PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

Program Regulations and Curriculum 2025-2029

BACHELOR OF TECHNOLOGY (B.Tech.) in Artificial intelligence and Data Science

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

Regulation Number: PU/AC-26.9/SoCSE6/ADS/2025-2029

Resolution No. 9 of the 26th Meeting of the Academic Council held on 25th July 2025, and ratified by the Board of Management in its 27th Meeting held on 28th July 2025.

July 2025

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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;*

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

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

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

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

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

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

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

ai. *"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;*

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

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

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

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

an. *"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;*

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

ap. "UGC" means University Grant Commission;

aq. "University" means Presidency University, Bengaluru; and

ar. "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 ADS

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 knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a

member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking 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 Demonstrate comprehensive knowledge of artificial intelligence and data science to describe foundational concepts, explore computational challenges, and apply theoretical and algorithmic principles in the design and development of intelligent and dependable systems.

PSO2 Employ software engineering practices, AI/ML algorithms, and domain knowledge to design and implement intelligent applications, preparing students for careers in advanced technology roles, research, innovation, entrepreneurship, or further academic pursuits.

PSO3 Apply data engineering and machine learning techniques for collecting, preprocessing, analyzing, and deploying structured and unstructured data using databases, cloud infrastructures, and AI platforms to enable efficient, scalable, and automated decision-making 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. in Artificial Intelligence and 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-	Percentage	–	100%	–	–	–	–	–	100	Only CA at School

#	L-T-P										
	2-1	age								0%	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.

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

The B.Tech. in Artificial Intelligence and 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 in Artificial Intelligence and 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. in Artificial Intelligence and 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.

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	2	0	0	2	2	S	Nil

		Communication						F	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

S. No	Course Code	Course Name	L	T	P	C	Contact Hours	Type of Skills/Focus	Pre-requisites/Co-requisites
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**		

S. No	Course Code	Course Name	L	T	P	C	Contact Hours	Type of Skills/Focus	Pre-requisites/Co-requisites
		Table 3.4: List of Program Core Courses (PCC)							
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	CSE2278	**Data Structures and Analysis of Algorithm**	**3**	**1**	**0**	**4**	**4**	**S**	**Nil**
5	CSE2279	**Data Structures and Analysis of Algorithm Lab**	**0**	**0**	**2**	**1**	**2**	**S**	**Nil**
6	CSD1712	**Statistical Foundations of Data Science**	**3**	**0**	**0**	**3**	**3**	**S**	**MAT2402**
7	CSD1713	**Statistical Foundations of Data Science Lab**	**0**	**0**	**2**	**1**	**2**	**S**	**MAT2402**
8	CSE2055	**Object Oriented Programming Using Java**	**3**	**0**	**0**	**3**	**3**	**S/EM**	**Nil**
9	CSE2056	**Object Oriented Programming Using Java Lab**	**0**	**0**	**2**	**1**	**2**	**S/EM**	**Nil**

S.No	Course Code	Course Name	L	T	P	C			
10	CSD2002	Introduction to Data Science	3	0	0	3	3	F	NIL
11	CSE2058	Web Technologies	3	0	0	3	3	S/EM	Nil
12	CSE2059	Web Technologies Lab	0	0	2	1	2	S/EM	Nil
13	CSE2060	Database Management Systems	3	0	0	3	3	S	Nil
14	CSE2061	Database Management Systems Lab	0	0	2	1	2	S	Nil
15	ADS2007	Exploratory Data Analysis	2	0	0	2	2	S	Nil
16	ADS2008	Exploratory Data Analysis Lab	0	0	2	1	2	S	Nil
17	ADS2009	*big Data Technologies*	3	0	0	3	3	S	Nil
18	*ADS2002*	*Big Data Technologies*	3	0	0	3	3	S	Nil
19	ADS2003	Machine Learning for Intelligent data Science	3	0	0	3	3	S/EM	Nil
20	ADS2004	Machine Learning Lab for Intelligent data Science	0	0	2	1	2	S/EM	Nil
21	CSE2069	Operating Systems	3	0	0	3	3	S	Nil
22	CSD2009	Data Handling and Visualization	2	0	0	2	2	S/EM	Nil
23	CSD2010	Data Handling and Visualization Lab	0	0	4	2	2	S/EM	Nil
24	CSE2071	Software Design and Development	3	0	0	3	3	S	Nil
25	ADS2501	Deep Learning and Reinforcement Learning	3	0	0	3	3	S	CSE2064
26	ADS2502	Generative AI and Prompt Engineering	3	0	0	3	3	S	CSE2064
27	ADS2503	Natural Language Understanding and Analytics	3	0	0	3	3	S/EM	CSE1500
28	ADS2504	Natural Language Understanding and Analytics Lab	0	0	2	1	2	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.

Table 3.6 : 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**

18.1 Internship / In-plant Training / Skill-based Program / International Immersion (IM) / Recognition of Prior Learning (RPL)

A student may undergo an Internship / In-plant Training / Skill-based Program / IM / RPL for a period minimum 04 weeks in an industry / company, government bodies, academic / research institution or recognized online platforms offering certified skill-based programs during the semester break between 4th and 5th semesters, subject to the following conditions:

18.1.1 The Internship / In-plant Training / Skill-based Program / IM / RPL shall be conducted in accordance with the Internship Policy prescribed by the University from time to time.

18.1.2 Internship: student shall undergo internship, either in industry / company, academic / research organizations, government bodies, or international

institutions. The objective is to provide practical exposure, industry insights, and real-world experience relevant to the student's field of study.

18.1.3   In-plant Training: student shall undergo training / industrial exposure program aimed at providing with practical insights into real-world working environments. The training may be conducted by industries / companies on-campus or through student visits to industries / companies, government bodies / institutions, or technical organizations.

18.1.4   Skill-based Program: student shall undergo a certified skill-based program of 30 hours / 04 weeks. Skill-based program should cater to Skill-Enhancement, Practical Focus, and Career orientation, Complementary to Curriculum or Industry relevant.

18.1.5   International Immersion (IM): student shall undergo IM aimed at providing global exposure through collaborations with foreign universities, industries, or research institutions. The International Immersion may include industry visits, expert interactions, and cultural exchange activities, enhancing students' international outlook, communication skills, and professional readiness.

18.1.6   Recognition of Prior Learning (RPL): student who shall undergo any formally recognize relevant prior work experience, internships, or project-based learning that meet the internship learning outcomes, thereby allowing students to earn internship credit without repeating equivalent practical training.

18.1.7   The number of Internships available for the concerned Academic Term. Further, the available number of Internships / In-plant training / Skill-based Program / IM / RPL shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student and as per the selection criteria. Provided further, the student fulfils the criteria, as applicable, specified by the industry / company, government bodies, academic / research or through certified courses.

18.1.8   A student may opt for Internship / In-plant Training / IM / RPL in an industry / company, government bodies / academic / research institution, international bodies of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the Internship / In-plant Training / IM / RPL on her / his own. Provided further, that the industry / company, government bodies, academic / research institution national or international offering such Internship / Training confirms to the University that the Internship shall be conducted in accordance with the Program Regulations and Internship Policy of the University / Rubrics.

18.1.9   A student undergoing RPL must submit an application with supporting documents such as experience letters, project reports, employer feedback, certifications, a self-reflection report etc. Application must be submitted before the commencement of the internship semester.

18.1.10 A student selected for an Internship / In-plant Training / Skill-based Program / IM / RPL in an industry / company, government bodies, academic / research institution shall adhere to all the rules and guidelines prescribed in the Internship Policy of the University.

The performance will be assessed and grades awarded as per the university's academic grading policy. It may be included as a non-GPA course (Grade-based Satisfactorily Completed / Not Completed). The student must secure a minimum of 50% of the total marks to be declared as having successfully completed the course.

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 3.7 : 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*	3	0	0	3	3	F	MAT240 2

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S.No		Course Code	Course Name	L	T	P	C	C.H	Type of Skill	Pre Requisite
			Machine Learning							
		CSD3405	Text Mining and Analytics	2	0	2	3	4	EM	CSE2264
PEC-II	SemVI	CSE3426	Front End Full Stack Development*	2	0	2	3		S/ EM	CSE2258
PEC III	Sem VI	CSE3427	Java Full Stack Development*	2	0	2	3		S/ EM	CSE2259
		CSE3428	.Net Full Stack Development*	2	0	2	3		S/ EM	CSE2258
PEC - IV		CSD3412	Graph Analytics	3	0	0	3	3	EM	MAT2303
PEC- IV	Sem VII	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	Type of 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	CSE2258
PEC III	Sem VI	CSE3427	Java Full Stack Development*	2	0	2	3		S/ EM	CSE2259
		CSE3428	.Net Full Stack Development*	2	0	2	3		S/ EM	CSE2258
PEC - IV		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	Sem VII	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	Type of Skill	Pre Requisite
PEC 1	Sem V	CSD3407	Statistical Inference	3	0	0	3	3	S/ EM	MAT240

S.No		Course Code	Course Name	L	T	P	C	C.H		
			and Modelling							2
		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	CSE2258
PEC III	Sem VI	CSE3427	Java Full Stack Development*	2	0	2	3	4	S/ EM	CSE2259
		CSE3428	.Net Full Stack Development*	2	0	2	3	4	S/ EM	CSE2258
PEC - IV		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	Sem VII	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 4 Intelligent Systems and Robotics

S.No		Course Code	Course Name	L	T	P	C	C.H		
PEC 1	Sem V	**CSD3431**	**Expert Systems**	**3**	**0**	**0**	**3**	**3**	**EM**	
		CSD3433	Computational Intelligence Research	3	0	0	3	3	EM	
PEC-II	SemVI	CSE3426	Front End Full Stack Development	2	0	2	3	3	S/ EM	CSE2258
PEC III	Sem VI	CSE3427	Java Full Stack Development	2	0	2	3	3	S/ EM	CSE2259
		CSE3428	.Net Full Stack Development	2	0	2	3	3	S/ EM	CSE2258
PEC - IV		CSD3429	Cognitive Robotics	3	0	0	3	3	EM	CSE1500
PEC-IV	Sem VII	CSD3430	Autonomous Navigation and Vehicles	3	0	0	3	3	EM	CSE1506
PEC - V		CSD3434	Digital Health and Imaging	3	0	0	3	3	EM	CSD1716
PEC - VI		CSD3432	Quantum Computing and AI	3	0	0	3	3	EM	CSE150

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Track 05: Special Basket

	Code	Course	L	T	P	C		S/E	Prereq
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

*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 3.8: 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	-	-	-

		L	T	P	C					
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

Code	Course									
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)

Code	Course									
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

Code	Course									
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	-	-	-	-

Code	Course	L	T	P	C					
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	2	0	2	3	S	-	-	-	-

Code	Title	L	T	P	C					
	for Placement									
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 Communication 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	2	0	0	2	F	HP/GS		-	-

	Succession								
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	3	0	0	3	S/EM	-	-	-	-

Code	Name	L	T	P	C	Sem			Pre-req	
	Simulink									
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	1	0	2	2	FC				

	Physics									
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	3	0	0	3	S/EM/	-	-	-	-

Code	Course	L	T	P	C					
	Management					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	-	-	-	-

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. in Artificial Intelligence and Data Science

		Table 3.9: MOOC Discipline Elective Courses		
Sl.No	**Course Code**	**Course Name**	**Credits**	**L–T–P–C**
1	CSE3111	Artificial Intelligence: Search Methods for Problem Solving	3	3-0-0-3
2	CSE3112	Privacy and Security in Online Social Media	3	3-0-0-3
3	CSE3113	Computational Complexity	3	3-0-0-3
4	CSE3114	Deep Learning for Computer Vision	3	3-0-0-3
5	CSE3115	Learning Analytics Tools	3	3-0-0-3
6	CSE502	Technical Skills in JAVA	3	0-0-6-3
7	CSE503	Technical Skills in Python	3	0-0-6-3
8	CSE504	Comprehensive Technical Skills	5	0-0-10-5
9	CSE505	The Joy of Computing Using Python	3	3-0-0-3
10	CSE3119	Coding Skills in Python	3	3-0-0-3
11	CSE3121	Parallel Computer Architecture	3	3-0-0-3
12	CSE3124	Games and Information	3	3-0-0-3
13	CSE3140	Introduction to Industry 4.0 and Industrial Internet of Things	3	3-0-0-3
14	CSE3142	Affective Computing	3	3-0-0-3
15	CSE3196	Foundations of Cyber Physical Systems	3	3-0-0-3
16	CSE3197	Getting Started with Competitive Programming	3	3-0-0-3
17	CSE3198	GPU Architectures and Programming	3	3-0-0-3
18	CSE3199	Artificial Intelligence: Knowledge Representation and Reasoning	3	3-0-0-3
19	CSE3200	Programming in Modern C++	3	3-0-0-3
20	CSE3201	Circuit Complexity Theory	3	3-0-0-3
21	CSE3202	Basics of Computational Complexity	3	3-0-0-3
22	CSE3212	Introduction to Computer and Network Performance Analysis using Queuing	1	1-0-0-1
23	CSE3213	C Programming and Assembly Language	1	1-0-0-1
24	CSE3214	Python for Data Science	1	1-0-0-1
25	CSE3215	Software Conceptual Design	1	1-0-0-1
26	CSE3117	Industrial Digital Transformation	3	3-0-0-3
27	CSE3118	Blockchain for Decision Makers	3	3-0-0-3
28	CSE3349	Technology for Lawyers	3	3-0-0-3
29	CSE3430	Deep Learning for Natural Language Processing	3	3-0-0-3
30	CSE3431	Machine Learning for Engineering and Science	3	3-0-0-3

31	CSE3432	Algorithms in Computational Biology and Sequence Analysis	3	3-0-0-3
32	CSE3433	Introduction to Large Language Models (LLMs)	3	3-0-0-3
33	CSE3434	Quantum Algorithms and Cryptography	3	3-0-0-3
34	CAI3430	Responsible & Safe AI Systems	3	3-0-0-3
35	CCS3416	Practical Cyber Security for Cyber Security Practitioners	3	3-0-0-3
36	IST3409	Design & Implementation of Human-Computer Interfaces	3	3-0-0-3

21.3 MOOC - Open Elective Courses for B. Tech. in Artificial Intelligence and Data Science

Sl. No.	Course Code	Course Name	Total Credits	L-T-P-C
Table 3.10: MOOC Open Elective Courses
Courses duration is 4 weeks (01 credit)/ 8 weeks (02 credits)/ 12 weeks (03 credits)
1	BBA2022	Supply Chain digitization	3	3-0-0-3
2	BBA2021	E Business	3	3-0-0-3
3	BBB2016	Business Analytics for Management Decisions	3	3-0-0-3
4	BBB2015	Artificial Intelligence for Investments	3	3-0-0-3
5	MEC3001	Design and Development of Product	1	1-0-0-1
6	ENG3004	Perspectives of Neurolinguistics	1	1-0-0-1
7	PPS4009	Working in Contemporary Teams	1	1-0-0-1
8	MGT3001	Data Analysis and Decision Making	3	3-0-0-3
9	MEC3001	Design and Development of Product	1	1-0-0-1
10	EEE3105	Microsensors and Nanosensors	3	3-0-0-3
11	CIV3065	Drone Systems and Cont¯rol	3	3-0-0-3
12	ECE3183	Neural Networks for Signal Processing - I	3	3-0-0-3
13	CIVXXXX	Disaster Management	3	3-0-0-3

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	21	27			
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	HSM

#	Code	Course Title	L	T	P	C	Credits	Sem	Prereq	Category
										C
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
11	ECE1511	Design Workshop	1	0	2	2	3	S/EM	Nil	ESC
Semester 2 - CHE Cycle			17	1	12	20	27			
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	CSE2000	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	LAW7601	Indian Constitution	0	0	0	0	0	F	Nil	MAC
9	CSE2001	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
Semester 3			18	1	6	23	26			
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
4	CSE2278	Data Structures and Analysis of Algorithm	3	1	0	4	4	S	Nil	PCC
5	CSE2279	Data Structures and Analysis of Algorithm Lab	0	0	2	1	2	S	Nil	PCC
6	CSD1712	Statistical Foundations of Data Science	3	0	0	3	3	S	MAT2402	PCC
7	CSD1713	Statistical Foundations of Data Science Lab	0	0	2	1	2	S	MAT2402	PCC
8	CSE2255	Object Oriented Programming Using Java	3	0	0	3	3	S/EM	Nil	PCC
9	CSE2256	Object Oriented Programming Using Java Lab	0	0	2	1	2	S/EM	Nil	PCC
10	CSD2002	Introduction to Data Science	3	0	0	3	3	F	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			14	1	8	22	23			
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

#	Course Code	Course Title	L	T	P	C		Eval	Prereq	Cat
5	CSE2261	Database Management Systems Lab	0	0	2	1	2	S	Nil	PCC
6	ADS2007	Exploratory Data Analysis	2	0	0	2	2	S	Nil	PCC
7	ADS2008	Exploratory Data Analysis Lab	0	0	2	1	2	S	Nil	PCC
8	CSE2264	Essentials of AI	3	0	0	3	3	S/EM	Nil	ESC
9	CSE2265	Essentials of AI Lab	0	0	2	1	2	S/EM	Nil	ESC
10	FIN1002	Essentials 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**	**8**	**23**	**25**			
1	ADS2009	Big Data Technologies	3	0	0	3	3	S	Nil	PCC
	CSD2004	Cloud Computing for Data Science	2	0	0	2	2	S	DS	Nil
2	CSD2005	Cloud Computing for Data Science Lab	0	0	2	1	2	S/EM	DS	Nil
3	ADS2003	Machine Learning for Intelligent data Science	3	0	0	3	3	S/EM	Nil	PCC
4	ADS2004	Machine Learning Lab for Intelligent data Science	0	0	2	1	2	S/EM	Nil	PCC
5	CSE2269	Operating Systems	3	0	0	3	3	S	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	2	S/EM	Nil	PCC
9	CSEXXXX	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	1	2	S/EM	Nil	HSMC
Semester 6			**21**	**0**	**8**	**25**	**29**			
1	CSE2274	Software Design and Development	3	0	0	3	3	S	Nil	PCC
	ADS2501	Deep Learning and Reinforcement Learning	3	0	0	3	3	S	CSE2064	PCC
2	ADS2502	Generative AI and Prompt Engineering	3	0	0	3	3	S	CSE2064	PCC
3	ADS2503	Natural Language Understanding and Analytics	3	0	0	3	3	S/EM	CSE1500	PCC
4	ADS2504	Natural Language Understanding and Analytics Lab	0	0	2	1	2	S/EM	CSE1500	PCC
5	CSE2224	Competitive Programming and Problem Solving	0	0	4	2	4	S/EM	Nil	ESC
6	CSEXXXX	Professional Elective – II	3	0	0	3	3	S	Nil	PEC
7	CSEXXXX	Professional Elective – III	3	0	0	3	3	S	Nil	PEC
8	XXXXXXX	Open Elective – I	3	0	0	3	3	S	Nil	OEC
9	APT4005	Aptitude for Employability	0	0	2	1	2	S	Nil	HSMC
Semester 7			**12**	**0**	**0**	**16**	**12**			
1	CSEXXXX	Professional Elective – IV	3	0	0	3	3	S	Nil	PEC
2	CSEXXXX	Professional Elective – V	3	0	0	3	3	S	Nil	PEC
3	CSEXXXX	Professional Elective – VI	3	0	0	3	3	S	Nil	PEC

4	XXXXX XX	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: CSD2010	Course Title: CSD1711 Data Handling and Visualization Lab Type of Course: Program Core	P- C	0		1
Version No.					
Course Pre-requisites					
Anti-requisites					
Course 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.				
Course 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.				
Course 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.				
Course 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

References

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

Course Code: CSE2260	Course Title: Database Management Systems Type of Course: Theory		L-T-P-C	3	0	0	3

Version No.	
Course Pre-requisites	NIL.
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 designusing 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: CSE7100	**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)

Course Code: CSE2224	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		3	0	0	3
	Type of Course: Discipline Elective/ Theory Only Course	L- T-P- C				
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.

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		CSE1500				
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.

Course Code: CSE2259	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	NIL					
Anti-requisites	**NIL**					
Course	This course highlights the comprehensive introduction to scripting					

Description		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

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: CSD3403	Course Title: Optimization for Data Science Type of Course: Theory Integrated	L- T-P-C	2	0	2	3
rsion No.						
Course Pre-requisites	MAT 1003					
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.					
Course 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:						
odule 1	undations 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.

odule 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.				
odule 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).

odule 4	vanced Topics and Applications in Data Science	hi 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

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

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

xt Book

1] Stephen Boyd and Lieven Vandenberghe "Convex Optimization" , 1st Edition (2004), Cambridge University Press.
2] Jorge Nocedal and Stephen J. Wright "Numerical Optimization" 2nd Edition (2006), Springer.
3] Sébastien Bubeck "Convex Optimization: Algorithms and Complexity", 1st Edition (2015), Now Publishers.
4] 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.

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		MAT2402				
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	Assignment		Problem Solving	10Sessions

	Modeling				
	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.				

Course Code: CSD1713	Course Title: Statistical Foundations for Data Science Lab Type of Course: Discipline elective Lab Integrated	T-P-C	0	0	2	1
Version No.						
Course Pre-requisites	MAT2402					
Anti-requisites						
Course 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.					
Course 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.					

	On successful completion of this course, students can expect to achieve the following outcomes:
urse 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

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

Course Code: CSD1712	Course Title: Statistical Foundations Of Data Science	T-P-C			
	Type of Course: Theory		3	0 0	3
Version No.					
Course Pre-requisites	MAT2402				
Anti-requisites	L				
Course 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.				
Course Objective	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.				
Course 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.				

Course Content:

Module 1	Introduction	Assignment	Programming	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.

Module 2	Multiple Linear Regression	Assignment	Programming	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

Web 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..**

Course Code:CSD2002	Course Title: Introduction to Data Science Type of Course: Program Core	L-T-P-C	3	0	0	3
Version No.						
Pre-requisites						
Course 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.					
Course 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					
Course 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					
Course Content:						

Module 1	Introduction to Data Science	Quiz	Knowledge 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)				

Module 2	Data Wrangling and Exploration	Assignment	Implementation	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)				

Module 3	Data Visualization and Communication	Term paper/Assignment	Implementation	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)

Course Code: ADS2004	urse Title: Machine Learning Lab for Intelligent Data Science pe of Course: Lab	**P- C**	0	0	2	1
Version No.						
Course Pre-requisites	˩					
Anti-requisites	˩					
ourse 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.					
ourse 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: ADS2003	**Course Title:** Machine Learning for Intelligent Data Science **Type of Course:** Theory	**L-T- P- C**	3	0	0	3
Version No.						
Course Pre-requisites	-					
Anti-requisites						
Course 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.					
Course 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.					
Course 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.					

Module 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.	

Module 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**)**	

Module 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),I**SBN:** 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.**

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		MAT2402					
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 Statistical 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

Course Code: CSE1500	Course Title: Computational Thinking using Python Type of Course: ESC		T-P-C	2	0	2	3
Version No.	0						
Course Pre-requisites							
Anti-requisites	L						
Course 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.						
Course 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.						
Course 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)						
Course Content:							
Module 1	**Computational Thinking And Problem Solving**	Assignment		Programming	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	Sessions

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	Sessions

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	Sessions

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	Sessions

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).

oject 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: CSE2256	Course Title: CSE2256 - Object Oriented Programming Using Java Lab Type of Course: Lab - PCC		L-T- P- C	0	0	2	1
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:** 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**
os://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q
os://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: 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: 5. Demonstrate the database concepts, practice, and SQL queries. [Apply] 6. Design and implement database schemas while applying normalization techniques to optimize structure. [Apply]] 7. Develop and implement stored procedures, triggers, and views for automation and efficiency. [Apply] 8. 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.

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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 designusing 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: CSE2274	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	

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

Course Code: CSE7300	**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)					

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: CSE3427	**Course Title:** Java Full Stack Development		
		L- T-P- C	2-0-2-3
Version No.	1.0		
Course Pre-requisites	**CSE2259**		
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&index=2

Course Code: PHY2504	Course Title: Optoelectronics and Quantum Physics Lab Type of Course: BSC	L-T-P-C	0	0	2	1
Version No.						
Course Pre-requisites	.					
Anti-requisites	.					

Course 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.**
Course 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
el 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.
el 1: Determination of Wavelength of Laser
el 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.
el 1: To determine the proportionality of Hall Voltage and magnetic flux density
el 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.
el 1:   To study I –V characteristics of the given Zener diode in reverse bias and to determine break down voltage.
el 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.
el 1: To determine the input resistance of a given transistor.
el 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.
el 1: To study the I-V characteristics
el 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. .
el 1: Calculate the numerical aperture.
el 2:   study the losses that occur in optical fiber cable.

Experiment No. 9: Plotting I-V characteristics in forward and reverse bias for LEDs and Determination of knee voltage.

Level 1: Plotting I-V characteristics in forward and reverse bias for LEDs

Level 2: Determination of knee voltage.

Experiment No. 10: Determination of Stefan's constant and verification of Stefan-Boltzmann Law.

Level 1: Determination of Stefan's constant

Level 2: Verification of Stefan-Boltzmann Law.

Experiment No. 11: Determination of dielectric constant of given materials.

Level 1: Determination of Stefan's constant

Level 2: compare the obtain results with other materials

Experiment No. 12: determine the wavelength of monochromatic light, such as sodium light, using Newton's rings.

Level 1: Determination of wavelength

Level 2: determine the radius of curvature of the Plano-convex lens.

Targeted 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.

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

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.

Course Code: **PHY2501**	Course Title: Optoelectronics and Quantum Physics Type of Course: BSC	-P-C	3	0	0	3
Version No.						
Course Pre-requisites	NIL					
Anti-requisites	.					
Course 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:				
odule 1	**ctrical Conductivity Of Solids And Semiconducting Devices**	ignment	ta 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				
odule 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				
odule 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.				
odule 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.

xt 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: ECE2022	Course Title: Digital Design Type of Course: ESC	L- T-P- C	2	0	0	2
Version No.	0					
Course Pre-requisites	-					
Anti-requisites	-					
Course 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.					
Course 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.					
Course 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					
Course Content:						
Module 1	Fundamentals of Number systems- Boolean algebra and digital logic	Application Assignment	Data Analysis task			06 classes

Topics:
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.

Module 2	Boolean function simplification	Application Assignment	Data Analysis task	08 Classes

Topics:
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.

Module 3	Combinational Logic circuits:	Application Assignment	Programming Task & Data Analysis task	08 Classes

Topics:
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.

Targeted Application & Tools that can be used:
Digital 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.

Course Code: ECE2052	Course Title: Digital Design Lab pe of Course: Theory &Integrated Laboratory	L- T-P- C	0	0		2	1
Version No.	)						
Course Pre-requisites							
Anti-requisites	L						
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.						
Course 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.						

:ourse 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.						

Course Content:							

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

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

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

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

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

Experiment No. 6: Study of Flip flops

Experiment No. 7: Design and Implementations of sequential logic circuit for specifications
Level 1: Specifications given in the form of Truth table

Level 2: Specification should be extracted from the given scenario

Experiment No.8: HDL coding for basic combinational logic circuits
Level 1: Gate level Modeling
Level 2: Behavioral Modeling
Experiment No.9: HDL coding for basic sequential logic circuit
Level 1: Gate level Modeling
Level 2: Behavioral Modeling

Targeted Application & Tools that can be used:

Digital 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):
  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: **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	-
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

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: CIV1200	Course Title: Foundations of Integrated Engineering Type of Course: Theory Only	L- T-P- C	2	0	0	2
Version No.						
Course Pre-requisites	NIL					
Anti-requisites	.					
Course 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.					
Course Objective	The objective of the course is skill development of student by using Participative Learning techniques.					
Course 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.					
Course Content:						

Module 1	undations of Engineering Practice	ignment	e studies	essions

Real-world problem-solving using data logic and practical applications, Collaboration and Innovation through multi-domain project, Engineering Ethics & Environmental Impact

Emerging Fields: Automation, and Introduction to bioinformatics and its application

Sustainability & Safety: Circular economy principles, carbon footprint analysis.

Module 2	il Engineering & Geomatics	ignment	icle Review	essions

Smart Infrastructure & Geomatics: GIS mapping, LiDAR, drone surveys for urban planning, Geospatial data analysis for disaster management.

Sustainable Construction: 3D-printed structures, self-healing concrete, Digital twins for infrastructure monitoring.

Green Innovations: Net-zero energy buildings, rainwater harvesting systems.

Module 3	echanical Engineering in Action	ignment & Quiz	ta Collection	essions

Advanced Manufacturing: Collaborative robots (cobots), additive manufacturing and 3D printing, Reverse engineering and prototyping.

Energy Systems: Solar/wind energy harvesting, piezoelectric applications.

Biomechanics: Prosthetics design, ergonomic product lifecycle.

Module 4	ctrical & Electronics Engineering	ignment & Quiz	ta Collection and visualization	essions

Smart Devices & Systems: Embedded systems, Wearable technology, Edge computing and hardware platforms

Energy Innovations: EV charging infrastructure, wireless power transfer, Smart grid integration with renewables.

Module 5	ndamentals of IT	ignment & Quiz	e studies	5 Sessions

Core IT Topics: Networking basics, Cloud computing

Cybersecurity & Data: Encryption, phishing prevention, zero-trust models, Database management.

Emerging Tech: Blockchain for supply chains, AI/ML basics, IoT integration with cloud platforms

Targeted Application & Tools that can be used:

Application Areas include Interdisciplinary problem-solving, Smart city planning, disaster management, Robotics prototyping, renewable energy systems, Wearable health tech, smart grids, Secure cloud systems.

Tools: 3D Printers, Autocad, Tinkercad, ArcGIS / QGIS, Arduino/Raspberry Pi

Text 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

References

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

Web-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

Course Code: CHE2502	Course Title: Chemistry of Smart Materials Lab (CSE and Allied) Type of Course: Laboratory course- Basic science course	L-T-P- C	0	0	2	1
Version No.						
Course Pre-requisites						
Anti-requisites	.					
Course 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**.					
Course 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.					
Course Content:	**Total 30 sessions**					

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

Experiment 5	...perimental	...ta Collection	...alysis and Interpretation
Conductometric estimation of mixture of acids in Recycling process of E- waste.			
Experiment 6	...perimental	...ta Collection	...alysis and Interpretation
Determination of viscosity coefficient of a given organic liquid using Ostwald's Viscometer (viscoelastic property).			
Experiment 7	...perimental	...ta Collection	...alysis and Interpretation
Recovery of valuable metals (copper) from e- waste by Iodometric titration.			
Experiment 8	...perimental	...ta Collection	...alysis and Interpretation
Estimation of iron in electronic devices using Std. Potassium permanganate solution.			
Experiment 9	Experimental	...ta Collection	Analysis
Flame photometric estimation of sodium (Battery Recycling- Optical Sensor).			
Experiment 10	Experimental	...ta Collection	Analysis
Synthesis of conducting polyaniline for gas sensor applications (Demonstration experiment).			
Experiment 11	Experimental	Data Collection	Analysis
Green synthesis of nanomaterials (Demonstration experiment).			
Experiment 12	Experimental	Data Collection	Analysis
Recovery of valuable metals from e- waste by eletroless method (Demonstration experiment).			
Any 8 experiments will be conducted out of 12			
Continuous Internal Assessment:			

Continuous Internal Assessment:

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

Text 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

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.

ENG2501	Advanced English	L- T- P- C	2	0	0	2
Version No.						
ourse Pre-requisites						
Anti-requisites	L					
Course 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.					
Course 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:

Module 1	Foundations of Effective Communication	Case Studies/ Role play	Cross-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

Module 2	Mastering Speech Delivery	JAM	Public Speaking Confidence	12 Classes

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

Activities:
- Speech Writing
- Impromptu Speech

Module 3	Critical Reading and Logical Analysis	Worksheet	Critical 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

Module 4	Writing Effective Arguments	Assignment	Clear and Coherent Writing	9 Classes

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

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

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

References

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

urse Code EEE1250	urse Title: Basics of Electrical and Electronics Engineering Laboratory pe 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.

Course Code: LAW7601	Course Title: Indian Constitution Type of Course: Theory	L-T-P-C	0	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 topics 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.

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						

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: 1. TED Talks, 2. You Tube Links 3. 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.

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						
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 erstanding the applications of Linear Algebra and Vector Calculus to engineering applications – The faculty will allocate pters/ parts of chapters to groups of students so that the entire syllabus of Linear Algebra and Vector Calculus is ered.

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=EBSCO 95_30102024_9607
2.   https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO 95_30102024_143156
3.   https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTO M_PACKAGE_EBSCO_29052023_270975
4.   https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO 95_30102024_94555
5.   https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO 95_30102024_243864
6.   https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO 95_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/

Course Code: MAT2301	Course Title: Calculus and Differential Equations Type of Course : BSC	T- P- C	3	1	0	4
Version No.						
ourse Pre-requisites						
Anti-requisites	L					
Course 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.					
Course 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.					
Course 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.					
Course Content:						

Module 1	ferential Calculus		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.			

Module 2	egral Calculus	signment	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.			

Module 3	ltivariable Calculus		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.			

Module 4	ferential Equations	signment	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.

rgeted 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

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.

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:

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.

Course Code: CSE1500	Course Title: Computational Thinking using Python Type of Course: ESC	-T-P-C	2	0	2	3
Version No.	0					
Course Pre-requisites						
Anti-requisites	L					
Course 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.					
Course 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.					
Course 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)					

Course Content:

odule 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

odule 2	tatypes, Expressions, Statements	signment		ogramming	Sessions

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	Sessions

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	Sessions

pics:

sts: 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	Sessions

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).

oject 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.

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: 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.					
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
1) Definition and Introduction to Design Thinking
2) 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:
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.

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

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:
4. TED Talks
5. You Tube Links
6. 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	1	0	4
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:

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.

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.

Course Code: CHE7601	Environmental Studies Type of Course: MOOC course	L- T- P- C	-	-	-	-
		Contact hours	-	-	-	-

Course Pre-requisites	NIL
Anti-requisites	L
Course 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**
Course Objective	The objective of the course is **'SKILL DEVELOPMENT'** of the student by using **'PARTICIPATIVE LEARNING'** techniques
Course 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

Course Content:

Module 1	Understanding Environment, Natural Resources, and Sustainability			

Topics:

Classification 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.

Concept 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.

Module 2	Ecosystems, Biodiversity, and Sustainable Practices			

Topics:

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.

Module 3	Environmental Pollution, Waste Management, and Sustainable Development			

Topics:

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.

Module 4	Social Issues, Legislation, and Practical Applications			

Topics:

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).

Targeted Application & Tools that can be used:

Application areas are Energy, Environment and sustainability

Tools: Online Tools – NPTEL and Swayam.

Project work/Assignment:

Assessment Type

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

Online 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.

Other source links are available in below Resources link.

Text 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.

Reference 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.

Course Code: CHE2501	Course Title: Chemistry of Smart Materials Type of Course: Theory - BSC	L-T- P- C	3	0	0	3
Version No.						
Course Pre-requisites	NIL					
Anti-requisites	-					
Course 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**					
Course Objective	The objective of the course is 'SKILL DEVELOPMENT' of the student by using Participative learning techniques.					
Course 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.					
Course Content:						
Module 1	**Computational Chemistry**	Assignment	Data Collection and analysis	**09 classes**		

Topics: 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

Self- learning topics: Scope, cost and efficiency of computational modeling.

Module 2	**Materials for Memory and Display Systems**	Assignment	Data 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

Module 3	**Nanomaterials based Smart Sensors and Devices**	Assignment	Data Collection and analysis	**09 Classes**

Topics: 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

Module 4	Sustainable Materials and Development	Quiz/Seminar	Data Collection and analysis	09 Classes

Topics: 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.

Module 5	Energy Science	Quiz/Seminar	Data Collection and analysis	Classes

Topics: 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

Targeted Application & Tools that can be used:

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

Tools: Molview, chemdraw, excel etc

Project work/Assignment:

Assessment 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

Text 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

Reference 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

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topics in theory component are relevant to Environment and Sustainability.

Course Code: CSE2000	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):
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/

Course Code: CSE2001	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 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):
    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: EEE1200	Course Title: Basics of Electrical and Electronics Engineering. Type of Course: Theory - ESC		L-T-P-C	3	0	0	3
Version No.							
Course Pre-requisites	NIL						
Anti-requisites							
Course 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.						
Course 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.						
Course Outcomes	**On successful completion of this course the students shall be able to:** 1. **Apply** basic law**s** 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.						
Course Content:							

Module 1	**Introduction to Electrical Circuits**	Assignment/ Quiz	Numerical solving Task	10 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.

Module 2	**Semiconductor and Diode applications**	Assignment/ Quiz	Memory 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.

Module 3	**Transistors and its Applications**	Assignment/ Quiz	Memory Recall- based Quizzes	10 Sessions

Transistor 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.

Module 4	**Fundamentals of Electrical Machines**	Assignment/ Quiz	Numerical 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.

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

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..

bject 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.

erence 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.

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: 7. TED Talks 8. You Tube Links 9. 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.			

Course Code: ECE1511	Course Title: Design Workshop Course Type : ESC		T-P- C	1	0	2	2
Version No.							
Course Pre-requisites	NIL						
Anti-requisites							
Course 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.						
Course Objective	The objective of the course is **Employability Skills** of student by using **PARTICIPATIVE LEARNING** techniques.						
Course 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.						
Course Content:							

Module 1	**Basic concepts of Microcontrollers**	Hands-on	Interfacing Task and Analysis	**3 Sessions**

Topics:
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.

Module 2	nsory Devices	nds-on	erfacing Task and Analysis	essions

Arduino Sensors: Humidity Sensor, Temperature Sensor, Water Detector / Sensor, PIR Sensor, Ultrasonic Sensor, Connecting Switches and actuators, sensor interface with Arduino.
Introduction to 3D Printer: 3D Printer technology and its working Principles, Applications. Introduction to online Simulators: Working with AutoCAD/Fusion 360 Simulator.

Module 3	roduction to Micro python	nds-on	erfacing Task and Analysis	Sessions

Topics:
Introduction to MicroPython, Comparison with other programming languages, Setting up the MicroPython development environment, Basics of MicroPython syntax and structure.

Module 4	orking 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**

Targeted Application & Tools that can be used:

Application Area:

Home 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.

Professionally Used Software: Students can use open SOURCE Software's Arduino IDE and Tincker CAD, Thonny Python, Python IDLE etc.

Project 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

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Textbook(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.hticiitm.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>

content:

   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.

Course Code: CSE2251	Course Title: Data Communication 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: CSE2255	Course Title: CSE2255 - Object Oriented Programming Using Java				3	0	0	3
	Type of Course: Theory - PCC	L-T- P- C						
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
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: N1002	Course Title: Essentials of Finance Type of Course: HSMC	L-T-P-C	3	0	0	3
Version No.	)					
Course Pre-requisites	This course is designed to be accessible to all students, regardless of their prior financial knowledge.					
Anti-requisites						
Course 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**.					
Course 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.**					
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** 5. **Understand the basic concepts of finance and financial markets and organizations.** 6. **Apply and interpret financial information for business decision making.** 7. **Identify various heads of income and deduction under Income Tax Act, 1961.**					
Course Content:						

Module 1	**Introduction to Finance**	Assignment/ Quiz	Numerical solving Task	0 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.

Module 2	Financial Management	Assignment/ Quiz	Numerical 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.

Module 3	xation	signment/ Quiz	merical solving Task	7 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.

Targeted Application & Tools that can be used:
Textbooks, PPT, Spreadsheet Software (e.g., Microsoft Excel), Official Website of Income Tax Department.

Project 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.

Text Book(s):
7.   **Dr. Vinod K. Singhania & Dr. Monica Singhania.** (Latest Assessment Year Edition). *Students' Guide to Income Tax including GST*. Taxmann Publications.
8.   Pandey, I. M. (2025). *Financial Management*. Vikas Publishing House.

Reference Book (s):
7.   **Bhole, L.M., & Mahakud, J.** (Current Edition). *Financial Institutions and Markets: Structure, Growth and Innovations*. McGraw Hill Education India.
8.   **Mehrotra, H.C., & Goyal, S.P.** (Latest Assessment Year Edition). *Income Tax Law & Practice*. Sahitya Bhawan Publications.
9.   **Gordon, E., & Natarajan, K.** (Current Edition). *Financial Markets and Services*. Himalaya Publishing House.
Online Resources (e-books, notes, ppts, video lectures etc.):

7.   https://presidencyuniversity.linways.com
8.   https://onlinecourses.nptel.ac.in/noc24_ec01/preview
9.   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.

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

> 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&uniqid=EBSCO95_30102024_54588
>
> https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&uniq

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: CSE2258	Course Title: Web Technologies Type of Course: Program core Theory		L-T- P-C	3	0	0	3
Version No.	1.0						
Course Pre-requisites	NIL						
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: CSE2279	Course Title: Data Structures Analysis of Algorithms Lab Type of Course: Lab - PCC	L- T-P- C	0	0	2	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

Course Code: CSE2264	Course Title: Essentials of Artificial Intelligence Type of Course: Program Core Course -Theory	-P-C	3	0	0	3
Version No.						
Course Pre-requisites	NIL					
Anti-requisites						
Course 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).					
Course Objectives	The objective of the course is EMPLOYBILITY of student by using EXPERIENTIAL LEARNING techniques.					
Course Out Comes	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:

Module 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.				

Module 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				

Module 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				

Module 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.

Project 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).

Textbook(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.

References:

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.

Weblinks

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.

urse Code: CSE2265	Course Title: Essentials of AI Lab be of Course: Program Core Course - Lab	-P-C	0	0	2	1
Version No.						
urse Pre-requisites	NIL					
Anti-requisites						
Course 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).					
Course 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.

Textbook(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.

References:
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.

Course Code: CSE2269	Course Title: Operating Systems			3	0	0	3
	Type of Course: Program Core and Theory Only	L-T- P- C					

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: 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)					

Course Code: CSE2274	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: **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.

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)					

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		
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

Course Code: CSD2006	Course Title: Edge AI and IoT Analytics Type of Course: Theory	T- P- C	3	0	0	3
Version No.						
Course Pre-requisites	Basics of Machine Learning, IoT fundamentals, and Python programming					
Anti-requisites	L					
Course Description	This course provides a comprehensive overview of the convergence between Edge Computing, Artificial Intelligence (AI), and the Internet of Things (IoT). Learners will explore how intelligent analytics can be performed on-device at the edge of the network, reducing latency and enabling real-time decision-making in resource-constrained environments. The course covers core concepts of edge architecture, IoT protocols, AI model optimization, and deployment on edge hardware such as Raspberry Pi, Jetson Nano, and Google Coral. . Real-world use cases from domains such as healthcare, smart cities, and Industry 4.0 are discussed along with emerging trends in DataOps, ModelOps, and Edge-to-Cloud integration. By the end of the course, students will be able to design, build, and deploy secure and efficient edge-AI-powered IoT systems.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Edge AI and IoT 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-world applications.					
Course Content:						

Module 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.	

Module 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-AI Frameworks for Edge: TensorFlow Lite, ONNX, PyTorch Mobile, Edge Impulse-Deployment Workflows: From Training to On-Device Inference-Power, Memory, and Latency Constraints in Edge Devices	

Module 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 Detection and Predictive Maintenance -Tools and Platforms: Azure IoT Hub, AWS Greengrass, Google IoT 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 in 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 Devices 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 developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.**

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. ApplZ 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.

Course Code: CSD2009	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	s i o n s

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	s i o n s

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	ss io n s

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	ss io n s

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.

3] Problem Solving: Choose an appropriate set of visualization elements and design for a dashboard.

4] Programming: Implementation of the chosen dashboard

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Text Books

</div>

5] McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media.

6] Munzner, T., "Visualization Analysis and Design", CRC Press, (2015).

7] Dr. Ossama Embarak, "Data Analysis and Visualization Using Python", Apress,(2018)

Course Code: CSE2278	Course Title: Data Structures and Analysis of Algorithm Type of Course: Program core Theory Only	L- T-P- C	3-1-0-4
Version No.			
Course Pre-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course introduces the concepts of abstract data types, data structures, and algorithm design techniques. Students will learn to represent data using arrays, linked lists, stacks, queues, trees, heaps, graphs, and hash tables, and analyze their time and space complexities. Emphasis is placed on the development of efficient algorithms and their correctness using Big-O, Big-Theta, and Big-Omega notations. Students will also explore algorithmic paradigms such as divide-and-conquer, greedy methods, and dynamic programming.		
Course Objective	To understand and implement fundamental data structures such as arrays, linked lists, stacks, queues, trees, heaps, hashing, and graphs. To analyze the time and space complexity of algorithms using asymptotic notations and solve recurrence relations for algorithm performance evaluation.		

	To design and apply efficient algorithmic techniques including divide-and-conquer, greedy methods, and dynamic programming for solving real-world computational problems.
Course Outcomes	Upon successful completion of this course, students will be able to: • **CO1**: Apply suitable data structures for problem solving in software systems. • **CO2**: Analyze the time and space complexity of algorithms using asymptotic notations. • **CO3**: Design efficient algorithms using divide-and-conquer, greedy, and dynamic programming paradigms. • **CO4**: Implement and evaluate algorithms for tree, heap, hashing, and graph-based problems.
Course Content:	

Module 1	**Introduction to Data Structures and Algorithm Analysis**	**6 Hours Lecture + 2 Hours Tutorial**

- Abstract Data Types (ADT), Time and Space Complexity
- Asymptotic Notations: Big O, Big Θ, Big Ω
- Empirical and Mathematical Analysis of Algorithms
- Recurrence Relations and Solving Techniques

Module 2	**Linear Data Structures**	10 Hours Lecture + 4 Hours Tutorial

- Arrays, Strings, Linked Lists (Singly, Doubly, Circular)
- Stacks and Queues: Implementation and Applications
- Deque, Priority Queue, Applications in Expression Evaluation, Backtracking

Module 3	**Trees and Heaps**	10 Hours Lecture + 3 Hours Tutorial

- Binary Trees, Traversals (Recursive and Non-recursive)
- Binary Search Trees (BST), AVL Trees, B-Trees
- Min-Heap, Max-Heap and Heap Operations
- Heap Sort and Priority Queue Implementation

Module 4	**Hashing and Searching Techniques**	(6 Hours Lecture + 2 Hours Tutorial)

- Hash Tables, Hash Functions, Collision Resolution
- Linear and Binary Search, Interpolation Search
- Complexity Analysis of Searching Algorithms

Module 5	**Graphs and Traversals**	7 Hours Lecture + 2 Hours Tutorial

- Graph Representations: Adjacency Matrix/List
- BFS, DFS, Topological Sort
- Shortest Path Algorithms: Dijkstra's, Bellman-Ford

Module 6	Algorithmic Strategies	6 Hours Lecture + 2 Hours Tutorial

- Divide and Conquer: Merge Sort, Quick Sort
- Greedy Method: Kruskal's and Prim's Algorithms
- Dynamic Programming: Matrix Chain Multiplication, 0/1 Knapsack

Text Books :**Sartaj Sahni, Ellis Horowitz**, *Fundamentals of Data Structures and Algorithms*, Universities Press, 2nd Edition, 2021. ISBN: 9788173716615

Reference Books
1. **Thomas H. Cormen et al.**, *Introduction to Algorithms*, MIT Press, 3rd Edition, 2009. ISBN: 9780262033848
2. **Mark Allen Weiss**, *Data Structures and Algorithm Analysis in C++*, Pearson, 4th Edition, 2014. ISBN: 9780132847377
3. **Narasimha Karumanchi**, *Data Structures and Algorithms Made Easy*, CareerMonk Publications,

Course Code: CIV7601	Course Title: Universal Human Values and Ethics Type of Course: MAC course	-T-P-C	-	-	-	)
Course Pre-requisites	NIL					
Anti-requisites	-					
urse Description	The purpose of the course is to develop a holistic perspective in students' life. The course adopts a self-reflective methodology of teaching and is designed to equip the students to explore their role in all aspects of living as a part of the society. It presents a universal approach to value education by developing the right understanding of reality through the process of self-exploration. This self-exploration develops more confidence and commitment in students enabling them to critically evaluate their pre-conditioning and present beliefs. As an outcome of the holistic approach, the students will be able to practice the ethical conduct in the social and professional life. The prime focus throughout the course is toward affecting a qualitative transformation in the life of the student rather than just a transfer of information. This course is designed to cater to Human Values and Professional Ethics.					
urse jective	The objective of the course is 'SKILL DEVELOPMENT' of the student by using 'SELF LEARNING' techniques					
urse Outcomes	On successful completion of this course the students shall be able to: CO.1 Recognize the importance of Value Education through the process of self-exploration CO.2 Explain the human being as the co-existence of the self and the body in harmony. CO.3 Describe the role of foundational values in building harmonious relationships. CO.4 Summarize the importance of a holistic perspective in developing ethical professional behavior.					
urse Content:						

dule 1	roduction to Value Education	Online Assessment	MCQ Quiz	Sessions

pics:
ght Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations.

dule 2	rmony in the Human Being	Online Assessment	MCQ Quiz	Sessions

pics:
Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, 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:
Harmony 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 Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Strategies for Transition towards Value-based Life and Profession

plication areas are Personal life, Education and Career, Workplace , Society and Environmental
 Responsibility

ols: Online Tools – NPTEL and Swayam.

oject work/Assignment:

ssessment Type
- Online exams (MCQs) will be conducted by the Department of Civil Engineering through
  Linways.

line Link*:
3) UHV II -
   https://www.youtube.com/watch?v=NhFBzn5qKIM&list=PLWDeKF97v9SO8vvjC1KyqteziTbTjN1
   So&pp=0gcJCWMEOCosWNin
4) Lecture by Dr. Kumar Sambhav, NPTEL course: Universal Human Values,
   https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
5) 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
12. 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
13. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2019.
14. Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing, New Delhi,
    2022.

ference Books
6. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond &
   Briggs, Britain.
7. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits
   to Growth – Club of Rome's report, Universe Books.
9. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
10. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
11. A N Tripathy, 2003, Human Values, New Age International Publishers.
12. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford
    University Press
13. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values),
    Eastern Economy Edition, Prentice Hall of India Ltd.
14. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
15. William P. Cunningham and Mary Ann Cunningham (2020), Principles of Environmental Science:
    Inquiry & Applications, 9th Edition, McGraw-Hill Education, USA.

Resources:
16. https://onlinecourses.swayam2.ac.in/imb25_mg195/preview
17. https://onlinecourses.nptel.ac.in/noc25_mg141/preview
18. https://onlinecourses.swayam2.ac.in/ini25_hs52/preview
19. https://onlinecourses.nptel.ac.in/noc25_hs219/preview
20. https://onlinecourses.swayam2.ac.in/cec25_mg14/preview
21. https://onlinecourses.swayam2.ac.in/imb25_mg195/preview
22. https://onlinecourses.swayam2.ac.in/imb25_mg196/preview

 Topics relevant to Skill Development:
 3. An attitude of enquiry.
 4. Write reports

e topics related to Human values and Professional ethics:

 topics in are relevant to Human values and Professional ethics.

Course Code: CSE2255	Course Title: 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: CSE2256	Course Title: Object Oriented Programming Using Java Lab		L-T- P- C	0	0	2	1
	Type of Course: Lab - PCC						
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:** 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**
https://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q
https://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.

Course Code: **CSD3411**	Course Title: **Cyber Security and Data Privacy** Type of Course: Theory		L- P- T-C	**3**	**0**	**0**	**3**
Version No.	1.0						
Course Pre-requisites	NIL						
Anti-requisites	NIL						
Course Description	This course provides a foundational yet comprehensive understanding of modern cyber security practices and data privacy principles. Students will explore real-world cyber threats, security frameworks, cryptographic techniques, and regulatory frameworks for privacy. Emphasis is placed on practical approaches to securing networks, ethical hacking, and forensic analysis to prepare learners for dynamic challenges in digital security.						
Course Outcomes	On successful completion of this course the students shall be able to: • Assess cyber threats across various domains and evaluate potential security risks. *(Bloom's Level: **Evaluate**)* • Apply cryptographic methods to secure data and communications. *(Bloom's Level: **Apply**)* • Implement security tools for protecting networks and systems. *(Bloom's Level: **Apply**)* • Understand data privacy laws, including frameworks like GDPR. *(Bloom's Level: **Understand**)* • Perform basic penetration testing and digital forensics investigations to detect and analyze security breaches. *(Bloom's Level: **Analyze**)*						

Course Content:

Module 1	**Foundations of Cyber Security**	Assignment	
Topics: Introduction to Cyber Security – Cyber threat landscape: malware, ransomware, phishing – Risk assessment and management – Security policies and standards (e.g., ISO 27001) – Security protocols and layers of defense.			
Module 2	**Cryptography and Network Security**	Assignment	13 Classes
Topics: Symmetric and asymmetric encryption – Hash functions and digital signatures – Public Key Infrastructure (PKI) – Secure communication protocols (TLS, SSH) – Network security fundamentals: firewalls, IDS/IPS, VPNs.			
Module 3	**Data Privacy and Legal Frameworks**	Assignment	10 Classes
Topics: Principles of data privacy and data governance – GDPR, HIPAA, and Indian IT Act – Data classification and anonymization techniques – Privacy-by-design in systems – Consent, rights, and responsibilities of data subjects.			

Module-4	Ethical Hacking and Digital Forensics	Assignment	12 Classes

Topics:
Introduction to ethical hacking & penetration testing – Footprinting, scanning, and enumeration techniques – Common tools: Nmap, Metasploit, Wireshark – Incident response and log analysis – Basics of digital forensics and evidence handling.

Project work/Assignment:

Assignment 1 on (Module 1 and Module 2)
Assignment 2 on (Module 3 and Module 4)

REFERENCE MATERIALS:
TEXTBOOKS
1. *Engebretson, P. The Basics of Hacking and Penetration Testing. Syngress, 2nd Edition, 2013. ISBN: 978-0124116443.*

2. *Singer, P. W., & Friedman, A. Cybersecurity and Cyberwar: What Everyone Needs to Know. Oxford University Press, 1st Edition, 2014. ISBN: 978-0199918119.*

3. *Kolah, A. The GDPR Handbook: A Guide to Implementing the EU General Data Protection Regulation. Kogan Page, 1st Edition, 2018. ISBN: 978-0749474942.*

REFERENCES
1. *William Stallings. Cryptography and Network Security: Principles and Practice. Pearson, 8th Edition, 2024. ISBN: 978-1292742366.*
2. *William Stallings and Lawrie Brown. Computer Security: Principles and Practice. Pearson, 5th Edition, 2023. ISBN: 978-0138091712.*
3. *William Stallings. Network Security Essentials: Applications and Standards. Pearson, 6th Edition, 2017. ISBN: 978-0134527338.*

JOURNALS/MAGAZINES
1. IEEE Security & Privacy Magazine

2. IEEE Transactions on Information Forensics and Security

3. IEEE Transactions on Dependable and Secure Computing

4. IEEE Internet Computing

5. IEEE Communications Magazine

SWAYAM/NPTEL/MOOCs:
1. NPTEL on SWAYAM – Cyber Security and Privacy

Weblink: https://onlinecourses.nptel.ac.in/noc24_cs121/preview

Course Code: CSD3406	Course Title: *Business Intelligence and Analytics* Type of Course: Discipline Elective/ Theory Only Course		L- T-P- C	3	0	0	3
Version No.							
Course Pre-requisites							
Anti-requisites		NIL					
Course Description	This course introduces the core concepts of business data analytics, emphasizing the practical application of analytics techniques in business environments. Students will learn to harness data to solve business problems, improve decision-making, and support organizational objectives. The course covers all four stages of analytics – descriptive, diagnostic, predictive, and prescriptive – along with tools and techniques widely used in the industry. Case studies, real datasets, and project-based learning are integrated to develop industry-ready analytical thinking.						
Course Objective	To enable students to apply data analytics techniques in business scenarios, with an emphasis on deriving insights that support strategic and operational decision-making. This course bridges the gap between data science and business understanding, empowering students to translate data into actionable business strategies.						
Course Out Comes	Upon successful completion of this course, students will be able to: At the end of the course, students will be able to: CO1: Understand the foundations of data analytics in the context of business processes and decision-making. CO2: Apply descriptive, diagnostic, predictive, and prescriptive analytics techniques to real-world business problems. CO3: Develop interactive data visualizations and dashboards using contemporary tools. CO4: Analyze business case studies to identify suitable data analytics methods and tools. CO5: Interpret analytical results to provide data-driven business insights and recommendations.						
Course Content:							

Module 1	**Introduction to Business Analytics**	Assignment	Data Collection	06 Sessions
Introduction to Business Analytics, Types of analytics: Descriptive, Diagnostic, Predictive, Prescriptive, Role of data analytics in business strategy, Analytics process and life cycle, Case examples from marketing, finance, HR, and operations				
Module 2	Data Preparation and Exploration	Quiz	Problem Solving	08 Sessions

Data collection methods and business data sources, Data cleaning, transformation, and feature engineering, Exploratory Data Analysis (EDA), Outlier detection and handling missing values , Introduction to data visualization using tools like Excel, Power BI, Tableau, or Python libraries				
Module 3	Descriptive and Diagnostic Analytics	Assignment	Problem Solving	07Sessions
Summary statistics and business KPIs, Trend, pattern, and anomaly detection, Hypothesis testing and correlation analysis, Cross-tabulation and drill-down analysis, Business dashboard design and reporting				
Module 4	Predictive Analytics for Business	Assignment	Problem Solving	10 Sessions
Introduction to predictive modelling, Regression models, decision trees, and classification techniques, Model evaluation metrics (accuracy, precision, recall, F1-score, AUC), Forecasting techniques for business data (time series models), Case studies: Customer churn, sales forecasting, credit scoring Module 5: 09 session				
Introduction to optimization techniques,Linear programming and goal seeking,Simulation and scenario analysis ,Decision analysis under uncertainty,Applications in supply chain, logistics, and resource planning				
References: **R1: Evans, J. R. (2016).** *Business Analytics***, 2nd Edition, Pearson.** **R2: Sharda, R., Delen, D., & Turban, E. (2020).** *Analytics, Data Science, and Artificial Intelligence: Systems for Decision Support***, 11th Edition, Pearson.** **R3:Provost, F., & Fawcett, T. (2013).** *Data Science for Business***, O'Reilly.**				

Course Code: CSE3415	urse Title: xtGen Predictive Analysis pe of Course: eory Integrated Lab Course		L-T-P-C	2	0	2	3
Version No.							
Course Pre-requisites		tistics & Probability , Machine Learning Fundamentals, Programming in Python					
Anti-requisites		L					
Course Description		This course introduces advanced predictive modeling techniques using machine learning, deep learning, and AI-driven analytics. Students will learn to design, train, and deploy predictive models for real-world applications, including business forecasting, healthcare diagnostics, and automated decision-making systems. Hands-on lab sessions will reinforce theoretical concepts through industry-relevant case studies.					

Course Objectives		The objective of the course is to familiarize the learners with the concepts of **Streaming Data Analytics** as mentioned above and attain **Skill Development** through **experiential Learning** techniques.
Course Outcomes		On successful completion of the course the students shall be able to: CO1: **Recognize** the foundational principles and significance of predictive analytics in various sectors CO2: *Demonstrate* proficiency in preparing and exploring datasets to identify meaningful patterns and insights. CO3: *Apply* appropriate predictive modeling techniques to analyze data and generate accurate forecasts C04 : *Implement* the various predictive models and assess ethical considerations in their application.
Course Content:		

Module 1	roduction to Next-Generation Analytics	signment/ Problem Solving	owledge [L1]		**16 Sessions** (L- 8 & P-8)

- **Fundamentals of Advanced Analytics** :Definitions and Core Concepts in Analytics Evolution from Traditional to Advanced Analytical Techniques, Types of predictive models (regression, classification, time-series). Data cleaning, outlier detection, and feature scaling

Module 2	ssical Machine Learning for Prediction	ogramming Assignment	ply [L3]		**16 Sessions** (L- 8 & P-8)

ssical **Machine Learning for Prediction** supervised learning techniques for predictive analytics, including Linear & Logistic Regression for continuous and binary outcomes, Decision Trees & Random Forests for interpretable and ensemble-based classification/regression, and Support Vector Machines (SVM) for high-dimensional data separation. **Ensemble Methods (Boosting, Bagging** to enhance model accuracy and robustness, hyperparameter tuning, performance evaluation (e.g., RMSE, precision-recall)

Module 3	Deep Learning & Advanced Models	ogramming Assignment	ply [L3]		**14 Sessions** (L- 7 & P-7)

Deep Learning models: Introduction to deep learning technique, Neural networks (MLPs, CNNs, RNNs), Time-series forecasting (LSTMs), Transformer-based models (e.g., BERT for text), Overview of predictive modeling techniques and their applications.

Module4	rescriptive Analytics and Optimization	ogramming Assignment	eaming Data analysis		**14 Sessions** (L- 7 & P-7)

Basics of Prescriptive Analytics: Concepts and Methods in Prescriptive Analytics, Using Optimization and Simulation to Inform Decision Making. **Ethics in Analytics:** Ethical Considerations in Data Collection and Analysis, Developing Guidelines for Ethical Use of

	Analytics.
	List of Laboratory Tasks: 1. **Design and implement data preprocessing techniques:** Perform data cleaning, handle missing values, detect outliers, and apply feature scaling on a raw dataset. 2. **Design and implement exploratory data analysis (EDA):** Use visualization tools to uncover patterns, correlations, and insights within a dataset. 3. **Design and implement regression models:** Develop and evaluate linear regression models to predict continuous outcomes. 4. **Design and implement classification models:** Apply logistic regression to classify binary outcomes in a dataset. 5. **Design and implement decision tree algorithms:** Build and interpret decision trees for classification tasks. 6. **Design and implement ensemble methods:** Implement Random Forest and evaluate its performance compared to individual decision trees. 7. **Design and implement support vector machines (SVM):** Train SVM models for classification tasks and visualize decision boundaries. 8. **Design and implement artificial neural networks (ANN):** Construct and train a multi-layer perceptron for a predictive task. 9. **Design and implement convolutional neural networks (CNN):** Develop a CNN for image classification problems. 10. **Design and implement recurrent neural networks (RNN):** Implement an RNN, such as LSTM, for time-series forecasting. 11. **Design and implement optimization models:** Formulate and solve linear programming problems relevant to business scenarios. 12. **Design and implement simulation models:** Use simulation techniques to model and analyze complex systems for decision-making.
	Targeted Application & Tools that can be used: • **IDEs: Jupyter Notebook, Google Colab, VS Code (with Python extensions)** • **Finance for risk assessment, and healthcare for patient outcome forecasting** • **Predictive Analytics**
	Project work/Assignment:
	Students will be asked to Design and Implement a Comprehensive Analytical Solution for a Hypothetical Business Scenario.
	Text Book 1. Drake, Alyson, and Amanda Watson. "Legal Research in the NextGen Era." *U of Houston Law Center Forthcoming, Buffalo Law Review Forthcoming* (2024). 2. Yan, Zhen, Kevin Kim, Haeuk Kim, Brendan Ha, Anaïs Gambiez, Jason Bennett, Marcus Fabiano de Almeida Mendes et al. "Next-generation IEDB tools: a platform for epitope prediction and analysis." *Nucleic acids research* 52, no. W1 (2024): W526-W532.
	References

ta Margret, A., Chrisanne Freeman, Mrs Merlyn Diana AS, and Preyenga Ramesh. *Next-gen Biology: Ai's Transformative Impact On Life Sciences: Ai Innovations In Biotechnology, Healthcare, And Agriculture*. OrangeBooks Publication, 2025.

eblinks:

http://www.liaad.up.pt/area/jgama/DataStreamsCRC.pdf
https://presiuniv.knimbus.com/user#/home

pics relevant to "SKILL DEVELOPMENT":
xtGen Predictive analysis of real time datasets like health monitoring analysis , finance for risk management using various tolls and libraries for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSD3412	Course Title: Graph Analytics ype of Course: Professional Core	L-P-C	3	0	0	3
Version No.	)					
Anti-requisites	L					
Course Description	This course introduces the fundamentals of graph theory and analytics, covering key algorithms and metrics. Students will learn to model and analyze real-world networks using tools like Neo4j and NetworkX. Topics include centrality, community detection, and graph querying. Applications in social networks, recommendation systems, and cybersecurity are explored.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of **Graph Analytics** and attain **Skill Development** through E**xperiential Learning** techniques.					
Course Out Comes	On successful completion of this course the students shall be able to: 1.Understand graph theory fundamentals and key algorithms.**[Understand]** 2.Gain skills in graph querying, analytics, and visualization.**[Application]** 3.Apply graph-based techniques to real-world problems.**[Application]** 4. Explore graph databases and machine learning applications.**[Application]**					
Course Content:						
Module 1	:roduction to iiz		owledge based	5 Session (L-8		

x

24

	Graphs and Graph Algorithms			+P-8)]
Basics of Graph Theory: Vertices, Edges, Types of Graphs, Graph Representations: Adjacency Matrix, Adjacency List,Graph Traversal: BFS, DFS,Shortest Path Algorithms: Dijkstra's, Bellman-Ford,Minimum Spanning Trees: Prim's, Kruskal's Real-world Applications: Social, Biological, and Web Graphs				
Module 2	aph Metrics, Centrality, and Clustering	signment	plementation	6 Session (L-8 +P-8)]
Graph Properties: Degree, Density, Diameter, Clustering Coefficient, Centrality Measures: Degree, Closeness, Betweenness, Eigenvector, PageRank, Community Detection: Modularity, Louvain Method, Label Propagation, Applications: Influence Analysis, Fraud Detection, Recommendation Systems				
Module 3	aph Databases and Query Languages	rm paper/Assignment	plementation	6 Session (L-8 +P-8)]
Graph Data Models: Property Graphs, RDF,Introduction to Graph Databases: Neo4j, OrientDB,Querying Graphs with Cypher (Hands-on examples),Introduction to SPARQL (for semantic web),Data Modeling and Importing Graph Data				
Module 4	aph Analytics Tools & Machine Learning Applications	rm paper/Assignment	plementation	2 Session (L-6 +P-6)]
Link Prediction, Node Classification,Graph Embeddings: Node2Vec, DeepWalk (Basics), Introduction to Graph Neural Networks (GNNs),Tools & Frameworks: NetworkX, Gephi, Neo4j, PyTorch Geometric,Case Studies: Social Networks, E-commerce, Cybersecurity				

rgeted Application & Tools that can be used:
- Implementing key algorithms and metrics- Anaconda-Jupyter Notebook/ Google-Colab.
- Mini-project on real-world graph dataset
- Hands-on with NetworkX (Python), Neo4j, Graph visualization with Gephi

oject work/Assignment:

1. Design and implementation of a real-world problem with Graph
2. Research paper review and presentation on a selected graph application

Textbook(s):

1. "Graph-Powered Analytics and Machine Learning with TigerGraph"
Authors: Victor Lee, Dr. Yu Xu,Publisher: O'Reilly Media,Year: 2022
2. "Graph Data Analytics: A Practical Guide to Process", Visualize, and Analyze
   Complex Graph Data,Author: Sumit Raj,Publisher: BPB Publications,Year: 2023

References:
4. "The Practitioner's Guide to Graph Data", Authors: Denise Gosnell, Matthias
   Broecheler, Publisher: O'Reilly Media,Year: 2020
5. "Graph Data Science for Dummies (2nd Edition)", Author: Alicia Frame,
   Publisher: Wiley / Neo4j,Year: 2022
6. "Managing and Mining Graph Data", Editors: Charu C. Aggarwal, Haixun Wang,
   Publisher: Springer ,Year: 2010
7. Frank Harary: Graph Theory, CRC Press, 2018 (originally published in 1969).

Weblinks:
8. https://presiuniv.knimbus.com/user#/home
9. Udemy: https://www.udemy.com/course/sdn-made-
   simple/?couponCode=LETSLEARNNOWPPNPTEL online course

Topics relevant to "SKILLS Development": Graph Analytics **Skills development** through **Experiential Learning techniques.**
This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. Srabana Pramanik -Assistant Professor (Senior Scale)				
Recommended by the Board of Studies on					
Date of Approval by the Academic Council	Academic Council Meeting No.				
Course Code: CSD3405	**Course Title:** Text Mining and Analytics **Type of Course: Program Core**	**P- C**	2	2	3
Version No.	1				

Course Pre-requisites	Probability and Statistics -MAT2001
Anti-requisites	NIL
Course Description	This course focuses on the extraction of meaningful information from unstructured textual data. It covers key concepts in natural language processing, text representation, information retrieval, and text-based predictive modeling. Students gain hands-on experience using tools like NLTK, Scikit-learn, and spaCy for analyzing large text corpora.
Course Objective	1.To introduce students to techniques for extracting, analyzing, and interpreting patterns in large-scale text data. 2.To equip learners with practical skills in building text-based analytical models for real-world applications.
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1**: Represent, preprocess, and tokenize textual data for analysis. **CO2**: Apply algorithms for topic modeling, classification, and clustering of text. **CO3**: Use sentiment analysis and opinion mining in real-world text datasets. **CO4**: Build text mining pipelines for analytics-driven business and research problems.
Course Content:	

Module 1	**Fundamentals of Text Mining and NLP**	**7 Sessions**

Text preprocessing: tokenization, stemming, lemmatization,Text representation: Bag-of-Words, TF-IDF, word embeddings,N-gram models, POS tagging, stop word removal, Overview of NLP libraries: NLTK, spaCy, Hugging Face.

Module 2	**Text Classification and Clustering**	**7 Sessions**

Supervised models: Naïve Bayes, SVM, Logistic Regression, Unsupervised models: K-means, Hierarchical clustering, LDA, Sentiment analysis and spam detection, Evaluation: Precision, Recall, F1, ROC, Confusion matrix

Module 3	**Sentiment Analysis and Topic Modeling**	**8 Sessions**

Lexicon-based and ML-based sentiment analysis,VADER, TextBlob, and transformer-based sentiment tools,Topic modeling using LDA and NMF, Case studies: reviews, tweets, customer feedback.

Module 4	**Advanced Text Analytics and Applications**	**8 Sessions**

Deep learning in NLP: RNNs, LSTMs, Transformer models (BERT, GPT), Text summarization, semantic search, and similarity matching, Information retrieval and question answering systems, Applications in healthcare, finance, legal, and e-commerce

List of Experiments (30 Hours)
Module 1: Fundamentals of Text Mining and NLP
1. Text   Preprocessing   Pipeline
   Implement tokenization, stop word removal, stemming, and lemmatization using NLTK and spaCy.
2. Bag-of-Words   and   TF-IDF   Representation
   Convert a text corpus into BoW and TF-IDF representations; analyze word importance.
3. Word   Embeddings   and   Similarity
   Use Word2Vec or GloVe embeddings to compute similarity between words and visualize them.
4. POS   Tagging   and   N-gram   Generation
   Perform Part-of-Speech tagging and extract n-grams (bi-grams, tri-grams) from text using spaCy or NLTK.
5. Comparative   Study   of   NLP   Libraries
   Preprocess the same text using NLTK, spaCy, and Hugging Face Transformers; compare speed and output.

◇ **Module 2: Text Classification and Clustering**
6. Text   Classification   using   Naïve   Bayes
   Implement a spam vs. ham classifier using the Naïve Bayes algorithm.
7. Text   Classification   using   SVM   and   Logistic   Regression
   Compare performance of SVM and Logistic Regression on a sentiment or spam dataset.
8. Clustering   Text   Documents
   Apply K-means and Hierarchical Clustering to a corpus (e.g., news articles); visualize clusters using PCA or t-SNE.
9. Topic   Extraction   using   LDA
   Extract dominant topics from a set of documents using Latent Dirichlet Allocation.
10. Model   Evaluation   Metrics
    Evaluate a classifier using confusion matrix, precision, recall, F1-score, and ROC curve.

◇ **Module 3: Sentiment Analysis and Topic Modeling**
11. Lexicon-Based   Sentiment   Analysis
    Perform sentiment analysis using VADER and TextBlob on social media texts or movie reviews.
12. Transformer-Based   Sentiment   Classification
    Use Hugging Face Transformers (e.g., BERT) to classify sentiment in a tweet or review dataset.

13. Topic Modeling with NMF
Apply Non-negative Matrix Factorization for topic discovery and compare with LDA.

◇ **Module 4: Advanced Text Analytics and Applications**
14. Text Summarization using Transformers
Use BERT or GPT to summarize long articles or reports.
15. Semantic Search and Similarity Matching
Build a semantic search engine using sentence transformers or BERT embeddings to find similar texts or answers from a corpus.

Text Book
1.Title: *Speech and Language Processing,***Authors**: Daniel Jurafsky and James H. Martin,**Publisher**: Pearson,**Edition**: 3rd Edition (Draft, updated content online),**Year**: **2023 (latest version online)**

2.Title : T*ext Mining with R: A Tidy Approach,***Authors**: Julia Silge, David Robinson,**Publisher**: O'Reilly Media,**Edition**: 2nd Edition,**Year**: **2022**

ferences
 R1 *Natural Language Processing with Transformers,***Authors**: Lewis Tunstall, Leandro von Werra, Thomas Wolf,**Publisher**: O'Reilly Media,**Year**: **2022.**

Course Code: CSD3416	Course Title: Probabilistic Modeling for Machine Learning	L- T-P- C	3	0	0	3
	Type of Course: Discipline Elective/ Theory Only Course					
Version No.	2.0					
Course Pre-requisites						
Anti-requisites	NIL					
Course Description	This course provides an in-depth understanding of probabilistic models and their application in machine learning. It explores techniques such as Bayesian inference, graphical models, and latent variable models for handling uncertainty in data. The focus is on both the theoretical foundations and practical implementations using modern libraries.					
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: 14. Understand the fundamental principles of probabilistic modeling and reasoning. 15. Design and implement probabilistic models for supervised and unsupervised learning. 16. Apply inference techniques and evaluate probabilistic models in real-world scenarios.			
Course Content:					
Module 1	Foundations of Probability and Statistics for ML	Assignment		Data Collection	10 Sessions
	Topics: Basics of probability theory, Random variables and distributions, Statistical decision theory, Introduction to Bayesian inference				
Module 2	Bayesian Methods and Inference Techniques	Quiz		Problem Solving	10 Sessions
	Topics: Prior, likelihood, and posterior, Bayesian parameter estimation, Conjugate priors and exponential families, MCMC and Variational Inference				
Module 3	Probabilistic Graphical Models	Assignment		Problem Solving	10Sessions
	Topics: Directed (Bayesian networks) and Undirected (Markov Random Fields) models, Structure learning and parameter learning, Exact and approximate inference algorithms				
Module 4	Advanced Topics and Applications	Assignment		Problem Solving	13 Sessions
	Latent variable models (e.g., Gaussian Mixture Models, LDA), Deep probabilistic models (e.g., Variational Autoencoders), Temporal models (e.g., Hidden Markov Models), Real-world case studies and project work				
	Text Book 3. **Murphy, Kevin P.** *Probabilistic Machine Learning: An Introduction*, MIT Press, 2022. 4. **Bishop, Christopher M.** *Pattern Recognition and Machine Learning*, Springer, 2006.				
	References: **R1 Koller, Daphne, and Nir Friedman.** *Probabilistic Graphical Models: Principles and Techniques*, MIT Press, 2009.				

	R2 Ghahramani, Zoubin. *An Introduction to Probabilistic Machine Learning*, Cambridge University Press (Forthcoming / Preprints), Latest Edition. **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.

Course Code: APT4006	Course Title: Logical and Critical Thinking Type of Course: Audited			L- T-P- C	0	0	2	1
Version No.	1.0							
Course Pre-requisites								
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
Quantitative Aptitude by R S Aggarwal
Verbal & Non-Verbal Reasoning by R S Aggarwal

References
www.indiabix.com
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.

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:
Fast Track Objective by Rajesh Verma
R S Aggarwal
Rakesh Yadav
References:
www.indiabix.com
www.testbook.com
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.

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	<mark>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.</mark>					
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:
TED Talks
You Tube Links
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.

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 Fast track objective by Rajesh Verma R S Aggarwal S.P Bakshi

References
www.indiabix.com
www.testbook.com
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.

Course Code: PPS 3018	Course Title: Preparedness for Interview			0	0	2	1
	Type of Course: Practical Only Course		L- T- P- C				

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: TED Talks You Tube Links 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.		

Course Code: CHE7601	Environmental Studies Type of Course: MOOC course	L- T- P- C	-	-	-	-
		Contact hours				
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course 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**					
Course Objective	The objective of the course is 'SKILL DEVELOPMENT' of the student by using 'PARTICIPATIVE LEARNING' techniques					
Course 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					
Course Content:						
Module 1	derstanding Environment, Natural Resources, and Sustainability					

Topics:					

Topics:

Classification 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.

Concept 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.

Module 2	...osystems, Biodiversity, and Sustainable Practices				

Topics:

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.

Module 3	...vironmental Pollution, Waste Management, and Sustainable Development				

Topics:

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.

Module 4	Social Issues, Legislation, and Practical Applications				

Topics:

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).

Targeted Application & Tools that can be used:

Application areas are Energy, Environment and sustainability

Tools: Online Tools – NPTEL and Swayam.

Project work/Assignment:

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

Online Link*:
6) Lecure by Dr. Samik Chowdhury, Dr. Sudha Goel, NPTEL course: Environmental Science,

https://nptel.ac.in/courses/109105203, 2024.

    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.

Text Book

15.   G. Tyler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA

16.   Poonia, M.P. Environmental Studies (3rd ed.), Khanna Book Publishing Co.

17.   Bharucha, E. Textbook of Environmental Studies (3rd ed.) Orient Blackswan Private Ltd.

18.   Dave, D., & Katewa, S. S. Text Book of Environmental Studies. Cengage Learning India Pvt Ltd.

19.   Rajagopalan, R. Environmental studies: from crisis to cure (4th ed.). Oxford University Press.

20.   Basu, M., & Xavier Savarimuthu, S. J. Fundamentals of environmental studies. Cambridge University Press.

21.   Roy, M. G. Sustainable Development: Environment, Energy and Water Resources. Ane Books.

22.   Pritwani, K. Sustainability of business in the context of environmental management. CRC Press.

23.   Wright, R.T. & Boorse, D.F. Environmental Science: Toward A Sustainable Future (13th ed,). Pearson.

ference Books

16. Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022), Conservation through Sustainable Use: Lessons from India. Routledge.

17. William P. Cunningham and Mary Ann Cunningham (2020), Principles of Environmental Science: Inquiry & Applications, 9th Edition, McGraw-Hill Education, USA.

18. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.

19. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press.
https://doi.org/10.1201/9781003096238

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

Resources:

23. https://nptel.ac.in/courses/109105203
24. https://archive.nptel.ac.in/courses/120/108/120108004/
25. https://nptel.ac.in/courses/127105018
26. https://onlinecourses.nptel.ac.in/noc23_lw06/preview
27. https://onlinecourses.swayam2.ac.in/ini25_bt02/preview
28. https://archive.nptel.ac.in/courses/120/108/120108002/
29. https://onlinecourses.swayam2.ac.in/ini25_bt02/preview
30. https://nptel.ac.in/courses/102104088
31. https://nptel.ac.in/courses/124107165
32. https://nptel.ac.in/courses/109106200
33. https://archive.nptel.ac.in/content/storage2/courses/120108004/module1/lecture1.pdf
34. https://onlinecourses.swayam2.ac.in/nou25_ge19/preview
35. https://onlinecourses.swayam2.ac.in/ini25_hs01/preview
36. http://kcl.digimat.in/nptel/courses/video/105105184/L32.html
37. https://nptel.ac.in/courses/105105169

Topics relevant to Skill Development:

5.   An attitude of enquiry.
6.   Write reports

e topics related to Environment and Sustainability :

topics in theory component are relevant to Environment and Sustainability.

Course Code: ADS2009	Course Title: **Big Data Technologies** Type of Course: **Program Core/Theory only**	**L- P- C**	3	0	3
Version No.	1.0				
Course Pre-					

requisites	
Anti-requisites	NIL
Course Description	This course provides an in-depth understanding of the technologies and frameworks used in Big Data processing, storage, and analytics. It covers theoretical foundations and practical implementations using distributed computing models such as MapReduce and Apache Hadoop, and explores graph processing, clustering, recommendation systems, and streaming analytics. Students will gain the ability to design scalable data processing workflows using concepts from leading industry and academic resources.
Course Out Comes	On successful completion of the course the students shall be able to: 1. Understand the architecture, components, and applications of Big Data technologies. [Understand] 2. Apply Hadoop, MapReduce, and Spark to process and analyze large-scale datasets. [Apply] 3. Analyze data mining algorithms such as clustering, classification, and recommendation systems in big data environment. [Analyze] 4. Design scalable big data solutions using distributed frameworks for real-world applications. [Create]
Course Content:	

Module 1	Introduction to Big Data and Hadoop Ecosystem		**10 Hours**

Topics: Introduction to Big Data: Characteristics, Challenges, and Use Cases - Hadoop Distributed File System (HDFS) Architecture - YARN and MapReduce Framework - Data Storage: HDFS I/O and File Formats - Overview of Big Data Tools: Hive, Pig, HBase, Spark

Module 2	Data Processing with MapReduce and Spark		**12 Hours**

Topics: Writing MapReduce Programs (Mapper, Reducer, Combiner, Partitioner) - Optimization Techniques in MapReduce - Introduction to Apache Spark and RDD - Spark SQL and DataFrame APIs - Comparisons: Spark vs. Hadoop MapReduce

Module 3	Mining and Analytics Algorithms for Big Data		**12 Hours**

Topics: · Frequent Itemsets and Market Basket Analysis (A-Priori, PCY algorithms) - Clustering Techniques for Big Data (K-Means, Locality-Sensitive Hashing) - Classification Techniques (Naive Bayes, Decision Trees) - Dimensionality Reduction (SVD, PCA)			
Module 4	Advanced Topics – Graph Processing, Recommendation & Streaming		**11 Hours**

Topics: Mining Social Networks and Web Graphs - PageRank, Community Detection, and Link Prediction - Recommendation Systems (User-based, Item-based Collaborative Filtering) - Introduction to Streaming Data and Algorithms - Case Study: Twitter or Netflix Big Data Pipeline·

Targeted Application & Tools that can be used:
Healthcare & Biomedical Systems, Smart Homes & Buildings, Industrial Automation & Robotics, Agriculture & Environment, Smart Cities & IoT Systems, Aerospace and Automotive

Tools / Platforms / Technologies Used:
Big Data Frameworks:
  Apache Hadoop, Apache Spark, MapReduce, Hive, Pig, HBase
Data Storage & Processing:
  HDFS, Parquet, Avro, NoSQL (MongoDB, Cassandra)
Data Streaming & Real-Time Processing:
  Apache Kafka, Apache Flink, Spark Streaming
Development & Deployment:
  Python, Java, Jupyter Notebooks, Docker, Kubernetes
Cloud & Scalable Infrastructure:
  Amazon Web Services (AWS), Google Cloud Platform (GCP), Microsoft Azure

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

· **Healthcare Analytics: Disease prediction using large-scale medical records**
· **IoT Data Processing: Real-time sensor data analysis from smart homes or agriculture**
· **Social Media Analysis: Trending topic detection or sentiment analysis using Twitter/YouTube data**
· **Retail Analytics: Market basket analysis or recommendation engine for e-commerce**
· **Industrial Monitoring: Fault detection or predictive maintenance using machine logs**

Text Book
   1. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, Cambridge University Press, 3rd Edition, 2020 (Latest)
   2. Big Data Analytics, Venkat Ankam (Big Data consultant, USA), Springer International Publishing, 2016.

References

   1. Data-Intensive Text Processing with MapReduce, Jimmy Lin, Chris Dyer, Morgan & Claypool, 2010.

   2. Big Data: Principles and Best Practices of Scalable Real-Time Data Systems, Nathan Marz and James Warren, Manning Publications, 2015.

Topics relevant to development of "FOUNDATION SKILLS": Big Data Fundamentals, Distributed Computing (MapReduce/Spark), Data Mining Algorithms, Programming & Problem Solving, Data Visualization & Interpretation, Team-based Project Work

Topics relevant to "HUMAN VALUES &PROFESSIONAL ETHICS": Ethical Data Collection & Usage, Data Privacy & Confidentiality, Algorithmic Fairness, Responsible AI & Automation, Environmental Sustainability in Data Centers

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:
4. TED Talks
5. You Tube Links
6. 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 use AI tools to get search prompts for desired email etiquettes.