level)
Anti-requisites		**NIL**
Course Description		This course explores the fundamental concepts of vectors, matrices, and their operations within the context of calculus, including vector differentiation and integration, while applying these tools to solve problems related to linear systems, transformations, and geometric interpretations in higher dimensions, often with applications in fields like physics, engineering, and computer graphics; key topics include vector algebra, matrix operations, determinants, eigenvalues, eigenvectors, gradients, divergence, curl, line integrals, surface integrals, and the fundamental theorems of vector calculus like Green's Theorem, Stokes' Theorem, and the Divergence Theorem.
Course Objective		The course is intended to develop computational proficiency involving procedures in Matrices, Linear Algebra and Vector Calculus which are useful to all engineering disciplines. This course is to equip students with the ability to understand and manipulate vectors in multidimensional space, apply matrix operations to solve systems of linear equations, and utilize concepts like gradients, divergence, and curl to analyze physical phenomena, all while developing a strong foundation for applying these tools in various scientific and engineering fields like physics, mechanics, and computer graphics.
Course Out Comes		On successful completion of the course the students shall be able to: CO1 - Use matrix methods and certain techniques to solve the system of linear equations and to find eigen values, eigen vectors of a matrix to check whether it is diagonalizable. CO2 - Understand the abstract notions of vector space and dimensionality of it. CO3 - find the matrix representation of a linear transformation given bases of the relevant vector spaces. CO4 - Learn different notions of vector and scalar fields with their properties. Understanding the major theorems (Green's, Stokes', Gauss') and some applications of these theorems.
Course Content:		

Module 1	**Systems of Linear Equations**		7. ***Classes)***
Systems of Linear Equations, Matrices and Elementary Row Operations, Echelon forms, Matrix operations, invertible matrices, Determinants and their properties, Cramer's Rule, LU-decomposition, Applications of Systems of Linear Equations.			
Module 2	**Vector Space**	**Assignment**	***(9Classes)***
Linear Combinations and Linear Independence, Vectors in n R^n, Linear Combinations, Linear Independence Vector Spaces, Definition of a Vector Space, Subspaces, Basis and Dimension, Coordinates and Change of Basis, Orthogonal bases and orthogonal projections.			

Module 3	**Linear Transformations**		***(15 lectures)***
Linear Transformations, Algebra of transformations, The Null Space and Range, Isomorphisms, Matrix Representation of Linear Transformations, Similarity Eigenvalues and Eigenvectors, Eigen values and Eigen vectors, Diagonalization. Inner Product Spaces, The Dot Product on R^n and Inner Product Spaces, Orthonormal Bases, Orthogonal Complements, Application: Least Squares Approximation, Diagonalization of Symmetric Matrices, Application: Quadratic Forms. Singular Value Decomposition: Singular values, computing singular value decomposition, and Introduction to principal component analysis.			
Module 4	**Vector Calculus**	**Assignment**	***(15 lectures)***
Vector & Scalar Functions and Fields, Derivatives, Curve, Arc length, Curvature & Torsion, Gradient of Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field, Physical interpretation, solenoidal and irrotational vector fields. Problems. Line Integrals, Path Independence of Line Integrals, Green`s Theorem in the plane, Surface Integrals, Divergence Theorem of Gauss, Stokes`s Theorem.			

Targeted Application & Tools that can be used:

- Solve systems of linear equations using various methods including Gaussian and Gauss Jordan elimination and inverse matrices.
- Perform matrix algebra, invertibility, and the transpose and understand vector algebra in R^n.
- Determine relationship between coefficient matrix invertibility and solutions to a system of linear equations and the inverse matrices.
- Find eigenvalues and eigenvectors and use them in applications.
- Find the dimension of spaces such as those associated with matrices and linear transformations.
- Understand real vector spaces and subspaces and apply their properties.
- Compute inner products in a real vector space and compute angle and orthogonality in inner product spaces.
- Create orthogonal and orthonormal bases: Gram-Schmidt process and use bases and orthonormal bases to solve application problems.
- Prove basic results in linear algebra using appropriate proof-writing techniques such as linear independence of vectors; properties of subspaces; linearity, injectivity and subjectivity of functions; and properties of eigenvectors and eigenvalues.

Assignment:

Preparation of power-point slides, which include videos, animations, pictures, graphics for better erstanding the applications of Linear Algebra and Vector Calculus to engineering applications – The faculty allocate chapters/ parts of chapters to groups of students so that the entire syllabus of Linear Algebra and tor Calculus is covered.

Text Book

2. Gilbert Strang, Linear Algebra and its applications, Wellesley-Cambridge Press,U.S.; 6th edition.

3. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

References:

2. Introduction to Linear Algebra with Application, Jim Defranza, Daniel Gagliardi, Tata McGraw-Hill

3. Elementary Linear Algebra, Applications version, Anton and Rorres, Wiley India Edition.

4. Advanced Engineering Mathematics, Erwin Kreysig, Wiley Publication.

5. Elementary Linear Algebra, Ron Larson, Cengage Learning .

6. Linear Algebra and its Applications, David C. Lay, Pearson Education.

E-resources/ Web links:

2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_9607

3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_143156

4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_EBSCO_29052023_270975

5. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_94555

6. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_243864

7. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_224531

8. NPTEL Video Lectures Matrices and Linear Algebra:

9. https://nptel.ac.in/courses/111106051/

10. NPTEL Video Lectures Differential Equations:

11. https://nptel.ac.in/courses/111106100/

12. NPTEL Vector Calculus:

13. https://nptel.ac.in/courses/111/105/111105122/

14. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html 15. https://www.scu.edu.au/study-at-scu/units/math1005/2022/
Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of Vector calculus and Linear Algebra with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem Solving**.** This is attained through the assessment component mentioned in the course handout.

Course Code: CSE2251	**Course Title:** Data Communications and Computer Networks **Type of Course:** Theory / PCC	**L- T-P- C**	3	**0**	0	**3**
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	**NIL**					
Course Description	The objective of this course is to provide knowledge in data communications and computer networks, its organization and its implementation, and gain practical experience in the installation, monitoring, and troubleshooting of LAN systems. The associated laboratory is designed to implement and simulate various networks using Cisco packet tracer, NS2. All the lab exercises will focus on the fundamentals of creating multiple networks, topologies and analyzing the network traffics.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Communications and Computer Networks and attain Employability through Problem Solving Methodologies.					
Course Outcomes	On successful completion of the course, the students shall be able to: 1] Ilustrate the Basic Concepts Of Data Communication and Computer Networks. 2] Analyze the functionalities of the Data Link Layer. 3] Apply the Knowledge of IP Addressing and Routing Mechanisms in Computer Networks. 4] Demonstrate the working principles of the Transport layer and Application Layer.					
Course Content:						
Module 1	Introduction and Physical Layer- CO1	Assignment	Problem Solving		**7 Sessions**	
Introduction to Computer Networks and Data communications, Network Components – Topologies, Transmission Media –Reference Models -OSI Model – TCP/IP Suite. Physical Layer -Analog and Digital Signals – Digital and Analog Signals – Transmission - Multiplexing and Spread Spectrum.						
Module 2	Reference Models and Data Link Layer – CO2	Assignment	Problem Solving		**7 Sessions**	
Data Link Layer - Error Detection and Correction – Parity, LRC, CRC, Hamming Code, Flow Control and Error Control, Stop and Wait, ARQ, Sliding Window, Multiple Access Protocols, CSMA/CD,CSMA/CA, IEEE 802.3, IEEE 802.11 Ethernet.						
Module 3	Network Layer –CO3	Assignment	Problem Solving		**10 Sessions**	
Network Layer Services - Network Layer Services, Switching Techniques, IP Addressing methods- IPv4 IPV6 – Subnetting. Routing, - Distance Vector Routing – RIP-BGP-Link State Routing –OSPF-Multi cast Routing-MOSPF- DVMRP – Broad Cast Routing. EVPN-VXLAN, VPLS, ELAN.						

Module 4	Transport and Application Layer -CO3	Assignment	Problem Solving	**10 Sessions**

Transport Layers - Connection management – Flow control – Retransmission, UDP, TCP, congestion control, – Congestion avoidance (DECbit, RED)
The Application Layer: Domain Name System (DNS), Domain Name Space, SSH, FTP, Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – – SNMP, Web Services, Virtual Networking.

Targeted Application & Tools that can be used: Cisco Packet Tracer, Wireshark, and NS2.
Case Study/Assignment: Choose and analyze a network from any organization/Assignment proposed for this course in CO1-CO4
Problem Solving: Choose and appropriate devices and implement various network concepts.
Programming: Simulation of any network using NS2.

Text Book(s):
1. 1. Behrouz A. Forouzan, "Data Communications and Networking 5E", 5 th Edition, Tata McGraw-Hill, 2017.
2. Andrew S Tanenbaum, Nick Feamster & David J Wetherall, "Computer Networks" Sixth Edition, Pearson Publication, 2022

Reference(s):
1.References
1. "Computer Networking: A Top-Down Approach", Eighth Edition, James F. Kurose, Keith W. Ross, Pearson publication, 2021.
2. William Stallings, Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.

E- Resources:
1. https://archive.nptel.ac.in/courses/106/105/106105183/
2. http://www.nptelvideos.com/course.php?id=393
3. https://www.youtube.com/watch?v=3DZLItfbqtQ
4. https://www.youtube.com/watch?v= fIdQ4yfsfM
5. https://www.digimat.in/keyword/106.html
6. https://puniversity.informaticsglobal.com/login

Course Code: CSE2252	**Course Title:** Data Communications and Computer Networks **Type of Course: Lab / PCC**	**L- T-P- C**	0	**0**	2	**1**
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	**NIL**					
Course Description	This lab-based course provides hands-on experience in the principles and practices of data communications and computer networking. It is designed to complement theoretical concepts covered in the associated lecture course. Through a series of structured experiments and practical exercises, students will gain proficiency in configuring, analyzing, and troubleshooting computer networks. Key topics include network topology design, IP addressing and subnetting, Ethernet and LAN technologies, routing and switching, TCP/IP protocol suite, and basic network security measures. Students will work with industry-standard tools and equipment, including routers, switches, protocol analyzers, and network simulation software such as Cisco Packet Tracer or Wireshark.					
Course Objective	The objective of this lab course is to provide students with practical, hands-on experience in the configuration, operation, and troubleshooting of data communication systems and computer networks. Through guided experiments and real-world scenarios, students will reinforce theoretical knowledge, develop essential technical skills, and gain a deeper understanding of networking concepts, protocols, and devices used in modern communication systems.					
Course Outcomes	On successful completion of the course, the students shall be able to: 1. Design and configure basic network topologies using routers, switches, and end devices to meet specified requirements. 2. Analyze and troubleshoot network connectivity and performance issues using tools such as Wireshark and network simulators. 3. Demonstrate understanding of key networking protocols (e.g., TCP/IP, ARP, ICMP, DHCP) through practical implementation and observation. 4. Apply IP addressing and subnetting techniques to efficiently allocate and manage network resources in various networking scenarios.					
Course Content:						
Module 1,2,3,4	Physical Layer, Network Layer, Transport Laye	Lab Assignment	Problem Solving	**24 Sessions**		

List of Laboratory Tasks:
Lab sheet -1, M-1, 3 [2 Hours]
Experiment No 1:
Level 1: Study of basic network commands and network configuration commands.

Lab sheet -2, M-1[2 Hours]
Experiment No 1:
Level 1: Identify and explore Network devices, models and cables. Introduction to Cisco packet tracer.

Experiment No. 2:
Level 2 – Create various network topologies using a cisco packet tracer.

Lab sheet -3, M-2,3 [2 Hours]
Experiment No. 1:
Level 2 - Basic Configuration of switch/router using Cisco packet tracer.
Experiment No. 2:
Level 2 -Configure the privilege level password and user authentication in the switch/router.

Lab sheet – 4, M-3 [2 Hours]
Experiment No. 1:
Level 2 - Configure the DHCP server and wireless router and check the connectivity

Lab sheet – 5, M-3 [2 Hours]
Experiment No. 1:
Level 2 - Configure the static routing in the Cisco packet tracer.
Experiment No. 2:
Level 2 - Configure the dynamic routing protocol in the Cisco packet tracer.

Lab sheet – 6, M-4 [2 Hours]
Experiment No. 1: Configuration of DNS Server with Recursive & Integrative approach in Cisco packet tracer.
Lab sheet – 7, M-4 [2 Hours]
Experiment No. 1:
Configure the telnet protocol in the router using the Cisco packet tracer.
Lab sheet – 8, M-4[2 Hours]
Experiment No. 1:
Level1- Introduction to NS2 and basic TCL program.
Lab sheet – 9, M-4 [2 Hours]
Experiment No. 1:
Level 1: Simulate three node Point to point network using UDP in NS2.
Experiment No. 2:
Simulate transmission of Ping message using NS2.
Lab sheet – 10, M-4[2 Hours]
Experiment No. 1:
Simulate Ethernet LAN using N-node in NS2.
Experiment No. 2:
Simulate Ethernet LAN using N-node using multiple traffic in NS2
Lab sheet –11, M-3,4 [2 Hours]
Experiment No. 1:
Level 1- Introduction to Wire Shark.
Experiment No. 2:
Level 2- Demonstration of packet analysis using wire shark.

Lab sheet –12, M-1,2,3 [2 Hours]
Experiment No. 1:
Level 2- Demonstration of switch and router configuration using real devices

Targeted Application & Tools that can be used: Cisco Packet Tracer, Wireshark, and NS2.
Case Study/Assignment: Choose and analyze a network from any organization/Assignment proposed for this course in CO1-CO4
Problem Solving: Choose and appropriate devices and implement various network concepts.
Programming: Simulation of any network using NS2.

Text Book(s):

1. Behrouz A. Forouzan, “Data Communications and Networking 5E”, 5 th Edition, Tata McGraw-Hill, 2017.

2. Andrew S Tanenbaum, Nick Feamster & David J Wetherall, “Computer Networks” Sixth Edition, Pearson Publication, 2022

Reference(s):

1. “Computer Networking: A Top-Down Approach”, Eighth Edition, James F. Kurose, Keith W. Ross, Pearson publication, 2021.
2. William Stallings, Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.

E- Resources:

1. https://archive.nptel.ac.in/courses/106/105/106105183/
2. http://www.nptelvideos.com/course.php?id=393
3. https://www.youtube.com/watch?v=3DZLItfbqtQ
4. https://www.youtube.com/watch?v=_fIdQ4yfsfM
5. https://www.digimat.in/keyword/106.html
6. https://puniversity.informaticsglobal.com/login

Course Code: CSE1508	**urse Title:** Data Structures **pe of Course: Theory**	**- P- C**	3	0	0	
Version No.						
Course Pre-requisites						
Anti-requisites						
urse Description	This course introduces the fundamental concepts of data structures and to emphasize the importance of choosing an appropriate data structure and technique for program development. This course has theory and lab component which emphasizes on understanding the implementation and applications of data structures using Java programming language. With a good knowledge in the fundamental concepts of data structures and practical experience in implementing them, the student can be an effective designer, developer for new software applications.					
ourse Objective	The objective of the course is SKILL DEVELOPMENT of student by using EXPERIENTIAL LEARNING techniques					
urse Out Comes	**On successful completion of the course the students shall be able to:** **CO1:** Describe the concept of basic data structure, stacks, queues, and arrays and their operations. **[Understand]** **CO2:** Utilize linked lists for real-time scenarios. **[Apply]** **CO3:** Apply an appropriate non-linear data structure for a given scenario. **[Apply]** **CO4:** Demonstrate different searching and sorting techniques. **[Apply]**					
urse Content:						
Module 1	**roduction to Data Structure and Linear Data Structure – Stacks and Queues**	ignment	gram activity			**9 Hours**
Introduction – Introduction to Data Structures, Types and concept of Arrays**.** **Stack -** Concepts and representation, Stack operations, stack implementation using array and Applications of Stack**.** **Queues -** Representation of queue, Queue Operations, Queue implementation using array, Types of Queue and Applications of Queue**.**						
Module 2	**near Data Structure-Linked List**	ignment	Program activity			**12 Hours**
Topics: Linked List - Singly Linked List, Operation on linear list using singly linked storage structures, Circular List, Applications of Linked list. **Recursion** - Recursive Definition and Processes.						
Module 3	**n-linear Data Structures - Trees**	ignment	Program activity			**12 Hours**
pics: Trees - Introduction to Trees, Binary tree: Terminology and Properties, Use of Doubly Linked						

List, Binary tree traversals: Pre-Order traversal, In-Order traversal, Post - Order traversal, Binary Serach Tree, AVL Trees - Red Black Tree, Expression Tree , Heaps.

dule 4	**n-linear Data Structures - Graphs and Hashing**	ignment	gram activity	**Hours**

Topics: Graphs: Basic Concept of Graph Theory and its Properties, Representation of Graphs . ADT, Elementary graph operations, Minimum Cost spanning trees, Shortest path and Transitive closure.
Hashing: Introduction, Static Hashing, Dynamic Hashing

Module 5	**Searching & Sorting**	Assignment	Program activity	**6 Hours**

Topic: Sorting & Searching - Sequential and Binary Search, Sorting – Selection and Insertion sort, Quick sort, Merge Sort, Bubble sort.

t of Laboratory Tasks:

o sheet -1
Level 1: Prompt the user, read input and print messages.Programs using class, methods and objects
Level 2: Programming Exercises on fundamental Data structure - Arrays based on Scenario.

o sheet -2
Level 1: Programming Exercises on Stack and its operations
Level 2: Programming Exercises on Stack and its operations with condition

o sheet -3
Level 1: Programming on Stack application infix to postfix Conversion
Level 2: -

o sheet -4
vel 1: Programming on Stack application – Evaluation of postfix

o sheet -5
Level 1: Programming Exercises on Queues and its operations with conditions
Level 2: -

o sheet -6
Level 1: Programming Exercises on Linked list and its operations.
Level 2: Programming Exercises on Linked list and its operations with various positions

o sheet -7
Level 1: Programming Exercises on Circular Linked list and its operations.
Level 2: Programming Exercises on Circular Linked list and its operations with various positions

o sheet -8
Level 1: Programming Exercises on factorial of a number
Level 2: Programming the tower of Hanoi using recursion

o sheet -9
Level 1: -
Level 2: Programming the tower of Hanoi using recursion

o sheet -10

Level 1: Programming Exercise on Doubly linked list and its operations
Level 2: -

b sheet -11

Level 1: Program to Construct Binary Search Tree and Graph
Level 2: Program to traverse the Binary Search Tree in three ways(in-order, pre-order and post-order) and implement BFS and DFS

b sheet -12

Level 1: Program to Implement the Linear Search & Binary Search
Level 2: Program to Estimate the Time complexity of Linear Search

b sheet -13

Level 1: Program to Implement and Estimate the Time complexity of Selection Sort
Level 2: Program to Implement and Estimate the Time complexity of Insertion Sort

b sheet -14 (Beyond syllabus activity)

vel 1: Program to Construct AVL Tree

el 2:

b sheet -15 (Beyond syllabus activity)

vel 1: Program to Construct RED BLACK Tree

geted Application & Tools that can be used

e of PowerPoint software for lecture slides and use of Modern IDE like VS Code and Eclipse for lab programs to execute.

Project work/Assignment:

signment: Students should complete the lab programs by end of each practical session and module wise assignments before the deadline.

Text Book

T1 Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Edition, Universities Press, reprint 2018.

T2 Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

ferences

R1 Data structures and program design in C by Robert Kruse, Tondo C L, Bruce Leung, Pearson education publishers, 2017.

R2 Programming and Data Structure by Jackulin C Salini etal., Ane books publishers, 2019.

Web resources:

1. For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview
2. https://puniversity.informaticsglobal.com/login

Topics relevant to development of "Skill Development":

ked list and stacks

pics relevant to development of "Environment and sustainability: Queues

Catalogue prepared by	Muthuraj
Recommended by the Board of Studies on	09th BOS held on 04/05/19

Date of Approval by the Academic Council	Academic Council Meeting No. 11, Dated 11/06/19

Course Code: CSE1509	**urse Title:** Data Structures Lab **pe of Course:Lab**		**- P- C**	0	0	1
Version No.						
Course Pre-requisites						
Anti-requisites						
urse Description	This course introduces the fundamental concepts of data structures and to emphasize the importance of choosing an appropriate data structure and technique for program development. This course has theory and lab component which emphasizes on understanding the implementation and applications of data structures using Java programming language. With a good knowledge in the fundamental concepts of data structures and practical experience in implementing them, the student can be an effective designer, developer for new software applications.					
ourse Objective	The objective of the course is SKILL DEVELOPMENT of student by using EXPERIENTIAL LEARNING techniques					
urse Out Comes	**On successful completion of the course the students shall be able to:** **CO1:** Describe the concept of basic data structure, stacks, queues, and arrays and their operations. **[Understand]** **CO2:** Utilize linked lists for real-time scenarios. **[Apply]** **CO3:** Apply an appropriate non-linear data structure for a given scenario. **[Apply]** **CO4:** Demonstrate different searching and sorting techniques. **[Apply]**					
urse Content:						
Module 1	**troduction to Data Structure and Linear Data Structure – Stacks and Queues**	ignment		**gram activity**		**9 Hours**
Introduction – Introduction to Data Structures, Types and concept of Arrays**.** **Stack -** Concepts and representation, Stack operations, stack implementation using array and Applications of Stack**.** **Queues -** Representation of queue, Queue Operations, Queue implementation using array, Types of Queue and Applications of Queue**.**						
Module 2	**near Data Structure-Linked List**	ignment		Program activity		**12 Hours**
Topics: Linked List - Singly Linked List, Operation on linear list using singly linked storage structures, Circular List, Applications of Linked list. **Recursion** - Recursive Definition and Processes.						
Module 3	**n-linear Data Structures - Trees**	ignment		Program activity		**12 Hours**
pics: Trees - Introduction to Trees, Binary tree: Terminology and Properties, Use of Doubly Linked						

List, Binary tree traversals: Pre-Order traversal, In-Order traversal, Post - Order traversal, Binary Serach Tree, AVL Trees - Red Black Tree, Expression Tree , Heaps.

dule 4	**n-linear Data Structures - Graphs and Hashing**	ignment	gram activity	**Hours**

Topics: Graphs: Basic Concept of Graph Theory and its Properties, Representation of Graphs . ADT, Elementary graph operations, Minimum Cost spanning trees, Shortest path and Transitive closure.
Hashing: Introduction, Static Hashing, Dynamic Hashing

Module 5	**Searching & Sorting**	Assignment	Program activity	**6 Hours**

Topic: Sorting & Searching - Sequential and Binary Search, Sorting – Selection and Insertion sort, Quick sort, Merge Sort, Bubble sort.

t of Laboratory Tasks:

o sheet -1
Level 1: Prompt the user, read input and print messages.Programs using class, methods and objects
Level 2: Programming Exercises on fundamental Data structure - Arrays based on Scenario.

o sheet -2
Level 1: Programming Exercises on Stack and its operations
Level 2: Programming Exercises on Stack and its operations with condition

o sheet -3
Level 1: Programming on Stack application infix to postfix Conversion
Level 2: -

o sheet -4
vel 1: Programming on Stack application – Evaluation of postfix

o sheet -5
Level 1: Programming Exercises on Queues and its operations with conditions
Level 2: -

o sheet -6
Level 1: Programming Exercises on Linked list and its operations.
Level 2: Programming Exercises on Linked list and its operations with various positions

o sheet -7
Level 1: Programming Exercises on Circular Linked list and its operations.
Level 2: Programming Exercises on Circular Linked list and its operations with various positions

o sheet -8
Level 1: Programming Exercises on factorial of a number
Level 2: Programming the tower of Hanoi using recursion

o sheet -9
Level 1: -
Level 2: Programming the tower of Hanoi using recursion

o sheet -10

Level 1: Programming Exercise on Doubly linked list and its operations
Level 2: -

b sheet -11
Level 1: Program to Construct Binary Search Tree and Graph
Level 2: Program to traverse the Binary Search Tree in three ways(in-order, pre-order and post-order) and implement BFS and DFS

b sheet -12
Level 1: Program to Implement the Linear Search & Binary Search
Level 2: Program to Estimate the Time complexity of Linear Search

b sheet -13
Level 1: Program to Implement and Estimate the Time complexity of Selection Sort
Level 2: Program to Implement and Estimate the Time complexity of Insertion Sort

b sheet -14 (Beyond syllabus activity)
vel 1: Program to Construct AVL Tree
el 2:

b sheet -15 (Beyond syllabus activity)
vel 1: Program to Construct RED BLACK Tree

geted Application & Tools that can be used
e of PowerPoint software for lecture slides and use of Modern IDE like VS Code and Eclipse for lab programs to execute.

Project work/Assignment:

signment: Students should complete the lab programs by end of each practical session and module wise assignments before the deadline.

Text Book

T1 Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Edition, Universities Press, reprint 2018.

T2 Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

ferences

R1 Data structures and program design in C by Robert Kruse, Tondo C L, Bruce Leung, Pearson education publishers, 2017.

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Web resources:

3. For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview
4. https://puniversity.informaticsglobal.com/login

Topics relevant to development of "Skill Development":
ked list and stacks
pics relevant to development of "Environment and sustainability: Queues

Catalogue prepared by	Muthuraj
Recommended by the Board of Studies on	09th BOS held on 04/05/19

Date of Approval by the Academic Council	Academic Council Meeting No. 11, Dated 11/06/19

Course Code: CSE2255	**Course Title:** CSE2255 - Object Oriented Programming Using Java **Type of Course: Theory - PCC**	**L-T- P- C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	Nil					
Anti-requisites	Nil					
Course Description	This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Problem-Solving using JAVA and attain **SKILL DEVELOPMENT** through **EXPERIENTIAL LEARNING** techniques					
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1:** Describe the basic programming concepts. [Understand] **CO2:** Apply the concept of classes, objects and methods to solve problems. [Application] **CO3:** Apply the concept of arrays and strings. [Appy] **CO4:** Implement inheritance and polymorphism building secure applications. [Apply] **CO5:** Apply the concepts of interface and error handling mechanism. [Apply]					
Course Content:						
Module 1	**Basic Concepts of Programming and Java**	Assignment	Problem Solving			**9 Sessions**
Topics: Introduction to Principles of Programming: Process of Problem Solving, Java program structure, Download Eclipse IDE to run Java programs, Sample program, Data types, Identifiers, Variables, Constants in java, Operators, Assignments and Expression, Basic Input/ Output functions, Control Statements: Branching and Looping.						
Module 2	**Classes, objects, methods and Constructors**	Assignment	Problem Solving			**10 Sessions**
Topics: Classes, Objects and Methods: Introduction to object Oriented Principles, defining a class, adding data members and methods to the class, access specifiers, instantiating objects, reference variable, accessing class members and methods. Static Polymorphism: Method overloading, constructors, constructor overloading, this keyword, static keyword, Nested classes, Accessing members in nested classes.						
Module 3	**Arrays, String and String buffer**	Assignment	Problem Solving			**8 Sessions**
Topics: Arrays: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Array of objects. String: Creation & Operation. String builder class, methods in String Buffer.						
Module 4	**Inheritance and Polymorphism**	Assignment	Problem Solving			**10 Sessions**
Topics: Inheritance: Defining a subclass, Types of Inheritance, super keyword. Dynamic						

Polymorphism: Method overriding. Final keyword: with data members, with member functions and with class. Abstract keyword: with data members, with member functions and with class, Exception handling.

Module 5	Input & Output Operation in Java	Assignment	Problem Solving	8 Sessions

Input/output Operation in Java(java.io Package), Streams and the new I/O Capabilities, Understanding Streams, working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces.

Text Book

T1 Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Education, 11th Edition,2019.

References

R1. Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Tenth Edition, Pearson 2015.

R2: James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.4th Edition, 2000.

R3. E. Balagurusamy, "Programming with Java", Tata McGraw Hill Education, 6th Edition, 2019.

E book link R1: http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-1.pdf

E book link R2: Java(tm) Design Patterns: A Tutorial([PDF] [7qmsenjl97t0] (vdoc.pub)

Web **resources**

ps://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q

ps://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to development of "Skill Development":

2. Static Polymorphism
4. Method overloading, constructors
5. constructor overloading
6. this keyword
7. static keyword and Inner classes
8. Inheritance and Polymorphism.

for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSEXXXX	**Course Title:** CSE2256 - Object Oriented Programming Using Java Lab **Type of Course: Lab - PCC**	**L-T- P- C**	0	0	4	2
Version No.	2.0					
Course Pre-requisites	CSEXXXX – Problem Solving Using C					
Anti-requisites	Nil					
Course Description	This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Problem-Solving using JAVA and attain **SKILL DEVELOPMENT** through **EXPERIENTIAL LEARNING** techniques					
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1:** Demonstrate basic programming concepts. [Apply] **CO2:** Apply the concept of classes, objects and methods to solve problems. [Application] **CO3:** Apply the concept of arrays and strings. [Appy] **CO4:** Implement inheritance and polymorphism building secure applications. [Apply] **CO5:** Apply the concepts of interface and error handling mechanism. [Apply]					
Course Content:						
Module 1	**Basic Concepts of Programming and Java**	Assignment	Problem Solving	**12 Sessions**		
Download Eclipse IDE to run Java programs, Sample programs on Data types, Identifiers, Variables, Constants in java, Operators, Assignments and Expression, Basic Input/ Output functions, Control Statements: Branching and Looping.						
Module 2	**Classes, objects, methods and Constructors**	Assignment	Problem Solving	**14 Sessions**		
Problem solving using Classes, Objects and Methods: defining a class, adding data members and methods to the class, access specifiers, instantiating objects, reference variable, accessing class members and methods. Use Static Polymorphism: Method overloading, constructors, constructor overloading, this keyword, static keyword, Nested classes, Accessing members in nested classes.						
Module 3	**Arrays, String and String buffer**	Assignment	Problem Solving	**10 Sessions**		
Using Arrays and Strings : Defining an Array, Initializing & Accessing Array, Multi – Dimensional Array, Array of objects. String: Creation & Operation. String builder class, methods in String Buffer.						
Module 4	**Inheritance and Polymorphism**	Assignment	Problem Solving	**12 Sessions**		

Inheritance: Defining a subclass, Types of Inheritance, super keyword. Dynamic Polymorphism: Method overriding. Final keyword: with data members, with member functions and with class. Abstract keyword: with data members, with member functions and with class, Exception handling.

Module 5	**Input & Output Operation in Java**	Assignment	Problem Solving	**12 Sessions**

Input/output Operation in Java(java.io Package), Streams and the new I/O Capabilities, Understanding Streams, working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces.

P1: Programming Exercises on Basic Concepts.
LEVEL 1: Discuss about datatypes and variables.
LEVEL 2: Demonstrate a simple java program
P2: Programming Exercises on Basic Concepts.
LEVEL 1: Discuss about datatypes and variables.
LEVEL 2: Demonstrate a simple java program
P3: Programming Exercises on operators, expressions based on a given scenario.
LEVEL 1: Explain operators, expressions.
LEVEL 2: Demonstrate operators
P4: Programming Exercises Command Line Arguments based on a given scenario.
LEVEL 1: Explain command line arguments
LEVEL 2: Demonstrate command line arguments
P5: Programming Exercises on basic Input/ Output functions and Control Statements: Branching
LEVEL 1: Explain Input/ Output functions
LEVEL 2:Demonstrate Control Statements: Branching
P6: Programming Exercises on Control Statements: Looping
LEVEL 1: Explain variour loops.
LEVEL 2:Demonstrate Control Statements: Looping
P7: Programming Exercises on Creating Objects, classes on a given scenario.
LEVEL 1: Illustrate class, object and methods.
LEVEL 2: Execute java program using class and objects
P8: Programming Exercises on Adding methods and Constructors to the class based on a given scenario.
LEVEL 1: Illustrate methods and constructors
LEVEL 2: Execute java program using methods and constructors
P9: Programming Exercises on methods based on a given scenario.
LEVEL 1: Illustrate method overloading
LEVEL 2: Apply method overloading for the given scenario.
P10: Programming Exercises on methods based on a given scenario.
LEVEL 1: Illustrate constructors overloading
LEVEL 2: Apply constructor overloading for the given scenario
P11: Programming Exercises on methods for static members bassed on a given scenario.
LEVEL 1: Benefits of usage static members
LEVEL 2: Usage of Static Members for the given scenario
P12: Programming Exercises on static methods based on a given scenario.
LEVEL 1: Benefits of usage static methods
LEVEL 2: Usage of Static Methods for the given scenario.
P13: Programming Exercises on nested Classes based on a given scenario.
LEVEL 1: Benefits of usage nested classes
LEVEL 2: Apply the concept of usage of nested classes for the given scenario
P14: Programming Exercises on Arrays and its built-in functions based on a given scenario.
LEVEL 1: Illustrate one dimensional arrays and its functions.
LEVEL 2: Demonstrate programs with single-dimensional arrays and operations.

P15: Programming Exercises on Arrays and its built-in functions based on a given scenario.
LEVEL 1: Illustrate multi dimensional arrays and its functions.
LEVEL 2: Demonstrate programs with multi-dimensional arrays and operations.
P16: Programming Exercises on String Class and its built-in functions based on a given scenario.
LEVEL 1: Explain about String class and String methods.
LEVEL 2: Execute simple java applications for String and StringBuffer operations
P17: Programming Exercises on String Buffer Class and its built-in functions based on a given scenario.
LEVEL 1: Explain about StringBuffer class and String methods.
LEVEL 2: Execute simple java applications for String and StringBuffer operations
P18: Programming Exercises on String Builders and its built-in functions based on a given scenario.
LEVEL 1: Explain about String Builders.
LEVEL 2: Execute java applications for String Builders
P19: Programming Exercises on single, multi level Inheritance and super keyword based on given scenario.
LEVEL 1: Explain single and multi level inheritance.
LEVEL 2: Demonstrate simple applications for the different types of inheritance
P20: Programming Exercises hierarchical Inheritance and super keyword based on given scenario.
LEVEL 1: Explain hierarchical inheritance.
LEVEL 2: Demonstrate simple applications for hierarchical inheritance
P21: Programming Exercises on Overriding.
LEVEL 1: Differentiate method overloading and method overriding.
LEVEL 2: Demonstrate simple program with dynamic method dispatch.
P22: Programming Exercises on Final based on given scenario.
LEVEL 1: Implement programs using concept of final.
LEVEL 2: Use final keyword for the given problem
P23: Programming Exercises on Abstract keyword based on given scenario.
LEVEL 1: Implement programs using concept of Abstract.
LEVEL 2: Use abstract keyword for the given problem
P24: Programming Exercises on Interface based on a given scenario.
LEVEL 1: Differentiate abstract class about interface
LEVEL 2: Implement interfaces in the given problem
P25: Programming Exercises on Exception Handling based on a given scenario.
LEVEL 1: Explain exception handling
LEVEL 2: Solve the given problem using exception handling mechanism.
P26: Programming Exercises on Character Stream Classes based on a given scenario.
LEVEL 1: Explain Character Stream Classes
LEVEL 2: Solve the given problem using Character Stream Class.
P27: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.
P28: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.
P29: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.
P30: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.

Targeted Application & Tools that can be used : JDK /Eclipse IDE/Visual Studio Code / net Beans IDE.

Text Book

T1 Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Education, 11th Edition,2019.

References

R1. Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Tenth Edition, Pearson 2015.

R2: James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.4th Edition, 2000.

R3. E. Balagurusamy, "Programming with Java", Tata McGraw Hill Education, 6th Edition, 2019.

E book link R1: http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-1.pdf

E book link R2: Java(tm) Design Patterns: A Tutorial([PDF] [7qmsenjl97t0] (vdoc.pub)

Web **resources**

ps://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q

ps://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to development of "Skill Development":

2. Static Polymorphism
5. Method overloading, constructors
6. constructor overloading
7. this keyword
8. static keyword and Inner classes
9. Inheritance and Polymorphism.

for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

urse Code: E2501	**urse Title:** Computer Organization and Architecture **pe of Course:** PCC	**T-P- C**	3	0	0	3
rsion No.						
urse Pre-requisites						
ti-requisites						
urse Description	This course introduces the core principles of computer architecture and organization frombasic to intermediate level. This theory based course emphasizes on understanding the interaction between computer hardware and software. It equips the students with the intuition behind assembly-level instruction set architectures. It helps the students to interpret the operational concepts of computer technology as well as performance enhancement.					
urse Objective	The objective of the course is to familiarize the learners with the concepts of **Computer Organization and Architecture** and attain **Skill Development** through **Participative Learning** techniques.					
urse Outcomes	On successful completion of the course the students shall be able to: 1] Describe the basic components of a computer and their interconnections. [Remember] 2] Explain Instruction Set Architecture and Memory Unit[Understand] 3] Apply appropriate techniques to carry out selected arithmetic operations [Apply] 4] Explain the organization of memory and processor sub-system [Understand]					
urse Content:						
Module 1	ic Structure of Computer	Assignment	Data Analysis task		**12 Sessions**	
Topics: Computer Types, Functional Units, Basic Operational concepts, Bus Structures, Computer systems RISC & CISC, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Arithmetic Operations on Signed numbers. Instructions and Instruction Sequencing, Instruction formats, Memory Instructions.						
dule 2	Instruction Set hitecture and Memory Unit	ignment	alysis, Data Collection		**12 Sessions**	
Topics: **Instruction Set Architecture:** Addressing Modes, Stacks and Subroutines. **mory System:** Memory Location and Addresses, Memory Operations, Semiconductor RAM Memories,Internal Organization of Memory chips, Cache memory mapping Techniques.						
dule 3	Arithmetic l Input/outputDesign	e Study	a analysis task		**10 Sessions**	
Topics: **Arithmetic:** Carry lookahead Adder, Signed-Operand Multiplication, Integer Division, and Floating point operations. ut/output Design: Accessing I/O Devices, I/O communication, Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits						
Module 4	BPU and Pipelining	Assignment	Analysis, Data Collection		**11 Sessions**	
Topics: **Basic Processing Unit:** Fundamental Concepts, Single Bus organization, Control sequence, Execution of a Complete Instruction, Multiple Bus Organization. **elining:** Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Hazards.						
rgeted Application & Tools that can be used: Targeted employment sector is processor manufacturing and memory chip fabrication vendors like Intel, AMD, Motorola, NVidia, Samsung, Micron Technology, western Digital etc. Targeted job profiles include						

Memory circuit design and verification engineers, Physical system design engineer, System programmer, Fabrication engineer etc.

Tools:
Virtual Lab, IIT KGP
Tejas – Java Based Architectural Simulator, IIT Delhi

ject work/Assignment:

ch batch of students (self-selected batch mates – up to 4 in a batch) will be allocated case studies/assignments

xtbook(s):

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", Sixth Edition, McGraw-Hill Higher Education, 2023 reprint.
2. William Stallings, "Computer Organization & Architecture – Designing for Performance", 11th Edition, Pearson Education Inc., 2019.

ferences

1. David A. Patterson & John L. Hennessy, "Computer Organization and Design MIPS Edition- The Hardware/Software Interface", 6th Edition, Morgan Kaufmann, Elsevier Publications, November 2020.
2. Web References:
3. NPTEL Course on "Computer architecture and organization" IIT Kharagpur By Prof. Indranil Sengupta,Prof. Kamalika Datta. https://nptel.ac.in/courses/106105163
4. NPTEL Course on "Computer Organization", IIT Madras By Prof. S. Raman.
5. https://nptel.ac.in/courses/106106092
6. https://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to "SKILL DEVELOPMENT": Generation of Computers, CISC and RISC processors, Bus Arbitration, Collaboration and Data collection for Term assignments and Case Studies for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

urse Code: N1002	**urse Title: Essentials of Finance pe of Course: HSMC**		**-T-P-C**			3
rsion No.						
urse Pre-requisites	This course is designed to be accessible to all students, regardless of their prior financial knowledge.					
ti-requisites						
urse Description	This course is designed to equip students with a **foundational understanding of key financial concepts and principles**. It will enable them to comprehend the **core functions of finance**, delve into the intricacies of **financial management within organizations**, and gain insights into the **fundamental aspects of taxation**. The course aims to develop students' abilities to **interpret financial statements, evaluate investment opportunities, understand capital structure decisions**, and navigate the **basics of tax implications**.					
urse Objective	Upon successful completion of this course, students will be able to: • **Understand the basic forms of business organization and their financial implications.** • **Understand the fundamental principles and concepts** that influence financial decision-making in various contexts. • **Analyse and interpret financial statements** to assess the financial health and performance of an organization. • **Identify income under various heads of income as per Income Tax Act, 1961 and determine the tax liability.**					
urse Outcomes	**List the course outcomes On successful completion of this course the students shall be able to:** 9. **Understand the basic concepts of finance and financial markets and organizations.** 10. **Apply and interpret financial information for business decision making.** 11. **Identify various heads of income and deduction under Income Tax Act, 1961.**					
urse Content:						
dule 1	**Introduction to Finance**	signment/ Quiz	merical solving Task		**Sessions**	
Definition and Scope of Finance, Areas of Finance: Corporate Finance, Investments, Financial Institutions, International Finance; Types of Financial Markets: Money Markets vs. Capital Markets, Primary vs. Secondary Markets; Forms of Business Organization and Financial Goals: Shareholder Wealth Maximization vs. Profit Maximization; Understanding Financial Statements: Balance Sheet and Income Statement- Simple Numerical.						
dule 2	**ancial Management**	signment/ Quiz	merical solving Task		**Sessions**	
Capital Budgeting Decisions: Payback Period, Net Present Value (NPV), Profitability Index (PI), Internal Rate of Return (IRR); Leverage- Basic Numerical; Capital Structure Decisions: Optimal Capital Structure, Trade-off Theory of Capital Structure; Cost of Capital: Equity, Debt, WACC; Dividend Policy: Factors influencing Dividend Policy.						

dule 3	**xation**	signment/ Quiz	merical solving Task	**Sessions**

Principles of a Good Tax System: Equity, Certainty, Convenience, Economy; Direct vs. Indirect Taxes; Residential Status of an Individual- Basic Problems; Heads of Income; Salary, House Property- Basic Numerical; Deductions under Chapter VI-A; Computation of Taxable Income and Tax Liability; E-Filing procedure.

rgeted Application & Tools that can be used:

xtbooks, PPT, Spreadsheet Software (e.g., Microsoft Excel), Official Website of Income Tax Department.

oject Work/ Assignment:

1. Presentation: There will be a group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.

2. Case Study: - At the end of the course students will be given a 'real-world' cases like business models of successful companies or tax evasion by reputed companies on which they have to come up with detailed analysis and assessment.

xt Book(s):

13. **Dr. Vinod K. Singhania & Dr. Monica Singhania.** (Latest Assessment Year Edition). *Students' Guide to Income Tax including GST*. Taxmann Publications.
14. **Pandey, I. M.** (2025). *Financial Management*. Vikas Publishing House.

ference Book (s):

13. **Bhole, L.M., & Mahakud, J.** (Current Edition). *Financial Institutions and Markets: Structure, Growth and Innovations*. McGraw Hill Education India.
14. **Mehrotra, H.C., & Goyal, S.P.** (Latest Assessment Year Edition). *Income Tax Law & Practice*. Sahitya Bhawan Publications.
15. **Gordon, E., & Natarajan, K.** (Current Edition). *Financial Markets and Services*. Himalaya Publishing House.

Online Resources (e-books, notes, ppts, video lectures etc.):

13. https://presidencyuniversity.linways.com
14. https://onlinecourses.nptel.ac.in/noc24_ec01/preview
15. https://www.incometax.gov.in/iec/foportal/

Topics relevant to "SKILL DEVELOPMENT": This course is designed to provide practical financial skills through participative learning techniques. Students will engage in performing suitable calculations to determine financial parameters (e.g., time value of money, investment returns, tax liabilities) and analysing financial statements to assess organizational performance and make informed decisions.

Catalogue prepared by	**Dr. Amit Saha**
Recommended by the Board of Studies on	S No: XXth BoS held on DD/MM/YYYY
Date of Approval by the Academic Council	th Academic Council Meeting held on DD/MM/YYYY

Course Code: MAT2404	Course Title: Discrete Mathematics Type of Course: Theory - ESC	L-T- P- C	3	1	0	4
Version No.	1.0					
Course Pre-requisites	MAT2302					
Anti-requisites	**NIL**					
Course Description	The course explores the study of mathematical structures that are fundamentally discrete (not continuous), focusing on concepts like set theory, logic, graph theory, combinatorics, and number theory, with applications primarily in computer science fields like algorithms, software development, and cryptography; it covers topics such as propositional logic, proof techniques, relations, functions, counting principles, and basic graph algorithms, providing a foundation for analyzing discrete problems and structures within computer science.					
Course Objective	The main objective of the course is that students should learn a particular set of mathematical facts and how to apply them. It teaches students how to think logically and mathematically through five important themes: mathematical reasoning, combinatorial analysis, discrete structures, algorithmic thinking, and applications and modeling. A successful discrete mathematics course should carefully blend and balance all five themes.					
Course Outcomes	On successful completion of the course the students shall be able to: CO1 - Explain logical sentences through predicates, quantifiers and logical connectives. CO2 - Deploy the counting techniques to tackle combinatorial problems CO3 - Comprehend the basic principles of set theory and different types of relations. CO4 - Apply different types of structures of trees for developing programming skills					
Course Content:						
Module 1	**Fundamentals of Logic**					**(10 Classes)**
Basic Connectives and Truth Tables, Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.						
Module 2	**Principle of Counting**	**Assignment**				**(15 Classes)**
The Well Ordering Principle – Mathematical Induction The Basics of Counting, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Generating Permutations and Combinations Advanced Principle Counting: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.						
Module 3	**Relations and Functions**					**(10 Classes)**
Cartesian Products and Relations, Functions, One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions. Relations, Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs,						

Partial Orders, Lattice, Hasse Diagrams, Equivalence Relations and Partitions.			
Module 4	**Recurrence Relations and Generating Functions**		**(10 Classes)**
Homogeneous and inhomogeneous recurrences and their solutions - solving recurrences using generating functions - Repertoire method - Perturbation method - Convolutions - simple manipulations and tricks.			
Module 5	**Graph Theory & Algorithms on Networks**	**Assignment**	**(15 Classes)**
Definitions and basic results - Representation of a graph by a matrix and adjacency list - Trees - Cycles - Properties - Paths and connectedness - Sub graphs - Graph Isomorphism - Operations on graphs - Vertex and edge cuts - Vertex and edge connectivity, Euler and Hamilton Paths, Shortest-Paths. Tree - Definitions, Properties, and Examples, Routed Trees, Binary search tree, Decision tree, spanning tree: BFS, DFS. Algorithms on Networks - Shortest path algorithm- Dijikstra's algorithm, Minimal spanning tree- Kruskal algorithm and Prim's algorithm.			
Targeted Application & Tools that can be used: Discrete mathematics provides the mathematical foundations for many computer science courses including data structures, algorithms, database theory, automata theory, formal languages, compiler theory, computer security, and operating systems.			
Assignment:			
Assignment 1: Logic Equivalences and Predicate calculus. **Assignment 2: Equivalence Relations and Lattices** **Assignment 3: Recurrence Relations**			
Text Book 2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", McGraw-Hill,s 8th Edition,2019. 3. Harary – Graph Theory, Addison-Wesley Publishing Company.			
References: 2. Arthur Gill, "Applied Algebra for Computer Science", Prentice Hall. 3. K.D. Joshi, "Discrete Mathematics", Wiley Eastern Ltd. 4. Ralph. P. Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia. **E-resources/ Web links:** https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&uni_id=EBSCO95_30102024_54588 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&uni_id=EBSCO95_30102024_375			

https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html https://www.scu.edu.au/study-at-scu/units/math1005/2022/
Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of calculus and differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving**.** This is attained through the assessment component mentioned in course handout.

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Course Code: CSE1504	**Course Title: Web Technologies** **Type of Course: Program core** **Theory**	**L-T- P-C**	2	0	0	2
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	**NIL**					
Course Description	This course highlights the comprehensive introduction to scripting languages that are used for creating web-based applications. The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills.					
Course Objective	**The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.**					
Course Outcomes	**On successful completion of this course the students shall be able to:** **CO1:** Implement web-based application using client-side scripting languages. **(Apply)** **CO2**: Apply various constructs to enhance the appearance of a website. **(Apply)** **CO3:** Apply server-side scripting languages to develop a web page linked to a database. **(Apply)**					
Course Content:						
Module 1	**Introduction to XHTML**	Quizzes and Assignments	Quizzes on various features of XHTML, simple applications		**20 Sessions**	
	Basics: Web, WWW, Web browsers, Web servers, Internet. **XHTML:** Origins and Evolution of HTML and XHTML: Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Frames, Syntactic Differences between HTML and XHTML, Demonstration of applications using XHTML for Responsive web pages.					

Module 2	**Advanced CSS**	Quizzes and assignments	Comprehension based Quizzes and assignments; Application of CSS in designing webpages		**20 Sessions**
	Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks				

XML: Basics, Demonstration of applications using XML with XSLT.				
Module 3	**PHP – Application Level**	Quizzes and assignments	Application of PHP in web designing	**20 Sessions**
PHP: Introduction to server-side Development with PHP, Arrays, Superglobal Arrays, $GET and $ POST, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object Oriented Design, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP, Applications.				

List of Laboratory Tasks:

Experiment No. 1: Demonstration of XHTML features

Level 1: Demonstration of various XHTML Tags (Level 1)
Level 2: Design and develop static web pages for an online Book store (Level 2).

Experiment No. 2: Application of CSS in web designing

Level 1: Design a document using XHTML and CSS to create a catalog of items for online electronic shopping.

Level 2: Create and save XML document for students' information and display the same using cascaded style sheet.

Experiment No. 3: Application of PHP in web designing.

Level 1: Write a PHP program to read the personal information of a person such as first name, last name, age, permanent address, and pin code entered by the user into a table created in MySQL. Read the same information from the database and display it on the front end.

Level 2: Using PHP develop a web page that accepts book information such as ISBN number, title, authors, edition, and publisher and store information submitted through the web page in MySQL database.

Experiment No. 4: Building a website.

Build a website for organizing an International Conference. The conference website must be able to collect the author's details and upload a file.

Targeted Application & Tools that can be used: **Xampp**
web server to be used to demonstrate PHP.

Project work/Assignment:

Assignments are given after completion of each module which the student need to submit within the stipulated deadline.

Textbook(s):

2] Robert. W. Sebesta, "*Programming the World Wide Web*", Pearson Education, 9th Edition, 2016.
2]Paul Deitel, Harvey Deitel, Abbey Deital,"Internet & World Wide Web How to Program", Fifth Edition, Pearson Education, 2021.

3]CSS Notes for Professionals, ebook available at https://books.goalkicker.com/CSSBook/ (Retrieved on Jan. 20, 2022)

4]Deitel, Deitel, Goldberg,"*Internet & World Wide Web How to Program*", Fifth Edition, Pearson Education, 2021.

Reference Book(s):

R1. Randy Connolly, Ricardo Hoar,"Fundamentals of Web Development", Pearson Education India, 1st. Edition.2016.

R2. Jeffrey C. Jackson,"Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition,2016.

Additional web-based resources

W1. W3schools.com
W2. Developer.mozilla.org/en-US/docs/Learn
W3. docs.microsoft.com
W4. informit.com/articles/ The Relationship Between Web 2.0 and Social Networking
https://presiuniv.knimbus.com/user#/home

Topics related to development of "FOUNDATION":

7. Web, WWW, Web browsers, Web servers, Internet.
8. CSS, PHP.
9. Designing the website for healthcare.

The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.

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Course Code: CSE1505	**Course Title: Web Technologies Lab** **Type of Course: Program core lab course**	**L-T- P-C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	**NIL**					

Course Description		This course highlights the comprehensive introduction to scripting languages that are used for creating web-based applications. The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills.
Course Objective		**The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.**
Course Outcomes		**On successful completion of this course the students shall be able to:** **CO1:** Implement web-based application using client-side scripting languages. **(Apply)** **CO2**: Apply various constructs to enhance the appearance of a website. **(Apply)** **CO3:** Apply server-side scripting languages to develop a web page linked to a database. **(Apply)**
Course Content:		

Module 1	**Introduction to XHTML Features**	Quizzes and Assignments	Quizzes on various features of XHTML, simple applications		**8 Sessions**
	Standard XHTML Document Structure, Basic Text Markup such as headings, paragraphs, lists, tables, forms, and semantic tags.				
Module 2	**CSS Styling**	Quizzes and assignments	Comprehension based Quizzes and assignments; Application of CSS in designing webpages		**10 Sessions**
	Apply CSS3 to style HTML elements, including layout techniques, color schemes, typography, and responsive design principles.				

XML: Basics, Demonstration of applications using XML with XSLT.				
Module 3	**PHP – Application Level**	Quizzes and assignments	Application of PHP in web designing	**12 Sessions**
PHP: Introduction to server-side Development with PHP, Arrays, Superglobal Arrays, $GET and $ POST, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object Oriented Design, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP, Applications.				

List of Laboratory Tasks:

Experiment No. 1: Demonstration of XHTML features

Level 1: Demonstration of various XHTML Tags (Level 1)
Level 2: Design and develop static web pages for an online Book store (Level 2).

Experiment No. 2: Application of CSS in web designing

Level 1: Design a document using XHTML and CSS to create a catalog of items for online electronic shopping.

Level 2: Create and save XML document for students' information and display the same using cascaded style sheet.

Experiment No. 3: Application of PHP in web designing.

Level 1: Write a PHP program to read the personal information of a person such as first name, last name, age, permanent address, and pin code entered by the user into a table created in MySQL. Read the same information from the database and display it on the front end.

Level 2: Using PHP develop a web page that accepts book information such as ISBN number, title, authors, edition, and publisher and store information submitted through the web page in MySQL database.

Experiment No. 4: Building a website.

Build a website for organizing an International Conference. The conference website must be able to collect the author's details and upload a file.

Targeted Application & Tools that can be used: **Xampp**
web server to be used to demonstrate PHP.

Project work/Assignment:

Assignments are given after completion of each module which the student need to submit within the stipulated deadline.

Textbook(s):

2] Robert. W. Sebesta, "*Programming the World Wide Web*", Pearson Education, 9th Edition, 2016.
2]Paul Deitel, Harvey Deitel, Abbey Deital,"Internet & World Wide Web How to Program", Fifth Edition, Pearson Education, 2021.

3]CSS Notes for Professionals, ebook available at https://books.goalkicker.com/CSSBook/ (Retrieved on Jan. 20, 2022)

4]Deitel, Deitel, Goldberg,"*Internet & World Wide Web How to Program*", Fifth Edition, Pearson Education, 2021.

Reference Book(s):

R1. Randy Connolly, Ricardo Hoar,"Fundamentals of Web Development", Pearson Education India, 1st. Edition.2016.

R2. Jeffrey C. Jackson,"Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition,2016.

Additional web-based resources

W1. W3schools.com
W2. Developer.mozilla.org/en-US/docs/Learn
W3. docs.microsoft.com

W4. informit.com/articles/ The Relationship Between Web 2.0 and Social Networking
https://presiuniv.knimbus.com/user#/home

Topics related to development of "FOUNDATION":

10. Web, WWW, Web browsers, Web servers, Internet.
11. CSS, PHP.
12. Designing the website for healthcare.

The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.

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Course Code: CSE2260	**Course Title: Database Management Systems** **Type of Course: Theory only - PCC**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Foundational understanding of data types, data structures, basic programming knowledge, familiarity with operating systems and file management. Basic knowledge of set theory, logic, and discrete mathematics to understand relational algebra and query formulation.					
Anti-requisites	NIL					
Course Description	This course introduces the foundational principles of database management systems, including data models, schemas, and architectures. This course provides a solid foundation on the relational model of data and the use of relational algebra. It develops skills in SQL for data definition, manipulation, and control, enabling students to construct and execute complex queries. The course also introduces the concept of object oriented and object relational databases and modern database technologies like **NoSQL.** The also course allows the students to gain insights into data storage structures and indexing strategies for optimizing query performance.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain **Employability** through **Problem Solving** Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 13. Describe the fundamental elements of relational database management systems. [Understand] 14. Examine databases using SQL query processing and Optimization. [Apply] 15. Design simple database systems applying the normalization constraints and demonstrate the database transaction processing, recovery, and security. [Apply] 16. Interpret the concept of advanced databases and its applications. [Apply]					
Course Content:						
Module 1	**Introduction to Database Modelling and Relational Algebra(Understand)**	Assignment	**Problem Solving**	**10 Sessions**		
Topics: **Introduction to Database:** Schema, Instance, 3-shema architecture, physical and logical data independence, Data isolation problem in traditional file system, advantages of database over traditional file systems. Entity Relationship (ER) Model, ER Model to Relational Model, Examples on ER model. **Relational Algebra** with selection, projection, rename, set operations, Cartesian product, joins (inner and outer joins), and division operator. Examples on Relational Algebra Operations.						

Module 2	**Fundamentals of SQL and Query Optimization (Apply)**	Assignment	**Programming**	**11 Sessions**

Topics:
SQL Database Querying, DDL, DML, Constraints, Operators, Set Operators, Aggregate Functions, Joins, Views, Procedures, Functions and Triggers.
Database programming issues and techniques: Embedded SQL, Dynamic SQL; SQL / PSM and NoSQL.
Query Optimization: Purpose, transformation of relational expressions, estimating cost and statistics of expression, choosing evaluation plans, linear and bushy plans, dynamic programming algorithms.

Module 3	**Relational Database Design & Transaction Management (Apply)**	Assignment	**Problem Solving**	**12 Sessions**

Topics:
Relational database design: Problems in schema design, redundancy and anomalies, Normal Forms based on Primary Keys-(1NF,2NF, 3NF), Boyce-Codd Normal Form, Multi valued Dependency (Fourth Normal Form), Join Dependencies (Fifth Normal Form), lossy and lossless decompositions, Database De-normalization.
Transaction Management: The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; The write-ahead log protocol; Check pointing; Recovering from a System Crash; Media Recovery; Other approaches and interaction with concurrency control.

Module 4	**Advanced DBMS Topics (Apply)**	**Assignment**	**Case Study**	**12 Sessions**

Topics:
Advanced topics: Object oriented database management systems, Deductive database management systems, Spatial database management systems, Temporal database management systems, Constraint database management systems.
New database applications and architectures such as Data warehousing, Multimedia, Mobility, NoSQL, Native XML databases (NXD), Document-oriented databases, Statistical databases.

Targeted Application & Tools that can be used:
Application Area: Relational database systems for Business, Scientific and Engineering Applications.
Tools/Simulator used: MySQL DB for student practice.
Also demonstration of ORACLE DB on object-relational database creation and JDBC connection.

7. Problem Solving: Constructing ER-Diagrams for a given real time requirements, Normalizing the databases, querying the databases using relational algebra.
8. Programming: Implementation of any given scenario using MySQL.

Text Books:
T1. Elmasri R and Navathe S B, “Fundamentals of Database System”, Pearson Publication, 7th Edition, 2018.
T2. RamaKrishna & Gehrke, “Database Management Systems” 3rd Edition, 2018, McGraw-Hill Education.
T3. W. Lemahieu, S. vanden Broucke and B. Baesens, “Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data”, Cambridge University Press, 2018.

References

R1 Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill ,7th Edition, 2019.
R2 M. Kleppmann, "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems", O'Reilly, 2017.

Topics relevant to development of "FOUNDATION SKILLS": S - Skill Development: Relational database design using ER- Relational mapping, Implementation of given database scenario using MYSQLDB.

Topics relevant to development of Employability: Develop, test and implement computer databases, creatingsophisticated, interactive and secure database applications

Topics relevant to "HUMAN VALUES &PROFESSIONAL ETHICS": Nil

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Course Code: CSE2261	**Course Title: Database Management Systems Laboratory** **Type of Course: 1) Laboratory - PCC**	**L-T-P-C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites	Foundational understanding of data types, basic programming knowledge, operating systems and file management.					
Anti-requisites	NIL					
Course Description	The Database Management Systems (DBMS) Laboratory is designed to provide students with hands-on experience in database design, implementation, and management using SQL and database management tools such as MySQL. The lab complements theoretical concepts learned in database courses by allowing students to practice database creation, querying, and optimization techniques. The DBMS Lab enables students to develop industry-relevant skills in database management, preparing them for careers in **software development, data engineering, and database administration**.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain **Employability** through **Problem Solving** Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 17. Demonstrate the database concepts, practice, and SQL queries. [Apply] 18. Design and implement database schemas while applying normalization techniques to optimize structure. [Apply]] 19. Develop and implement stored procedures, triggers, and views for automation and efficiency. [Apply] 20. To Design and build database applications for real world problems. [Apply]					

Course Content:

List of Laboratory Tasks:
Create Employee, Student, Banking and Library databases and populate them with required data. Do the following experiments of different lab sheets on those databases.

Labsheet-1 [3 Practical Sessions]
Experiment No 1: [1 Session]
1. To study and implement the different language of Structured Query Language.
Level 1: Perform operations using Data Definition Language and Data Manipulation Language commands including different variants of SELECT on Student DB.
Level 2: Identify the given requirements; valid attributes and data types and Perform DDL and DML operations on a given scenario. [Banking Databases]
Experiment No. 2: [2 Sessions]
2. To study and implement the concept of integrity constraints in SQL.
Level 1: Create tables on Banking database using PRIMARY KEY, NOT NULL, UNIQUE, FOREIGN KEY and demonstrate the working of relational, logical, pattern matching, BETWEEN, IS NULL, IN and NOT IN Special

Operators on Student Database.
Level 2: Enforce different types of data and referential integrity constraints. Then try queries with special operators based on the student database. [Banking Database].

Labsheet-2 [3 Practical Sessions]
Experiment No. 3: [1 Session]
3. Implement complex queries in SQL.
Level 1: Implement the conjugate of GROUP BY, ORDER BY and aggregate functions on Banking Database.
Level 2: Implement MySQL DB queries on library database using appropriate clauses and aggregate functions. Also order the data either in ascending and descending order using corresponding clause. [Library databases].

Experiment No. 4: [2 Session]
4. To study and implement different types of Set and Join Operations [2 Slots]
Level 1: Demonstrate different types of Set Operations (UNION, UNION ALL, INTERSECT, MINUS) and Join Operations (INNER JOINs, OUTER JOINS, CROSS JOIN, NATURAL JOIN) on two or more tables of Airline Database. Level 2: Use Set and Join operations to retrieve the data from two or more relations(tables) as per the given
scenario. [Airline Database]

Labsheet-3 [2 Practical Sessions]
Experiment No. 5: [2 sessions]
5. To study and implement Views, and Procedures in MySQL DB.
Level 1: Implement MySQL Views, and Procedures in ORACLE DB on Employee database.
Level 2: Analyze the requirement and construct views, and Procedures on Mini Project Domain. [Banking Database]

Labsheet-4 [2 Practical Sessions]
Experiment No. 6: [2 Sessions]
6. To study and implement Functions, and Triggers in MySQL DB.
Level 1: Implement Oracle Functions and Triggers in Oracle on Employee database.
Level 2: Analyze the requirement and construct Functions and Triggers. [Supply chain Database]

Labsheet-5 [2 Practical Sessions]
Experiment No. 7: [2 Sessions]
7. To study and implement Functions, and Triggers in MySQL DB.
Level 1: Implement Oracle Functions and Triggers in Oracle on Employee database.
Level 2: Determine the requirement and construct Functions and Triggers. [Supply chain Database]

Labsheet-6 [4 Practical Sessions]
Experiment No. 8: [2 Sessions]
8. To implement the concept of forms and reports.
Level 1: Implement the concept of forms and reports.
Level 2: Examine the schema relationship.

Experiment No. 9: [2 Sessions]
9. Create the database using the given schema. (Flight Management)
Level 1: Implement a relational database based on the provided schema for the Flight Management system, including the creation of tables, relationships, and constraints.
Level 2: Demonstrate schema relationships by defining primary and foreign keys to ensure data integrity within the Flight Management database.

Labsheet-7 [4 Practical Sessions]
Experiment No. 10: [2 Sessions]
10. Create the database using the given schema. (Company database)
Level 1: Implement the database schema by defining tables, relationships, and constraints according to the given Company Database schema.
Level 2: Demonstrate the schema's relationships and data integrity by creating and linking tables as per the specified requirements.
Experiment No. 11: [2 Sessions]
11. Create the database using the given schema. (Student Library)
Level 1: Implement forms and reports based on the provided Student Library database schema, ensuring effective data entry and reporting mechanisms.
Level 2: Demonstrate the schema relationships within the Student Library database, demonstrating how these relationships influence the creation and functionality of forms and reports.

Labsheet-8 [1 Sessions]
12. Design a mini project based on the databases such as Inventory Management System, University Management System, Hospital Management System, etc.
Level 1: Implement the real time database.
Level 2: Analyze the working of database in real time.

Targeted Application & Tools that can be used:
Application Area: Relational database systems for Business, Scientific and Engineering Applications.
Tools/Simulator used: MySQL DB for student practice.
Also demonstration of ORACLE DB on object-relational database creation and JDBC connection.

Percentage of changes in this version: 50% of changes from earlier version. New topics are highlighted in italic.

9. Problem Solving: Constructing ER-Diagrams for a given real time requirements, Normalizing the databases, querying the databases using relational algebra.
10. Programming: Implementation of any given scenario using MySQL.

Text Books:
T1. Elmasri R and Navathe S B, “Fundamentals of Database System”, Pearson Publication, 7th Edition, 2018.
T2. RamaKrishna & Gehrke, “Database Management Systems” 3rd Edition, 2018, McGraw-Hill Education.
T3. W. Lemahieu, S. vanden Broucke and B. Baesens, “Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data”, Cambridge University Press, 2018.

References
R1 Avi Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, McGraw-Hill ,7th Edition, 2019.
R2 M. Kleppmann, “Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems”, O’Reilly, 2017.

Topics relevant to development of “FOUNDATION SKILLS”: S - Skill Development: Relational database design using ER- Relational mapping, Implementation of given database scenario using MYSQLDB.
Topics relevant to development of Employability: Develop, test and implement computer databases, creatingsophisticated, interactive and secure database applications
Topics relevant to “HUMAN VALUES &PROFESSIONAL ETHICS”: Nil

Course Code: CSE2500	**Course Title: Data Analytics** **Type of Course: Theory - PCC**			**L-T-P- C**	2	0	0	2
Version No.	**1.0**							
Course Pre-requisites	MAT2402							
Anti-requisites	**NIL**							
Course Description	**Fundamentals of Data Analytics is designed for inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, and supports in decision-making. The course begins by covering Data extraction, pre-processing, and transformation. It delivers the basic statistics and taught in an intuitive way to analysis the data. This course will help the students to apply the knowledge on data analysis to a wide range of applications.**							
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Fundamentals of Data Analytics** and attain **SKILL DEVELOPMENT** through **PROBLEM SOLVING** Methodologies.							
Course Out Comes	**On successful completion of this course, the students shall be able to:** **CO1**:Describe different types of data and variables. **CO2**: Explain data using appropriate statistical methods. **CO3**: Demonstrate the collection, processing and analysis of data for any given application and illustrate various charts using visualization methods. **CO4**: Apply the Data Analysis techniques by R Programming							
Course Content:								
Module 1	**Introduction to Data Analysis- CO1**	Assignment	Data Collection, data analysis, Programming	**06 classes**				
Topics: Introducing Data, overview of data analysis: Data in the Real World, Data vs. Information, The Many "Vs" of Data, Structured Data and Unstructured Data, Types of Data, Data Analysis Defined, Types of Variables, Central Tendency of Data, Scales of Data, Sources of Data. Data preparation. **R Studio:** Base R-R Studio IDE-Introduction to R Projects and R Markdown. Basic R: R as a calculator-Scripts and Comments-R Variables. Data I/O: Working Directories-Importing Data Exporting Data-More ways to save-Data I/O in Base R.								
Module 2	**Data Analysis and Visualization-CO2**	Case studies	Programming	**10 classes**				
Topics: Data Summarization**:** One Quantitative and Categorical Variable. Data Classes: One Dimensional Data Classes-Data Frames and Matrices-Lists. Data Cleaning: Dealing with Missing Data-Strings and Recoding Variables. Manipulating Data in R: Reshaping Data-Merging Datasets. Data Visualizations: Plotting with ggplot2- Plotting with Base R								
Module 3	**Statistical Analysis -CO3**	Case studies	R programming	**7 classes**				
Topics: Proportion tests-Chi squared test-Fisher exact test-Correlation-T test-Wilcoxon Rank sum tests-Wilcoxon signed rank test- one-way ANOVA test- Kruskal Wallis test								

Module 4	Predictive Analysis-CO4	Case studies	Programming	**7 classes**

Topics: Linear least-squares – implementation – the goodness of fit – testing a linear model – weighted resampling. Regression using Stats models – multiple regression – nonlinear relationships – logistic regression – estimating parameters – accuracy. Time series analysis – moving averages – missing values – serial correlation – autocorrelation. Introduction to survival analysis

Targeted Application & Tools that can be used:

Application Area are Decision making in business, health care, financial sector, Medical diagnosis etc.

Text Books

1. Glenn J. Myatt and Wayne P. Johnson, "Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining Paperback", Import, 22 July 2014.
2. Introduction to statistics and Data analytics, Christian H, Michael S, Springer,2016
3. Introduction to R- Robert Parker, John Mushcelli and Andrew Jaffe, Johns Hopkins University, 2020 (E-resource)
4. Introduction to Time Series and Forecasting (Springer Texts in Statistics), Peter Brockwell, Richard A. Davis, Springer, 2016.

References

1. Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining Paperback, Glenn J. Myatt and Wayne P. Johnson, Import, 22 July 2014.
2. The R Software-Fundamentals of Programming and Statistical Analysis -Pierre Lafaye de Micheaux, Remy Drouilhet, Benoit Liquet, Springer 2013.

Online resources:

http://www.modernstatisticswithr.com/solutions.html#solutionsch3
https://johnmuschelli.com/intro_to_r/
https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/

Topics relevant to development of "FOUNDATION SKILLS":

1. Statistical Concepts for data, visualization techniques.
2. Data collection for project based assignments.
3. Inferential Statistics (T test, Z test)
4. Probability Calculation

for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE2501	**Course Title: Fundamentals of Data Analytics** **Type of Course: Lab - PCC**	**L-T-P- C**	0	0	2	1
Version No.	**1.0**					
Course Pre-requisites	MAT2402					
Anti-requisites	**NIL**					
Course Description	**Fundamentals of Data Analytics is designed for inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, and supports in decision-making. The course begins by covering Data extraction, pre-processing, and transformation. It delivers the basic statistics and taught in an intuitive way to analysis the data. This course will help the students to apply the knowledge on data analysis to a wide range of applications.**					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Fundamentals of Data Analytics** and attain **SKILL DEVELOPMENT** through **PROBLEM SOLVING** Methodologies.					
Course Out Comes	**On successful completion of this course, the students shall be able to:** **CO1**:Describe different types of data and variables. **CO2**: Explain data using appropriate statistical methods. **CO3**: Demonstrate the collection, processing and analysis of data for any given application and illustrate various charts using visualization methods. **CO4**: Apply the Data Analysis techniques by R Programming					
Course Content:						
Module 1	**Introduction to Data Analysis- CO1**	Assignment	Programming		**09 classes**	

List of Laboratory Tasks:

Experiment No. 1: Introduction to R and RStudio

Level 1: Getting Started with R and RStudio

- Installing R and RStudio.
- Basic R syntax and commands.

Level 2: Working with RStudio

- Understanding the RStudio interface.
- Creating and managing R scripts.

Experiment No. 2: Basic Data Handling in R

Level 1: Data Types and Structures in R

- Vectors, matrices, and data frames.
- Lists and factors.

Level 2: Data Import and Export

- Reading data from CSV, Excel, and text files.
- Exporting data to different formats.

Level 3: Exploring Datasets

- Using functions like head(), summary(), and str().

Experiment No. 3: Basic Data structure in R

Level 1: a. Demonstrate a program to join columns and rows in a data frame using cbind() and rbind() in

R.

b. Implement different data structures in R (Vectors, Lists, Data Frames)

Level 2: R AS CALCULATOR APPLICATION a. Using with and without R objects on console

a. Using mathematical functions on console

b. Write an R script, to create R objects for the calculator application

Module 2	**Data Analysis and Visualization-CO2**	Assignment	Programming	**13 classes**

Experiment No. 1: Data Cleaning and Preprocessing

Level 1: Handling Missing Data in R

- Identifying missing values.
- Imputing missing values using mean, median, or other methods.

Level 2: Data Transformation in R

- Standardizing and normalizing data.
- Log-transformations and scaling.

Experiment No. 2: Exploratory Data Analysis (EDA) with R

Level 1: Descriptive Statistics

- Calculating mean, median, and standard deviation.
- Visualizing data using histograms, box plots, and scatter plots.

Experiment No. 3: Data Visualization with ggplot2

Level 1: Demonstrate various graphs that can be made and altered using the ggplot2 package.

Level 2: Create 500 random temperature readings for six cities over a season and then plot the generated data using ggplot2 packages in R

Module 3	**Statistical Analysis -CO3**	Assignment	programming	**10 classes**

Experiment No. 1: Perform Tests of Hypotheses hypothesis test (parametric)

Level 1: How to perform tests of hypotheses about the mean when the variance is known. How to compute the p-value. Explore the connection between the critical region, the test statistic, and the p-value.

Level 2: A teacher claims that people who work for only five hours per week will score significantly lower than people who work for ten hours per week on a quantitative abilities test. He brings twenty people and randomly assigned them to one or two groups. In one group he has participants who work for ten hours and in another group, he has participants who work for five hours. He conducts the test for all participants. Scores on the test range from one to ten with higher scores representing better performance. Test if there is any significant difference between those who work for five hours per week versus those who work for ten hours per week based on the test performance.

Experiment No 2: Hypothesis – Non-Parametric Test

Level 1: A car manufacturing company like to find the sales of three types of cars produced by them in three regions and is given. Test if there is an association between the regions and types of cars purchased.

Experiment No 3: Correlation and Covariance

Level 1: Using the iris data set in R

a. Find the correlation matrix.
b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.

Level 2 : Ramesh is doing a statistics paper in his post-graduation course. He met his friend Amal who is a textile engineer. Ramesh, who is doing his internship at ABC Researchers, is interested in a question. He poses this question to Amal and tries to find if he can answer. The question is as follows: The data regarding sales of soft- drinks and sales of cotton clothes in a place during the last 12 months are given. Find if there is any association between sales of soft drinks and sales of cotton clothes. Also explain the reason if there is any relationship.

Module 4	Predictive Analysis-CO4	Assignment	Programming	**10 classes**

Experiment No 1: Regression Model

Level 1: Import data from web storage (http://www.ats.ucla.edu/stat/data/binary.csv). Name the dataset and now do Logistic Regression to find out the relation between variables that are affecting the admission of a student in an institute based on his or her GRE score, GPA obtained, and rank of the student. Also check the model is fit or not. Require (foreign), require (MASS).

Level 2: Demonstrate multiple regressions, if data have a continuous Independent variable. Apply on the above dataset

Experiment No. 2: Time Series Analysis in R
Level 1: Demonstrate Timeseries analysis using Time Series Data Library at http://robjhyndman.com/TSDL/.

Targeted Application & Tools that can be used:
Application Area are Decision making in business, health care, financial sector, Medical diagnosis etc.

Text Books

5. Glenn J. Myatt and Wayne P. Johnson, "Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining Paperback", Import, 22 July 2014.
6. Introduction to statistics and Data analytics, Christian H, Michael S, Springer,2016
7. Introduction to R- Robert Parker, John Mushcelli and Andrew Jaffe, Johns Hopkins University, 2020 (E-resource)
8. Introduction to Time Series and Forecasting (Springer Texts in Statistics), Peter Brockwell, Richard A. Davis, Springer, 2016.

References

3. Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining Paperback, Glenn J. Myatt and Wayne P. Johnson, Import, 22 July 2014.

4. The R Software-Fundamentals of Programming and Statistical Analysis -Pierre Lafaye de Micheaux, Remy Drouilhet, Benoit Liquet, Springer 2013.

Online resources:
http://www.modernstatisticswithr.com/solutions.html#solutionsch3
https://johnmuschelli.com/intro_to_r/
https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/

Topics relevant to development of "FOUNDATION SKILLS":

2. Statistical Concepts for data, visualization techniques.
3. Data collection for project based assignments.
4. Inferential Statistics (T test, Z test)
5. Probability Calculation

for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

urse Code: 2262	urse Title: Analysis of Algorithms e of Course: Theory PCC	-P- C	3	1	0	4
sion No.						
urse Pre-requisites						
ti-requisites						
urse Description	This course introduces techniques for the design and analysis of efficient algorithms and methods of applications. This course discusses the classic approaches for algorithm design such as Divide and Conquer, Dynamic Programming, Greedy method. This course also describes other basic strategies searching solution space. The core concepts of analyzing algorithms and classifying them into various complexity classes is covered in the end.					
urse Objective	The objective of the course is to familiarize the learners with the concepts of **Analysis of Algorithms** and attain **Skill Development** through **Problem Solving** Methodologies.					
urse Out Comes	On successful completion of the course the students shall be able to: 1. Compute efficiency of a given algorithm.[Apply] 2. Apply divide and conquer technique for searching and sorting Problems.[Apply] 3. Apply the Dynamic Programming technique for a given problem. [Apply] 4. Apply greedy technique for solving a Problem.[Apply] 5. Demonstrate Back tracking technique and limitations of Algorithms.[Apply]					
urse Content:						
dule 1	**roduction**	ignment	ulation/Data Analysis	**10 Sessions**		
Introduction, Asymptotic Notations and its properties, Best case, worst case and average case- Sequential search, Sorting; Mathematical analysis for Recursive and Non-recursive algorithms: Substitution method and Master's Theorem.						
dule 2	**ide-and-conquer**	ignment	ulation/Data Analysis	**08 Sessions**		
roduction. Insertion Sort; Merge sort, Quick sort, Binary search.						
dule 3	**namic programming**	m paper/Assignment	ulation/Data Analysis	**10 Sessions**		
roduction with examples, Principles of Memoization, 0-1 Knapsack Problem, Bellman-Ford algorithm, Floyd-Warshall's Algorithms. Chain Matrix Multiplication.						
dule 4	**eedy technique**	m paper/Assignment	ulation/Data Analysis	**09 Sessions**		
Introduction, Fractional Knapsack Problem, Minimal Spanning Tree: Prim's Algorithm and Kruskal's Algorithm, Single-source Shortest Path: Dijkstra's Algorithm						
dule 5	**mplexity Classes**	m paper/Assignment	ulation/Data Analysis	**08 Sessions**		
Complexity Classes- P,NP- NP Hard and NP Complete - Boolean Satisfiability Problem (SAT). nch and Bound: Knapsack problem; Backtracking, - N-Queens problem.						
t Book 1. Anany Levitin, *"Introduction to the Design and Analysis of Algorithms"*, 3rd edition, Pearson Education, 2018.						

2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, *"Introduction to Algorithms*", 4th edition, MIT Press, 2022.

ferences

1. J. Kleinberg and E. Tardos, "*Algorithm Design*", Addison-Wesley, 2005.
2. Tim Roughgarden, *"Algorithms Illuminated"* (books 1 through 3), "Operating Systems Design and Implementation", Soundlikeyourself Publishing, 2017-2019.
3. AV Aho, J Hopcroft, JD Ullman, *"The Design and Analysis of Algorithms"*, Addison-Wesley, 1974.
4. Donald E. Knuth, "*The Art of Computer Programming",* Volumes 1and 3 Pearson.

b-Resources

1. NPTEL: https://onlinecourses.nptel.ac.in/noc19_cs47/preview
2. Coursera: Analysis of Algorithms by Princeton University
3. Algorithms Specialization in Coursera by Stanford University(Group of 4 courses).
4. Algorithms Coding Contest Links maintained by Prof Gerth Stølting Brodal of Aarhus University

pics relevant to "SKILL DEVELOPMENT": knapsack, prim's, kruskal's algorithm, quick sort, binary search for **Skill Development** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr Murali Parameswaran
Recommended by the Board of Studies on	S NO: XXth BOS, held on N/NN/202N
Date of Approval by the Academic Council	ademic Council Meeting No. XX^{th,} Dated N/NN/202N

Course Code: CSE2263	**Course Title:** Analysis of Algorithms Lab **Type of Course:** Lab - PCC	**L- T-P- C**	0	0	1
Version No.	1				
Course Pre-requisites	**Nil**				
Anti-requisites	NIL				
Course Description	This course introduces techniques for the design and analysis of efficient algorithms and methods of applications. This course discusses the classic approaches for algorithm design such as Divide and Conquer, Dynamic Programming, Greedy method. This course also describes other basic strategies searching solution space. The core concepts of analyzing algorithms and classifying them into various complexity classes is covered in the end.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Analysis of Algorithms** and attain **Skill Development** through **Experiential Learning** Methodologies.				
Course Out Comes	**On successful completion of the course the students shall be able to:** 1. Compute efficiency of a given algorithm. [Applying] 2. Apply divide and conquer technique for searching and sorting Problems.[Applying] 3. Apply the Dynamic Programming technique for a given problem. [Applying] 4. Apply greedy technique for solving a Problem.[Applying] 5. Demonstrate Back tracking technique and limitations of Algorithms.[Applying]				
Course Content					
Module 1	**Introduction**	**3 Sessions**			
Measuring running time of an algorithm, Compare running time of algorithms, Implement sorting algorithms such as bubble sort, selection sort					
Module 2	**Divide-and-conquer**	**3 Sessions**			
Compare searching algorithms: Linear Search, Binary Search; Compare Sorting algorithms: Insertion Sort, Merge Sort, QuickSort.					

Module 3	**Dynamic programming**	**3 Sessions**
Introduction and memorization: Factorial; Coin Change Problem ; Floyd-Warshall's Algorithm.		
Module 4	**Greedy technique**	**3 Sessions**
Fractional Knapsack Problem; Minimal Spanning Tree Algorithms-Prim's Algorithm, Kruskal's algorithm		
Module 5	**Complexity Classes**	**3 Sessions**
Branch and Bound: Knapsack problem; Backtracking, - N-Queens problem.		
	List of Laboratory Tasks: **1. Measuring running time of an algorithm** **Objective: To experimentally determine the running time of basic algorithms for input size n=10, 100, 1000, etc. by taking difference of starting time and ending time.** **2. Compare running time of algorithms** **Objective: To execute two algorithms to solve the same problem, and to comparatively evaluate the better algorithm for large values of N.** **3. Implement sorting algorithms such as bubble sort, selection sort** **Objective: To implement comparison based sorting strategies.** **4. Compare searching algorithms** **Objective: To implement two searching strategies and compare their performance.** **5. Compare Sorting algorithms** **Objective: To implement searching strategies that follow top down design approach(Insertion sort, merge sort).**	

	6. Quick Sort **Objective: To demonstrate Quick sort and its variants, and their impact on running time.** **7. Dynamic Programming** **Objective: To demonstrate Dynamic Programming approach with the help of Factorial algorithm.** **8. Coin Change Problem** **Objective: To implement an efficient algorithm for the Coin Change problem.** **9. Floyd-Warshall's Algorithm** **Objective: To demonstrate how dynamic programming is used with the help of Floyd-Warshall's algorithm.** **10. Fractional Knapsack Problem** **Objective: To demonstrate how greedy method can be used to solve the Fractional Knapsack Problem.** **11. Minimal Spanning Tree Algorithm** **Objective: To implement greedy strategy to solve the Minimal Spanning Tree problem using Prim's Algorithm.** **12. Kruskal's Minimal Spanning Tree Algorithm** **Objective: To implement greedy strategies to solve the Minimal Spanning Tree problem using Kruskal's Algorithm.** **13. Knapsack Problem** **Objective: To implement Knapsack problem using branch and bound technique.** **14. N-Queen's Problem** **Objective: To demonstrate backtracking method with the help of N-Queen's problem.** **15. Case Study** **Objective: To demonstrate how various techniques can be used to solve the same problem with the help of Knapsack problem.**
	Targeted Application & Tools that can be used 1. PyTorch/Jupyter Notebook – For Python programming
	Text Book **T1** Anany Levitin, *"Introduction to the Design and Analysis of Algorithms"*, 3rd edition, Pearson Education, 2018. **T2** Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, *"Introduction to Algorithms"*, 4th edition, MIT Press, 2022.
	References R1. J. Kleinberg and E. Tardos, "*Algorithm Design*", Addison-Wesley, 2005. R2. Tim Roughgarden, *"Algorithms Illuminated"* (books 1 through 3), "Operating Systems Design and Implementation", Soundlikeyourself Publishing, 2017-2019. R3. AV Aho, J Hopcroft, JD Ullman, *"The Design and Analysis of Algorithms"*, Addison-Wesley, 1974. R4. Donald E. Knuth, "*The Art of Computer Programming",* Volumes 1and 3 Pearson. Web Based Resources and E-books: W1. NPTEL: https://onlinecourses.nptel.ac.in/noc19_cs47/preview W2. Coursera: Analysis of Algorithms by Princeton University W3. Algorithms Specialization in Coursera by Stanford University(Group of 4 courses).

	W4. Algorithms Coding Contest Links maintained by Prof Gerth Stølting Brodal of Aarhus University
	Topics relevant to "EMPLOYABILITY SKILLS": The lab experiments and assessments enable the student to acquire Skill Development through Experiential Learning techniques

urse Code: CSE2264	Course Title: Essentials of Artificial Intelligence Type of Course: Program Core Course -Theory	-P-C	3			3
sion No.						
urse Pre-requisites	NIL					
i-requisites						
urse Description	This course introduces the student to the basics of artificial intelligence. In this course, the student first learns the various search methods for problem-solving, followed by knowledge-based logic representations. After that, the student will learn about uncertainty in AI, as well as approaches to solve such challenges such as Naïve Bayes Classifier and Hidden Markov Models. Topics: Uninformed search, Heuristic search, Local search, Adversarial search, Constraint satisfaction, logic, First Order Resolution, Probability, Naïve Bayes Classifier, and Hidden Markov Model (HMM).					
urse Objectives	The objective of the course is EMPLOYBILITY of student by using EXPERIENTIAL LEARNING techniques.					
urse OutComes	On successful completion of this course the students shall be able to: 5. Explain different methods of searching, proving, and analysis in AI [Understand] 6. Implement various graphical and adversarial search algorithms. [Apply] 7. Prove, by resolution, different situations using First Order Logic [Apply] 8. Solve sequence labeling problems using HMM [Apply]					

Course Content:

dule 1	rch Methods for Problem-Solving	blem-Solving Tests	TEL Assignments	No. of Sessions: 13
Introduction – History of AI, Agents and Environment, Types of AI and Learning. State Space Search; General Formulation of Search Problems; Data Structures used in Searching. **Uninformed Search Algorithms** – Breadth First Search, Depth First Search, Uniform Cost Search, Generalized Uniform Cost Search (a.k.a Dijkstra's Single-Source Shortest Path), Iterative Deepening Depth-First Search, Time and Space Complexity Analysis of Uninformed Search Algorithms. **Heuristic Search Algorithms** – Heuristics and Admissibility, Greedy Best-First Search, A* Search and weighted A* Search.				
dule 2	vanced Search Methods	blem-Solving Tests	TEL Assignments	No. of Sessions: 12
Local Search – Local Search, Hill Climbing, Genetic Algorithms, Gradient Descent. **Adversarial Search** – Minimax Search, Alpha-Beta Pruning, Ideal Ordering. **Constraint Satisfaction** – Constraint Satisfaction Problems Definitions and Examples – Map Colouring, N Queens, Cryptarithmetic, Generalized CSP; Back-tracking Heuristics; Arc Consistency and Path Consistency				
dule 3	owledge-Based Logic Representation	tomated Theorem Proving using FOL Resolution	TEL Assignments	No. of Sessions: 10
Propositional Logic – Syntax and Semantics of Propositional Logic. Logical connectives. Inference Rules. Conjunctive and Disjunctive Normal Forms. **First Order Logic** – Syntax and Semantics of Propositional Logic. Logical connectives. Inference Rules. Conjunctive and Disjunctive Normal Forms. **Resolution** – Resolution Principle. Propositional and First Order Resolution. Applications for solving story problems using Resolution				
dule 4	certainty in AI	presenting problems as HMM	TEL Assignments	No. of Sessions: 06

Probability – Probability Definitions. Conditional Probability. Bayes Theorem. Naïve Bayes Classifier. Using Naïve Bayes Classifier for Supervised Learning. **Hidden Markov Models** – Definition of HMM. Sequence Labeling and Markov Assumption. Sub-Problems in HMM and their solutions – Forward Probability and Viterbi Algorithm. Applications of Sequence Labeling in Natural Language Processing (Eg. Part-of-Speech Tagging). **Introduction to Deep Learning** – Artificial Neurons, Activation Functions, Multilayer Perceptron.

Targeted Application & Tools that can be used:

5. Implementation of a shortest-path finder using different search algorithms.
6. Implementation of a sequence labeler using Viterbi Algorithm.

ject work/Assignment: Mention the Type of Project /Assignment proposed for this course

2. Group project on one of the topics mentioned above (Eg. Adversarial search).

tbook(s):

4. Stuart Russel and Peter Norvig. *Artificial Intelligence: A Modern Approach*. 4th Edition. Pearson Education. 2022.
5. Lavika Goel. *Artificial Intelligence: Concepts and Applications*. 1st Edition. Wiley. 2021.
6. Elaine Rich, Kevin Knight and Shivashankar B Nair. *Artificial Intelligence*. 4th Edition. MedTech Science Press. 2024.

erences:

4. Deepak Khemani. *A First Course in Artificial Intelligence*. 1st Edition. 6th Reprint, 2018.
5. Munesh Chandra Trivedi. *A Classical Approach to Artificial Intelligence*. 2nd Edition. Khanna Publishers. 2018.
6. George Luger. *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*. 6th Edition. Pearson Education. 2021.

blinks

6. NPTEL Courses: Mausam (IIT Delhi), "An Introduction to Artificial Intelligence" Link: https://nptel.ac.in/courses/106102220.
7. Shyamanta M. Hazarika (IIT Guwahati), "Fundamentals of Artificial Intelligence". Link: https://nptel.ac.in/courses/112103280. Useful for the full course.
8. Deepak Khemani (IIT Madras), "Artificial Intelligence: Search Methods for Problem-Solving". Link: https://nptel.ac.in/courses/106106226. Useful for Module 1 and 2
9. Deepak Khemani (IIT Madras), "Artificial Intelligence: Knowledge Representation and Reasoning". Link: https://nptel.ac.in/courses/106106140. Useful for Module 3.
10. Deepak Khemani (IIT Madras), "AI: Constraint Satisfaction". Link: https://nptel.ac.in/courses/106106158. Useful for Module 2.

Catalogue prepared by	Dr. Sandeep Albert Mathias
Recommended by the Board of Studies on	BOS NO: SOCSE 2nd BOS held on 17/03/25
Date of Approval by the Academic Council	Academic Council Meeting No 21, Dated 17/03/25

urse Code: CSE2265	Course Title: Essentials of AI Lab pe of Course: Program Core Course - Lab	-P-C	0			1
rsion No.						
urse Pre-requisites	NIL					
i-requisites						
urse Description	This course introduces the student to the basics of artificial intelligence. In this course, the student first learns the various search methods for problem-solving, followed by knowledge-based logic representations. After that, the student will learn about uncertainty in AI, as well as approaches to solve such challenges such as Naïve Bayes Classifier and Hidden Markov Models. Topics: Uninformed search, Heuristic search, Local search, Adversarial search, Constraint satisfaction, logic, First Order Resolution, Probability, Naïve Bayes Classifier, and Hidden Markov Model (HMM).					
urse Objectives	The objective of the course is EMPLOYBILITY of student by using EXPERIENTIAL LEARNING techniques.					
urse OutComes	On successful completion of this course the students shall be able to: 5. Explain different methods of searching, proving, and analysis in AI [Understand] 6. Implement various graphical and adversarial search algorithms. [Apply] 7. Prove, by resolution, different situations using First Order Logic [Apply] 8. Solve sequence labeling problems using HMM [Apply]					

Course Content: **No. of Sessions: 15 (30 hours)**

Experiment No. 1: File Handling
Level 1: Read text files using Python
Level 2: Parse text files using Python

Experiment No. 2: Implementation of Graph Representations
Level 1: Implement graph representations by taking input from the console
Level 2: Implement graph representations by taking input from files.

Experiment No. 3 & 4: Implementation of Uninformed Search Algorithms
Level 1: Implement uninformed search algorithms – BFS and DFS – on unweighted graphs.
Level 2: Implement uninformed search algorithms – Uniform Cost Search and Dijkstra's SSSP – on weighted graphs

Experiment No. 5: Implementation of Heuristic Search Algorithms
Level 1: Calculate the upper-bounds of admissible heuristics using Dijkstra's SSSP.
Level 2: Implement Greedy Best-First Search and A* Search Algorithms.

Experiment No. 6 & 7: Implementation of Adversarial Search
Level 1: Implement a Game Tree
Level 2: Perform Alpha-Beta Pruning and Ideal Ordering

Experiment No. 8 & 9: Implementation of a CSP Solver
Level 1: Implement a CSP solver to solve a cryptarithmetic problem

Level 2: Implement a CSP solver for map colouring

Experiment No. 10: Using Python Packages for CSP
Level 1: Implement a CSP solver for Sudoku
Level 2: Implement a CSP solver for Addoku

Experiment No. 11: Implement a Family Tree Parser
Level 1: Perform logic programming using logpy.
Level 2: Implement a family tree parser

Experiment No. 12 & 13: Implement a Decision Maker
Level 1: Implement a Minesweeper solver
Level 2: Implement a Battleship solver

Experiment No. 14 & 15: Hidden Markov Model
Level 1: Implement a generic HMM
Level 2: Build a PoS Tagger using a HMM with the Brown Corpus and the Universal Dependencies Tagset.

Targeted Application & Tools that can be used:

7. Google Colab
8. Python IDEs like PyCharm

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

The course is a lab-based course with all the assessments centrally evaluated. Every experiment consists of **two sessions**. The first session involves exploring a solution to the problem. The second session involves solving a particular problem.

tbook(s):

3. Stuart Russel and Peter Norvig. *Artificial Intelligence: A Modern Approach*. 4th Edition. Pearson Education. 2022.
4. Prateek Joshi and Alberto Artasanchez. *Artificial Intelligence with Python*. 2nd Edition. Packt. 2020.

erences:

3. Deepak Khemani. *A First Course in Artificial Intelligence*. 1st Edition. 6th Reprint, 2018.
4. Munesh Chandra Trivedi. *A Classical Approach to Artificial Intelligence*. 2nd Edition. Khanna Publishers. 2018.

Catalogue prepared by	Dr. Sandeep Albert Mathias
Recommended by the Board of Studies on	BOS NO: SOCSE 2nd BOS held on 17/03/25
Date of Approval by the Academic Council	Academic Council Meeting No 21, Dated 17/03/25

Course Code: **CSE2266**	**Course Title:** Theory of Computation **Type of Course:** Theory Only		**L- T-P- C**	3	**0**	0	**3**
Version No.	2.0					
Course Pre-requisites						
Anti-requisites	**NIL**					
Course Description	The course deals with introduction of formal languages and the correspondence between language classes and the automata that recognize them. Topics include: Formal definitions of grammars and acceptors, Deterministic and Nondeterministic systems, Grammar ambiguity, finite state and push-down automata; normal forms; Turing machines and its relations with algorithms.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Theory of Computation as mentioned above and attain Skill Development through Problem Solving Methodologies.					
Course Outcomes	On successful completion of the course the students shall be able to: 1. Describe various components of Automata. (Knowledge) 2. Illustrate Finite Automata for the given Language. (Application) 3. Distinguish between Regular grammar and Context free grammar. (Comprehension) 4. Construct Push down Automata. (Application) 5. Construct Turing machine for a Language. (Application)					
Course Content:						
Module 1	Introduction to automata theory	Assignment	Problems on Strings and Language operations	**6 classes**		
Topics: Introduction to Automata Theory, Applications of Automata Theory, Alphabets, Strings, Languages & operations on languages, Representation of automata, Language recognizers, Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs						
Module 2	Finite Automata	Assignment	Assignment Problems on DFA, NFA's	13 Sessions		

Topics:

Basic concepts of Finite automata, DFA- definitions of DFA, Deterministic Accepters Transition Graphs and Languages

and DFA's, Regular Languages, NFA- Definition of a Nondeterministic Accepter, Languages and NFA's Why Non- determinism? Equivalence of Deterministic and Nondeterministic Finite Accepters, Reduction of the Number of States in Finite Automata.

Module 3	Regular Expressions & Context Free Grammar	Assignment	Problems on RE, CFG, PT, PL and Ambiguity	12 Sessions

Topics:

Formal Definition of a Regular Expression, Languages Associated with Regular Expressions, Languages, Regular Languages (RL) and Non-regular Languages: Closure properties of RLs, to show some languages are not RLs, Closure Properties of Regular Context Free Grammars-Examples of Context-Free Languages, Leftmost and Rightmost Derivations, Derivation Trees, Relation Between Sentential Forms and Derivation Trees, Ambiguity in Grammars and Languages: Ambiguous Grammars, Removing Ambiguity, Chomsky Normal Form, Gribiche Normal Form.

Module 4	Push down Automata	Assignment	Problems on pushdown Automaton	08 Sessions

Topics:

Definition of a Pushdown Automaton, Language Accepted by a Pushdown Automaton, Acceptance by Final State, Acceptance by Empty Stack, From Empty Stack to Final State, From Final State to Empty Stack Equivalence of PDA's and CFG's: From Grammars to Pushdown Automata.

Module 5	Turing Machine	Assignment	Problems on Turning Machine	07 Sessions

Topics:

Definition of a Turing Machine, Turing Machines as Language Accepters, Example Languages to construct Turing

machine, Turing Machines as Transducers, Halting Programming Techniques for Turing Machines

Targeted Application & Tools that can be used:

Targeted Application:

1. Text Processing

2. Compilers

3. Text Editors

4. Robotics Applications

5. Artificial Intelligence

Tools:

1. JFLAP (Java Formal Language and Automata Package) Software simulation tool. It's interactive educational

software written in Java to experiment topics in automata theory.

2. Turing machine Online simulators.

Text Book(s):

1. Peter Linz, "An introduction to Formal Languages and Automata", Jones and Bartlett Publications 6th Ed, 2018.

Reference(s):

1. Aho, Ullman and Hopcroft, "Theory of Computation", Pearson India 3rd Edition 2008.

2. Michael Sipser, "Theory of Computation", Cengage India 3rd Ed, 2014.

E-Resources

NPTEL course – https://onlinecourses.nptel.ac.in/noc21_cs83/preview

Course Code: **CSE502**	**Course Title:** Cryptography and Network Security **Type of Course:** Theory - PCC		**L- T-P- C**	3	**0**	0	**3**
Version No.	2.0					
Course Pre-requisites						
Anti-requisites	**NIL**					
Course Description	The Course deals with the principles and practice of cryptography and network security, focusing in particular on the security aspects of the web and Internet					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cryptography and Network Security above and attain Skill Development through Problem Solving methodologies.					
Course Outcomes	On successful completion of this course the students shall be able to: 1. Describe the basic concept of Cryptography 2. Classify different types of Cryptographic Algorithms 3. Solve Mathematical problems required for Cryptography 4. Illustrate Network Security concepts					
Course Content:						
Module 1	Introduction to Cryptography	Assignment	Recognize the techniques	**7 Sessions**		
Introduction to Cryptography, Model of Network Security, OSI Security architecture, Security Attacks: active attacks, passive attacks, services: Authentication, Access Control, Data Confidentiality, Data Integrity, Nonrepudiation, Substitution Ciphers : Play-fair and Hill Cipher, Vigenere cipher, Introduction to Block Cipher and Stream Cipher, Feistel Structure, ECB modes of block cipher.						
Module 2	Symmetric Encryption Algorithm	Assignment	Analysis of solutions	9 Sessions		

Overview of Public Key Cryptography, RSA, Diffie-Helman Key exchange, Man in the middle attack, Cryptographic Hash functions, Secure Hash Algorithm, Message Authentication Codes – HMAC, Digital Signature, Ei-gamal Encryption, Elliptic curve cryptography overview.

Module 3	Public Key Cryptography	Assignments	Analysis of solutions	9 Sessions

Overview of Public Key Cryptography, RSA, Diffie-Helman Key exchange, Man in the middle attack, Cryptographic Hash functions, Secure Hash Algorithm, Message Authentication Codes – HMAC, Digital Signature, Ei-gamal Encryption, Elliptic curve cryptography overview

Module 4	Network Security	Assignment	Analysis of solutions	05 Sessions

Topics:

Network Security fundamentals, Network Security applications: Authentication: Kerberos, PKI, Network Security applications: e-mail security: PGP, MIME, Network Security applications: IP Security: IPSec architecture, Network Security applications: DNS Security.

Targeted Application & Tools that can be used:

Students get the knowledge about cryptography techniques followed, the algorithms used for encryption and decryptions & the techniques for authentication and confidentiality of messages.

Text Book(s):

T1 William Stallings, "Cryptography and Network Security - Principles and Practices", 7th Edition, Pearson publication, ISBN: 978-93-325-8522-5, 2017

Reference(s):

R1 Bruice Schneier, “Applied Cryptography – Protocols, Algorithms and Source code in C”, Second Edition, Wiley

Publication, ISBN: 978-81-265-1368-0, 2017

R2 Cryptography and Network Security, Express Learning, ITL Education Solution Limited.

R3 e-pg pathshala UGC lecture series

Web references:
https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2233842&site=ehost-live

https://nptel.ac.in/courses/106105031.

Topics relevant to “Skill Development”: Topics relevant to “Skill Development”:

1. Play-fair and Hill Cipher

2. Euclidean and Extended Euclidean Algorithm

3. Secure Hash Algorithm

4. Diffie-Helman Key exchange

5. Totient Function.

6. Fermat’s little theorem

urse Code: CSE2267	**Course Title: Machine Learning Techniques** **Type of Course: Program Core -Theory**	-P-C	3			3
rsion No.						
urse Pre-requisites	NIL					
ti-requisites						
urse Description	Machine Learning algorithms are the key to developing intelligent systems such as Apple's Siri, Google's self-driving cars, and more. This course introduces the core concepts and essential algorithms of various machine learning techniques, including Regression learning, Bayesian learning, Ensemble learning, Perceptron learning (foundations of Neural Networks), Unsupervised learning, Competitive learning, learning from Gaussian Mixture Models, and learning to detect outliers. The course lectures cover both the theoretical foundations and practical algorithms for these learning methods. Lab sessions complement the lectures, enabling students to develop intelligent systems for real-life problems using Python libraries.					
urse Objectives	The primary objective of this course is to enhance the **EMPLOYABILITY** of students by leveraging **EXPERIENTIAL LEARNING** techniques. Students will gain practical skills in applying machine learning to real-world challenges.					
urse OutComes	On successful completion of this course the students shall be able to: 9. **Apply** advanced supervised machine learning methods for predictive modeling. [APPLY] 10. **Produce** machine learning models with better predictive performance using meta-learning (ensemble) algorithms. [APPLY] 11. **Create** predictive models using Perceptron learning algorithms, understanding their foundational role in neural networks. [APPLY] 12. **Employ** advanced unsupervised learning algorithms for clustering, competitive learning, and outlier detection. [APPLY] 13. **Implement** machine learning-based intelligent models using Python libraries and frameworks. [APPLY]					

Course Content:

dule 1	pervised Learning	signment	dule Tests	**No. of Sessions: 12**
Overview of Machine Learning (ML): ML workflow, types of ML (supervised, unsupervised, reinforcement), types of features, Feature Engineering (Data Imputation Methods). Regression: Introduction, Simple Linear Regression, Loss Functions (MSE, MAE, RMSE), Polynomial Regression, Logistic Regression, Softmax Regression with Cross-Entropy as cost function. Bayesian Learning: Bayes Theorem, estimating conditional probabilities for categorical and continuous features, Naïve Bayes for supervised learning, Bayesian Belief Networks. Support Vector Machines (SVM): Soft margin and kernel tricks (Polynomial, RBF, Sigmoid). Evaluation Methodologies: Testing Dataset, Train-Validation-Testing split, N-Fold Cross Validation (K-Fold, Stratified K-Fold)..				
dule 2	semble Learning	signment	dule Tests	**No. of Sessions: 11**
Introduction to Ensemble Learning: Motivation, bias-variance trade-off. Bagging: Using subsets of instances (Bagging, Pasting), using subsets of features (Random Patches, Random Subspaces method). Ensemble Methods: Voting Classifier (Hard and Soft Voting), Random Forest (Algorithm, Feature Importance). Boosting: AdaBoost (Adaptive Boosting), Gradient Boosting Machines (GBM), Extremely Randomized Trees, Stacking (Meta-Learning).				
dule 3	rceptron Learning &	signment	dule Tests	**No. of**

	Neural Networks Foundation			**Sessions: 11**

From Biological to Artificial Neurons: Basic structure of a neuron. Perceptrons: Single-layer Perceptrons, Linear Threshold Units, logical computations with Perceptrons (AND, OR, NOT). Activation Functions: Common activation functions (Sigmoid, Tanh, ReLU, Leaky ReLU, ELU, Softmax) and their properties. Loss Functions: Common loss functions for classification (Binary Cross-Entropy, Categorical Cross-Entropy) and regression (MSE, MAE). Multi-layer Perceptrons (MLP): Architecture, advantages over single Perceptrons. Backpropagation Algorithm: Understanding the concept of backpropagation, Gradient Descent and its variants (Stochastic Gradient Descent, Mini-batch Gradient Descent, Adam, RMSprop).

dule 4	**supervised Learning & Advanced Topics**	**ignment**	**dule Tests**	**No. of Sessions: 11**

Clustering: Simple K-Means Clustering (Algorithm, Simple and Mini-Batch), updating centroids incrementally. K-Means Enhancements: Finding the optimal number of clusters (Elbow Method, Silhouette Coefficient), drawbacks of K-Means, K-Means++. Hierarchical Clustering: Divisive hierarchical clustering (Bisecting K-Means), clustering using Minimum Spanning Tree (MST). Competitive Learning: Clustering using Kohonen's Self-Organizing Maps (SOM). Density-Based Clustering: DBSCAN (Density-Based Spatial Clustering of Applications with Noise). Probabilistic Clustering: Clustering using Gaussian Mixture Models (GMM) with Expectation-Maximization (EM) algorithm. Outlier Detection Methods: Isolation Forest, Local Outlier Factor (LOF). Association Rule Mining: Introduction, Apriori Algorithm (concepts only). Collaborative Filtering: Introduction (User-based, Item-based).

Targeted Application & Tools that can be used:

9. Google Colab
10. Python IDEs like PyCharm

aching Methodology

1. **Lectures:** Interactive lectures covering theoretical foundations and algorithmic details.
2. **Lab Sessions:** Hands-on sessions focusing on implementing algorithms using Python libraries (e.g., scikit-learn, NumPy, Pandas, Matplotlib, Seaborn, Keras/TensorFlow for Perceptron).
3. **Problem-Based Learning:** Real-world case studies and problems will be discussed and solved in labs.
4. **Experiential Learning:** Emphasis on practical application through assignments, mini-projects, and a final course project.
5. **Discussions:** Encouraging critical thinking and peer learning through in-class discussions.

ject work/Assignment:

3. Students can be assigned a mini project to develop a machine learning application for real-life problems in various domains such as health care, business intelligence, environmental modeling, etc.

xtbook(s):

T1. Aurélien Géron. *Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow*, Oreilly, 3rd Edition, 2022.

ferences:

R1. Raschka, S., Liu, Y., & Mirjalili, V. (2022). Machine Learning with PyTorch and Scikit-Learn: Develop machine learning and deep learning models with Python. Packt Publishing Ltd.
R2. Alpaydin, E. (2021). Machine Learning, revised and updated edition. MIT Press.
R3. Deisenroth, M. P., Faisal, A. A., & Ong, C. S. (2020). Mathematics for machine learning. Cambridge University Press.
R4. Andreas C Muller, and Sarah Guido. *Introduction to Machine Learning with Python: A Guide for Data Scientists*, O'Reilly, 1st Edition, 2016.

eblinks

W1. W1. NPTEL Courses: https://nptel.ac.in/courses/106106139 (IIT M), https://nptel.ac.in/courses/106105152 (IIT Kgp)
W2. Scikit-learn documentation: https://scikit-learn.org/stable/
W3. TensorFlow documentation: https://www.tensorflow.org/
W4. Keras documentation: https://keras.io/
W5. Pandas documentation: https://pandas.pydata.org/

W6. NumPy documentation: https://numpy.org/
W7. Kaggle: For datasets and competitions.

urse Code: CSE2268	Course Title: Machine Learning Techniques Lab pe of Course: Program Core -Laboratory	-P-C	0			1
sion No.						
urse Pre-requisites	CSE1500 – Computational Thinking with Python CSE3157 – Artificial Intelligence and Machine Learning					
i-requisites						
urse Description	Machine Learning algorithms are the key to develop intelligent systems such as Apple's Siri, Google's self-driving cars etc. This course introduces the concepts of the core machine learning techniques such as Regression learning, Bayesian learning, Ensemble learning, Perceptron learning, Unsupervised learning, Competitive learning, learning from Gaussian mixture models and learning to detect outliers. Course lectures covers both the theoretical foundations as well as the essential algorithms for the various learning methods. Lab sessions complement the lectures and enable the students in developing intelligent systems for real life problems.					
urse Objectives	The objective of the course is EMPLOYBILITY of student by using EXPERIENTIAL LEARNING techniques.					
urse OutComes	On successful completion of this course the students shall be able to: 1. **Apply** advanced supervised machine learning methods for predictive modeling. [Apply] 2. **Produce** machine learning models with better predictive performance using meta learning algorithms [Apply] 3. **Create** predictive models using Perceptron learning algorithms [Apply] 4. **Employ** advanced unsupervised learning algorithms for clustering, competitive learning and outlier detection [Apply] 5. **Implement** machine learning based intelligent models using Python libraries. [Apply]					

Course Content: No. of Sessions: 15 (30 hours)

Experiment No. 1: File Handling Using Python
Level 1: Read a CSV file using Python
Level 2: Read a text file using Python

Experiment No. 2: Methods for handling missing values
Level 1: Given a data set from UCI repository, implement the different ways of handling missing values in it using Scikit-learn library of Python
Level 2: Implement one of these methods using a custom defined function in Python.

Experiment No. 3: Data Visualization
Level 1: Perform Exploratory Data Analysis for a given data set by creating Scatter Plot, Pair Plot, Count Plot using Matplotlib and Seaborn
Level 2: Create Heat Maps, WordCloud

Experiment No. 4: Regression learning
Level 1: Given a data set from UCI repository, implement the simple linear regression algorithm and estimate the models parameters and the performance metrics. Plot the learning curves.
Level 2: Implement the polynomial regression algorithm. Compare the learning curves of Polynomial and

Linear Regression.

Experiment No. 5: Logistic Regression
Level 1: Write custom code for generating the logistic/sigmoid plot for a given input
Level 2: Given a data set from UCI repository, implement the Logistic regression algorithm. Estimate the class probabilities for a given test data set. Plot and analyze the decision boundaries.

Experiment No. 6: Bayesian Learning
Level 1: Given a data set from UCI repository, implement a classification model using the Bayesian algorithm.
Level 2: Implement a Naïve Bayes classifier using 5-fold cross-validation

Experiment No. 7: Support Vector Machine (SVM)
Level 1: Given data sets from UCI repository, implement a linear SVM and a non-linear SVM based classification model.
Level 2: Construct kernels with 5-fold cross-validation for SVM.

Experiment No. 8 & 9: Ensemble Learning
Level 1: Implement Ensemble Learning algorithms such as Bagging, Pasting and Out-of Bag Evaluation
Level 2: Random Patches and Random Subspace Method, Adaboost and Gradient Boosting, Stacking.

Experiment No. 10: Perceptron Learning
Level 1: Implement the Perceptron Classifier
Level 2: An Image Classifier Using the Sequential API of Keras

Experiment No. 11 & 12: Unsupervised Learning
Level 1: K-means – simple and mini-batch. Finding the optimal number of clusters using Elbow method and Silhoutte Coefficient . Compare the inertia of both as k increases. Tuning the hyperparameter 'k' using GridSearchCV.
Level 2: Using clustering for Image segmentation and Preprocessing. Kmeans++

Experiment No. 13: Density Based Clustering
Level 1: Implement DBSCAN – clustering using the local density estimation. Perform hard and soft clustering for new instances.
Level 2: Outlier Detection using Isolation Forest and Local Outlier Factor

Experiment No. 14: Association Rule Mining
Level 1: Implement the Apriori Algorithm for Association Rule Mining
Level 2: Implement the Dynamic Itemset Counting Algorithm for Association Rule Mining.

Experiment No. 15: Collaborative Filtering
Level 1: Implement Collaborative Filtering using Item-Based Filtering
Level 2: Implement Collaborative Filtering using User-Based Filtering

Targeted Application & Tools that can be used:

11. Google Colab
12. Python IDEs like PyCharm

ject work/Assignment: Mention the Type of Project /Assignment proposed for this course

Students can be assigned a mini project to develop a machine learning application for real-life problems in various domains such as health care, business intelligence, environmental modeling, etc.

tbook(s):

5. Aurélien Géron. *Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow*, Oreilly, 3rd Edition, 2022.

erences:

R1. Andreas C Muller, and Sarah Guido. *Introduction to Machine Learning with Python: A Guide for Data Scientists*, O'Reilly, 1st Edition, 2016.

eblinks

W1. NPTEL Courses: https://nptel.ac.in/courses/106106139 (IIT M), https://nptel.ac.in/courses/106105152 (IIT Kgp)

Course Code: CSE2269	**Course Title: Operating Systems** **Type of Course: Program Core and Theory Only**		**L-T- P- C**	3	0	0	3
Version No.	1.0						
Course Pre-requisites	Nil						
Anti-requisites	**NIL**						
Course Description	This course introduces the concepts of operating system operations, operating system structure and its design and implementation. It covers the classical operating systems internal algorithms such as process scheduling, synchronization, deadlocks detection and recovery and memory management. The course also enhances the problem solving, systems programming ability and case studies.						
Course Object	The objective of the course is to familiarize the learners with the concepts of Operating Systems and attain **Employability** through **Problem Solving** Methodologies.						
Course Out Comes	On successful completion of the course the students shall be able to: 1] Describe the fundamental concepts of operating Systems and case studies. [**Knowledge**] 2] Demonstrate various CPU scheduling algorithms. .[**Application**] 3] Apply various tools to handle synchronization problems.[**Application**] 4] Demonstrate deadlock detection and recovery methods **[Application]** 5] Illustrate various memory management techniques.[**Application**]						
Course Content:							
Module 1	Introduction to Operating System	Assignment	Programming	**9 Hours**			
Topics: Introduction to OS , Operating-System Operations, Operating System Services, , System Calls and its types, Operating System Structure, System Program and its types, Linkers and Loaders, Overview of OS design and implementation, Open-source operating system							
Module 2	Process Management	Assignment/Case Study	Programming/Simulation	**11 Hours**			
Topics: Process Concept, Operations on Processes, Inter Process Communication, Communication in client-server systems (sockets, RPC, Pipes), Introduction to threads - Multithreading Models, Thread Libraries, Threading Issues, Process Scheduling– Basic concepts, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, SRTF, RR and Priority.							
Module 3	Process Synchronization and Deadlocks	Assignment	Programming	**11 Hours**			
Topics: The Critical-Section Problem- Peterson's Solution, Synchronization hardware, Semaphores, Classic Problems of Synchronization with Semaphore Solution- Producer-Consumer Problem, Reader-Writer problems, Dining Philosopher's Problem, . Introduction to Deadlocks, Necessary conditions for deadlock, Resource allocation Graph, Methods for handling deadlock: Deadlock Prevention and Implementation, Deadlock Avoidance and Implementation, Deadlock detection & Recovery from Deadlock.							
Module 4	Memory Management	Assignment	Programming/Simulation	**10 Hours**			

Topics:
Introduction to Memory Management, Basic hardware-Base and Limit Registers, Memory Management Unit(MMU), Dynamic loading and linking, Swapping, Contiguous and Non-Contiguous Memory Allocation, Segmentation, Paging - Structure of the Page Table – Virtual Memory and Demand Paging – Page Faults and Page Replacement Algorithms, Copy-on-write, Allocation of Frames, Thrashing
Introduction to File system management: File System Interface (access methods, directory structures), File system implementation.

Targeted Application:
Application area is traffic management system, banking system, health care and many more systems where in there are resources and entities that use and manage the resources.

Software Tools:

Oracle Virtual Box/VMWare Virtualization software [Virtual Machine Managers]. Used to install and work on multiple guest Operating Systems on top of a host OS.

Intel Processor identification utility: This software is used to explain about multi-core processors. It helps to identify the specifications of your Intel processor, like no of cores, Chipset information, technologies supported by the processor etc.

Project work/Assignment

Demonstrate process concepts in LINUX OS.
Simulation of CPU scheduling algorithms.
Develop program to demonstrate use of Semaphores in threads.
Develop program to demonstrate use of deadlock avoidance algorithms.
Develop program to demonstrate use of page replacement algorithms.
Simulation of memory allocation strategies [first fit, best fit and worst fit].

Text Book

Silberschatz A, Galvin P B and Gagne G , “Silberschatz's Operating System Concepts”, Paperback, Global Edition Wiley, 2019

References

Silberschatz A, Galvin P B and Gagne G, “Operating System Concepts”, 10th edition Wiley, 2018.
William Stallings, “Operating Systems”,Ninth Edition, By Pearson Paperback ,1 March 2018.
Sundaram RMD, Shriram K V, Abhishek S N, B Chella Prabha, “ Cracking the Operating System skills”, Dreamtech, paperback, 2020
Remzi H. Arpaci-Dusseau Andrea C. Arpaci-dusseau , “Operating Systems: Three Easy Pieces, Amazon digital Services”, September 2018.

E-resources/Weblinks

https://www.os-book.com/OS9/
https://pages.cs.wisc.edu/~remzi/OSTEP/
https://codex.cs.yale.edu/avi/os-book/OS10/index.html

Course Code: CSE2270	**Course Title: Operating Systems Lab** **Type of Course: Lab Only**	**L-T- P- C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites	Nil					
Anti-requisites	**NIL**					
Course Description	This laboratory course provides hands-on experience with the core concepts of operating systems through practical assignments, simulations, and case studies. It covers foundational aspects such as system calls, process and thread management, inter-process communication, synchronization, deadlocks, memory management, and file systems. Students will implement and simulate real-time OS components and scheduling algorithms, fostering deeper understanding of OS architecture and design. The lab also introduces modern OS tools, programming interfaces, and the basics of open-source OS environments.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Operating Systems and attain **Employability** through **Problem Solving** Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Demonstrate system-level programming using system calls and OS structures. [**Apply**] 2] Simulate process scheduling and multithreading techniques. [**Apply**] 3] Apply various tools to handle synchronization problems using semaphores and shared memory. [**Apply**] 4] Demonstrate memory management and file system concepts using simulation or scripting. **[Apply]**					
Course Content:						

Targeted Application:
Application area is traffic management system, banking system, health care and many more systems where in there are resources and entities that use and manage the resources.

Software Tools:

Oracle Virtual Box/VMWare Virtualization software [Virtual Machine Managers]. Used to install and work on multiple guest Operating Systems on top of a host OS.

Intel Processor identification utility: This software is used to explain about multi-core processors. It helps to identify the specifications of your Intel processor, like no of cores, Chipset information, technologies supported by the processor etc.

of Laboratory Tasks:

sheet -1

L1: Write a program to demonstrate the use of fork() and exec() system calls in process creation.

L2: A system has limited memory and high-priority real-time processes. Design a scheduling algorithm that ensures responsiveness while preventing starvation.

sheet -2

L1: Implement First-Come-First-Serve (FCFS) process scheduling using C or Python.

L2: You are designing a server that handles thousands of client connections. Compare multithreading and multiprocessing for this task and implement a basic server model.

sheet -3

L1: Implement Round Robin Scheduling with a fixed time quantum.

L2: In a banking system, concurrent access to accounts leads to data corruption. Design a synchronization solution to avoid race conditions.

sheet -4

L1: Write a program to create threads using Pthreads or Python's threading module.

L2: You're tasked with building a file access tracker in an OS. Implement a system to log file access patterns and identify frequent accesses.

sheet -5

L1: Demonstrate inter-process communication (IPC) using pipes.

L2: A simulation tool needs to emulate process suspension and resumption. Design and implement such a mechanism using signals or condition variables.

sheet -6

L1: Simulate the Producer-Consumer problem using semaphores.

L2: You're developing a system where sensor devices (producers) generate temperature readings, and data processors (consumers) store and process these readings. To prevent race conditions and ensure buffer safety, implement a synchronization mechanism using semaphores.

sheet -7

L1: Implement Dining Philosophers Problem using threads and synchronization.

L2: In a multi-threaded cafeteria simulation, five philosophers sit around a circular table, each alternating between thinking and eating. To eat, a philosopher must hold two forks (represented by shared resources). Your task is to avoid deadlock and ensure no philosopher starves using thread synchronization techniques.

sheet -8

L1: Write a program to simulate First Fit, Best Fit, and Worst Fit memory allocation strategies.

L2: A system with limited memory blocks needs to allocate memory to processes arriving with various size requests. Your task is to implement three classic memory allocation strategies—First Fit, Best Fit, and Worst Fit—to allocate memory to each process efficiently. Simulate and compare how memory gets allocated in each strateg

sheet -9

L1: Demonstrate paging using a simple page table simulation.

L2: A program has a logical address space divided into pages. The system's memory is divided into equal-sized frames. When a program executes, its pages are loaded into available frames in main memory. Simulate the address translation process using a page table and demonstrate how a logical address is converted to a physical address.

sheet -10

L1: Write a program to simulate page replacement algorithms like FIFO and LRU.

L2: In a virtual memory system, a process accesses pages in a specific order. The memory can only hold a limited number of pages (frames). When a page is needed and the memory is full, a page replacement algorithm is used to decide which page to evict. Simulate and compare FIFO and LRU algorithms for a given page reference string.

sheet -11

L1: Simulate file directory structure (single level/two level).

L2: A university campus computer lab has limited memory space available for each student login session. When students open files or run programs, memory pages are loaded into available memory frames. Due to the limited number of frames, some pages must be replaced when new ones are needed. The lab system uses page replacement algorithms to decide which pages to evict when memory is full..

sheet -12

L1: Write a shell script to demonstrate file handling commands in Linux.

L2: Design a command-line mini shell that can run background and foreground processes and handle basic built-in commands like cd, pwd, exit.

Project work/Assignment

Demonstrate process concepts in LINUX OS.
Simulation of CPU scheduling algorithms.
Develop program to demonstrate use of Semaphores in threads.
Develop program to demonstrate use of deadlock avoidance algorithms.
Develop program to demonstrate use of page replacement algorithms.
Simulation of memory allocation strategies [first fit, best fit and worst fit].

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William Stallings, “Operating Systems”,Ninth Edition, By Pearson Paperback ,1 March 2018.

Sundaram RMD, Shriram K V, Abhishek S N, B Chella Prabha, “ Cracking the Operating System skills”, Dreamtech, paperback, 2020

Remzi H. Arpaci-Dusseau Andrea C. Arpaci-dusseau , “Operating Systems: Three Easy Pieces, Amazon digital Services”, September 2018.

E-resources/Weblinks

https://www.os-book.com/OS9/
https://pages.cs.wisc.edu/~remzi/OSTEP/
https://codex.cs.yale.edu/avi/os-book/OS10/index.html

Course Code: **CSE2505**	**Course Title:** Scalable Application Development using Java **Type of Course:** Lab	**L- T-P- C**	0	**0**	4	**2**
Version No.	2.0					
Course Prerequisites	Basic Java Programming Knowledge, Java framework, understanding of databases and fundamentals of web development, basics of multithreading and concurrency.					
Anti-requisites	**NIL**					
Course Description	This course provides a hands-on, practical approach to building scalable, high-performance applications using Java and related technologies. This course is designed to complement theoretical concepts by offering real-world lab exercises focused on the development of microservices architectures, cloud-native applications, and distributed systems. In this lab-intensive course, students will work on building and deploying scalable applications using Spring Boot, Spring Cloud, Docker, Kubernetes, and Apache Kafka. Students will gain experience in implementing RESTful APIs, asynchronous messaging, data caching, and load balancing to ensure that applications can handle increased traffic and scale efficiently. The course will also cover essential techniques for optimizing performance, including JVM tuning, database optimization, and memory management.					
Course Objective	The primary objectives of the course are to Develop hands-on expertise in building scalable applications using Java and modern frameworks like Spring Boot, Spring Cloud, and Apache Kafka, Implement microservices architectures that enable applications to handle increasing loads efficiently through distributed systems and cloud-native practices, Gain practical experience in optimizing performance by leveraging tools for JVM tuning, database optimization, and memory management to improve application responsiveness and scalability., Work with containerization technologies such as Docker and Kubernetes to deploy Java applications in cloud environments with automated continuous integration/continuous deployment (CI/CD) pipelines, Master service discovery, load balancing, and caching mechanisms to ensure high availability, fault tolerance, and low-latency operations in production-grade applications and Apply					

	event-driven architectures to build scalable and resilient systems using tools like Apache Kafka for real-time data processing and messaging.			
Course Outcomes	On successful completion of the course the students shall be able to: 1. Implement Performance Optimization Techniques 2. Design and Build Scalable Microservices 3. Integrate Event-Driven Architectures and Caching. 4. Deploy and Scale Applications in Cloud Environments.			
Course Content:				
Module 1	Foundations of Scalable Java Applications	Assignment	Implementation	**10 Sessions**

Lab Assignment 1: Setting Up Development Environment

Objective: Set up the Java development environment and configure a Spring Boot project for scalability testing.
Tasks:

- Install **Java 17**, **Maven**, and **IDE** (IntelliJ or Eclipse).
- Set up a basic **Spring Boot project** using **Spring Initializr** with **RESTful endpoints**.
- Verify application functionality by running a **local server** and testing API responses via **Postman** or **curl**.
- Add a basic **Spring Boot Actuator** to monitor application health and performance.
  Deliverables:
- Working **Spring Boot application** with basic endpoints.
- Screenshots of successful tests (Postman or curl).

Lab Assignment 2: Performance Optimization with JVM

Objective: Profile and optimize a Java application for better performance.
Tasks:

- Implement a **simple Java application** that performs a memory-intensive task (e.g., sorting a large dataset).
- Use **VisualVM** to monitor **JVM memory usage, CPU usage, and garbage collection**.
- Optimize the application by adjusting **JVM flags** (e.g., **heap size**, **garbage collection strategy**).
- Measure the impact of optimizations on **execution time and memory usage**.
  Deliverables:
- Profiled and optimized **Java application** with performance comparison charts.

- Detailed report on **JVM tuning** and optimization strategies.

Lab Assignment 3: Implementing Multi-threading

Objective: Understand Java's concurrency model and implement multi-threading for parallel tasks.
Tasks:

- Implement a **multi-threaded Java application** that simulates multiple tasks (e.g., processing large files, image processing).
- Use the **Executor framework** to manage thread pools.
- Measure the **execution time** and compare the performance of **single-threaded** vs **multi-threaded** approaches.
  Deliverables:
- Source code for **multi-threaded application** with explanations of thread management.
- Execution time comparison chart.

Module 2	Scalable Architectures and Microservices	Assignment	Implementation	10 Sessions

Lab Assignment 4: Building a Simple Microservice with Spring Boot

Objective: Develop a **basic microservice** with Spring Boot.
Tasks:

- Create a **Spring Boot microservice** that provides a RESTful API (e.g., a book or customer service).
- Implement **basic CRUD operations** (Create, Read, Update, Delete).
- Use **Spring Data JPA** to interact with an **SQL database** (e.g., MySQL).
- Write unit tests using **JUnit** for API endpoints.
  Deliverables:
- Working **Spring Boot microservice** with API documentation.
- Source code with unit tests.

Lab Assignment 5: Implementing Service Discovery & Load Balancing

Objective: Enable **service discovery** and **load balancing** using **Spring Cloud Eureka**.
Tasks:

- Set up a **Spring Cloud Eureka server** for service discovery.
- Create two **Spring Boot microservices** that register with the Eureka server.
- Implement **load balancing** with **Spring Cloud Ribbon** by making API calls to different instances of the microservices.

- Test and verify load balancing behavior using **Postman** or **curl**.
  Deliverables:
- Spring Cloud **Eureka server** and two **microservices**.
- Load balancing validation and test results.

Lab Assignment 6: Building an Event-Driven System with Kafka

Objective: Implement an **event-driven architecture** using **Apache Kafka** for inter-service communication.
Tasks:

- Set up **Apache Kafka** locally or in Docker.
- Create two Spring Boot applications: one as a **Kafka producer** and the other as a **consumer**.
- Implement asynchronous message communication where the producer sends messages (e.g., order events) and the consumer processes them.
- Add error handling and retry logic using **Spring Kafka**.
  Deliverables:
- Kafka producer and consumer applications with **message processing logic**.
- Screenshots or logs showing messages being passed from producer to consumer.

Module 3	Scalable Data Management and Caching	Mini - Project	Implementation	10 Sessions

Lab Assignment 7: Integrating SQL and NoSQL Databases

Objective: Learn to integrate **relational (SQL)** and **non-relational (NoSQL)** databases with Spring Boot applications.
Tasks:

- Integrate a **MySQL** database into a **Spring Boot microservice** and implement CRUD operations.
- Set up a **MongoDB** instance (locally or via Docker) and create a second microservice using **Spring Data MongoDB**.
- Compare the performance and scalability aspects of both databases.
  Deliverables:
- Source code for Spring Boot microservices using **MySQL** and **MongoDB**.
- Database performance comparison with benchmarks.

Lab Assignment 8: Implementing Redis Caching

Objective: Improve application performance using **Redis** as an in-memory cache.
Tasks:

1. Integrate **Redis** with your Spring Boot application.

2. Cache frequently accessed data (e.g., product information, user profiles) in Redis.
3. Implement **cache expiration** and **cache invalidation** strategies.
4. Measure the performance improvement by comparing **cache hits vs. misses**.
   Deliverables:
5. Redis-integrated Spring Boot application with caching logic.
6. Performance comparison between cached and non-cached operations.

Lab Assignment 9: Data Streaming with Kafka

Objective: Implement a **data streaming pipeline** with Kafka for real-time data processing.
Tasks:

- Build a **data pipeline** where **Kafka producers** stream events (e.g., logs, transactions) to **Kafka brokers**.
- Use **Kafka consumers** to process these events in real-time (e.g., updating a database or triggering a workflow).
- Implement **Kafka Streams** to process data within the Kafka ecosystem.
  Deliverables:
- Kafka producer-consumer setup with real-time data flow.

Module 4	Cloud Deployment and DevOps for Scalability	Quiz	Implementation	10 Sessions

Lab Assignment 10: Dockerizing a Spring Boot Application

Objective: Containerize a Spring Boot application using **Docker** for scalability.
Tasks:

- Write a **Dockerfile** for your Spring Boot application.
- Build a **Docker image** and run the application in a Docker container.
- Test the application running in the container and compare performance to local deployment.
  Deliverables:
- Dockerized **Spring Boot application** with a functional test.
- Docker image and run command documentation.

Lab Assignment 11: Deploying with Kubernetes

Objective: Deploy a Spring Boot microservice to a **Kubernetes cluster** for horizontal scaling.
Tasks:

- Deploy the **Dockerized Spring Boot application** to a **Kubernetes cluster** (local Minikube or cloud-based).
- Set up **Kubernetes Pods, Services, and Deployments** to scale the microservice.

- Implement **auto-scaling** based on CPU or memory usage.
  Deliverables:
- Kubernetes **deployment YAML files** for Spring Boot application.
- Running Kubernetes cluster with auto-scaling behavior.

Lab Assignment 12: Setting Up CI/CD for Scalable Applications

Objective: Automate the deployment process using **CI/CD pipelines**.
Tasks:

- Set up a **Jenkins** or **GitHub Actions** CI/CD pipeline to automate the build, test, and deployment process.
- Implement **continuous deployment** (CD) for deploying a **Dockerized microservice** to a Kubernetes cluster.
- Test the pipeline by pushing changes to a GitHub repository and triggering the deployment process automatically.
  Deliverables:
- **CI/CD pipeline configuration** (Jenkins or GitHub Actions).
- Deployment automation logs and screenshots.

Targeted Application & Tools that can be used:

Applications:

The course will focus on building and scaling the following types of applications:

- **E-Commerce Platforms** – Handling high traffic, product catalogs, and real-time inventory.
- **Banking & FinTech Applications** – Secure and high-availability transactions.
- **Streaming & Event-Driven Applications** – Using Kafka for real-time data processing.
- **Social Media & Messaging Platforms** – Scalable messaging and real-time updates.
- **SaaS & Cloud-Native Applications** – Multi-tenant, API-based scalable solutions.

Tools:

Programming & Frameworks

- **Java 17+** – Core programming language for scalable applications.
- **Spring Boot** – Microservices development, REST APIs, and dependency injection.
- **Spring Cloud** – Service discovery, load balancing, and resilience patterns.
- **Quarkus** – Lightweight, high-performance microservices alternative.

Database & Caching

- **SQL Databases:** MySQL, PostgreSQL – Scalable relational data management.
- **NoSQL Databases:** MongoDB, Cassandra – High-availability distributed databases.
- **Redis / Memcached** – In-memory caching for faster response times.

Messaging & Event-Driven Architecture

- **Apache Kafka** – Real-time event streaming and asynchronous communication.
- **RabbitMQ** – Message brokering for decoupling services.
- **gRPC** – High-performance inter-service communication.

Cloud & Deployment

- **Docker** – Containerization for application portability.
- **Kubernetes** – Scaling, orchestration, and auto-recovery.
- **AWS / GCP / Azure** – Cloud deployment and auto-scaling.

CI/CD & DevOps

- **GitHub Actions / Jenkins** – Automated build and deployment pipelines.
- **Terraform** – Infrastructure as Code for cloud provisioning.
- **Helm** – Kubernetes package management for scalable applications.

Text Book(s):

T1: "Spring in Action" by Craig Walls

T2: "Java Performance: The Definitive Guide" by Scott Oaks

T3: "Designing Data-Intensive Applications" by Martin Kleppmann

T4. "Spring Microservices in Action" by John Carnell

Reference(s):

1. **"Designing Data-Intensive Applications"** – *Martin Kleppmann*
2. **"Java Performance: The Definitive Guide"** – *Scott Oaks*
3. **"Spring Microservices in Action"** – *John Carnell*
4. **"Kubernetes Up & Running"** – *Kelsey Hightower, Brendan Burns, Joe Beda*

Catalogue prepared by	
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: **CSEXXXX**	**Course Title:** Scalable Application Development using Java **Type of Course:** Lab	**L- T-P- C**	3	**0**	0	**3**
Version No.	2.0					
Course Prerequisites	Basic Java Programming Knowledge, Java framework, understanding of databases and fundamentals of web development, basics of multithreading and concurrency.					
Anti-requisites	**NIL**					
Course Description	This course provides a comprehensive guide to designing, developing, and deploying scalable Java applications, covering high-performance architectures, distributed systems, microservices, cloud deployment, and DevOps integration.					
Course Objective	The objective of the course is to Understand Scalability Principles, developing high performance Java applications, design and implement scalable architecture, deploy and manage scalable data.					
Course Outcomes	On successful completion of the course the students shall be able to: CO 1: Design and Develop Scalable Java Applications CO 2: Design and Implement Scalable Architectures and Micro services CO 3: Implement Scalable Data Management Techniques CO 4: Deploy and Monitor Applications in Cloud Environments					
Course Content:						
Module 1	Foundations of Scalable Java Applications	Assignment	Implementation		**10 Sessions**	
Topics: **Introduction to Scalability -** Defining scalability: vertical vs. horizontal scaling, Monolithic vs. Microservices Architecture, Performance bottlenecks and solutions. **Java Performance Optimization -** JVM internals and tuning, Garbage Collection (GC) strategies, Profiling and monitoring Java applications						

Concurrency and Multithreading - Java concurrency model and thread management, Executor framework, ForkJoinPool, Thread safety, locks, and synchronization.

Module 2	Scalable Architectures and Microservices	Assignment	Implementation	10 Sessions

Topics:

Microservices and Distributed Systems - Principles of microservices, Service-to-service, communication (REST, gRPC, Kafka), API Gateway, Service Discovery, and Load Balancing

Design Patterns for Scalability - Singleton, Factory, and Builder patterns, CQRS (Command Query Responsibility Segregation), Circuit Breaker and Retry patterns (Resilience4j)

Event-Driven Architecture & Asynchronous Processing - Event Sourcing with Kafka, WebSockets and Reactive Programming, Handling failures in distributed systems.

Module 3	Scalable Data Management and Caching	Mini - Project	Implementation	10 Sessions

Topics:

Database Scalability - SQL vs. NoSQL databases (MySQL, PostgreSQL, MongoDB, Cassandra), Sharding, Replication, and Partitioning strategies, Optimizing queries (Indexing, Query Caching)

Caching Strategies - In-memory caching with **Redis, Memcached,** Distributed caching techniques, Cache Invalidation and Eviction Policies

Data Streaming & Batch Processing - Apache Kafka for event-driven data pipelines, Apache Spark for large-scale data processing.

Module 4	Cloud Deployment and DevOps for Scalability	Quiz	Implementation	10 Sessions

Topics:

Cloud-Native Development - Containerization with **Docker,** Kubernetes for scaling and orchestration, Cloud deployment strategies (AWS, GCP, Azure),

CI/CD & DevOps for Scalable Applications - Building CI/CD pipelines (Jenkins, GitHub Actions), Canary & Blue-Green Deployments, Infrastructure as Code (Terraform, Kubernetes Helm)

Security & Reliability - Securing APIs with **OAuth2, JWT, API Gateway,** Load Balancing & Rate Limiting, Monitoring with **Prometheus, ELK Stack**

Targeted Application & Tools that can be used:

Applications:

The course will focus on building and scaling the following types of applications:

- **E-Commerce Platforms** – Handling high traffic, product catalogs, and real-time inventory.
- **Banking & FinTech Applications** – Secure and high-availability transactions.
- **Streaming & Event-Driven Applications** – Using Kafka for real-time data processing.
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5.

Tools:

Programming & Frameworks

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- **Apache Kafka** – Real-time event streaming and asynchronous communication.
- **RabbitMQ** – Message brokering for decoupling services.
- **gRPC** – High-performance inter-service communication.

Cloud & Deployment

5. **Docker** – Containerization for application portability.
6. **Kubernetes** – Scaling, orchestration, and auto-recovery.
7. **AWS / GCP / Azure** – Cloud deployment and auto-scaling.

CI/CD & DevOps

- **GitHub Actions / Jenkins** – Automated build and deployment pipelines.
- **Terraform** – Infrastructure as Code for cloud provisioning.
- **Helm** – Kubernetes package management for scalable applications.

Text Book(s):

T1: "Designing Data-Intensive Applications" – *By Martin Kleppmann*

T2: "Java Concurrency in Practice" – *By Brian Goetz*

T3: "Spring Microservices in Action" – *By John Carnell*

T4. "Cloud Native Java" – *By Josh Long & Kenny Bastani*

Reference(s):

- **"Designing Data-Intensive Applications"** – *Martin Kleppmann*
- **"Java Performance: The Definitive Guide"** – *Scott Oaks*
- **"Spring Microservices in Action"** – *John Carnell*
- **"Kubernetes Up & Running"** – *Kelsey Hightower, Brendan Burns, Joe Beda*

Catalogue prepared by	
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: CSE7000	**Course Title:** Internship **Type of Course:**	**L- T-P- C**	-	-	-	2
Version No.	**1.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: 6. Identify the engineering problems related to local, regional, national or global needs. (Understand) 7. Apply appropriate techniques or modern tools for solving the intended problem. (Apply) 8. Design the experiments as per the standards and specifications. (Analyze) 9. Interpret the events and results for meaningful conclusions. (Evaluate)					
Catalogue prepared by	Mr. Md Ziaur Rahman					
Recommended by the Board of Studies on						
Date of Approval bythe Academic Council						

Course Code: CSE2271	**Course Title: Software Design and Development Type of Course: School Core [Theory Only]**		**L-T- P-C**	**3-0-0-3**
Version No.	1.0			
Course Pre-requisites	**NIL**			
Anti-requisites	**NIL**			
Course Description	The objective of this course is to provide the fundamentals concepts of Software Engineering process and principles. The course covers software requirement engineering processes, system analysis, design, implementation and testing aspects of software system development. The course covers software quality, configuration management and maintenance.			
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Software Engineering and attain Skill Development through Participative Learning techniques.			
Course Out Comes	On successful completion of this course the students shall be able to: 1] Describe the Software Engineering principles, ethics and process models(Knowledge) 2] Identify the requirements, analysis and appropriate design models for a given application(Comprehension) 3] Understand the Agile Principles(Knowledge) 4] Apply an appropriate planning, scheduling, evaluation and maintenance principles involved in software(Application)			
Module 1	**Introduction to Software Engineering and Process Models (Knowledge level)**	Quiz		**10 Hours**
Introduction: Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Software Engineering Practice-Essence of Practice, General Principles Software Development Life Cycle **Models:** Waterfall Model – Classical Waterfall Model, Iterative Waterfall Model, Evolutionary model-Spiral, Prototype.				
Module 2	**Software Requirements, Analysis and Design (Comprehension level)**	Assignment	Development of SRS documents for a given scenario	**12 Hours**
Requirements Engineering: Eliciting requirements, Functional and non- Functional requirements, Software Requirements Specification (SRS), Requirement Analysis and validation. Requirements modelling- Introduction to Use Cases, Activity diagram and Swim lane diagram. CASE support in Software Life Cycle, Characteristics of CASE Tools, Architecture of a CASE Environment. **Design:** Design concepts, Architectural design, Component based design, User interface design.				
Module 3	**Agile Principles & Devops (Knowledge level)**	Quiz		**10 Hours**
Agile: Scrum Roles and activities, Sprint Agile software development methods - Scaling, User Stories, Agile estimation techniques, Product backlogs, Stake holder roles, Dynamic System Development Method. **Devops:** Introduction, definition, history, tools.				
Module 4	**Software Testing and Maintenance (Application Level)**	Assignment	Apply the testing concepts using Programing	**13 Hours**

Software Testing-verification and validation, Test Strategies - White Box Testing, Black box Testing. Automation Tools for Testing.

Software Quality Assurance-Elements of software quality assurance, SQA Tasks, Goals and Metrics, Software configuration management- SCM process, SCM Tools (GitHub).

Maintenance- Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models.

Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools

Text Book

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", VII Edition, McGraw-Hill, 2017.
2. Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", VI Edition, McGraw-Hill, 2018.

References

4. Rajib Mall, "Fundamentals of Software Engineering", VI Edition, PHI learning private limited, 2015.
5. Ian Sommerville, "Software Engineering", IX Edition, Pearson Education Asia, 2011.
6. Agile Software Development Principles, Patterns and Practices.1st Edition, Wiley, 2002

Topics Relevant to "Skill Development: Balck box Testing, White box Testing, Automated Testing for Skill development through Participative Learning Techniques. This is attained through assessment mentioned in the course handout

Course Code: CSE2272	**Course Title:** Cloud computing **Type of Course:** Theory	**L- T-P- C**	3	**0**	0	**3**
Version No.	2.0					
Course Pre-requisites						
Anti-requisites	**NIL**					
Course Description	This Course is designed to introduce the concepts of Cloud Computing as a new computing paradigm. Cloud Computing has emerged in recent years as a new paradigm for hosting and delivering services over the Internet. The students can explore various Cloud Computing terminology, principles and applications. Understanding different views of the Cloud Computing such as theoretical, technical and commercial aspects. Topics include: Evolution of cloud computing and its services available today, Introduction, Architecture of cloud computing, Infrastructure, platform, software, Types of cloud, Business models, cloud services, Collaborating using cloud services, Virtualization for cloud, Security, Standards and Applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Could computing and Virtualization and attain Employability through Participative Learning techniques.					
Course Outcomes	On successful completion of the course the students shall be able to: · Describe fundamentals of cloud computing, virtualization and cloud computing services. · Discuss high-throughput and data-intensive computing. · Explain security and standards in cloud computing. · Demonstrate the installation and configuration of virtual machine.					
Course Content:						

Module 1	Introduction to Cloud and Virtualization	Assignment	Virtualization	**10 Sessions**
Topics: Introduction to Cloud and Virtualization Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies, Virtualization, Characteristics of Virtualized Environments Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Technology Examples, Cloud Computing Architecture, IaaS, PaaS, SaaS, Types of Clouds, Economics of Cloud				
Module 2	High Throughput and Data Intensive Computing	Assignment	Virtualization	**10 Sessions**
Topics: High Throughput and Data Intensive Computing: Task computing, MPI applications, Task based programming, Introduction to DIC, Technologies for DIC, Aneka Map Reduce Programming.				
Module 3	Cloud Security and Standards	Assignment	Virtualization	**9 Sessions**
Topics: Cloud Security and Standards: Cloud Security Challenges, Software-as-a-Service Security, Application standards, Client standards, Infrastructure and Service standards.				
Module 4	Cloud Platforms	Assignment	Virtualization	**9 Sessions**
Cloud Platforms, Advances in cloud: introduction to Amazon Web Services: Introduction to Google App Engine, Introduction to Microsoft Azure. Media Clouds - Security Clouds - Computing Clouds - Mobile Clouds – Federated Clouds – Hybrid Cloud				
Targeted Application & Tools that can be used:				
Text Book(s):				

1. John Rittinghouse and James Ransome, “Cloud Computing, Implementation, Management and

Security”, CRC Press.

2. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, “Mastering Cloud Computing”, McGraw

Hill Education.

Reference(s):

1. David E.Y. Sarna, “Implementing and Developing Cloud Applications”, CRC Press.

2. Anthony T Velte, Toby J Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, Tata McGraw-Hill. Web resources: https://presiuniv.knimbus.com/user#/home

Course Code: **CSE2273**	**Course Title:** Cloud computing **Type of Course :** Lab	**L- T-P- C**	0	**0**	2	**1**
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	**NIL**					
Course Description	This course is designed to give hands-on experience with cloud platforms, services, and deployment models. Students will learn to set up, configure, and manage cloud environments using platforms like AWS, Microsoft Azure, and Google Cloud. The course covers virtualization, containerization, serverless computing, cloud storage, security, and scalability. Through practical assignments, students will develop skills in deploying cloud applications, managing cloud resources, automating cloud workflows, and implementing cost-effective cloud solutions.					
Course Objective	The objective of the course is to Understand Cloud Infrastructure, deploy and manage virtual machines, implement cloud storage, develop and deploy cloud applications, optimize cost and performance.					
Course Outcomes	On successful completion of the course the students shall be able to: CO1· Deploy and Manage Cloud Resources. CO2. Develop and Deploy Cloud-based Applications CO3. Optimize Performance and Cost in the Cloud CO4. Implement Security and Automation in Cloud Environments					
Course Content:						
Module 1	Introduction to Cloud and Virtualization	Assignment	Virtualization		**10 Sessions**	
Lab Assignment 1: Setting Up Virtual Machines on Cloud						

- Create a **Virtual Machine (VM)** on AWS/Azure/GCP
  Configure OS, storage, and network settings
- Connect to the VM using SSH/RDP
  Install web server (Apache/Nginx) and deploy a static webpage

Lab Assignment 2: Containerization Using Docker

- Install **Docker** on a local or cloud VM
- Create and run a **Docker container**
- Build a **custom Docker image** with a simple Python/Node.js application
- Push the image to **Docker Hub** and deploy it on a new VM

Module 2	High Throughput and Data Intensive Computing	Assignment	Virtualization	**10 Sessions**

Lab Assignment 1: Setting Up a Distributed Computing Environment

- Launch a **Hadoop or Spark cluster** on AWS EMR / Azure HDInsight / Google Dataproc
- Configure **HDFS (Hadoop Distributed File System)** for big data storage
- Run a **basic MapReduce job** on sample data

Lab Assignment 2: Data Preprocessing with Cloud Storage

- Store large datasets in **Amazon S3 / Azure Blob Storage / Google Cloud Storage**
- Use **Apache Spark or Hadoop** to read, clean, and process data
- Convert datasets into **Parquet or Avro formats** for efficient storage

Lab Assignment 3: Batch Processing with Apache Spark

- Load large datasets (e.g., logs, tweets, transaction data) into **Spark DataFrame**
- Perform **ETL (Extract, Transform, Load) operations** on the data
- Use **SparkSQL** for querying large datasets

Lab Assignment 4: Real-Time Data Processing with Spark Streaming

- Set up **Kafka / AWS Kinesis / Google Pub/Sub** for real-time data ingestion
- Process streaming data using **Spark Streaming**
- Perform windowed aggregations and visualize real-time trends

Lab Assignment 5: Cloud-Based Machine Learning with Big Data

- Use **Google BigQuery ML / AWS SageMaker / Azure Machine Learning** for model training
- Train a **linear regression or classification model** on a large dataset
- Deploy the trained model as an API for real-time predictions

Lab Assignment 6: Running Parallel Machine Learning Workloads

- Implement **distributed ML training** using **Spark MLlib or TensorFlow on Cloud TPUs**
- Train models on a large dataset and optimize performance using distributed execution

Lab Assignment 7: Auto-Scaling and Load Balancing for Data Processing

- Deploy a **serverless Spark job** using **AWS Glue / Azure Synapse**
- Implement **auto-scaling for high-throughput jobs**
- Measure performance improvements using cloud monitoring tools

Lab Assignment 8: Cost Optimization for High-Throughput Data Processing

- Analyze **cloud cost reports** for data-intensive workloads
- Optimize cloud storage and compute resources for cost-efficiency
- Compare **on-demand vs. reserved vs. spot instances** for cost savings

Module 3	Cloud Security and Standards	Assignment	Virtualization	**9 Sessions**

Lab Assignment 9: Configuring Identity and Access Management (IAM)

- Set up **IAM roles and policies** in AWS / Azure / Google Cloud

- Create and assign users with **least privilege access**
- Implement **Multi-Factor Authentication (MFA)** for added security
- Audit IAM policies using **AWS IAM Access Analyzer / Azure Security Center**

Lab Assignment 10: Setting Up Single Sign-On (SSO) and Role-Based Access Control (RBAC)

- Configure **AWS Cognito / Azure Active Directory / Google IAM** for authentication
- Implement **Role-Based Access Control (RBAC)** for users and groups
- Integrate **OAuth 2.0 / OpenID Connect (OIDC) / SAML** for secure authentication

Lab Assignment 11: Encrypting Data at Rest and in Transit

- Encrypt **cloud storage (S3, Blob, Cloud Storage)** using **KMS (Key Management Service)**
- Set up **TLS/SSL certificates** for secure web traffic encryption
- Enable **database encryption (AWS RDS, Azure SQL, GCP Cloud SQL)**

Lab Assignment 12: Implementing Compliance & Governance in Cloud

- Enable **GDPR, HIPAA, ISO 27001 compliance tools** in cloud platforms
- Use **AWS Config / Azure Policy / GCP Security Command Center** to enforce compliance
- Conduct **security audits and generate compliance reports**

Lab Assignment 13: Implementing Cloud Monitoring & Threat Detection

- Configure **AWS CloudTrail / Azure Monitor / GCP Operations Suite** for activity logging
- Set up **intrusion detection systems (IDS) & anomaly detection**
- Analyze security logs using **Amazon GuardDuty / Azure Sentinel / Chronicle Security**

Lab Assignment 14: Automating Security Incident Response

- Deploy a **Serverless Lambda / Azure Logic App** to automatically respond to security incidents
- Implement **automated alerts** for suspicious activity

- Test a **denial-of-service (DDoS) simulation** and implement mitigation strategies

Module 4	Cloud Platforms	Assignment	Virtualization	**9 Sessions**

Lab Assignment 15: Getting Started with Cloud Platforms

- Create a **free-tier account** on AWS, Azure, or Google Cloud
- Navigate the **Cloud Console, CLI, and SDKs**
- Explore and configure **dashboard, billing, and IAM settings**

Lab Assignment 16: Launching a Virtual Machine (VM) on Cloud

- Deploy a **VM instance** using **AWS EC2, Azure Virtual Machines, or Google Compute Engine**
  Configure **OS, storage, networking, and security groups**
  Connect to the instance using **SSH (Linux) or RDP (Windows)**

Lab Assignment 17: Cloud Storage and File Management

- Create **Object Storage (AWS S3 / Azure Blob Storage / Google Cloud Storage)**
  Upload, download, and set access permissions for files
  Implement **Lifecycle Policies and Versioning**

Lab Assignment 18: Cloud Database Management

- Deploy a **Relational Database (AWS RDS / Azure SQL Database / Cloud SQL)**
  Connect and query the database using **MySQL/PostgreSQL clients**
  Set up database **backups and automatic scaling**

Lab Assignment 19: Configuring Virtual Networks in Cloud

- Set up a **Virtual Private Cloud (VPC) / Azure Virtual Network / GCP VPC**
  Configure **subnets, firewalls, and security groups**
  Test **network communication between two VMs**

Lab Assignment 20: Deploying a Web Application on Cloud

Deploy a Python/Node.js/Java web app using:

- **AWS Elastic Beanstalk**
- **Azure App Service**

- **Google App Engine**
  Connect the app to Cloud Database (RDS, CosmosDB, Firestore)
  Monitor application performance and logs

Targeted Application & Tools that can be used:

Text Book(s):

1. John Rittinghouse and James Ransome, "Cloud Computing, Implementation, Management and Security", CRC Press.

2. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education.

Reference(s):

1. David E.Y. Sarna, "Implementing and Developing Cloud Applications", CRC Press.

2. Anthony T Velte, Toby J Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGraw-Hill. Web resources: https://presiuniv.knimbus.com/user#/home

Catalogue prepared by	
Recommended by the Board of Studies on	
Date of Approval by	

the Academic Council	

Course Code: CSE2505	**Course Title:** Mobile Application Development **Type of Course:** Theory	**L- T-P- C**	2	**0**	0	2
Version No.	2.0					
Course Pre-requisites	CSE2255					
Anti-requisites	**NIL**					
Course Description	The course deals with the basics of android platform and application life cycle. The goal of the course is to develop mobile applications with Android containing at least one of the following phone material components: GPS, accelerometer or phone camera, use simple GUI applications and work with database to store data locally or in a server. Topics include user interface design; user interface building; input methods; data handling; network techniques and URL loading; GPS and motion sensing. Android application framework and deployment. Power management, Screen resolution, Touch interface, Store data on the device.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Mobile Applications and Development as mentioned above and attain Employability Skills through Experiential Learning Techniques.					
Course Outcomes	On successful completion of the course the students shall be able to: 1. Discuss the fundamentals of mobile application development and its architecture. (Comprehension) 2. Illustrate mobile applications with appropriate android view. (Application) 3. Demonstrate the use of services, broadcast receiver, Notifications and content provider.(Application) 4. Apply data persistence techniques, to perform CRUD operations. (Application) 5. Use advanced concepts for mobile application development. (Application)					
Course Content:						
Module 1	Introduction and Architecture of Android	Assignment	Simulation/Data Analysis	10 Sessions		

Topics:

Android: History and features, Architecture, Development Tools, Android Debug Bridge (ADB), and Life cycle.

Module 2	User Interfaces, Intent and Fragments	Term paper/Assignment	Simulation/Data Analysis	15 Sessions

Topics:

Views, Layout, Menu, Intent and Fragments.

Module 3	Components of Android	Term paper/Assignment	Simulation/Data Analysis	15 Sessions

Topics:

Activities, Services, Broadcast receivers, Content providers, User Navigation

Module 4	Notifications and Data Persistence	Term paper/Assignment	Simulation/Data Analysis	15 Sessions

Topics:

Notification, Shared Preferences, SQLite database, Android Room with a View, Firebase.

Module 5	Advance App Development	Term paper/Assignment	Simulation/Data Analysis	15 Sessions

Topics:

Graphics and Animation, App Widgets, Sensors, Performance, Location, Places, Mapping, Custom Views, Canvas.

Targeted Application & Tools that can be used:

Applications:

Native Android Applications

Native iOS Applications

Cross Platform mobile Apps

Mobile web Applications

Text Book(s):

T1. Pradeep kothari “Android Application Development - Black Book”, dreamtechpress

T2. Barry Burd (Author), “Android Application Development” ALL – IN – ONE FOR Dummies

T3. Jeff Mcherter (Author),Scott Gowell (Author), “Professional mobile Application

Development" paperback, Wrox - Wiley India Private Limited

T4. Wei-Meng Lee (Author) "Beginning Android Application Development" Wrox – Wiley India Private Limited

Reference(s):

1. Bill Phillips, Chris Stewart, and Kristin Marsicano (Author) "Android Programming" 3rd edition, 2017.The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 5. The Big Nerd Ranch Guide, by"

2. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014.

3. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015.

4. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580

5. Anubhav Pradhan, Anil V Deshpande, " Composing Mobile Apps" using Android, Wiley 2014, ISBN: 978-81-265-4660-2

6. Reto Meier "Professional Android Application Development"

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Course Code: **CSE2506**	**Course Title:** Mobile Application Development Lab **Type of Course:** Lab		**L- T-P- C**	0	**0**	4	2
Version No.	2.0					
Course Pre-requisites	CSE2256					
Anti-requisites	**NIL**					
Course Description	The course provides hands-on experience in designing, developing, and deploying mobile applications for Android and iOS platforms. Students will work with native development frameworks such as Android Studio (Java/Kotlin) and Xcode (Swift), as well as explore cross-platform tools like Flutter or React Native.					
Course Objective	The objective of the course is to develop Native and Cross-Platform Mobile Applications, design Interactive and Responsive User Interfaces, integrate Backend Services and APIs, implement State Management and Performance Optimization, ensure Mobile App Security and Data Protection					
Course Outcomes	On successful completion of the course the students shall be able to: 1. Develop Functional Mobile Applications 2. Design and Implement Interactive UIs 3. Integrate Cloud Services and APIs 4. Integrate Backend Systems and Data Management 5. Deploy, Publish, and Maintain advanced Mobile Application					
Course Content:						
Module 1	Introduction and Architecture of Android	Assignment	Simulation/Data Analysis	10 Sessions		

1.a. Design an app to read user inputs using edit text and display the result of arithmetic operations using toast message.

1.b. Create an android app to calculate the current age of yourself, select your DOB using date picker.

2. Design an app to input your personal information. Use an autocomplete text view to select your place of birth.

Module 2	User Interfaces, Intent and Fragments	Term paper/Assignment	Simulation/Data Analysis	15 Sessions

3. a. Design an app to select elective course using spinner view and on click of the display button,

toast your ID and selected elective course.

3. b. Design a restaurant menu app to print the total amount of orders.

Module 3	Components of Android	Term paper/Assignment	Simulation/Data Analysis	15 Sessions

4. Develop an android app that uses intent to maintain the following scenario.

Check the eligibility criteria for voting. Input the Aadhar no., Name & age in the first activity. If the age is above 18, display the voter's detail in the second activity. Else, display, “You are not eligible to vote” in the second Activity.

5. Demonstrate the use of fragment with list of buttons representing various colors, and on click of these buttons, the appropriate color is filled in the next fragment. Create an Android application to input the vitals of a person (temperature, BP). If the vitals are abnormal, give proper notification to the user.

6. Create an android app to for movie ticket booking. Save the user name of the customer using shared preferences. After completion of booking, retrieve the username from the shared preferences and print the ticket details.

Module 4	Notifications and Data Persistence	Term paper/Assignment	Simulation/Data Analysis	15 Sessions

7. Create an android application to manage the details of students' database using SQLite.Use necessary UI components, which perform the operations such as insertion, modification, removal and

view.Presidency University needs an APP for Admission eligibility checking for students, for that you need to take the following information from the Student: registration ID, physics, chemistry and mathematics marks (PCM), fees is allotted as below criteria.

PCM (Total marks %) Fee concession

90 above 80 %

70 to 89 60 %

Below 69 % no concession

On click on the button “Registration” details should be stored in the database using SQLite. Create button DISPLAY ALL (full students list) on click on the button it should display the students list per the fee

concession.

8. A company need to design an app that plays soft music automatically in the background. Create an app to achieve this functionality.

9. Create an android application such that your view object in the Activity can be Animated with fade-in effect. Create an appropriate XML file named fade-in and write the application to perform the property animation.

Module 5	Advance App Development	Term paper/Assignment	Simulation/Data Analysis	15 Sessions

10. Demonstrate how to send SMS and email.

11. Create an android application to transfer a file using WiFi. Create an android application “Where am I” with an Activity that uses the GPS Location provider to find the device’s last known location.

Targeted Application & Tools that can be used:

Applications:

1. Native Android Applications (Java/Kotlin)
    - Android Mobile Apps built for Android smartphones and tablets using Java or Kotlin programming languages.
    - Target audience: Android users.
- Native iOS Applications (Swift)
    - iOS Mobile Apps designed for iPhone and iPad using Swift.
    - Target audience: iOS users (Apple ecosystem).
- Cross-Platform Mobile Apps (Flutter, React Native)
    - Cross-platform apps designed to run on both Android and iOS from a single codebase using frameworks like Flutter or React Native.
    - Target audience: Users on both Android and iOS platforms.
- Mobile Web Applications (Progressive Web Apps - PWA)
    - Mobile-optimized web applications using HTML5, CSS3, and JavaScript that run in a browser with native-like functionality (offline support, push notifications).

- Target audience: Users accessing apps via mobile browsers.

Development Tools and Frameworks

1. Integrated Development Environments (IDEs)
    - Android Studio (for Android): The official IDE for Android development, supporting Java, Kotlin, and Android SDK.
    - Xcode (for iOS): The official IDE for iOS development with Swift and Objective-C, providing a comprehensive suite of development tools for iPhone/iPad applications.
    - Visual Studio Code (VS Code): Lightweight IDE for working with Flutter, React Native, and web development projects.

- Cross-Platform Development Frameworks
    - Flutter: Open-source UI framework by Google for building natively compiled applications for mobile, web, and desktop from a single codebase.
    - React Native: Open-source framework developed by Facebook for building cross-platform apps with JavaScript and React.
- Backend & Cloud Tools
    - Firebase: Google's backend-as-a-service (BaaS) platform offering authentication, real-time databases, cloud storage, and push notifications for mobile apps.
    - AWS Amplify: Cloud platform for backend services (API, storage, authentication) and mobile deployment.
    - SQLite / Realm: Local storage solutions for mobile apps to manage data storage and retrieval on-device.
- Mobile App Testing and Debugging Tools
    - Android Emulator (for Android): A virtual device to run and test Android apps without needing physical devices.
    - Xcode Simulator (for iOS): A tool to simulate different iOS devices and test apps during development.
    - Appium: Open-source tool for automated testing across native, hybrid, and mobile web applications.
- Version Control and Collaboration
    - Git: Version control system for managing code changes and collaborating with teams.
    - GitHub / GitLab / Bitbucket: Online platforms for hosting Git repositories, collaboration, and version control management.
- Mobile App Deployment Tools
    - Google Play Console: For managing Android app publishing, distribution, and monitoring.

- Apple App Store Connect: For managing iOS app submissions, reviews, and releases on the Apple App Store.

- UI/UX Design Tools
  - Figma / Adobe XD: Tools for UI/UX design and wireframing to create the visual elements of mobile applications before development.
  - Sketch: Vector-based design tool for iOS UI design and prototyping

Text Book(s):

T1. Pradeep kothari "Android Application Development - Black Book", dreamtechpress

T2. Barry Burd (Author), "Android Application Development" ALL – IN – ONE FOR Dummies

T3. Jeff Mcherter (Author),Scott Gowell (Author), "Professional mobile Application Development" paperback, Wrox - Wiley India Private Limited

T4. Wei-Meng Lee (Author) "Beginning Android Application Development" Wrox – Wiley India Private Limited

Reference(s):

1. Bill Phillips, Chris Stewart, and Kristin Marsicano (Author) "Android Programming" 3rd edition, 2017.The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 5. The Big Nerd Ranch Guide, by"

2. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014.

3. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015.

4. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580

5. Anubhav Pradhan, Anil V Deshpande, " Composing Mobile Apps" using Android, Wiley 2014, ISBN: 978-81-265-4660-2

6. Reto Meier "Professional Android Application Development"

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Catalogue prepared by	
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

urse Code: E2274	**urse Title:** Competitive Programming and Problem Solving **pe of Course: Program Core**	-P-C	0	0		
rsion No.						
urse Pre-requisites						
ti-requisites						
urse Description	The **Competitive Programming and Problem Solving** course equips students with efficient problem-solving skills for coding competitions and real-world challenges. Starting with brute-force solutions, students learn to optimize time and space complexity using advanced techniques like dynamic programming, greedy algorithms, and backtracking. Hands-on practice on platforms like CodeChef and Codeforces helps tackle problems involving number theory, data structures, and algorithmic paradigms. By understanding CP constraints and fostering a strategic mindset, students gain the confidence to excel in competitions, technical interviews, and practical applications.					
urse Out Comes	On successful completion of the course the students shall be able to: CO1 : Understanding the issues of online platforms and Competitive Programming (CP) and developing brute force coding for commonly asked CP problems. CO2 : Analyzing the space and time complexity of brute force solutions and designing efficient solutions. CO3 : Evaluating the applicability of suitable algorithmic approaches to solve relevant CP problems. CO4: Creating efficient solutions of CP problems using the learnt algorithmic approaches.					
urse Objective	The objective of the course is to familiarize the learners with the concepts of **Competitive Programming and Problem Solving** and attain **Skill Development** through **Experiential Learning** techniques.					

dule 1: Introduction to Competitive Programming

erview of Efficient Coding for Problem Solving and CP: Introduction to competitive programming (CP); revisit of complexity analysis; introduction to online platforms such as codechef, codeforces etc and online submission; constraints during CP, online testing process and common errors such as TLE; use of STL

dule 2: Number Theory for Problem-Solving

e of Number Theory for problem-solving: reducing time/space complexity of brute force coding solution of Sieve Method, Inverse Module, Euclidian Method of factorization; efficient coding

for Permutation Combination; XORing based and pattern-based solutions.

dule 3: Optimizing Time & Space Using Sequential Storage

ding for Optimizing time and Space using Sequential Storage: two pointer approach; problem-solving using arrays and strings such as rotation on sorted arrays, duplicate removal, string matching algorithms; Kadane's algo, stacks, priority-queues and hashing based efficient coding; median based problems and alternate solutions.

dule 4: Non-Linear Data Structures

plying Non-Linear Data Structures for real-life problems: design of efficient solutions for problems such as finding loops in a linked list, memory efficient DLL, block reversal in LL; problem solving using trees and binary trees, Catalan numbers, applications of graphs, spanning tree and path algos for CP problems with reduced time/space complexity.

dule 5: Problem Solving using Advanced Topics

Problem Solving using Advanced Topics: concept of disjoint sets and their efficient representation, algorithmic approaches such as Greedy, Backtracking, Dynamic Programming and applying them for CP problems using bottom-up dynamic programming.

t of Laboratory Tasks:

31. You are given the finishing times of 'N' runners in a marathon. Write a program to find the runner who finished in the third position. **Focus:** Basic data structures (arrays), sorting algorithms (e.g., insertion sort, selection sort), and basic input/output.
32. In the same marathon, you are given the finishing times of 'N' runners and their bib numbers. Write a program to efficiently find the top 10 runners and their corresponding bib numbers. **Focus:** Efficient sorting algorithms (e.g., merge sort, quick sort), data structures like priority queues, and optimizing for large datasets.
33. A library maintains a list of books with their unique IDs. Write a program to check if a given book ID is present in the library. Focus: Searching algorithms (linear search), basic data structures (arrays or lists).
34. The library wants to implement a system to quickly find books by their titles. Suggest an efficient data structure (e.g., a hash table or a trie) and explain how to implement it to achieve fast book lookups. Focus: Understanding the trade-offs between different data structures, choosing the most appropriate data structure for a specific problem, and implementing efficient search operations.
35. An online store sells products with different prices. Write a program to calculate the total cost of a given list of products. **Focus:** Basic arithmetic operations, working with arrays or lists to store product prices.
36. The online store offers discounts based on the total purchase amount. Design an algorithm to efficiently calculate the final cost of an order, considering different discount rules (e.g., percentage discounts, fixed amount discounts, tiered discounts). Focus: Algorithmic design, conditional statements, handling complex scenarios with multiple rules, and potentially using dynamic programming techniques for optimization.
37. You are given two integers, 'a' and 'm'. Calculate 'a' raised to the power 'm' modulo a large prime number 'p'. **Focus:** Basic modular arithmetic operations (modular exponentiation), understanding the modulo operator.

38. In a secure communication system, you need to efficiently compute the modular exponentiation for very large values of 'm'. Implement and analyze the efficiency of the binary exponentiation algorithm for this task. **Focus:** Efficient algorithms for modular exponentiation (binary exponentiation), time complexity analysis, and understanding the importance of efficient algorithms in cryptography.
39. You have a deck of 'N' cards. Calculate the total number of possible hands of size 'K' that can be drawn from the deck. **Focus:** Basic combinatorics (combinations), factorial calculations.
40. In a card game, you need to calculate the probability of drawing certain combinations of cards (e.g., a pair, a three-of-a-kind) from a shuffled deck. Design an efficient algorithm to calculate these probabilities. **Focus:** Advanced combinatorics (permutations and combinations with repetitions), probability calculations, and optimizing calculations to avoid overflows.
41. You are given a network of devices represented as a graph. Determine if there is a path between two given devices in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search).
42. In a secure network, you need to detect and isolate compromised devices. Design an algorithm that efficiently identifies devices that exhibit anomalous behavior (e.g., unusual traffic patterns) using XOR-based techniques for data comparison and pattern matching. **Focus:** Applying XOR operations for data comparison and pattern recognition, understanding the properties of XOR (e.g., commutative, associative), and designing algorithms for network anomaly detection.
43. You are given an array representing the speeds of cars on a highway. Find the minimum time required for all cars to pass a certain point. **Focus:** Basic array traversal, finding the minimum element in an array.
44. In a more realistic scenario, cars have different lengths. Implement a two-pointer approach to simulate the movement of cars and determine the minimum time for all cars to pass a given point. **Focus:** Two-pointer technique, simulating real-world scenarios with arrays, optimizing time complexity.
45. Given a string, find the number of occurrences of a specific substring within the string. **Focus:** Basic string manipulation, string matching (brute-force approach).
46. Implement the KMP (Knuth-Morris-Pratt) string matching algorithm to efficiently find all occurrences of a given pattern within a large text document. **Focus:** Advanced string matching algorithms, understanding the concept of the "next" array in KMP, optimizing for large input sizes.
47. An online auction platform receives bids for different items. Implement a data structure (e.g., a priority queue) to efficiently track the highest bid for each item. **Focus:** Priority queues, insertion and extraction operations on priority queues, basic implementation of a priority queue using an array or a suitable library.
48. The auction platform needs to handle a large number of bids concurrently. Design and implement a system that efficiently processes bids, updates the highest bid for each item, and handles potential race conditions. **Focus:** Concurrent data structures and algorithms, thread safety, handling race conditions, optimizing for high-throughput scenarios.
49. A social network can be represented as a graph where users are nodes, and connections between users are edges. Write an algorithm to find if two given users are connected in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search), basic graph representation (adjacency list or adjacency matrix).
50. In a large social network, efficiently finding the shortest path between two users is crucial. Implement Dijkstra's algorithm to find the shortest paths between users in the network,

considering edge weights (e.g., representing the strength of connections). **Focus:** Shortest path algorithms (Dijkstra's algorithm), graph algorithms with weighted edges, optimizing for large graphs.

51. A file system can be modeled as a tree structure. Implement a function to traverse the file system and print the names of all files and directories. **Focus:** Tree traversal algorithms (depth-first search or breadth-first search), basic tree representation (using nodes and pointers).
52. Design and implement a file system that supports efficient operations like creating directories, deleting files, and finding files based on their names or paths. Consider using a combination of tree structures and hash tables for efficient indexing and searching. **Focus:** Designing and implementing file system structures, using multiple data structures together, optimizing for common file system operations.
53. An online shopping cart can be represented as a tree, where each node represents an item or a category of items. Write an algorithm to calculate the total price of all items in the shopping cart. **Focus:** Tree traversal, calculating sums within a tree structure.
54. Implement a system that allows customers to apply discounts and coupons to their shopping carts. Consider using a combination of trees and other data structures (e.g., hash tables) to efficiently apply discounts and calculate the final price. **Focus:** Applying discounts and promotions to tree-like structures, efficient implementation of discount rules, optimizing for complex pricing scenarios.
55. In a social network, users can form groups. Given a list of friendships, determine if all users in a specific group are connected (directly or indirectly) through friendships. **Focus:** Disjoint set union (DSU) data structure, basic connectivity checks.
56. Design an efficient algorithm to find the minimum number of new friendships needed to connect all users in the social network into a single, connected component. **Focus:** Applying DSU for finding connected components, greedy algorithms, optimization for minimizing connections.
57. A treasure hunt involves a series of clues leading to the final treasure. Given a list of possible paths and their associated costs, find the cheapest path to reach the treasure. **Focus:** Greedy algorithms (e.g., Dijkstra's algorithm for shortest paths), basic graph representation.
58. In a more complex treasure hunt, there are time constraints associated with each path. Design an algorithm to find the fastest path to the treasure while considering both path costs and time constraints.

Focus: Combining greedy approaches with other techniques (e.g., priority queues), handling multiple constraints, optimizing for time-critical scenarios.

59. In a simplified chess game with only rooks, determine the minimum number of moves required for a rook to reach a specific target square on an empty board. **Focus:** Breadth-first search (BFS) on a graph (the chessboard), basic graph traversal.
60. In a more realistic chess game with multiple pieces and obstacles, implement a minimax algorithm with alpha-beta pruning to determine the best move for a player. **Focus:** Game tree search, minimax algorithm, optimization techniques like alpha-beta pruning, handling complex game states.

geted Application & Tools that can be used:

10. C or C++ Compiler (g++): The standard compiler for CP. Familiarize students with compilation flags (e.g., -O2 for optimization).

11. IDE (Integrated Development Environment): Code:: Blocks, Visual Studio, CLion, or similar IDEs. These provide debugging capabilities, code completion, and other helpful features.
12. Online Judges (CodeChef, Codeforces, LeetCode, HackerRank): Essential for practicing and submitting solutions.
13. Debugger (gdb): Crucial for understanding code execution and finding bugs. Origin, excel and Mat lab soft wares for programming and data analysis.
14. Number Theory Libraries: Some libraries provide pre-built functions for number theory operations (though often it's better to implement them yourself for learning).
15. Wolfram Alpha: A useful tool for verifying number theory calculations and exploring concepts.
16. **String Libraries:** Familiarize students with the string manipulation functions available in C++.
17. **Graph Visualization Tools:** Tools like Graphviz can be helpful for visualizing graphs and understanding graph algorithms.
18. **DP Debugging Techniques:** Practice debugging DP solutions, as they can be complex. Visualizing the DP table can be helpful.

xt Books:

3 **Guide to Competitive Programming: Learning and Improving Algorithms Through Contests" (3rd Edition),** ***Antti Laaksonen, springer, 2024***

4 **"Data Structures and Algorithms in Java: A Project-Based Approach" –** ***Dan S. Myers, Cambridge University Press***

Reference Books:

3. **Data Structures and Algorithmic Thinking with Python/C++/Java",** ***Narasimha Karumanchi, 5th Edition, Career Monk, 2017.***
4. **Introduction to Algorithms, Thomas H. Cormen (Author), Charles E. Leiserson (Author), Ronald L. Rivest , fourth edition April 2022**

Web Resources

3. https://nptel.ac.in/courses/106106231
4.

ject work/Assignment: Mention the Type of Project /Assignment proposed for this course

Assessment Type

- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.)
- Quiz
- End Term Exam
- Self-Learning

Course Code: **PPS 3019**	**Course Title: Corporate Communication** Type of Course: Practical Only Course	L- T - P- C	0	0	2	1
Version No.	1.0					
Course Pre-requisites	• Students are expected to understand Basic English. • Students should have desire and enthusiasm to involve, participate and learn.					
Anti-requisites	NIL					
Course Description	This course is designed to enable students to understand concepts of corporate communication, improve confidence, and develop professional skills. This course will give the students a competitive advantage and increase their chances of success in the professional world by building their strong resumes and better online presence. This will benefit learners in effectively presenting their concepts and ideas in a corporate environment through various activities and learning methodologies.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Corporate Communication" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.**					
Course Out Comes	**On successful completion of this course, the students shall be able to:** CO1: Demonstrate effective communication while presenting oneself and others CO2: Design resume based on industrial standards CO3: Employ techniques to face interview and Group discussion					
Course Content:						
Module 1	Introduction to Corporate Communication	Classroom activity	6 Hours			
Topics: Setting Expectations, Ice Breaker, Cs of communication, Significance of corporate communication, Communication process, barriers in communication and solutions, Structuring messages, non-verbal communication, written communication, Self introduction.						
Module 2	Presentation Skills	Group Presentation	8 Hours			

Topics: Presentation Skills, Opening Body & Closing Body, Audibility, Speech Clarity, Fluency, Voice Modulation, Non-verbal Communication and Body Language.			
Module 3	Resume Writing	Individual Assessment	8 Hours
Topics: Importance of a Resume, Types of Resumes (Chronological, Functional, and Combination), Understanding Job Descriptions, Optimizing for Applicant Tracking Systems (ATS), Understanding ATS Requirements, Formatting Tips for ATS Compliance, The Digital Edge: Online Profiles (Aligning Resumes with LinkedIn Profiles)			
Module 4	Personal Interview	Individual Assessment	8 Hours
Understanding Personal Interviews, Self-Awareness and Preparation (SWOT Analysis: Knowing Your Strengths and Weaknesses), **Handling Common Questions (**Tell Me About Yourself: Structuring a Strong Response, Answering Situational and Behavioral Questions (STAR Method) **Practical Skills for Success (**Dressing for Success: Professional Appearance, Mock Interviews: Practice with Feedback, Follow-Up Etiquette: Thank You Emails and Calls)			
Targeted Application & Tools that can be used: 1. TED Talks 2. You Tube Links 3. Activities			
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course			
1) Resume 2) Self-Introduction 3) Personal Interview			
Targeted Application & Tools that can be used: 1. TED Talks **2.** YouTube Links **Assignments proposed for this course** 1. Self-Introduction 2. Resume			

YouTube Links: https://youtu.be/z_jxoczNWc (Steve Jobs Introducing the iPhone 4 in June 2010)

References

1. "Talk Like TED - The 9 Public-Speaking Secrets of the World's Top Minds" By Carmine Gallo St. Martin's Press Copyright © 2014 Carmine Gallo All rights reserved. ISBN: 978-1-250-04112-8
2. "The Presentation Secrets of Steve Jobs: How to Be Insanely Great in Front of Any Audience" MP3 CD – Import, 22 April 2014
3. "The Definitive Book of Body Language: The Hidden Meaning Behind People's Gestures and Expressions" Hardcover – Illustrated, 25 July 2006
4. "Crucial Conversations: Tools for Talking When Stakes Are High" Paperback – Import, 1 July 2002

Web links:

1. https://www.wordstream.com/blog/ws/2014/11/19/how-to-improve-presentation-skills

https://www.cbs.de/en/blog/15-effective-presentation-tips-to-improve-presentation-skills/

2. https://hbr.org/2022/05/the-art-of-asking-great-questions

Topics relevant to development of "SKILL": Art of Presentation, Team building, Art of questioning and Personal Branding for Skill Development through Participative Learning Techniques. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Faculty of L&D
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code:CSE 7100	**Course Title: Mini Project** **Type of Course:**	**L- T-P- C**	0	0	0	4
Version No.	**1.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: 6. Identify the engineering problems related to local, regional, national or global needs. (Understand) 7. Apply appropriate techniques or modern tools for solving the intended problem. (Apply) 8. Design the experiments as per the standards and specifications. (Analyze) 9. Interpret the events and results for meaningful conclusions. (Evaluate) 10. Appraise project findings and communicate effectively through scholarly publications. (Create)					
Catalogue prepared by	Dr. Sampath A K					
Recommended by the Board of Studies on						
Date of Approval bythe Academic Council						

Course Code: CSE 7300	**Course Title: Capstone Project** **Type of Course:**	**L- T-P- C**	0	0	0	10
Version No.	**1.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: 8. Identify problems based on societal /research needs. (Understand) 9. Apply Knowledge and skill to solve societal problems in a group. (Apply) 10. Develop interpersonal skills to work as member of a group or leader. (Apply) 11. Analyze the inferences from available results through theoretical / Experimental / Simulations. (Analyze) 12. Analyze the impact of solutions in societal and environmental context for sustainable development. (Analyze) 13. Improve in written and oral communication. (Create) 14. Demonstrate capabilities of self-learning in a group, which leads to lifelong learning. (Understand)					
Catalogue prepared by	Dr. Sampath A K					
Recommended by the Board of Studies on						
Date of Approval bythe Academic Council						

Course Code: CSD3408	Course Title: Data Mining and Warehousing Type of Course:1] Program Core	L-T-P-C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	CSE1510					
Anti-requisites	**NIL**					
Course Description	This course covers the fundamental concepts, techniques, and tools used in data mining and data warehousing. Students will learn how to design and implement data warehouses and how to extract meaningful patterns and knowledge from large datasets using data mining methods. Topics include data preprocessing, association rules, classification, clustering, OLAP operations, and warehouse schema design. Real-world applications and hands-on projects using industry-standard tools form an essential part of the learning experience.					
Course Objective	To teach principles, concepts and applications of data warehousing and data mining To introduce the task of data mining as an important phase of knowledge recovery process To inculcate Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment. for **Employability** through **Problem Solving** Methodologies.					
Course Out Comes	On successful completion of this course the students shall be able to: 1. Design a data mart or data warehouse for any organization (Understand) 5. Extract knowledge using data mining techniques. (Apply) 6. Adapt to new data mining tools. (Apply) 7. Explore recent trends in data mining such as web mining, spatial-temporal mining. (Apply)					
Course Content:						

Module 1	**Introduction to Data Mining**	Assignment	**10 Hours**
Data Mining - Definition - DM Techniques - Current Trends in Data Mining - Different forms of Knowledge - Data Selection, Cleaning, Integration, Transformation, Reduction and Enrichment. Data: Types of Data - Data Quality - Data Preprocessing - Measures of Similarity and Dissimilarity. Exploration: Summary Statistics Visualization.			

Module 2	**Data Warehouse**	Assignment	**10 Hours**
Introduction to Data Ware House, Differences between operational data base systems and data Ware House, Data Ware House characteristics, Data Ware House Architecture and its components, Extraction-Transformation-Loading, Logical (Multi- Dimensional), Data Modeling, Schema Design, star and snow-Flake Schema, Fact Constellation, Fact Table, Fully Addictive, Semi-Addictive, Non-Addictive Measures.			
Module 3	**ASSOCIATION RULE MINING AND CLASSIFICATION**	Assignment	**13 Hours**

Introduction: - Clustering Paradigms - Partitioning Algorithms - K Means & K Medoid Algorithms - CLARA - CLARANS - Hierarchical Clustering - DBSCAN - BIRCH - Categorical Clustering Cluster Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms.			
Module 4	**WEB MINING**	Assignment	**12 Hours**
Introduction: Web Content Mining - Web Structure Mining - Web Usage Mining - Text Mining - Text Clustering, Temporal Mining - Spatial Mining. Visual Data Mining: Knowledge Mining - Various Tools and Techniques for Implementation using Weka, Rapidminer and MATLAB.			
Text Book 1. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education. 2. Data Mining-Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.			
References 1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press. 2. Data Ware Housing Fundamentals, Pualraj Ponnaiah, Wiley Student Edition. 3. The Data Ware House Life Cycle Toolkit- Ralph Kimball, Wiley Student Edition. 4. Data Mining, Vikaram Pudi, P Radha Krishna, Oxford University			
Catalogue prepared by	Dr. Manjunath KV		
Recommended by the Board of Studies on			
Date of Approval by the Academic Council			

Course Code: CSD2006	**urse Title: Edge AI and IoT Analytics** **pe of Course: Theory**	**T- P- C**	3	0	0	3
Version No.						
Course Pre-requisites	Basics of Machine Learning, IoT fundamentals, and Python programming					
nti-requisites	L					
Course Description	This course provides a comprehensive overview of the convergence between Edg Computing, Artificial Intelligence (AI), and the Internet of Things (IoT). Learners wi explore how intelligent analytics can be performed on-device at the edge of the networ reducing latency and enabling real-time decision-making in resource-constraine environments. The course covers core concepts of edge architecture, IoT protocols, A model optimization, and deployment on edge hardware such as Raspberry Pi, Jetson Nan and Google Coral. . Real-world use cases from domains such as healthcare, smart citie and Industry 4.0 are discussed along with emerging trends in DataOps, ModelOps, an Edge-to-Cloud integration. By the end of the course, students will be able to design, buil and deploy secure and efficient edge-AI-powered IoT systems.						
ourse Objective	e objective of the course is to familiarize the learners with the concepts of **Edge AI and Io Analytics** and attain **Employability** through **Participative Learning** techniques.					
Course Out Comes	**On successful completion of the course the students shall be able to:** 5. Understand and analyze the architecture of IoT systems and Edge AI platforms. 6. Select and apply appropriate hardware, tools, and optimization techniques for deploying AI models on edge devices. 7. Perform real-time analytics on IoT data streams using lightweight ML models and appropriate platforms. 8. Design and develop secure, scalable, and intelligent Edge-IoT solutions for real-worl applications.					
urse Content:						

dule 1: Fundamentals of Edge AI and IoT Systems	**Sessions**
Introduction to IoT and Edge Computing- Edge vs Cloud vs Fog Computing-Architectures of IoT Edge Devices-Key Communication Protocols: MQTT, CoAP, BLE, LoRaWAN. Overview of Edge AI: Concepts and Industry Trends-Introduction to TinyML and Embedded AI.	

dule 2: Edge Hardware, Platforms, and AI Model Deployment	**Sessions**
Edge AI Hardware Platforms: Raspberry Pi, NVIDIA Jetson, Google Coral, Arduino Nano 33 BLE Model Optimization Techniques for Edge: Quantization, Pruning, Knowledge Distillation-A Frameworks for Edge: TensorFlow Lite, ONNX, PyTorch Mobile, Edge Impulse-Deployme Workflows: From Training to On-Device Inference-Power, Memory, and Latency Constraints in Edg Devices	

dule 3 IoT Data Analytics and Real-Time Processing	**Sessions**

	IoT Data Acquisition, Streaming, and Preprocessing -Time-Series Analysis for IoT Sensors Lightweight ML Models for Edge: Decision Trees, k-NN, Naïve Bayes, SVMs -Anomaly Detectio and Predictive Maintenance -Tools and Platforms: Azure IoT Hub, AWS Greengrass, Google Io Core-Data Visualization for Edge Analytics (Grafana, ThingsBoard)
Module 4 Applications, Security, and Project Implementation	**10 Sessions**
	Smart Home, Smart Agriculture, Industrial IoT (IIoT), Smart Cities-Case Studies: Edge AI i Surveillance, Energy Monitoring, Healthcare-Security in Edge AI and IoT (Device Authentication Secure Boot, Data Privacy)-Edge-to-Cloud Integration
	Text Book 2. Xiaofei Wang, Yi Pan "Edge AI: Machine Learning for Embedded Applications" Publisher: Springer- 1st Edition (2022) 3. Yunchuan Sun et al " Learning Edge AI: Algorithms and Applications". Publisher: Springer Edition: 1st Edition (2022) 4. Arshdeep Bahga, Vijay Madisetti "Internet of Things: A Hands-On Approach" Publisher: Universities Press Edition: 2nd Edition (2023) 5. William Lawless et al. "Artificial Intelligence for the Internet of Everything" Publisher: Academic Press (Elsevier) Edition: 1st Edition (2022)
	ferences **9.** Colin Dow "Hands-On Edge Analytics with Azure IoT: Stream Data Processing from Device to Cloud" Publisher: Packt Publishing Edition: 1st Edition (2022). **Web resources:** 1. NPTEL – Introduction to Internet of Things https://nptel.ac.in/courses/106/105/106105166/ 2. Google Developers – Edge AI Overview https://developers.google.com/edge-tpu 3. Google Cloud IoT Core (Edge to Cloud Integration) https://cloud.google.com/iot-core
	Topics relevant to "EMPLOYABILITY SKILLS": Edge computing vs. cloud computing: trade offs and applications- Use of analytics platforms (Grafana, AWS IoT, Azure IoT) **for developin Employability Skills through Participative Learning techniques. This is attained throug assessment component mentioned in course handout.**
Catalogue	Dr.S.Saravana Kumar

prepared by	
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: CSD3418	Course Title: Feature Engineering and Model Optimization Type of Course: Discipline Elective/ Theory Only Course	L- T-P- C	3	0	0	3
Version No.		2.0				
Course Pre-requisites						
Anti-requisites		NIL				
Course Description		This course provides a deep dive into the techniques of transforming raw data into valuable inputs for machine learning models through effective feature engineering. It explores strategies for feature selection, transformation, dimensionality reduction, and hyperparameter tuning. Emphasis is placed on model optimization techniques including regularization, ensemble methods, and automated machine learning pipelines.				
Course Objective		The objective of the course is to familiarize the learners with the concepts of Data Mining and attain Employability through Problem Solving Methodologies				
Course Out Comes		Upon successful completion of this course, students will be able to: 11. Apply various feature engineering techniques to preprocess and transform data effectively. 12. Evaluate and optimize machine learning models using advanced tuning and selection techniques.				

		13. Integrate feature engineering and model optimization strategies into complete machine learning pipelines.			
Course Content:					
Module 1	Introduction to Feature Engineering	Assignment		Data Collection	10 Sessions
	Topics: Understanding data types and quality, Missing value handling, outlier detection, encoding categorical variables, Feature scaling and normalization techniques				
Module 2	Feature Selection and Extraction	Quiz		Problem Solving	10 Sessions
	Topics: Filter, wrapper, and embedded methods, Principal Component Analysis (PCA), LDA, t-SNE, Feature importance and interpretability in models				
Module 3	Model Optimization Techniques	Assignment		Problem Solving	10Sessions
	Topics: Hyperparameter tuning (Grid Search, Random Search, Bayesian Optimization), Cross-validation strategies, Regularization techniques (L1, L2, ElasticNet)				
Module 4	Advanced Techniques and AutoML	Assignment		Problem Solving	12 Sessions
	Feature generation using domain knowledge and interactions, Ensemble learning and stacking, Introduction to AutoML frameworks (e.g., AutoSklearn, H2O.ai, TPOT)				
	5. Feature Engineering and Selection: A Practical Approach for Predictive Models",Author: Max Kuhn, Kjell Johnson, Publisher: CRC Press, Taylor & Francis Group, Year: 2019 6. "Hands-On Feature Engineering with Python", Author: Soledad Galli, Publisher: Packt Publishing, Year: 2020				
	References: **R1 "Automated Machine Learning: Methods, Systems, Challenges",** Editors: Frank Hutter, Lars Kotthoff, Joaquin Vanschoren, Publisher: Springer, Year: 2021 **R2 "Machine Learning Engineering",** Author: Andriy Burkov, Publisher: True Positive Inc., Year: 2020 **Additional web-based resources:** W1. https://onlinecourses.swayam2.ac.in/cec20_cs12/preview Text book of Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufmann Publishers, 2012. W2.https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=7&sid=e2d7362a-				

	fd3049a98f0393e963521dbd%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=377411&db=nlebk https://nptel.ac.in/courses/105105157
	Topics relevant to "EMPLOYABILITY SKILLS": Data Mining Techniques, FP Growth for developing Employability Skills through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Catalogue prepared by		Shaik Salma Begum
Recommended by the Board of Studies on		
Date of Approval by the Academic Council		

Course Code: CIV7601	Course Title: Universal Human Values and Ethics Type of Course: MAC course	-T-P-C	-	-	-	)
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The purpose of the course is to develop a holistic perspective in students' life. Th course adopts a self-reflective methodology of teaching and is designed to equip th students to explore their role in all aspects of living as a part of the society. It presen a universal approach to value education by developing the right understanding of reali through the process of self-exploration. This self-exploration develops more confidence and commitment in students enablin them to critically evaluate their pre-conditioning and present beliefs. As an outcome the holistic approach, the students will be able to practice the ethical conduct in the soci and professional life. The prime focus throughout the course is toward affecting qualitative transformation in the life of the student rather than just a transfer information. This course is designed to cater to Human Values and Professional Ethics.					
Course Objective	e objective of the course is 'SKILL DEVELOPMENT' of the student by using 'SELF LEARNIN techniques					
Course Outcomes	successful completion of this course the students shall be able to: CO.1 Recognize the importance of Value Education through the process of sel exploration CO.2 Explain the human being as the co-existence of the self and the body harmony. CO.3 Describe the role of foundational values in building harmoniou relationships. CO.4 Summarize the importance of a holistic perspective in developing ethic professional behavior.					

Course Content:				
Module 1	roduction to Value Education	Online Assessment	MCQ Quiz	Sessions

pics:

ht Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education Understanding Value Education, Self-exploration as the Process for Value Education, Continuou Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenari Method to Fulfil the Basic Human Aspirations.

dule 2	rmony in the Human Being	Online Assessment	MCQ Quiz	Sessions

pics:

derstanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Nee of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Sel Harmony of the Self with the Body, Programme to ensure self-regulation and Health

dule 3	rmony in the Family and Society	Online Assessment	MCQ Quiz	Sessions

pics:

rmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

dule 4	plications of the Holistic Understanding – A Look at Professional Ethics	line Assessment	Q Quiz	Sessions

pics:

tural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanist Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethic Holistic Technologies, Strategies for Transition towards Value-based Life and Profession

rgeted Application & Tools that can be used:

plication areas are Personal life, Education and Career, Workplace , Society and Environment Responsibility

ols: Online Tools – NPTEL and Swayam.

ject work/Assignment:

ssessment Type

- Online exams (MCQs) will be conducted by the Department of Civil Engineering through Linway

line Link*:

5) UHV II - https://www.youtube.com/watch?v=NhFBzn5qKIM&list=PLWDeKF97v9SO8vvjC1KyqteziTbTjN1So&pp=0gcJCWMEOCosWNin
6) Lecture by Dr. Kumar Sambhav, NPTEL course: Universal Human Values, https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
7) Lecture by Dr. Padmavati, Dr Narendran Thiruthy, NPTEL Course: Biodiversity Protection, Farmers and Breeders Rights, https://nptel.ac.in/courses/129105008, 2024.

Other source links are available in below Resources link.

xt Book

23. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
24. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2019.
25. Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing, New Delhi, 202

ference Books

11. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
12. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986.
13. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
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15. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
16. A N Tripathy, 2003, Human Values, New Age International Publishers.
17. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
18. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
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20. William P. Cunningham and Mary Ann Cunningham (2020), Principles of Environmental Science Inquiry & Applications, 9th Edition, McGraw-Hill Education, USA.

sources:

31. https://onlinecourses.swayam2.ac.in/imb25_mg195/preview
32. https://onlinecourses.nptel.ac.in/noc25_mg141/preview
33. https://onlinecourses.swayam2.ac.in/ini25_hs52/preview
34. https://onlinecourses.nptel.ac.in/noc25_hs219/preview
35. https://onlinecourses.swayam2.ac.in/cec25_mg14/preview
36. https://onlinecourses.swayam2.ac.in/imb25_mg195/preview
37. https://onlinecourses.swayam2.ac.in/imb25_mg196/preview

pics relevant to Skill Development:

5. An attitude of enquiry.
6. Write reports

e topics related to Human values and Professional ethics:

topics in are relevant to Human values and Professional ethics.

Catalog prepared by	s. Divya Nair
Recommended by the Board of Studies on	)th BoS dated 06 June 2025
Date of Approval by the Academic Council	ademic Council no. 26 dated __ June 2025

Course Code: **PPS 1025**	**Course Title: Industry Readiness Program – I (Audited Course)** Type of Course: Practical Only Course	L- T - P- C	0	0	2	0
Version No.	1.0					
Course Pre-requisites	• Students are expected to understand Basic English. • Students should have desire and enthusiasm to involve, participate and learn.					
Anti-requisites	NIL					
Course Description	This course is designed to enable students to set SMART goals, form professional & personal ethics for success and learn various email writing techniques. The course will benefit learners in presenting themselves effectively through various activities and learning methodologies.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Employability for Young Professionals" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.**					
Course Out Comes	**On successful completion of this course the students shall be able to:** CO 1 **Define** their career goals CO 2 **Practice ethical habits** for better career success CO3 **Demonstrate** effective email writing techniques					
Course Content						

Module 1	**Goal Setting & Grooming**	Classroom activities	**10 Hours**

<table>
<tr><td colspan="4">Topics: SMART Goals, formal grooming through self-introduction activity

Activity: Real world scenarios</td></tr>
<tr><td>Module 2</td><td>Habit Formation</td><td>Role plays</td><td>10 Hours</td></tr>
<tr><td colspan="4">Topics: Professional and Personal ethics for success and activity-based practice

Activity: Students to present 2 min video on building professional ethics</td></tr>
<tr><td>Module 3</td><td>Email Etiquettes</td><td>Individual and group presentation</td><td>10 Hours</td></tr>
<tr><td colspan="4">Topics: Types of prompts to generate effective or desired results for email etiquettes

Activity: Individual student presenting various search prompts</td></tr>
<tr><td colspan="4">Faculty: L&D</td></tr>
<tr><td colspan="4">Targeted Application & Tools that can be used:
13. TED Talks
14. You Tube Links
15. Activities</td></tr>
<tr><td colspan="4">Assignment proposed for this course

Assignment 1: SMART Goal

Assignment 2: AI tools for prompt search</td></tr>
<tr><td colspan="4">Continuous Individual Assessment

Module 1: Presentation

Module 2: Activity based assessment

Module 3: Class assessment</td></tr>
</table>

The topics related to skill development: Students acquire knowledge on SMART goals, implement grooming standards, practice ethical behavior in class and campus, acquire hands-on experience to use AI tools to get search prompts for desired email etiquettes.	
Catalogue prepared by	Faculty of L&D
Recommended by the Board of Studies on	**BOS held on**
Date of Approval by the Academic Council	**Academic Council Meeting held on**

Course Code: APT4006	**Course Title: Logical and Critical Thinking** **Type of Course:** Audited	**L- T-P- C**	0	0	2	0
Version No.	1.0					
Course Pre-requisites	Students should have the basic concepts of Logical reasoning and Critical thinking, along with its applications in real life problems.					
Anti-requisites	Nil					
Course Description	This is a skill-based training program for the engineering students (Undergraduate). This course is designed to enable the students to enhance their skills in Logical reasoning and Critical thinking.					
Course Objective	The objective of the course is to familiarize the learners with concepts in in Logical reasoning and Critical thinking through problem solving techniques suitable for their career development.					
Course Outcomes	On successful completion of the course the students shall be able to:					
	CO1] **Understand** all the concepts.					
	CO2] **Apply** the concepts in problem solving (Bloom's taxonomy Level 3)					
	CO3] **Analyze** and structure the reasoning techniques and spatial visualization skills					
Course Content:						
Module 1	Logical Thinking	Assignment				**16 Hours**
	Topics:					
	Syllogisms, Cubes and Dices, Mirror and Water images, Paper cutting and Folding, Embedded figures & Completion of figures, Data Interpretation, Data sufficiency					
Module 2	Critical Thinking	Assignment				**14 Hours**
	Topics:					
	Analogy, Symbol and Notations, Statement and assumption, Cause of action, Statement and conclusion, Puzzles					
	Targeted Application & Tools that can be used:					
	Application area: Placement activities and Competitive examinations.					
	Tools: LMS					
Evaluation	**Continuous Evaluation**					

	· Topic wise evaluation
	· Internal Assessments
	Text Book
	1. A new approach to reasoning verbal, non-verbal & analytical by BS Sijwali
	2. R S Aggarwal
	3. Kiran publications
	References
	1. www.indiabix.com
	2. www.testbook.com
	3. www.youtube.com/c/TheAptitudeGuy/videos
	Topics relevant to Skill Development Logical reasoning and Critical thinking for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.
Catalogue prepared by	L&D Department Faculty Member
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: APT4002	**Course Title: Introduction to Aptitude** **(Audited)**	**L- P- C**	0	2	0
Version No.	1.0				
Course Pre-requisites	Students should know the basic Mathematics & aptitude along with understanding of English				
Anti-requisites	Nil				

Course Description	The objective of this course is to prepare the trainees to tackle the questions on various topics and various difficulty levels based on Quantitative Ability, and Logical Reasoning asked during the placement drives. There will be sufficient focus on building the fundamentals of all the topics, as well as on solving the higher order thinking questions. The focus of this course is to teach the students to not only get to the correct answers, but to get there faster than ever before, which will improve their employability factor.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Aptitude and attain Skill Development through Problem Solving techniques.			
Course Outcomes	On successful completion of the course the students shall be able to: CO1] **Recall** all the basic mathematical concepts they learnt in high school. CO2] **Identify** the principle concept needed in a question. CO3] **Solve** the quantitative and logical ability questions with the appropriate concept. CO4] **Analyze** the data given in complex problems. CO5] **Rearrange** the information to simplify the question			
Course Content:				
Module 1	Quantitative Ability	Assignment	Bloom's Level : Application	**12 Hours**
Topics: Introduction to Aptitude, working of Tables, Squares, Cubes				
Module 2	Logical Reasoning	Assignment	Bloom's Level : Application	**18 Hours**
Topics: Linear & Circular Arrangement Puzzle, Coding & Decoding, Blood Relations, Directions, Ordering and Ranking, Clocks and Calendars, Number Series, Wrong number series, Visual Reasoning				
Targeted Application & Tools that can be used: Application area: Placement activities and Competitive examinations. Tools: LMS				
Text Book 1. Quantitative Aptitude by R S Aggarwal 2. Verbal & Non-Verbal Reasoning by R S Aggarwal				

References 1. www.indiabix.com 2. www.youtube.com/c/TheAptitudeGuy/videos	
Topics relevant to Skill development: Quantitative and reasoning aptitude for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	L&D Department faculty members
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: **APT4004**	**Course Title: Aptitude Training- Intermediate** Type of Course: Practical Only Course	L- T - P- C	0	0	2	0
Version No.	1.0					
Course Pre-requisites	Students should have the basic concepts of Quantitative aptitude along with its applications in real life problems.					
Anti-requisites	NIL					
Course Description	This is a skill-based training program for the students. This course is designed to enable the students to enhance their skills in Quantitative Aptitude.					
Course Objective	**The objective of the course is to familiarize the learners with the concepts of Aptitude and attain Skill Development through Problem Solving techniques.**					

Course Out Comes	**On successful completion of this course the students shall be able to:** CO1: Recall all the basic mathematical concepts. CO2: Identify the principle concept needed in a question. CO3: Solve the quantitative and logical ability questions with the appropriate concept. CO4: Analyze the data given in complex problems.		
Course Content:			
Module 1	**Quantitative Ability 1**	Assignment	**16 Hours**
Topics: Number System, Percentage, Ratio and Proportion, Average, Mixture and Allegation, Time and Work, Profit and Loss			

Module 2	Quantitative Ability 2	Assignment	**14 Hours**
Topics: Time Speed and Distance, Boats and Streams, Simple Interest, Compound Interest, Probability, Permutation and Combination			
Targeted Application & Tools that can be used: Application area: Placement activities and Competitive examinations. Tools: LMS			
Continuous Evaluation:			
CA1 – Online Test CA2 – Online Test CA3 – Online Test Assignment			

Text Book:

1. Fast Track Objective by Rajesh Verma
2. R S Aggarwal
3. Rakesh Yadav

References:

1. **www.indiabix.com**
2. **www.testbook.com**
3. **www.youtube.com/c/TheAptitudeGuy/videos**

Topics relevant to Skill Development: Quantitative aptitude for Skill Development through Problem solving Techniques. This is attained through components mentioned in course handout.

Catalogue prepared by	Faculty of L&D
Recommended by the Board of Studies on	**BOS held on**
Date of Approval by the Academic Council	**Academic Council Meeting held on**

Course Code: **PPS 1026**	**Course Title: Industry Readiness Program – II (Audited Course)** Type of Course: Practical Only Course	L- T - P- C	0	0	2	0
Version No.	1.0					
Course Pre-requisites	• Students are expected to understand Basic English. • Students should have desire and enthusiasm to involve, participate and learn.					
Anti-requisites	NIL					
Course Description	This course is designed to enable students learn styles of communication, team building and use empathy in leadership. The course will benefit learners in preparing themselves effectively through various activities and learning methodologies.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Industry Readiness for Young Professionals" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.**					
Course Out Comes	**On successful completion of this course the students shall be able to:** CO 1 **Apply** different communication skills for success in workplace CO 2 **Practice team building skills** for career success CO3 **Demonstrate** ethical leadership skills in workplace					

Course Content			
Module 1	**Effective Communication**	Classroom activities	**10 Hours**
Topics: Practice effective communication skills (Verbal, Non-verbal, Written and Visual) **Activity:** Use social media prompts to prepare self-introduction videos			
Module 2	**Team Building**	Group Activity	**10 Hours**
Topics: Skills of an effective team player **Activity:** Student group activity to build class networking			
Module 3	**Leadership**	Case study	**10 Hours**
Topics: Types of leadership, using empathy in leadership **Activity:** Individual presentation by students on corporate leaders.			
Faculty : L&D			
Targeted Application & Tools that can be used: 16. TED Talks 17. You Tube Links 18. Activities			
Assignment proposed for this course Assignment 1: One minute reel Assignment 2: Team building assignment			
Continuous Individual Assessment Module 1: L-S-R-W class assessment Module 2: Team Presentation Module 3: Individual Assessment			

The topics related to skill development: Students acquire knowledge on effective communication skills, team building skills and how to prepare themselves to be leaders in workplace using empathy and implement various skill sets during the course of their time in the university.	
Catalogue prepared by	Faculty of L&D
Recommended by the Board of Studies on	**BOS held on**
Date of Approval by the Academic Council	**Academic Council Meeting held on**

Course Code: **APT4005**	**Course Title: Aptitude For Employability** **Type of Course: Practical Only**	**L- T-P- C**	0	0	2	1
Version No.		1.0				
Course Pre-requisites		Students should have the basic concepts of Quantitative aptitude, Verbal ability along with its applications in real life problems.				
Anti-requisites		Nil				
Course Description		This course is designed to enable the students to enhance their skills in quantitative aptitude and verbal ability skills.				
Course Objective		The objective of the course is to familiarize the learners with concepts in Quantitative Aptitude and Verbal ability through problem solving techniques suitable for their career development.				
Course Outcomes		On successful completion of the course the students shall be able to: CO1] **Recall** all the basic mathematical concepts CO2] **Identify** the principle concept needed in a question CO3] **Solve** the quantitative and logical ability questions with the appropriate concept.				
Course Content:						
Module 1	Quantitative Ability	Lab-10hrs		Platform Assessment-10hrs		**20 Hours**
	Topics: Number System, Percentage, Ratio and Proportion, Average, Mixture and Allegation, Time and Work, Profit and Loss, Time Speed and Distance, Simple Interest and Compound Interest, Probability, Permutation and Combination.					

Module 2	Verbal Ability	Lab-5hrs		Platform Assessment-5hrs	**10 Hours**
	Topics: - Parts of Speech, Subject Verb Agreement, Spotting Error, Cloze Test, Verbal Analogies, Reading Comprehension, Idioms & Phrases, Para Jumbles				
	Targeted Application & Tools that can be used: Application area: Placement activities and Competitive examinations. Tools: LMS				
Evaluation	**Continuous Evaluation** • Topic wise evaluation				

	Text Book 1. Fast track objective by Rajesh Verma 2. R S Aggarwal 3. S.P Bakshi
	References 1. www.indiabix.com 2. www.testbook.com 3. www.youtube.com/c/TheAptitudeGuy/videos
	Topics relevant to Skill development: Quantitative and reasoning aptitude for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.

Catalogue prepared by		Faculty of L&D
Recommended by the Board of Studies on		
Date of Approval by the Academic Council		

Course Code: PPS 3018	**Course Title: Preparedness for Interview** Type of Course: Practical Only Course	L- T- P- C	0	0	2	1

Version No.		1.0
Course Pre-requisites		Students are expected to understand Basic English. Students should have desire and enthusiasm to involve, participate and learn.
Anti-requisites		NIL

Course Description		This course is designed to enable students to understand soft skills concepts to be corporate ready. The modules are set to improve self-confidence, communicate effectively and Prepare for the Interview to assist in employability. It helps the students to get a glimpse of the acceptable corporate readiness and equip them with the fundamental necessities of being able to confidently deal with the highly competitive corporate environment and helps in crafting different types of resumes. The pedagogy used will be group discussions, flipped classrooms, continuous feedback, role-play and mentoring.
Course Objective		The objective of the course is to familiarize the learners with the concepts of "**Preparing for Interview**" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.
Course Out Comes		**On successful completion of this course the students shall be able to:** CO1: **Develop** professional Resumes CO2: **Illustrate** Resumes effectively CO3: **Apply** skills and knowledge learnt for active and effective Group Discussions and Interview
Course Content:		

Module 1	**Resume Building**	**Classroom activity**		10 Hours
	Topics: Resume structure, use of templates, Do's and Don'ts, ATS methods, Cover Letter and Video Resume **Activity:** Real world scenarios			
Module 2	**Group Discussion**	**Mock G D**		9 Hours
	Topics: -Group discussion as a placement process, GD techniques like Keyword. SPELT & POV of affected parties. Do & Don't of GD, Case-lets and topics for GD, practice session and evaluation **Activity:-** Real world scenarios			
Module 3	**Personal Interview**	**Grooming checks + Evaluation + Mock Interview+ Role Play**		9 Hours
	Topics: Placement process, Different interview rounds, HR interviews, Interview questions and desired answers, Different types of interviews, Do's and Don'ts. **Activity: -** Role Play & Real-world scenario			
Module 4	**Recap/Revision /Feedback Session**	**Practice sessions**		2 Hours
	Targeted Application & Tools that can be used: 1. TED Talks 2. You Tube Links 3. Role Play activities			

	Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
	Continuous Individual Assessment
	The Topics related to Skill Development: Art Of Presentation and Group Discussion for **Skill Development** through **Participative Learning** Techniques. This is attained through assessment Component mentioned in course handout.

Catalogue prepared by		**Faculty of L&D**
Recommended by the Board of Studies on		**BOS held on**
Date of Approval by the Academic Council		**Academic Council Meeting held on**

Course Code: **APT4002**	**Course Title:** **Introduction to Aptitude** **(Audited)**	**L- P- C**	0	2	0
Version No.	1.0				
Course Pre-requisites	Students should know the basic Mathematics & aptitude along with understanding of English				
Anti-requisites	Nil				
Course Description	The objective of this course is to prepare the trainees to tackle the questions on various topics and various difficulty levels based on Quantitative Ability, and Logical Reasoning asked during the placement drives. There will be sufficient focus on building the fundamentals of all the topics, as well as on solving the higher order thinking questions. The focus of this course is to teach the students to not only get to the correct answers, but to get there faster than ever before, which will improve their employability factor.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Aptitude and attain Skill Development through Problem Solving techniques.				

Course Outcomes	On successful completion of the course the students shall be able to: CO1] **Recall** all the basic mathematical concepts they learnt in high school. CO2] **Identify** the principle concept needed in a question. CO3] **Solve** the quantitative and logical ability questions with the appropriate concept. CO4] **Analyze** the data given in complex problems. CO5] **Rearrange** the information to simplify the question			
Course Content:				
Module 1	Quantitative Ability	Assignment	Bloom's Level : Application	**12 Hours**
Topics: Introduction to Aptitude, working of Tables, Squares, Cubes				
Module 2	Logical Reasoning	Assignment	Bloom's Level : Application	**18 Hours**
Topics: Linear & Circular Arrangement Puzzle, Coding & Decoding, Blood Relations, Directions, Ordering and Ranking, Clocks and Calendars, Number Series, Wrong number series, Visual Reasoning				
Targeted Application & Tools that can be used: Application area: Placement activities and Competitive examinations. Tools: LMS				
Text Book 3. Quantitative Aptitude by R S Aggarwal 4. Verbal & Non-Verbal Reasoning by R S Aggarwal				
References 3. www.indiabix.com 4. www.youtube.com/c/TheAptitudeGuy/videos				
Topics relevant to Skill development: Quantitative and reasoning aptitude for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.				
Catalogue prepared by	L&D Department faculty members			
Recommended by the Board of Studies on				
Date of Approval by the Academic Council				