PRESIDENCY UNIVERSITY

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

PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

Program Regulations and Curriculum

2024-2028

BACHELOR OF TECHNOLOGY (B.Tech.) in Computer Science and Engineering(Data Science)

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

Regulations No.: PU/AC-24.5/SOCSE04/CSD/2024-28

Resolution No.5 of the 24th Meeting of the Academic Council held on 03rd August 2024, and ratified by the Board of Management in its 24th Meeting held on 05th August, 2024.

(As amended up to 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)

AUGUST 2024

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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 Presidency School of Computer Science and Engineering, committed to developing globally-competent Engineers, dedicated to developing cutting-edge technology, towards enhancing Quality of Life.

1.4 Mission of Presidency School of Computer Science and Engineering

▪ Cultivate a practice-driven environment, with computing-based pedagogy, integrating theory and practice.

· Attract and nurture world-class faculty to excel in Teaching and Research, in the realm of Computing Sciences.

· Establish state-of-the-art computing facilities, for effective Teaching and Learning experiences.

· Promote Interdisciplinary Studies to nurture talent 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 2023-2027.
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 2023-2027 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 2023-2024.

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 organising the delivery of the Course;*
p. *"Course Instructor" means the teacher/faculty member responsible for teaching and evaluation of a Course;*
q. *"Course" means a specific subject usually identified by its Course-code and Course-title, with specified credits and syllabus/course-description, a set of references, taught by some teacher(s)/course-instructor(s) to a specific class (group of students) during a specific Academic Term;*
r. *"Curriculum Structure" means the Curriculum governing a specific Degree Program offered by the University, and, includes the set of Baskets of Courses along with minimum credit requirements to be earned under each basket for a degree/degree with specialization/minor/honours in addition to the relevant details of the Courses and Course catalogues (which describes the Course content and other important information about the Course). Any specific requirements for a particular program may be brought into the Curriculum structure of the specific program and relevant approvals should be taken from the BOS and Academic Council at that time.*
s. *"DAC" means the Departmental Academic Committee of a concerned Department/Program of Study of the University;*
t. *"Dean" means the Dean / Director of the concerned School;*

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

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

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

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

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

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

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

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

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

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

ee. *"Program Regulations" means the Bachelor of Technology Degree Program Regulations and Curriculum, 2023-2027;*

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

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

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

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

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

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

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

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

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

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

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

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

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

5. Program Description

The Bachelor of Technology Degree Program Regulations and Curriculum 2023-2027 are subject to, and, pursuant to the Academic Regulations, ~~2021~~. These Program Regulations shall be applicable to the following ongoing Bachelor of Technology

(B.Tech.) Degree Programs of 2023-2027 offered by the Presidency School of Computer Science and Engineering (PSCS):

1. Bachelor of Technology in Computer Science and Engineering, abbreviated as B.Tech. Computer Science and Engineering;
2. Bachelor of Technology in Computer Science and Technology (Big Data), abbreviated as B.Tech. Computer Science and Technology (Big Data);
3. Bachelor of Technology in Computer Science and Engineering (Block Chain), abbreviated as B.Tech. Computer Science and Engineering (Block Chain);
4. Bachelor of Technology in Computer Science and Technology (Dev Ops), abbreviated as B.Tech. Computer Science and Technology (Dev Ops);
5. Bachelor of Technology in Computer Science and Engineering (Cyber Security), abbreviated as B.Tech. Computer Science and Engineering (Cyber Security);
6. Bachelor of Technology in Computer Science and Engineering (Internet of Things), abbreviated as B.Tech. Computer Science and Engineering (Internet of Things);
7. Bachelor of Technology in Computer Science and Engineering (Data Science), abbreviated as B.Tech. Computer Science and Engineering (Data Science);
8. Bachelor of Technology in Computer Science and Technology (Artificial Intelligence and Machine Learning), abbreviated as B.Tech. Computer Science and Technology (Artificial Intelligence and Machine Learning);
9. Bachelor of Technology in Information Science and Technology, abbreviated as B.Tech. Information Science and Technology;
10. Bachelor of Technology in Computer Science and Information Technology, abbreviated as B.Tech. Computer Science and Information Technology;
11. Bachelor of Technology in Computer Science and Engineering (Networks), abbreviated as B.Tech. Computer Science and Engineering (Networks);
12. Bachelor of Technology in Computer Engineering (Artificial Intelligence and Machine Learning), abbreviated as B.Tech. Computer Engineering (Artificial Intelligence and Machine Learning);
13. Bachelor of Technology in Information Science and Engineering (Artificial Intelligence and Robotics), abbreviated as B.Tech. Information Science and Engineering (Artificial Intelligence and Robotics); and
14. Bachelor of Technology in Computer Science and Engineering (Artificial Intelligence and Machine Learning) abbreviated as B.Tech. Computer Science and Engineering (Artificial Intelligence and Machine Learning);

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~~Error: Reference source not found~~ of Academic Regulations) in the prescribed maximum duration (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 01: Demonstrate as a Computer Engineering Professional with innovative skills and moral and ethical values

PEO 02: Engage in lifelong learning through research and professional development

PEO 03: Serve as a leader in the profession through consultancy, extension activities and/ or entrepreneurship

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:

PO 1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern Tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO 6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to

comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

8.2 Program Specific Outcomes (PSOs):

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

PSO1 Illustrate comprehensive knowledge of computer science to describe fundamental ideas, investigate computational issues, and apply theoretical understanding in the design of efficient and reliable systems.

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

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

9 Admission Criteria (as per the concerned Statutory Body)

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

9.1 An applicant who has successfully completed Pre-University course or Senior Secondary School course (+2) or equivalent such as (11+1), 'A' level in Senior School Leaving Certificate Course from a recognized university of India or outside or from Senior Secondary Board or equivalent, constituted or recognized by the Union or by the State Government of that Country for the purpose of issue of qualifying certificate on successful completion of the course, may apply for and be admitted into the Program.

9.2 Provided further, the applicant must have taken Physics and Mathematics as

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

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

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

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

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

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

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

10 Lateral Entry / Transfer Students requirements

10.1 Lateral Entry

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

10.1.1 Admission to 2nd year (3rd Semester) of the B.Tech. Degree program shall be open to the candidates who are holders of a 3-year Diploma in Engineering (or equivalent qualification as recognized by the University), who have secured not less than forty-five percentage (45%) marks in the final year examination (5th and 6th Semesters of the Diploma Program) in the appropriate branch of Engineering. Provided that, in case of SC / ST and OBC candidates from Karnataka the minimum marks for eligibility shall be forty percent (40%).

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

computations.

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

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

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

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

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

The ***Minimum Credit Requirements*** for the award of the Bachelor of Technology (B.Tech.) Degree prescribed by the concerned Bachelor of Technology Degree Program Regulations and Curriculum, 2024-2028, minus the number of Credits prescribed / accepted by the Equivalence Committee for the 1st Year (1st and 2nd Semesters) of the B.Tech. Program.

For instance, if the *Minimum Credit Requirements* for the award of the Bachelor of Technology (B.Tech.) Degree as prescribed by the Regulations for B.Tech. Computer Science and Engineering (Data Science) is “N” Credits, and, if the total credits prescribed in the 1st Year (total credits of

the 1st and 2nd Semesters) of the Program concerned is “M” Credits, then the *Minimum Credit Requirements* for the award of the B.Tech. Computer Science and Engineering in Data Science 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. , 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:

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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. , 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)

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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 12.5 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)shall 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

Table 1: Assessment Components and Weightage for different category of Courses		
Nature of Course and Structure	**Evaluation Component**	**Weightage**
Lecture-based Course L component in the L-T-P Structure is predominant (more than 1) (Examples: 3-0-0; 3-0-2; 2-1-0; 2-0-2, 2-0-4 etc.)	Continuous Assessments	50%
	End Term Examination	50%
Lab/Practice-based Course P component in the L-T-P Structure is predominant (Examples: 0-0-4; 1-0-4; 1-0-2; etc.)	Continuous Assessments	75%
	End Term Examination	25%
Skill based Courses like Industry Internship, Capstone project, Research Dissertation, Integrative Studio, Interdisciplinary Project, Summer / Short Internship, Social Engagement / Field Projects, Portfolio, and such similar Non-Teaching Credit Courses, where the pedagogy does not lend itself to a typical L-T-P structure	Guidelines for the assessment components for the various types of Courses, with recommended weightages, shall be specified in the concerned Program Regulations and Curriculum / Course Plans, as applicable.	

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.

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 Sub-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:

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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 the 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 the 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 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 summarised 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.

13.3.10 The University shall not reimburse any fees/expense; a student may incur for the SWAYAM/NPTEL/other approved MOOCs.

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

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

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

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

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

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

PART B: PROGRAM STRUCTURE

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

The B.Tech. Computer Science and Engineering(CSD) Program Structure (2024-2028) totalling 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 3.0: B.Tech. (Data Science) 2024-2028: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets

Sl. No.	Baskets	Credit Contribution
1	School Core	68

Table 3.0: B.Tech. (Data Science) 2024-2028: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets		
Sl. No.	**Baskets**	**Credit Contribution**
2	Program Core	65
3	Discipline Elective	18
4	Open Elective	09
	Total Credits	**160 (Minimum)**

In the entire Program, the practical and skill based course component contribute to an extent of approximately 57% out of the total credits of 160 for B.Tech. (CSD) program of four years' duration.

15. Minimum Total Credit Requirements of Award of Degree

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

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

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

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

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

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

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

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

PART C – CURRICULUM STRUCTURE

17. Curriculum Structure – Basket Wise Course List ~~(not Semester Wise)~~

List of Courses Tabled – aligned to the Program Structure

~~(Course Code, Course Name, Credit Structure (LTPC), Contact Hours, Type of Skills etc., as applicable).~~

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

Table 3.1 : School Core Courses

S.No	Course Code	Course Name	L	T	P	C	Contact Hr	Type of Skill	Pre Requisite
1	MAT1001	Calculus and Linear Algebra	3	0	2	4	5	F	--
2	PHY1002	Optoelectronics and Device Physics	2	0	2	3	4	F	--
3	ECE1001	Elements of Electronics Engineering	3	0	2	4	5	F	--
4	ENG1002	Technical English	1	0	2	2	3	S	--
5	PPS1001	Introduction to soft skills	0	0	2	1	2	S	--
6	CSE1004	Problem Solving Using C	1	0	4	3	5	S	--
7	CHE1018	Environmental Science	1	0	2	0	3	F	--
8	PPS1011	Introduction to Verbal Ability	0	1	0	0	1		--
9	MAT1003	Applied Statistics	1	0	2	2	3	F	--
10	CIV1008	Basic Engineering Sciences	2	0	0	2	2	F	--
11	MEC1006	Engineering Graphics	2	0	0	2	2	F	--
12	CSE1006	Problem Solving using JAVA	1	0	4	3	5	S	--
13	ENG2001	Advanced English	1	0	2	2	3	F	--
14	PPS1002	Soft Skills for Engineers	0	0	2	1	2	S	--
15	ECE2010	Innovative Projects Using Arduino	-	-	-	1	-	S	--

16	MAT1002	Transform Techniques, Partial Differential Equations and Their Applications	3	0	0	3	3	F	---
17	CSE2001	Data Structures and Algorithms	3	0	2	4	5	F	--
18	MAT2004	Discrete Mathematical Structures	3	0	0	3	3	F	--
19	ECE2011	Innovative Projects Using Rasperry Pi	-	-	-	1		S	--
20	CSE1005	Programming in Python	1	0	4	3	5	S	--
21	PPS4002	Introduction to Aptitude	0	0	2	1	2	S	--
22	MAT2003	Numerical Methods for Engineers	3	0	0	3	3	F	--
23	PPS4004	Aptitutde Training Intermediate	0	0	2	1	2	S	--
24	CSE3216	Mastering Object-Oriented Concepts in Python	0	0	2	1	2	F	--
25	CSE7000	Internship	0	0	0	2	0	S	--
26	PPSXXXX	Industry PreparednessProgram	2	0	0	0	2		--
27	CSE2074	Competitive Programming and Problem Solving	0	0	4	2	4	S	--
28	CSE7100	Mini Project	-	-	-	4		S	--
29	CSE7300	Capstone Project	-	-	-	10		S	--
		Total Credit				**68**			--

Table 3.2 : Program Core Courses (PCC)

Sl No	Course Code	Course Name	L	T	P	C	Contact Hr	Type of Skill	Pre Requisite
1	ECE2007	Digital Design	2	0	2	3	4	F	--
2	CSE2251	Data Communications and Computer Networks	3	0	2	4	5	F	--
3	CSE2257	Computer Organization and Architecture	3	0	0	3	3	F	--

4	CSE3190	Fundamentals of Data Analytics	2	0	2	3	4	F	--
5	CSE2014	Software Engineering	3	0	0	3	3	F	--
6	CSE2007	Design and Analysis of Algorithms	3	0	0	3	3	F	--
7	CSE3156	Database Management System	3	0	2	4	5	F	--
8	CSE3351	Operating Systems	3	0	0	3	3	F	--
9	CSE3078	Cryptography and Network Security	3	0	0	3	3	F	--
10	CSE1700	Essentials of AI	3	0	0	3	3	F	--
11	CSD1712	Statistical Foundations of Data Science	3	0	0	3	3	F	--
12	CSD1703	Introduction to Data Science	3	0	0	3	3	F	--
13	CSE2021	Data Mining	3	0	0	3	3	F	--
14	CSE3078	Cryptography and Network Security	3	0	0	3	3	F	--
15	CSE1701	Essentials of AI Lab	0	0	4	2	4		--
16	CSD1713	Statistical Foundations of Data Science Lab	0	0	2	1	2	S	--
17	AID1701	Machine Learning for Intelligent data Science	2	0	0	2	2	F	--
18	CSD1714	Predictive Analytics	2	0	0	2	2	F	--
19	AID1705	Explainable AI (XAI)	3	0	0	3	3	F	--
20	CSD1701	Social Media Analytics	3	0	0	3	3	F	--
21	CSD1705	Cloud Computing for Data Science	2	0	0	2	2	F	--
22	CSD1709	Edge AI and IoT Analytics	3	0	0	3	3	F	--
23	CSD1715	Predictive Analytics Lab	0	0	2	1	2	S	--
24	CSD1702	Social Media Analytics Lab	0	0	2	1	2	S	--
25	CSE1706	Cloud Computing for Data Science Lab	0	0	2	1	2	S	--
26	AID1707	Generative AI and Prompt Engineering	3	0	0	3	3	F	--
27	CSD1714	Predictive Analytics	2	0	0	2	2	F	--
		Total No. of Credits				**65**			

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

Practical / Skill based Courses like internship, project work, capstone project, research project / dissertation, and such similar courses, where the pedagogy does not lend itself

to a typical L-T-P-C Structure as defined in Clause 5.1 of the Academic Regulations, are simply assigned the number of Credits based on the quantum of work / effort required to fulfill the learning objectives and outcomes prescribed for the concerned Courses. Such courses are referred to as Non-Teaching Credit Courses (NTCC). These Courses are designed to provide students with hands-on experience and skills essential for their professional development. These courses aim to equip students with abilities in problem identification, root cause analysis, problem-solving, innovation, and design thinking through industry exposure and project-based learning. The expected outcomes are first level proficiency in problem solving and design thinking skills to better equip B.Tech. graduates for their professional careers. The method of evaluation and grading for the Practical / Skill based Courses shall be prescribed and approved by the concerned Departmental Academic Committee (refer Annexure A of the Academic Regulations). The same shall be prescribed in the Course Handout.

18.1 Internship / 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 4^{th} and 5^{th} 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 Mini Project 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 Mini Project 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 mini project 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 Mini project 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 18.4.1). 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 Specialisations / Stream Basket

Discipline Elective courses/Specialization Tracks – Minimum of 12 credits is to be earned by the student in a particular track and overall 18 credits

Table 3.3: Discipline Electives Courses/Specialization Tracks – Minimum of 12 credits is to be earned by the student in a particular track and overall 18 credits.

			L	T	P	C	Cont	Type of Skill	Pre Requisite
	Data Science Basket								
1	CSD3401	Business Continuity and Risk Analysis for Data	3	0	0	3	3	S/EM	CSE2074
2	CSD3402	Web Data Analytics for Data Science	2	0	2	3	4	S/EM	CSE2067
3	CSD3403	Optimization techniques for Data Science	2	0	2	3	4	S	MAT1001
4	CSE3088	Business Intelligence and Analytics	3	0	0	3	3	S	CSE3190
5	CSD3419	Edge Computing for Data Science	3	0	0	3	3	S	-
6	CSD3426	Cloud Services for Big Data and Analytics	3	0	0	3	3	S	CSE3343
7	CSD3421	Mobile Application for Data Science	3	0	0	3	3	S	-
8	CSD3422	Intelligent Interfaces and User Experience	3	0	0	3	3	S	-
11	CSE3002	Big Data Technologies	2	0	2	3	4	S	-
12	CSD3423	Applied Artificial Intelligence	2	0	2	3	4	S	
13	CSE3006	Neural Networks and Fuzzy Logic	3	0	0	3	3	S/EM	MAT1002
15	CSD3445	Social Media Analytics	2	0	2	3	3	S/EM	
16	CSD3424	Data warehousing and its application	3	0	0	3	3	S/EM	
17	CSD3406	Business Oriented Data Analytics	3	0	0	3	3	S/EM	
18	CSD3416	Probabilistic Modelling for Machine Learning	3	0	0	3	3	F	MAT2402

19	CSD3405	Text Mining and Analytics	2	0	2	3	4	EM	CSE2064
20	CSE3426	Front End Full Stack Development	2	0	2	3	S/EM	0	CSE2058
21	CSE3427	Java Full Stack Development	2	0	2	3	S/EM	0	CSE2059
22	CSE3428	.Net Full Stack Development	2	0	2	3	S/EM	0	CSE2058
23	CSD3412	Graph Analytics	3	0	0	3	3	EM	MAT2303
24	CSD3415	NextGen Predictive Analytics	2	0	2	3	4	EM	CSD2011
25	CSD3411	Cybersecurity and Data Privacy	3	0	0	3	3	EM	-
26	CSD3413	Data Visualization and Dashboards	3	0	0	3	3	S	CSD2009
27	CSD3402	Web Data Analytics	2	0	2	3	4	EM	CSE1500
28	CSD3404	E-Business and Marketing Analytics	2	0	2	3	4	EM	CSD2002
29	CSD3410	IoT and Sensor Data Analysis	3	0	0	3	3	EM	CSE1014
30	CSD3409	Financial Data Analysis	2	0	2	3	4	EM	CSD2002
31	CSD3407	Statistical Inference and Modelling	3	0	0	3	3	S/EM	MAT2402
33	CSD3414	Statistics-Driven Data Science	2	0	2	3	4	S/EM	MAT2402
34	CSD3408	Data Mining and Warehousing	3	0	0	3	3	EM	CSE1510
35	CSD2006	Edge AI and IoT Analytics	3	0	0	3	3	EM	0
36	CSD3417	Scientific Computing for Intelligent Systems	3	0	0	3	3	EM	CSE1500

37	CSD3403	Optimization for Data Science	2	0	2	3	4	F	MAT1003
38	CSD3418	Feature Engineering and Model Optimization	3	0	0	3	3	EM	CSE1500
39	CSD3431	Expert Systems	3	0	0	3	3	EM	0
40	CSD3433	Computational Intelligence Research	3	0	0	3	3	EM	0
41	CSD3429	Cognitive Robotics	3	0	0	3	3	EM	CSE1500
42	CSD3430	Autonomous Navigation and Vehicles	3	0	0	3	3	EM	CSE1506
43	CSD3434	Digital Health and Imaging	3	0	0	3	3	EM	CSD1716
44	CSD3432	Quantum Computing and AI	3	0	0	3	3	EM	CSE1500
45	Track 12 : Special Basket								
1	CAI3427	Language Models for Text Mining	2	0	2	3	4	S/EM	CSE3001
2	CAI3428	Practical Deep Learning with TensorFlow	2	0	2	3	4	S/EM	CSE3001
3	CAI3429	Deep Learning Techniques for Computer Vision	2	0	2	3	4	S/EM	MAT1003
	Total No of Credits to be earned from DE = 18.12 Credits from program specialization baskets and 6 from other baskets."								

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

Table 3.4 : Open Elective Courses Baskets: Minimum Credits to be earned from this Basket is 09

Sl. No.	Course Code	Course Name	L	T	P	C	Type of Skill/ Focus	Course Caters to	Prerequisites/ Corequisites	Antirequisites	Future Courses that need this as a Prerequisite

Chemistry Basket											
1	CHE1003	Fundamentals of Sensors	3	0	0	3	S	ES	-	-	-
2	CHE1004	Smart materials for IOT	3	0	0	3	S	ES	-	-	-
3	CHE1005	Computational Chemistry	2	0	0	2	S	ES	-	-	-
4	CHE1006	Introduction to Nano technology	3	0	0	3	S	ES	-	-	-
5	CHE1007	Biodegradable electronics	2	0	0	2	S	ES	-	-	-
6	CHE1008	Energy and Sustainability	2	0	0	2	S	ES	-	-	-
7	CHE1009	3D printing with Polymers	2	0	0	2	S	ES	-	-	-
8	CHE1010	Bioinformatics and Healthcare IT	2	0	0	2	S	ES	-	-	-
9	CHE1011	Chemical and Petrochemical catalysts	3	0	0	3	S	ES	-	-	-
10	CHE1012	Introduction to Composite materials	2	0	0	2	S	ES	-	-	-
11	CHE1013	Chemistry for Engineers	3	0	0	3	S	ES	-	-	-
12	CHE1014	Surface and Coatings technology	3	0	0	3	S	ES	-	-	-
13	CHE1015	Waste to Fuels	2	0	0	2	S	ES	-	-	-
14	CHE1016	Forensic Science	3	0	0	3	S	ES	-	-	-
Civil Engineering Basket											
1	CIV1001	Disaster mitigation and management	3	0	0	3	S	-	-	-	-
2	CIV1002	Environment Science and Disaster Management	3	0	0	3	FC	-	-	-	-
3	CIV2001	Sustainability Concepts in Engineering	3	0	0	3	S	-	-	-	-
4	CIV2002	Occupational Health and Safety	3	0	0	3	S	-	-	-	-
5	CIV2003	Sustainable Materials and Green Buildings	3	0	0	3	EM	-	-	-	-
6	CIV2004	Integrated Project Management	3	0	0	3	EN	-	-	-	-

7	CIV2005	Environmental Impact Assessment	3	0	0	3	EN	-	-	-	-
8	CIV2006	Infrastructure Systems for Smart Cities	3	0	0	3	EN	-	-	-	-
9	CIV2044	Geospatial Applications for Engineers	2	0	2	3	EM	-	-	-	-
10	CIV2045	Environmental Meteorology	3	0	0	3	S	-	-	-	-
11	CIV3046	Project Problem Based Learning	3	0	0	3	S	-	-	-	-
12	CIV3059	Sustainability for Professional Practice	3	0	0	3	EN	-	-	-	-
Commerce Basket											
1	COM2001	Introduction to Human Resource Management	2	0	0	2	F	HP/GS	-	-	-
2	COM2002	Finance for Non Finance	2	0	0	2	S	-	-	-	-
3	COM2003	Contemporary Management	2	0	0	2	F	-	-	-	-
4	COM2004	Introduction to Banking	2	0	0	2	F	-	-	-	-
5	COM2005	Introduction to Insurance	2	0	0	2	F	-	-	-	-
6	COM2006	Fundamentals of Management	2	0	0	2	F	-	-	-	-
7	COM2007	Basics of Accounting	3	0	0	3	F	-	-	-	-
Computer Science Basket (not to be offered for Computer Science and Engineering students)											
1	CSE2002	Programming in Java	2	0	2	3	S/EM	-	-	-	-
2	CSE2003	Social Network Analytics	3	0	0	3	S	GS	-	-	-
3	CSE2004	Python Application Programming	2	0	2	3	S/ EM	-	-	-	-
4	CSE2005	Web design fundamentals	2	0	2	3	S/ EM/EN	-	-	-	-
Design Basket											
1	DES1001	Sketching and Painting	0	0	2	1	S	-	-	-	-
2	DES1002	Innovation and Creativity	2	0	0	2	F	-	-	-	-
3	DES1121	Introduction to UX design	1	0	2	2	S	-	-	-	-

4	DES1122	Introduction to Jewellery Making	1	0	2	2	S	-	-	-	-
5	DES1124	Spatial Stories	1	0	2	2	S	-	-	-	-
6	DES1125	Polymer Clay	1	0	2	2	S	-	-	-	-
7	DES2001	Design Thinking	3	0	0	3	S	-	-	-	-
8	DES1003	Servicability of Fashion Products	1	0	2	2	F	ES	-	-	-
9	DES1004	Choices in Virtual Fashion	1	0	2	2	F	ES, GS, HP	-	-	-
10	DES1005	Fashion Lifestyle and Product Diversity	1	0	2	2	F	ES, GS, HP	-	-	-
11	DES1006	Colour in Everyday Life	1	0	2	2	F	ES	-	-	-
12	DES2080	Art of Design Language	3	0	0	3	S	-	-	-	-
13	DES2081	Brand Building in Design	3	0	0	3	S	-	-	-	-
14	DES2085	Web Design Techniques	3	0	0	3	S	-	-	-	-
15	DES2089	3D Modeling for Professionals	1	0	4	3	S	-	-	-	-
16	DES2090	Creative Thinking for Professionals	3	0	0	3	S	-	-	-	-
17	DES2091	Idea Formulation	3	0	0	3	S	-	-	-	-
Electrical and Electronics Basket											
1	EEE1002	IoT based Smart Building Technology	3	0	0	3	S	-	-	-	-
2	EEE1003	Basic Circuit Analysis	3	0	0	3	S	-	-	-	-
3	EEE1004	Fundamentals of Industrial Automation	3	0	0	3	S	-	-	-	-
4	EEE1005	Electric Vehicles & Battery Technology	3	0	0	3	S	-	-	-	-
5	EEE1006	Smart Sensors for Engineering Applications	3	0	0	3	S	-	-	-	-
Electronics and Communication Basket											
1	ECE1003	Fundamentals of Electronics	3	0	0	3	F	-	-	-	-
2	ECE1004	Microprocesso	3	0	0	3	F	-	-	-	-

		r based systems									
3	ECE3089	Artificial Neural Networks	3	0	0	3	S	-	-	-	-
4	ECE3097	Smart Electronics in Agriculture	3	0	0	3	F/EM	-	-	-	-
5	ECE3098	Environment Monitoring Systems	3	0	0	3	F/EM	-	-	-	-
6	ECE3102	Consumer Electronics	3	0	0	3	F/EM	-	-	-	-
7	ECE3103	Product Design of Electronic Equipment	3	0	0	3	S/F/ EM / EN	-	-	-	-
8	ECE3106	Introduction to Data Analytics	3	0	0	3	F/EM	-	-	-	-
9	ECE3107	Machine Vision for Robotics	3	0	0	3	F/EM	-	-	-	-
English Basket											
1	ENG1008	Indian Literature	2	0	0	2	-	GS/ HP	-	-	-
2	ENG1009	Reading Advertisement	3	0	0	3	S	-	-	-	-
3	ENG1010	Verbal Aptitude for Placement	2	0	2	3	S	-	-	-	-
4	ENG1011	English for Career Development	3	0	0	3	S	-	-	-	-
5	ENG1012	Gender and Society in India	2	0	0	2	-	GS/ HP	-	-	-
6	ENG1013	Indian English Drama	3	0	0	3	-	-	-	-	-
7	ENG1014	Logic and Art of Negotiation	2	0	2	3	-	-	-	-	-
8	ENG1015	Professional Communicatio n Skills for Engineers	1	0	0	1	-	-	-	-	-
DSA Basket											
1	DSA2001	Spirituality for Health	2	0	0	2	F	HP	-	-	-
2	DSA2002	Yoga for Health	2	0	0	2	S	HP	-	-	-
3	DSA2003	Stress Management and Well Being	2	0	0	2	F	-	-	-	-
Kannada Basket											
1	KAN1001	Kali Kannada	1	0	0	1	S	-	-	-	-

2	KAN1003	Kannada Kaipidi	3	0	0	3	S	-	-	-	-
3	KAN2001	Thili Kannada	1	0	0	1	S	-	-	-	-
4	KAN2003	Pradharshana Kale	1	0	2	2	S	-	-	-	-
5	KAN2004	Sahithya Vimarshe	2	0	0	2	S	-	-	-	-
6	KAN2005	Anuvadha Kala Sahithya	3	0	0	3	S	-	-	-	-
7	KAN2006	Vichara Manthana	3	0	0	3	S	-	-	-	-
8	KAN2007	Katha Sahithya Sampada	3	0	0	3	S	-	-	-	-
9	KAN2008	Ranga Pradarshana Kala	3	0	0	3	S	-	-	-	-
Foreign Language Basket											
1	FRL1004	Introduction of French Language	2	0	0	2	S	S	-	-	-
2	FRL1005	Fundamentals of French	2	0	0	2	S	S	-	-	-
3	FRL1009	Mandarin Chinese for Beginners	3	0	0	3	S	S	-	-	-
Law Basket											
1	LAW1001	Introduction to Sociology	2	0	0	2	F	HP		-	-
2	LAW2001	Indian Heritage and Culture	2	0	0	2	F	HP/GS		-	-
3	LAW2002	Introduction to Law of Succession	2	0	0	2	F	HP/GS		-	-
4	LAW2003	Introduction to Company Law	2	0	0	2	F	HP		-	-
5	LAW2004	Introduction to Contracts	2	0	0	2	F	HP	-	-	-
6	LAW2005	Introduction to Copy Rights Law	2	0	0	2	F	HP	-	-	-
7	LAW2006	Introduction to Criminal Law	2	0	0	2	F	HP	-	-	-
8	LAW2007	Introduction to Insurance Law	2	0	0	2	F	HP	-	-	-
9	LAW2008	Introduction to Labour Law	2	0	0	2	F	HP	-	-	-
10	LAW2009	Introduction to Law of Marriages	2	0	0	2	F	HP/GS	-	-	-
11	LAW2010	Introduction to Patent Law	2	0	0	2	F	HP	-	-	-
12	LAW2011	Introduction to Personal	2	0	0	2	F	HP	-	-	-

		Income Tax									
13	LAW2012	Introduction to Real Estate Law	2	0	0	2	F	HP	-	-	-
14	LAW2013	Introduction to Trademark Law	2	0	0	2	F	HP	-	-	-
15	LAW2014	Introduction to Competition Law	3	0	0	3	F	HP	-	-	-
16	LAW2015	Cyber Law	3	0	0	3	F	HP	-	-	-
17	LAW2016	Law on Sexual Harrassment	2	0	0	2	F	HP/GS	-	-	-
18	LAW2017	Media Laws and Ethics	2	0	0	2	F	HP/GS	-	-	-
Mathematics Basket											
1	MAT2008	Mathematical Reasoning	3	0	0	3	S	-	-	-	-
2	MAT2014	Advanced Business Mathematics	3	0	0	3	S	-	-	-	-
3	MAT2041	Functions of Complex Variables	3	0	0	3	S	-	-	-	-
4	MAT2042	Probability and Random Processes	3	0	0	3	S	-	-	-	-
5	MAT2043	Elements of Number Theory	3	0	0	3	S	-	-	-	-
6	MAT2044	Mathematical Modelling and Applications	3	0	0	3	S	-	-	-	-
Mechanical Basket											
1	MEC1001	Fundamentals of Automobile Engineering	3	0	0	3	F	-	-	-	-
2	MEC1002	Introduction to Matlab and Simulink	3	0	0	3	S/EM	-	-	-	-
3	MEC1003	Engineering Drawing	1	0	4	3	S	-	-	-	-
4	MEC2001	Renewable Energy Systems	3	0	0	3	F	ES	-	-	-
5	MEC2002	Operations Research & Management	3	0	0	3	F	-	-	-	-
6	MEC2003	Supply Chain Management	3	0	0	3	S/ EM/ EN	-	-	-	-
7	MEC2004	Six Sigma for Professionals	3	0	0	3	S/EM	-	-	MEC2008	-
8	MEC2005	Fundamentals of Aerospace Engineering	3	0	0	3	F	-	-	-	-
9	MEC2006	Safety	3	0	0	3	S/EM	ES	-	-	-

		Engineering									
10	MEC2007	Additive Manufacturing	3	0	0	3	F/EM	-	-	-	-
11	MEC3069	Engineering Optimisation	3	0	0	3	S/EM	-	-	-	-
12	MEC3070	Electronics Waste Management	3	0	0	3	F/S	ES	-	-	-
13	MEC3071	Hybrid Electric Vehicle Design	3	0	0	3	S/EM	ES	-	-	-
14	MEC3072	Thermal Management of Electronic Appliances	3	0	0	3	S/EM	-	-	-	-
15	MEC3200	Sustainable Technologies and Practices	3	0	0	3	S/EM	-	-	-	-
16	MEC3201	Industry 4.0	3	0	0	3	S/EM	-	-	-	-
Petroleum Basket											
1	PET1011	Energy Industry Dynamics	3	0	0	3	FC	ES	-	NIL	-
2	PET1012	Energy Sustainability Practices	3	0	0	3	FC	ES	-	NIL	-
Physics Basket											
1	PHY1003	Mechanics and Physics of Materials	3	0	0	3	FC / SD				
2	PHY1004	Astronomy	3	0	0	3	FC				
3	PHY1005	Game Physics	2	0	2	3	FC / SD				
4	PHY1006	Statistical Mechanics	2	0	0	2	FC				
5	PHY1007	Physics of Nanomaterials	3	0	0	3	FC				
6	PHY1008	Adventures in nanoworld	2	0	0	2	FC				
7	PHY2001	Medical Physics	2	0	0	2	FC	ES			
8	PHY2002	Sensor Physics	1	0	2	2	FC / SD				
9	PHY2003	Computational Physics	1	0	2	2	FC				
10	PHY2004	Laser Physics	3	0	0	3	FC	ES			
11	PHY2005	Science and Technology of Energy	3	0	0	3	FC	ES			
12	PHY2009	Essentials of Physics	2	0	0	2	FC				
Management Basket- I											
1	MGT2007	Digital Entrepreneurship	3	0	0	3	S/EM/EN	-	-	-	-
2	MGT2015	Engineering	3	0	0	3	S	-	-	-	-

		Economics									
3	MGT2023	People Management	3	0	0	3	S/EM/ EN	HP	-	-	-
Management Basket- II											
1	MGT1001	Introduction to Psychology	3	0	0	3	F	HP	-	-	-
2	MGT1002	Business Intelligence	3	0	0	3	EN	-	-	-	-
3	MGT1003	NGO Management	3	0	0	3	S	-	-	-	-
4	MGT1004	Essentials of Leadership	3	0	0	3	EM/ EN	GS/ HP	-	-	-
5	MGT1005	Cross Cultural Communicatio n	3	0	0	3	S/EM/ EN	HP	-	-	-
6	MGT2001	Business Analytics	3	0	0	3	S/ EM/EN	-	-	-	-
7	MGT2002	Organizational Behaviour	3	0	0	3	F	HP	-	-	-
8	MGT2003	Competitive Intelligence	3	0	0	3	S	-	-	-	-
9	MGT2004	Development of Enterprises	3	0	0	3	S/EM/EN	-	-	-	-
10	MGT2005	Economics and Cost Estimation	3	0	0	3	S/EM	-	-	-	-
11	MGT2006	Decision Making Under Uncertainty	3	0	0	3	S	-	-	-	-
12	MGT2008	Econometrics for Managers	3	0	0	3	S	-	-	-	-
13	MGT2009	Management Consulting	3	0	0	3	S/EM/EN	-	-	-	-
14	MGT2010	Managing People and Performance	3	0	0	3	S/EM/EN	HP/GS	-	-	-
15	MGT2011	Personal Finance	3	0	0	3	F	-	-	-	-
16	MGT2012	E Business for Management	3	0	0	3	S/EM	-	-	-	-
17	MGT2013	Project Management	3	0	0	3	EN / EM	GS/HP/ES	-	-	-
18	MGT2014	Project Finance	3	0	0	3	EN / EM	HP	-	-	-
19	MGT2016	Business of Entertainment	3	0	0	3	EM/ EN	-	-	-	-
20	MGT2017	Principles of Management	3	0	0	3	S/EM/ EN	-	-	-	-
21	MGT2018	Professional and Business Ethics	3	0	0	3	S/EM/ EN	HP	-	-	-
22	MGT2019	Sales Techniques	3	0	0	3	S/EM/ EN	HP	-	-	-
23	MGT2020	Marketing for Engineers	3	0	0	3	S/EM/ EN	HP	-	-	-
24	MGT2021	Finance for	3	0	0	3	S/EM/	HP	-	-	-

		Engineers					EN				
25	MGT2022	Customer Relationship Management	3	0	0	3	S/EM/ EN	HP	-	-	-
Media Studies Basket											
1	BAJ3050	Corporate Filmmaking and Film Business	0	0	4	2	EM	HP	-	-	-
2	BAJ3051	Digital Photography	2	0	2	3	EM	HP	-	-	-
3	BAJ3055	Introduction to News Anchoring and News Management	0	0	2	1	EM	-	-	-	-

21.List of MOOC Courses for B.Tech (Computer Science and Engineering (Data Science))

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 The student needs to study and complete School Core and Program Core Courses in offline mode only.

21.2 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.

21.3 SWAYAM/NPTEL/ other approved MOOCs shall be approved by the concerned Board of Studies and placed in the concerned PRC.

21.4 Student shall register for these courses in the ERP of Presidency University.

21.5 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.

21.6 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.

21.7 The question paper shall be prepared by the MOOCs coordinator(s).

21.8 Students write the exams in online mode. These exams are scheduled and conducted by the School.

21.9 Results are evaluated by School and given to the Office of the Controller of

Examinations (CoE).

21.10 The

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**

details of the duration, credits and evaluation are given below:

21.2 MOOC - Discipline Elective Courses for B. Tech. Computer Science and Engineering -Data Science

Sl.No	Course Code	Table 3.5 MOOC Discipline Elective Courses Discipline Elective Courses duration is 4 weeks (01 credit)/ 8 weeks (02 credits)/ 12 weeks (03 credits)	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	CSE505	The Joy of Computing Using Python	3	3-0-0-3
7	CSE3119	Coding Skills in Python	3	3-0-0-3
8	CSE3121	Parallel Computer Architecture	3	3-0-0-3
9	CSE3124	Games and Information	3	3-0-0-3
10	CSE3140	Introduction to Industry 4.0 and Industrial Internet of Things	3	3-0-0-3
11	CSE3142	Affective Computing	3	3-0-0-3
12	CSE3196	Foundations of Cyber Physical Systems	3	3-0-0-3
13	CSE3197	Getting Started with Competitive Programming	3	3-0-0-3
14	CSE3198	GPU Architectures and Programming	3	3-0-0-3

15	CSE3199	Artificial Intelligence: Knowledge Representation and Reasoning	3	3-0-0-3
16	CSE3200	Programming in Modern C++	3	3-0-0-3
17	CSE3201	Circuit Complexity Theory	3	3-0-0-3
18	CSE3202	Basics of Computational Complexity	3	3-0-0-3
19	CSE3212	Introduction to Computer and Network Performance Analysis using Queuing	1	1-0-0-1
20	CSE3213	C Programming and Assembly Language	1	1-0-0-1
21	CSE3214	Python for Data Science	1	1-0-0-1
22	CSE3215	Software Conceptual Design	1	1-0-0-1
23	CSE3117	Industrial Digital Transformation	3	3-0-0-3
24	CSE3118	Blockchain for Decision Makers	3	3-0-0-3
25	CSE3349	Technology for Lawyers	3	3-0-0-3
26	CSEXXXX	Deep Learning for Natural Language Processing	3	3-0-0-3
27	CSEXXXX	Machine Learning for Engineering and Science Applications	3	3-0-0-3
28	CSEXXXX	Algorithms in Computational Biology and Sequence Analysis	3	3-0-0-3
29	CSEXXXX	Introduction to Large Language Models (LLMs)	3	3-0-0-3
30	CSEXXXX	Quantum Algorithms and Cryptography	3	3-0-0-3

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

Table 3.6: NPTEL Open Elective Courses				
Sl. No.	Course ID	Course Name	Total Credits	L-T-P-C
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	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

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

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

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

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

Sl No	Course Code	Course Name	L	T	P	Credits	Contact hours

	Semester 1 - Physics Cycle					**17**	**28**
1	MAT1001	Calculus and Linear Algebra	3	0	2	4	5
2	PHY1002	Optoelectronics and Device Physics	2	0	2	3	4
3	ECE1001	Elements of Electronics Engineering	3	0	2	4	5
4	ENG1002	Technical English	1	0	2	2	3
5	PPS1001	Introduction to soft skills	0	0	2	1	2
6	CSE1004	Problem Solving Using C	1	0	4	3	5
7	CHE1018	Environmental Science	1	0	2	0	3
8	PPS1011	Introduction to Verbal Ability	0	1	0	0	1
	Semester 2 - Engineering Science Cycle					**16**	**21**
1	MAT1003	Applied Statistics	1	0	2	2	3
2	ECE2007	Digital Design	2	0	2	3	4
3	CIV1008	Basic Engineering Sciences	2	0	0	2	2
4	MEC1006	Engineering Graphics	2	0	0	2	2
5	CSE1006	Problem Solving using JAVA	1	0	4	3	5
6	ENG2001	Advanced English	1	0	2	2	3
7	PPS1002	Soft Skills for Engineers	0	0	2	1	2
8	ECE2010	Innovative Projects Using Arduino	-	-	-	1	0
	Course Code	**Course Name**	**L**	**T**	**P**	**Credits**	
	Semester 3					**25**	**31**
1	MAT2501	Integral Transforms and Partial Differential Equations	3	1	0	4	4
2	CSE2253	Data Structures	3	0	0	3	3
3	CSE2258	Web Technologies	3	0	0	3	3
4	CSE1500	Computational Thinking using Python	2	0	2	3	4
5	CSE2251	Data Communication and Computer Networks	3	0	0	3	3
6	CSE2257	Computer Organization and Architecture	3	0	0	3	3
7	CSE2254	Data Structures Lab	0	0	2	1	2
8	CSE2259	Web Technologies Lab	0	0	2	1	2
9	CSE2252	Data Communication and Computer Networks Lab	0	0	2	1	2
10	FIN1002	Essentials of Finance	3	0	0	3	3
11	CIV7601	Universal Human Values and Ethics	0	0	0	0	0
12	APT4002	Introduction to Aptitude	0	0	2	0	2
	Semester 4					**28**	**35**
1	MAT2503	Discrete Mathematics	3	1	0	4	4
2	CSE2260	Database Management Systems	3	0	0	3	3
3	CSE2261	Database Management Systems Lab	0	0	2	1	2
4	CSE2262	Analysis of Algorithms	3	1	0	4	4
5	CSE2263	Analysis of Algorithms Lab	0	0	2	1	2
6	CSE2264	Essentials of AI	3	0	0	3	3
7	CSE2265	Essentials of AI Lab	0	0	2	1	2
8	CSD2002	Introduction to Data Science	3	0	0	3	3
9	AID2007	Exploratory Data Analysis	3	0	0	3	3

10	AID2008	Exploratory Data Analysis lab	0	0	2	1	2
11	CSE2269	Operating Systems	3	0	0	3	3
12	CSE2270	Operating Systems Lab	0	0	2	1	2
13	APT4004	Aptitude Training-Intermediate	0	0	2	0	2
	Semester 5					**26**	**30**
1	CSE2266	Theory of Computation	3	0	0	3	3
2	CSD2007	R programming for Data Science	3	0	0	3	3
3	CSD2008	R programming for Data Science Lab	0	0	2	1	2
5	CSD2004	Cloud Computing for Data Science	2	0	0	2	2
6	CSD2005	Cloud Computing for Data Science Lab	0	0	2	1	2
7	AID2004	Machine Learning for Intelligent data Science	3	0	0	3	3
8	AID2003	Machine Learning Lab for Intelligent data Science	0	0	2	1	2
9	CSD1712	Statistical Foundations of Data Science	3	0	0	3	3
10	CSD1713	Statistical Foundations of Data Science Lab	0	0	2	1	2
11	CSEXXXX	Professional Elective - I	3	0	0	3	3
12	CSE2271	Software Design and Development	3	0	0	3	3
13	APT4006	Logical and Critical Thinking	0	0	2	0	2
14	CSE7000	Internship	0	0	0	2	0
	Semester 6					**22**	**30**
1	CSE2274	Competitive Programming and Problem Solving	0	0	4	2	4
2	CSD2009	Data Handling and Visualization	2	0	0	2	2
3	CSD2010	Data Handling and Visualization Lab	0	0	4	2	4
4	CSD2014	Deep Learning for Data Science	3	0	0	3	3
5	CSD2015	Deep Learning for Data Science Lab	0	0	2	1	2
6	CSD2501	Predictive Analytics	2	0	0	2	2
7	CSD2502	Predictive Analytics Lab	0	0	2	1	2
8	APT4026	Aptitude for Employability	0	0	2	0	2
9	CSEXXXX	Professional Elective – II	3	0	0	3	3
10	CSEXXXX	Professional Elective – III	3	0	0	3	3
11	XXXXXXX	Open Elective – I	3	0	0	3	3
	Semester 7					**16**	**14**
1	CSEXXXX	Professional Elective – IV	3	0	0	3	3
2	CSEXXXX	Professional Elective – V	3	0	0	3	3
3	CSEXXXX	Professional Elective – VI	3	0	0	3	3
4	XXXXXX X	Open Elective – II	3	0	0	3	3
5	PPS4027	Preparedness for Interview	0	0	2	0	2
6	CSE7100	Mini Project	0	0	0	4	0
	Semester 8					**10**	
1	CSE7300	Capstone Project	-	-	-	10	

Course Catalogue

Course Code: MAT1001	**Course Title: Calculus and Linear Algebra** **Type of Course: School Core** **Lab Integrated**	**L-T-P- C**	**2**	**1**	**2**	**4**
Version No.	3.0					
Course Pre-requisites	Basic Concepts of Limits, Differentiation, Integration					
Anti-requisites	**NIL**					
Course Description	The course focuses on the concepts of calculus and linear algebra with reference to specific engineering problems. The course is of both conceptual and analytical type in nature. The lab sessions associated with the course are concerned with acquiring an ability to use the MATLAB software.					
Course Objective	The objective of the course is **Skill Development** of student by using **Problem Solving Techniques.**					
Course Out Comes	On successful completion of the course the students shall be able to: 1) Comprehend the knowledge of applications of matrix principles. 2) Understand the concept of partial derivatives and their applications. 3) Apply the principles of integral calculus to evaluate integrals. 4) Adopt the various analytical methods to solve differential equations. 5) Demonstrate the use of MATLAB software to deal with a variety of mathematical problems.					
Course Content:						
Module 1	**Linear Algebra**					**10 Classes**
Review: Types of matrices, elementary transformations, rank of a matrix, normal form, Solution of systems of linear equations: (Homogenous and non-homogenous system) AX = O and AX = B using rank method.						

Linear Algebra:

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.
Engineering Applications of Linear Algebra

Module 2	**Partial Derivatives**			**10 CLASSES**

eview: Differential calculus with single variable.

Partial Derivatives:

Homogeneous functions and Euler‘s theorem, Total derivative, Change of variables, Jacobians, Partial differentiation of implicit functions, Taylor‘s series for functions of two variables, Maxima and minima of functions of two variables, Lagrange‘s method of undetermined multipliers.Engineering Applications of partial derivatives.

Module 3	**Advanced Integral calculus**			**12 Classes**

Review: Integral calculus for single integrals.

Advanced Integral calculus:

Beta and Gamma functions–interrelation-evaluation of integrals using gamma and beta functions; error function-properties. Multiple Integrals-Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves, evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical polar co-ordinates.

Engineering applications of partial derivatives.

Module 4	**Ordinary Differential Equations**	**Assignment**	**Programming**	**12 Classes**

Review: First order and first-degree Ordinary Differential Equations, Method of separation of variables, Homogeneous and Non-Homogeneous Equations reducible to Homogeneous form.

Linear Differential Equations, Bernoulli's Differential Equation, Exact and Non- Exact Differential Equations, Higher order Differential Equation with constant coefficients and with right hand side of the form e^{ax}, sinax, cosax, $e^{ax}f(x)$, $x^{n}f(x)$ etc., Linear equations with variable coefficients such as Cauchy Equation and Lagrange's Equation, D-operators and Inverse D- operators, Method of Variation of Parameters.

Engineering applications of differential equations.

List of Laboratory Tasks:

Introductory Task: Introduction to usage of the software and simple programming tasks. [3 Sessions]
Experiment N0 1: Solution of Simple differentiation with single variable and use of chain Rule.
Experiment No. 2: Solution based on application of Tailors' Series using software
Experiment No. 3: Application of Maxima and Minima condition using software.
Experiment No. 4 Computation of different functions for a specific problem
Experiment No. 5 Computation of Area under a curve.
Experiment No. 6 Solution of a set of simultaneous equations in matrix method
Experiment No. 7 Computation of Eigen Values and Eigen Vectors.
Experiment No. 8 Solution of Partial Differential equation
Experiment No. 9 solution using Cauchy Equation and Lagrange's Equation

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: MatLab, Zylink.

Assignment:

1. List at least 3 sets of Matrix Applications concerning the respective branch of Engineering and obtain the solution using MATLAB.
2. Select any one simple differential equation pertaining to the respective branch of engineering, identify the dependent and independent variable – Obtain the solution and compare the solution sets by varying the values of the dependent variable.

Text Book

1. Sankara Rao, Introduction to Partial differential equations, Prentice Hall of India, edition, 2011
2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

References:

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. Lay, Linear Algebra ansd its applications, 3rd Ed., 2002, Pearson Education India.
4. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition
5. MatLab usage manual

E-resources/ Web links:

1. https://nptel.ac.in/courses/109104124

2. https://nptel.ac.in/courses/111106051

3. https://nptel.ac.in/courses/111102137

4. https://www.cuemath.com/learn/mathematics/algebra-vs-calculus/

5. https://stanford.edu/~shervine/teaching/cs-229/refresher-algebra-calculus

6. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/linear-algebra/

7. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html

8. https://www.scu.edu.au/study-at-scu/units/math1005/2022/

Topics relevant to the development of Foundation Skills: All solution methods

Topics relevant to development of Employability skills: Use of Matlab software.

Course Code: PHY1002	**Course Title: Optoelectronics and Device Physics** **Type of Course: 1] School Core & Laboratory integrated**	L-T-P-C	2-0-2-3

Version No.	1.0
Course Pre-requisites	**NIL**
Anti-requisites	**NIL**
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, experimental and analytical skills. The associated 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: Describe the concepts of semiconductors, magnetic materials and superconductors. CO2: Apply the concept of materials in the working of optoelectronic and magnetic devices. CO3: Discuss the quantum concepts used in advanced microscopy and quantum computers. CO4: Explain the applications of lasers and optical fibers in various technological fields. CO5: Interpret the results of various experiments to verify the concepts used in optoelectronics and advanced devices. **[Lab oriented].**
Course Objective	The objective of the course is to familiarize the learners with the concepts of “Optoelectronics and device physics “and attain **Skill Development** through **Experiential Learning** techniques

Course Content :				
Module 1	**Fundamentals of Materials.**	Assignment	Plotting of magnetization (M) v/s Magnetic field (H) for diamagnetic, paramagnetic and ferromagnetic materials using excel/ origin software.	**No. of Classes: 07**
	Topics: Concept of energy bands, charge carriers, carrier concentration, concept of Fermi level, Hall effect, Magnetic materials, Superconductors:			
Module 2	**Advanced Devices and applications**	Assignment	Data collection on efficiency of solar cells.	**No. of Classes: 8**
	Topics: p-n junctions, Zener diode, transistor characteristics, Optoelectronic devices:, Solar cells, I-V characteristics, and LEDs			
Module 3	**Quantum concepts and Applications**	Term paper	Seminar on quantum computers.	**No. of classes: 8**
	Topics: Planck's quantum theory, applications of Quantum theory: de-Broglie hypothesis, matter waves, properties. de-Broglie wavelength associated with an electron. Heisenberg's uncertainty principle. Schrodinger time independent wave equation. Particle in a box			
Module 4	**Lasers and Optical fibers**	Term paper	Case study on medical applications of Lasers.	**No. of classes :07**
	Topics: Interactions of radiations with matter, Characteristics of laser, conditions and requisites of laser, Modern day applications of laser: LIDAR, LASIK, Cutting, Welding and Drilling. 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.			

	List of Laboratory Tasks: Experiment No. 1: Experimental errors and uncertainty using excel Level 1: Calculation of accuracy and precision of a given data Level 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. Level 1: Determination of Wavelength of Laser Level 2: Finding the particle size of lycopodium powder. Experiment No. 3: To determine the proportionality of Hall Voltage, magnetic flux density and the polarity of Charge carrier. Level 1: To determine the proportionality of Hall Voltage and magnetic flux density Level 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. Level 1: To study I –V characteristics of the given Zener diode in reverse bias and to determine break down voltage. Level 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. Level 1: To determine the input resistance of a given transistor. Level 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. Experiment No. 7: To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance and To measure the photo-current as a function of the irradiance at constant voltage. Level 1 To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance. Level 2: To measure the photo-current as a function of the irradiance at constant voltage.

	Experiment No. 8: To study the I-V characteristics and I-R characteristics of a solar cell as a function of the irradiance. Level 1: To study the I-V characteristics Level 2: I-R characteristics of a solar cell as a function of the irradiance. Experiment No. 9: Calculate the numerical aperture and study the losses that occur in optical fiber cable. . Level 1: Calculate the numerical aperture. Level 2: study the losses that occur in optical fiber cable. Experiment No. 10: To determine the magnetic susceptibility of a given diamagnetic and paramagnetic substances using Quincke's method. Level 1: To determine the magnetic susceptibility of a given diamagnetic substance. Level 2: To determine the magnetic susceptibility of a given paramagnetic substance. Experiment No. 11: 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. 12: 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.
	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.
	Text Book 1. Engineering Physics by Avadhanalu, Revised edition, S. Chand Publications,2018.
	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.

<table>
<tr><td>Course Code:
ENG1002</td><td colspan="2">Course Title: Technical English
Type of Course:1] School Core
2] Laboratory integrated</td><td>L-T-P-C</td><td>1-0-2-2</td></tr>
<tr><td>Version No.</td><td colspan="4">1.0 V. 3</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="4">Intermediate Level English</td></tr>
<tr><td>Course Anti-requisites</td><td colspan="4">NIL</td></tr>
<tr><td>Course Description</td><td colspan="4">Technical English course is designed to equip students with the language skills necessary for effective communication in technical and scientific contexts. The course focuses on the specialized vocabulary, writing styles, and communication techniques used in various technical fields, including engineering and information technology.</td></tr>
<tr><td>Course Objectives</td><td colspan="4">The objective of this course is to develop the learners' EMPLOYABILITY SKILLS by using EXPERIENTIAL LEARNING and PARTICIPATIVE LEARNING TECHNIQUES.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">On successful completion of the course, the students shall be able to:
1. Develop proficiency in using technical vocabulary and terminology.
2. Apply language skills for better speaking skills in technical fields.
3. Write technical descriptions
4. Demonstrate writing skills in writing technical documents such as reports, manuals, and articles.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Fundamentals of Technical Communication</td><td>Worksheets& Quiz</td><td>Vocabulary building</td><td>9 Classes</td></tr>
<tr><td colspan="5">Introduction to Technical English
Differences between Technical English and General English
Technical Writing Basics
Technical Vocabulary</td></tr>
</table>

Module 2	**Technical Presentation**	**Presentations**	**Speaking Skills**	**12 Classes**
Introduction ,Planning the Presentation ,Creating the Presentation ,Giving the Presentation				
Module 3	**Technical Description**	**Assignment**	**Group Presentation**	**12 Classes**
Product Description ,Process Description ,User Manuals ,Transcoding: Diagrams, charts and images				
Module 4	**Technical Writing**	**Assignment**	**Writing Skills**	**12 Classes**
Email Writing,Persuasive and Descriptive Language ,Professional Email Etiquette ,Writing clear and concise technical emails Communicating technical information effectively ,**Technical Report Writing,**Types of technical reports (Lab reports, research reports, etc.),Components of technical reports,Writing an abstract and executive summary,Structure and content organization Transcoding: diagrams, charts and images				

List of Laboratory Tasks:

1. Module-1

Level 1: Worksheets
Level 2: Worksheets

2. Module 2

Level 1: Preparing Presentation
Level 2: Giving Presentation (Individual)

3. Module-3

Level 1: Product Description & User Manual
Level 2: Process Description & Transcoding

4. Module 4

Level 1: Email Writing
Level 2: Report Writing

Targeted Applications & Tools that can be used:

1. Flipgrid
2. Quizzes
3. Youtube Videos
4. Podcast

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

Bring out the essence of technical communication with reference to the conventions of technical communication, with examples
Prepare a technical presentation on the importance of Technical Communication and its relevance in a technical field, with real-life examples.

The following individual, as well as group Assignments, will be given to the students.

1. **Presentation**
2. **Describing a product/process**
3. **Individual Reports**

Text Books

1. Kumar, Sanjay; Pushpalatha. *English Language and Communication Skills for Engineers.* Oxford University Press. 2018.
2. Brieger, Nick and Alison Paul. *Technical English Vocabulary and Grammar*. https://nmetau.edu.ua/file/technical_english_vocabulary_and_grammar.pdf

Reference Book:

Chauhan, Gajendra Singh, and Kashmiramka, Smita, ***Technical Communication.*** Cengage Publication. 2018.

Sunder Jain. *Technical Report Writing*. Centrum Press, 2013.

John Bowden. "Writing a Report: How to Prepare, Write & Present Really Effective Reports?". 9th Edition 2011

Comfort, Jeremy et. al. 1984. *Business Reports in English*. Cambridge University Press.

Sharma, R.C. and K. Mohan. 2011. Business Correspondence and Report Writing, Fourth Edition. Tata McGraw Hill.

Web Resources:

1:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=JSTOR1_3307.

2;https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=5&sid=3a77d69b-abe5-4681-b39d-32dfdcb8f4a5%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=154223466&db=iih

3: Last,Suzan, et. al. ***Technical Writing Essentials.*** University of Victoria, British Columbia, 2019 (E- Book)

4 Wambui, Tabita Wangare, et al. ***Communication Skills- Volume 1***, LAP LAMBRET, USA, 2012 (E Book)

Topics Relevant to the Development of Employability Skills:
Speaking Skills, Writing Skills, Critical Thinking and Critical Analysis, and Group Communication.

Course Code: PPS 1001	**Course Title: Introduction to Soft Skills** **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 understand soft skills concepts and improve confidence, communication and professional skills to give the students a competitive advantage and increase chances of success in the professional world. 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 "Soft Skills" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.**			
Course Out Comes	**On successful completion of this course the students shall be able to:** CO1: **Recognize** significance of soft skills CO2: **Illustrate** effective communication while introducing oneself and others CO3: **List** techniques of forming healthy habits CO4: **Apply** SMART technique to achieve goals and increase productivity			
Course Content:				
Module 1	INTRODUCTION TO SOFT SKILLS		**Classroom activity**	**04 Hours**
Topics: Setting Expectations, Ice Breaker, Significance of soft skills, Formal grooming, punctuality				
Module 2	EFFECTIVE COMMUNICATION		**Individual Assessment**	**10 Hours**
Topics: Different styles of communication, Difference between hearing and listening, Effective communication for success, Email etiquette, Self-introduction framework, Video introduction, email- writing, Resume				

Building- Digital, Video, Traditional.				
Module 3	HABIT FORMATION		**Worksheets & Assignment**	**4 Hours**
Topics: Professional and personal ethics for success, Identity based habits, Domino effect, Habit Loop, Unlearning, standing up for what is right				
Module 4	Goal setting & Time Management		**Goal sheet**	**8 Hours**
A session where students will be introduced to Time management, setting SMART Goals, Introduction to OKR Techniques, Time Management Matrix, steps to managing time through outbound group activity, making a schedule, Daily Plan and calendars (To Do List), Monitoring/charting daily activity				
Targeted Application & Tools that can be used: LMS				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
1) Individual Assessment 2) LMS MCQ				
The topics related to Skill Development: Communication and professional grooming, Goal setting and presentation for skill development through participative learning techniques. This is attained through assessment component mentioned in course handout.				

Course Code: CSE1004	Course Title: Problem Solving Using C Type of Course: School Core Lab Integrated.	L- T-P-C	1	0	4	3
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. AC Also by learning the basic programming constructs they can easily switch over to any other language in future.					

<table>
<tr><td>Course Object</td><td colspan="4">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.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">On successful completion of this course the students shall be able to:
Write algorithms and to draw flowcharts for solving problems
Demonstrate knowledge and develop simple applications in C programming constructs
Develop and implement applications using arrays and strings
Decompose a problem into functions and develop modular reusable code
Solve applications in C using structures and Union
Design applications using Sequential and Random Access File Processing.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to C Language</td><td>Quiz</td><td>Problem Solving</td><td>9 Hrs.</td></tr>
<tr><td colspan="5">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.</td></tr>
<tr><td>Module 2</td><td>Introduction to Arrays and Strings</td><td>Quiz</td><td>Problem Solving</td><td>9 Hrs.</td></tr>
<tr><td colspan="5">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.</td></tr>
<tr><td>Module 3</td><td>Functions and Pointers</td><td>Quiz</td><td>Problem Solving</td><td>9 Hrs.</td></tr>
<tr><td colspan="5">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.</td></tr>
<tr><td>Module 4</td><td>Structures and Union</td><td>Quiz</td><td>Problem Solving</td><td>9 Hrs.</td></tr>
<tr><td colspan="5">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.</td></tr>
<tr><td>Module 5</td><td>File handling</td><td>Case Study</td><td>Problem</td><td>9 Hrs.</td></tr>
</table>

			Solving	

Topics:
Files: Defining and Opening a File – Closing a File – Input / Output Operations on File – Random Access Files

List of
Practical
Tasks Lab
Sheet 1
(Module I)
CHE1018
Lab Sheet 2 (Module II)
Programs using Arrays and Strings
Lab Sheet 3 (Module III)
Programs using Functions and Pointers
Lab Sheet 4 (Module IV)
Programs using Structures and Unions
Lab Sheet 5 (Module V)
Programs using 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: CHE1018	**Course Title: Environmental Science** **Type of Course: School Core- Theory and Lab**	**L- T-P- C**	1	0	2	0
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	**NIL**					

Course Description	This course emphasizes the need to conserve biodiversity and adopt a more sustainable lifestyle by utilizing resources in a responsible way. Topics covered include basic principles of ecosystem functions; biodiversity and its conservation; human population growth; water resources, pollution; climate change; energy resources, and sustainability; Sustaining human societies, policies, and education. **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 "Environmental Science" and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.**
Course Outcomes	On successful completion of this course the students shall be able to: Appreciate the historical context of human interactions with the environment and the need for eco-balance. Describe basic knowledge about global climate change with particular reference to the Indian context. Understand biodiversity and its conservation Develop an understanding on types of pollution and ways to protect the environment Learn about various strategies on Global environmental management systems
Course Content:	

Module 1	**Humans and the Environment**	Assignment	Data Collection	**01 class**

Topics: The man-environment interaction: Mastery of fire; Origin of agriculture; Emergence of city states; Great ancient civilizations and the environment.

Self-learning topics: Humans as hunter-gatherers; Industrial revolution and its impact on the environment; Environmental Ethics and emergence of environmentalism.

Module 2	**Natural Resources and Sustainable Development**	Assignment		**03 Classes**

Topics:
Overview of natural resources: Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable. **Water resources**: Types of water resources- fresh water and marine resources;**Soil and mineral resources**: Important minerals; Mineral exploitation Soil as a resource and its degradation.**Energy resources**: Sources of energy and their classification, renewable and non-renewable sources of energy; Advantages and disadvantages.

Self- learning topics: Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges.; Environmental problems due to extraction of minerals and use; Sustainable Development Goals (SDGs)- targets, indicators, and challenges for SDGs.

Module 3	**Environmental Issues: Local, Regional and Global**	Case study		**02 Classes**

Topics:
Environmental Pollution: Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Trans- boundary air pollution; Acid rain; Smog.

Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Global change: Ozone layer depletion; Climate change

Self -learning topics: Environmental issues and scales

	Module 4	**Conservation of Biodiversity and Ecosystems**	Assignment		**02 Classes**

Topics:
Biodiversity-Introduction, types, Species interactions, Extinct, endemic, endangered and rare species, Threats to biodiversity: Natural and anthropogenic activities.

Self-learning topics: Mega-biodiversity, Hot-spots, Major conservation policies. Biodiversity loss: past and current trends, impact.

	Module 5	**Environmental Pollution and Health**	Case study		**03 Classes**

Topics:
Pollution, Definition, point and nonpoint sources of pollution, **Air pollution**- sources, major air pollutants, health impacts of air pollution.

Water pollution– Pollution sources, adverse health impacts on human and aquatic life and mitigation, Water quality parameters and standards.

Soil pollution and solid waste- Soil pollutants and their sources, solid and hazardous waste, Impact on human health.

Self-learning topics: Noise pollution, Thermal and radioactive pollution.

	Module 6	**Climate Change: Impacts, Adaptation and Mitigation**	Assignment/case		**02 Classes**

Topics:
Understanding climate change: Natural variations in climate; Projections of global climate change with special reference to temperature, rainfall and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Impacts

Vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Indigenous knowledge for adaptation to climate change.

Self-learning topics: Mitigation of climate change: Synergies between adaptation and mitigation measures; National and international policy instruments for mitigation.

	Module 7	**Environmental Management**	Case study	Data analysis	**02 Classes**

Topics:
Environmental management system: ISO 14001; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability.

Self-learning topics: Environmental audit and impact assessment; Eco labeling /Eco mark scheme

	Module 8	**Environmental Treaties and Legislation**	Case study	Data analysis	**01 Classes**

Topics:
Major International Environmental Agreements: Convention on Biological Diversity (CBD), Major Indian Environmental Legislations: Environmental Protection Act, Forest Conservation Act, Public awareness.

Self-learning topics: Paris Agreement, Conference of the Parties (COP), India's status as a party to major conventions: Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act.

List of laboratory tasks : Any eight experiments will be conducted

Determination of total alkalinity of a water sample (knowledge)

Estimation of water hardness by EDTA method and its removal (by zeolite/ ion exchange method) (Comprehensive)

Estimation of copper from industrial effluents by colorimetric method (Comprehensive)

Estimation of iron from industrial effluents by titrimetric method/potentiometric method (Comprehensive)

Estimation of nickel from industrial effluents by titrimetric method (Comprehensive)

Estimation of chloride in drinking water by titrimetric method (Comprehensive)

Estimation of fluoride in ground water by colorimetric method (Comprehensive)

Determination of calcium in aqueous solution (Comprehensive)

Determination of Total Dissolved Salts, conductivity and pH of a water samples (Knowledge)

Determination of Chemical oxygen demand in the industrial effluent. (Comprehensive)

Biological oxygen demand of waste water sample (Comprehensive)

Determination of dissolved oxygen of an industrial effluent (Comprehensive)

Quality monitoring analysis of a soil sample (knowledge)

Flame photometric estimation of Sodium and potassium (Application)

Gas Chromatographic analysis of volatile organic compounds (Application)

Targeted Application & Tools that can be used:

Application areas are Energy, Environment and sustainability

Tools: Statistical analysis of environmental pollutants using excel, origin 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.)

Lab evaluation/Assignment

End Term Exam

Self-learning

Assignment 1: Write a Statement of Environment report of your town/city/state/country

Assignment 2: Individual students will carry out the analyses of polluted solid, liquid, and gaseous samples and propose suitable mitigation measures. A detailed and in-depth report needs to be submitted for each case. This may include preparation of reagents, sample preparation (extraction), chemical analysis carried out, instruments and tools used, data collected and processed, inferences made and conclusions arrived at. Necessary support is given in the form of lab manual and reference links to e-books.

Text Book

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

Krishnamurthy, K.V. (2003) Text book of Biodiversity, Science Publishers, Plymouth, UK.

Jackson, A.R. & Jackson, J.M. (2000), Environmental Science: The natural environment and human impact, Pearson Education.

Reference Books

Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.

William P. Cunningham and Mary Ann Cunningham (2017), Principles of Environmental Science: Inquiry & Applications, 8th Edition, McGraw-Hill Education, USA.

Sinha N., (2020) Wild and Wilful. Harper Collins, India.

www.ipcc.org; https://www.ipcc.ch/report/sixth-assessment-report-cycle/

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

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

E-resources:

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_18126
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_8761
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAJ_1_02082022_3333
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_3063
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_20719
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_16824
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_3954
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_491
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_488
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_583
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=SPRINGER_INDEST_1_171
https://presiuniv.knimbus.com/user#/searchresult?searchId=3R%20principle&_t=1687427221129
https://presiuniv.knimbus.com/user#/searchresult?searchId=eco%20labelling&_t=1687427279979
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=TEXTBOOK_LIBRARY01_06082022_395&xIndex=4
https://www.ugc.gov.in/oldpdf/modelcurriculum/env.pdf

Topics relevant to Skill Development:

Industrial revolution and its impact on the environment, Environmental impact of over-exploitation of water resources, pollution and ill effects, lab experiments for Skills development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.

All topics in theory component are relevant to Environment and Sustainability.

Course Code: MAT1003	**Course Title: Applied Statistics** **Type of Course:** School Core	**L T P C**	1	0	2	2
Version No.	3.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	The goal of this course is to provide a firm understanding of probability and statistics by means of a thorough treatment of descriptive statistics, probability and probability distributions keeping in mind the future courses having statistical, quantitative and probabilistic components. The course covers topics such as descriptive statistics, probability, rules for probability, random variables and probability distributions, standard discrete and continuous probability distributions.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "**Applied Statistics" and attain **Skill Development Through Problem Solving techniques**.					
Expected Outcome:	At the end of this course, students will be in a position to apply the techniques of descriptive statistics effectively interpret the ideas of probability and conditional probability demonstrate the knowledge of probability distributions Compute statistical parameters, correlation and regression, probability and sampling distributions using R software.					
Module 1	**Descriptive Statistics**	Assignment	Coding needed		**10 classes**	
Introduction to Statistics, Data and statistical thinking, review of basic statistical parameters, Covariance, Correlation, Types of Measures of Correlation - Karl Pearson's Correlation Coefficient, Spearman Rank						

Correlation, linear regression, Multi linear regression **.**				
Module 2	**Probability**			**6 classes**
Introduction to Probability, Probability of an event, Addition Principle, Multiplication law, Conditional Probability, Total Probability and Baye's theorem with examples				
Module 3	**Random Variables and Probability Distributions**		Coding needed	**14 classes**
Introduction to Random variables, Discrete Random Variables and Continuous Random Variables, Probability Distributions, Probability Mass Function and Probability Density Function, Various Probability distributions, Binomial, **Negative Binominal (Self Study)**, Poisson, Normal and Exponential distributions				
Module 4	**Sampling Theory**		Coding needed	**15 classes**
Introduction to Sampling Theory, Population, Statistic, Parameter, Sampling Distribution, Standard Error. Testing of Hypothesis, Types of Errors, Critical Region, level of Significance. Difference between Parametric and Non-parametric Tests, Large Sample Tests: Z-Test for Single Mean and **Difference of Means (Self Study)**, Small Sample Tests: Student's t-Test for Single Mean and **Difference of Means,** F-Test, Chi-Square Test.				
Targeted Application & Tools that can be used: The objective of the course is to familiarize students with the theoretical concepts of probability and statistics and to equip them with basic statistical tools to tackle engineering and real-life problems. Tools used: R Software / MS-Excel				
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, 2016.				
References				

1. James T. McClave, P. George Benson and Terry Sincich, Statistics for Business and Economics, 2018.
2. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Essentials of Modern Business Statistics with Microsoft Excel, 2020.
3. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Essentials of Statistics for Business and Economics, 2019.
4. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, John Wiley and Sons, 2018.
5. Richard A. Johnson, Miller and Freund's Probability and Statistics for Engineers, 2018.
6. Kishor S Trivedi, Probability and Statistics with reliability, Queuing and Computer Science Applications, John Wiley & Sons, 2008.

Topics relevant to SKILL DEVELOPMENT: The goal of this course is to provide a firm understanding of probability and statistics by means of a thorough treatment of descriptive statistics, probability and probability distributions keeping in mind the future courses having statistical, quantitative and probabilistic components. The course covers topics such as descriptive statistics, probability, rules for probability, random variables and probability distributions, standard discrete and continuous probability distributions for **Skill Development through Problem Solving methodologies.** This is attained through assessment component mentioned in course handout.

Course Code: CIV1008	**Course Title: Basic Engineering Sciences Type of Course: Theory Only**	**L-T-P-C**	2	0	0	2
Version No.	1.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	This basic course on engineering science is designed to introduce students to the fields of civil, mechanical and					

	petroleum engineering. Student will be exposed to various fields in civil engineering and different manufacturing techniques in addition to machinery for power production and consumption. Additionally, students will be getting an overview of various sectors of oil & gas industries. This course acquaints students to basics of Industry 4.0 and Construction 4.0. The course aims to enable students to appreciate the multidisciplinary nature of engineering design and operations in the current era with mechanization and digitization transforming every aspect of engineering.			
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] Recognize the significance of various disciplines in Civil Engineering 2] Discuss the recent evolutions in Civil Engineering 3] Explain various energies, energy generating machineries and energy consumption machineries 4] Describe the fundamental concept and terminology associated with the Petroleum Industry 5] Distinguish between conventional and modern manufacturing techniques.			
Course Content:				
Module 1	**Introduction to various fields in Civil Engineering**	Assign ment	Case studies on different Civil Engineering Projects	**6 Sessions**
Topics: Introduction to Civil Engineering: Definition, scope and branches of Civil Engineering, Role of Civil Engineer, Overview of Infrastructure.				
Module 2	**Current Trends and Evolution in Civil Engineering**	Assign ment	Article Review	**6 Sessions**
Topics: Mechanization in Construction, Application of Digital Technologies				

in Planning, Design, execution, monitoring and maintenance of Construction. Overview of Smart Cities.				
Module 3	**Power Production and Consumption Machinery**	Assignment & Quiz	Data Collection	**6 Sessions**
Topics: Energy and its types, Engines and their applications, Pumps-Compressors and their applications.				
Module 4	**Overview of Petroleum Engineering**	Assignment & Quiz	Article Review	**6 Sessions**
Overview of the Petroleum Industry, Importance of Petroleum Engineering, lifecycle of Petroleum products, Classifications of E&P activities: Key difference between Offshore and Onshore, Onshore facilities, offshore platforms, Digitization of petroleum engineering				
Module 5	**Industry 4.0**	Assignment & Quiz	Data Collection	**6 Sessions**
Topics: Conventional manufacturing process: Metal forming, metal removal and metal joining process. Modern Manufacturing process: 3D Printing / Additive Manufacturing.				
Targeted Application & Tools that can be used: Application Areas include design and implementation of Smart City projects, Infrastructure maintenance, Power production, IC engines, Electric vehicles, onshore and offshore exploration and production activities				
Project work/Assignment:				
Assignment 1: Collect data and prepare report on various Mega Projects in Civil Engineering Assignment 2: Review Articles on current evolutions in Civil Engineering. Assignment 3: Collect data related to renewable energy generation (Wind, Solar) Assignment 4: Prepare an energy consumption chart for a compressor or pumps. Assignment 5: Prepare a report on role of 3D printing across various industries. Assignment 6: Prepare an assignment on geopolitical influence on oil and gas industries.				

Text Book:

T1. Elements of Civil and Mechanical Engineering, L.S. Jayagopal & R Rudramoorthy, Vikas Publishers

T2. Elements of Mechanical Engineering, by VK Manglik

T3. Fundamentals of Oil & Gas Industry for Beginners by Samir Dalvi, Notion Press; 1st edition

References

1. K.P. Roy, S.K. Hajra Choudhury, Nirjhar Roy, "Elements of Mechanical Engineering", Media Promoters and Publishers Pvt Ltd, Mumbai.
2. Nontechnical Guide to Petroleum Geology, Exploration, Drilling & Production by Norman J. Hyne, PennWell Books; 3rd Revised edition

Web-resources:

1. Basic Civil Engineering
   https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2706932&site=ehost-live
2. Post-parametric Automation in Design and Construction
   https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1155197&site=ehost-live
3. Smart Cities : Introducing Digital Innovation to Cities
   https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1993146&site=ehost-live
4. 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
5. Mechanical Engineering
   https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO106_REDO_1705
6. Additive Manufacturing: Opportunities, Challenges, Implications
   https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1134464&site=ehost-live
7. Society of Petroleum Engineers (SPE)
   https://www.spe.org/en/
8. PetroWiki: A comprehensive online resource created by the Society of Petroleum Engineers that provides information on various aspects of petroleum engineering.
   https://petrowiki.spe.org/PetroWiki
9. Rigzone: A resource for news and information about the oil and gas industry, including job postings and industry trends.
   https://www.rigzone.com/

Topics relevant to the development of SKILLS:
Engines-Turbines and their applications.
Mechanization in Construction. Digitization in Petroleum Industries

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 and Planes under different conditions. **(3)** Prepare multiview orthographic projections of Solids by visualizing them in different positions. **(4)** Prepare pictorial drawings using the principles of isometric projections to visualize objects in three dimensions**.**		

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

Module 2	Orthographic projections of 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 in all 4 quadrants. Projections of Straight Lines (located in first quadrant/first angle projection only): True and apparent lengths, true and apparent Inclinations to reference planes. (No application problems). Projection of Plane surfaces (First angle projection): Regular plane surfaces – triangle, square, rectangle, pentagon, hexagon and circle – in different positions inclined to both the planes using change of position method only. **[10 Hours: Application Level]**				
Module 3	Orthographic Projections of Solids	Assignment	Multi-view drawing Analysis	**10 Sessions**
Topics: Introduction, Projection of right regular prisms, pyramids, cone, hexahedron and tetrahedron in different positions (Problems resting on HP only and First angle projection). **[10 Hours: Application Level]**				
Module 4	Isometric Projections of Solids (Using isometric scale only)	Assignment	Spatial Visualization	**8 Sessions**
Topics: Introduction, Isometric scale, Isometric projections of right regular prisms, cylinders, pyramids, cones and their frustums, spheres and hemispheres, hexahedron (cube), and combination of 2 solids, conversion of orthographic view to isometric projection of simple objects. **[8 Hours: Application Level]**				
Text Book: 1.N. D. Bhatt, "Engineering Drawing: Plane and Solid Geometry," Charotar Publishing House Pvt. Ltd.				

References:

1. K.R. Gopalakrishna, "Engineering Graphics", Subhash Publishers, Bangalore.

2. D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, "Engineering Graphics with AutoCAD," Prentice Hall.

3. D. A. Jolhe, "Engineering Drawing with Introduction to AutoCAD," Tata McGraw Hill.

Web resources:

https://nptel.ac.in/courses/112103019

Topics relevant to "SKILL DEVELOPMENT": Projection in first and third angle for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout.

Course Code: **CSE1006**	**Course Title:** Problem Solving using JAVA **Type of Course: Lab Integrated**	**L- T- P- C**	1	0	4	3
Version No.	2.0					
Course Pre-requisites	CSE1004 – Problem-Solving Using C					
Anti-requisites	Nil					
Course Description	This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes 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:** **C.O. 1:** Describe the basic programming concepts. [Knowledge] **C.O. 2:** Apply the concept of classes, objects and methods to solve problems. [Application]					

	C.O. 3: Apply the concept of arrays and strings. [Application] **C.O. 4:** Implement inheritance and polymorphism in building secure applications. [Application] **C.O. 5:** Apply the concepts of interface and error handling mechanism. [Application]			
Course Content:				
Module 1	**Basic Concepts of Programming and Java**	Assignment	Data Collection/Interpretation	**12 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**	Case studies / Case let	Case studies / Case let	**12 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**	Quiz	Case studies / Case let	**14 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**	Quiz	Case studies / Case let	**14 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**	Quiz	Case studies / Case let	**14 Sessions**

Input/output Operation in Java(java.io Package), Streams and the new I/O Capabilities, Understanding Streams, working with File Objects, 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.

List of Laboratory Tasks:

P1 - Problem Solving using Basic Concepts.

P2 - Problem Solving using Basic Concepts and Command Line Arguments.

P3 - Programming assignment with class, objects, methods and Constructors.

P4 - Programming assignment with method overloading.

P5 - Programming assignment with constructor overloading.

P6 - Programming assignment with Static members and static methods.

P7 - Programming assignment with Nested classes.

P8 - Programming assignment using Arrays.

P9 - Programming assignment using Strings.

P10 - Programming assignment using String Builder.

P11 - Programming assignment using Inheritance and super keyword.

P12 - Programming assignment using Method overriding and Dynamic method invocation.

P13 - Programming assignment using Final keywords.

P14 - Programming assignment using Abstract keywords.

P15 - Programming assignment using Interface.

P16 - Programming assignment using Interface.

P17 - Programming assignment CharacterStream Classes

P18 - Programming assignment Read/Write Operations with File Channel
Targeted Application & Tools that can be used : JDK /eclipse IDE/ net Beans IDE.
Text Book **T1** Herbert Schildt, “The Complete Reference Java 2”, Tata McGraw Hill Education.
References **R1**: Cay S Horstmann and Cary Gornell, “CORE JAVA volume I-Fundamentals”, Pearson **R2:** James W. Cooper , “Java TM Design Patterns – A Tutorial”, Addison-Wesley Publishers. **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 the 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 the assessment component mentioned in the course handout.

ENG2001	**Advanced English**	**L- T- P- C**	1	0	2	2
Version No.	1.3					
Course Pre-	ENG1002 Technical English					

requisites	
Anti-requisites	**NIL**
Course Description	The course emphasizes on technical communication at advanced level by exploring critical reading, technical presentation and review writing. The purpose of the course is to enable learners to review literature in any form or any technical article and deliver technical presentations. Extensive activities in practical sessions equip to express themselves in various forms of technical communications. Technical presentations and the module on career setting focus on learners' area of interests and enhance their English language writing skills to communicate effectively.
Course Out Come	On successful completion of the course the students shall be able to: 1. Develop a critical and informed response reflectively, analytically, discursively, and creatively to their reading. 2. Communicate effectively, creatively, accurately and appropriately in their writing. 3. Deliver technical presentations 4. Design resume and create professional portfolio to find a suitable career

Course Content: Theory

Module 1	**Critical Reasoning and Writing**	**Writing Essays**	**Critical Reading**	**4 Classes**

Topics:

- A Catalog of Reading Strategies
- The Myth of Multitasking
- A Guide to Writing Essays Speculating about Causes or Effects
- Is Google Making Us Stupid (Self Study)

Module 2	**Technical Presentation**	**Presentation**	**Oral Skills**	**3 Classes**

Topics:

- Planning the presentation
- Creating the presentation

- Giving the presentation

Module 3	**Writing Reviews**	**Prezi**	**Review Writing**	**4 Classes**

Topics:

- Review Writing
- Short film reviews
- Advanced English Grammar (Self Study)

Module 4	**Starting your Career**	**Online Writing Lab**	**Writing Skills**	**4 Classes**

Topics**:**

- Preparing a Resume
- Writing Effective Application Letter
- Creating a Professional Portfolio

Course Content: Practical Sessions

Module 1	**Critical Reasoning and Writing**	**8 Classes**

1. Reading and Analyzing
   Level 1 – Annotation
   Level 2 - Assumptions
2. Writing Narrative Essays
   Level 1 – Draft 1
   Level 2 – Draft 2

Module 2	**Technical Presentation**	**10 Classes**

3. Fishbowl
   In Fishbowl, students form concentric circles with a small group inside and a larger group outside. Students in the inner circle engage in an in-depth discussion, while students in the outer circle listen and critique content, logic, and group interaction.
   Level 1 – within group
   Level 2 – Among 2 group
4. Technical Group Presentation

Module 3	**Writing Reviews**	**4 Classes**

5. Practice Worksheets
   Level 1 – Eliminating the Passive Voice
   Level 2 – Simple, compound and complex sentences
6. Writing Short Film Reviews

Module 4	**Starting your Career**	**6 Classes**
7. Collaborative Project Job search and writing report Writing Resume		
Module 1-4	**Academic Journal**	**2 Classes**
8. Academic Journal Writing Level 1- Mid Term Level 2 – End Term		
Targeted Application & Tools that can be used: Writing reports, Review writing, Group Discussion, Dyadic interviews, Grammarly.com		
Project work/Assignment:		
Academic Journal – Assignment In Academic Journal (CIJ), students compile task and activities completed in each module and submit to the instructor at the middle and end of the semester.		
References 1. Hering, Heik. *How to Write Technical Reports: Understanding Structure, Good Design, Convincing Presentation*. Springer. 2. Johnson, Richard. (2010) *Technical Communication Today.* Pearson, 2015 3. Rice B. Adelrod, Charles R. Cooper and Ellen C. Carillo. (2020) *Reading Critically Writing Well: A Reader and Guide*. Beford/St. Martin's Macmillan Learning, New York. 4. The Princeton Review. (2010) *MCAT Verbal Reasoning & Writing.* The Princeton Review, Inc. 5. https://www.hitbullseye.com/Strong-and-Weak-Arguments.php Accessed on 10 Dec 2021 6. https://www.inc.com/guides/how-to-improve-your-presentation-skills.html Accessed on 10 Dec 2021		
Topics Relevant to "employability": Critical Reasoning, Presentation, Review Writing and Starting Career **Topics Relevant to "Human Values and Professional Ethics":** Critical reasoning		

Course Code:	**Course Title: Innovative Projects using Arduino**	**L- T-P-C**	-	-	-	1

ECE2010						
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course is designed to provide an in-depth understanding of Arduino microcontrollers and their application in various real time projects involving sensors. Throughout the course, students will learn the fundamentals of Arduino programming and gain hands-on experience with a wide range of sensors. Students will explore how to connect and interface sensors with Arduino 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 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 prototype board 2) Demonstrate the hardware interfacing of the peripherals to Arduino system. 3) Understand the types of sensors and its functions 4) Demonstrate the functioning of live projects carried out using Arduino system**.**					
Course Content:						
Module 1	**Basic concepts of Arduino**	Hands-on	Interfacing Task and Analysis	**4 Sessions**		
Topics: Introduction to Arduino, 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	**Sensory Devices**	Hands-on	Interfacing Task and Analysis	**4 Sessio**		

				ns

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 Tinkercad Simulator.

Topics: Types of Arduino boards, 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 and sensors can be applied. The flexibility and affordability of Arduino, combined with the wide range of sensors available, allow for endless possibilities in creating innovative projects.

Professionally Used Software: students can use open SOURCE Softwares Arduino IDE and Tincker CAD

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 .

3. 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

Textbook(s):

Monk Simon “Programming Arduino: Getting Started with Sketches”, Mc Graw Hill Publications Second Edition

References

Reference 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.

Online 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>

E-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.

Topics relevant to development of "SKILL": System design for achieving Sustainable Development Goals.

Course Code: CSE2253	**Course Title:** Data Structures **Type of Course: Theory**		**L-T- P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	NIL					
Course Description	This course introduces the fundamental concepts of data structures and to emphasize the importance of choosing an appropriate data structure and technique for program development. This course has theory and lab component which emphasizes on understanding the implementation and applications of data structures using Java programming language. With a good knowledge in the fundamental concepts of data structures and practical experience in implementing them, the student can be an effective designer, developer for new software applications.					
Course Objective	The objective of the course is SKILL DEVELOPMENT of student by using EXPERIENTIAL LEARNING techniques					
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1:** Describe the concept of basic data structure, stacks, queues, and arrays and their operations. **[Understand]** **CO2:** Utilize linked lists for real-time scenarios. **[Apply]** **CO3:** Apply an appropriate non-linear data structure for a given scenario. **[Apply]** **CO4:** Demonstrate different searching and sorting techniques. **[Apply]**					
Course Content:						
Module 1	**Introduction to Data Structure and Linear Data Structure – Stacks and Queues**	Assignment	Program activity			**9 Hours**
Introduction – Introduction to Data Structures, Types and concept of Arrays. **Stack -** Concepts and representation, Stack operations, stack implementation using array and Applications of Stack. **Queues -** Representation of queue, Queue Operations, Queue implementation using array, Types of Queue and Applications of Queue.						
Module 2	**Linear Data Structure-Linked List**	Assignment	Program activity			**12 Hours**
Topics: Linked List - Singly Linked List, Operation on linear list using singly linked storage structures,						

Circular List, Applications of Linked list.

Recursion - Recursive Definition and Processes.

Module 3	**Non-linear Data Structures - Trees**	Assignment	Program activity	**12 Hours**

Topics: Trees - Introduction to Trees, Binary tree: Terminology and Properties, Use of Doubly Linked List, Binary tree traversals: Pre-Order traversal, In-Order traversal, Post - Order traversal, Binary Serach Tree, AVL Trees - Red Black Tree, Expression Tree , Heaps.

Module 4	**Non-linear Data Structures - Graphs and Hashing**	Assignment	Program activity	**6 Hours**

Topics: Graphs: Basic Concept of Graph Theory and its Properties, Representation of Graphs . ADT, Elementary graph operations, Minimum Cost spanning trees, Shortest path and Transitive closure.

Hashing: Introduction, Static Hashing, Dynamic Hashing

Module 5	**Searching & Sorting**	Assignment	Program activity	**6 Hours**

Topic: Sorting & Searching - Sequential and Binary Search, Sorting – Selection and Insertion sort, Quick sort, Merge Sort, Bubble sort.

List of Laboratory Tasks:

Lab sheet -1

Level 1: Prompt the user, read input and print messages.Programs using class, methods and objects

Level 2: Programming Exercises on fundamental Data structure - Arrays based on Scenario.

Lab sheet -2

Level 1: Programming Exercises on Stack and its operations

Level 2: Programming Exercises on Stack and its operations with condition

Lab sheet -3

Level 1: Programming on Stack application infix to postfix Conversion

Level 2: -

Lab sheet -4

Level 1: Programming on Stack application – Evaluation of postfix

Lab sheet -5

Level 1: Programming Exercises on Queues and its operations with conditions

Level 2: -

Lab sheet -6

Level 1: Programming Exercises on Linked list and its operations.

Level 2: Programming Exercises on Linked list and its operations with various positions

Lab sheet -7

Level 1: Programming Exercises on Circular Linked list and its operations.

Level 2: Programming Exercises on Circular Linked list and its operations with various positions

Lab sheet -8

Level 1: Programming Exercises on factorial of a number

Level 2: Programming the tower of Hanoi using recursion

Lab sheet -9

Level 1: -

Level 2: Programming the tower of Hanoi using recursion

Lab sheet -10

Level 1: Programming Exercise on Doubly linked list and its operations

Level 2: -

Lab sheet -11

Level 1: Program to Construct Binary Search Tree and Graph

Level 2: Program to traverse the Binary Search Tree in three ways(in-order, pre-order and post-order) and implement BFS and DFS

Lab sheet -12

Level 1: Program to Implement the Linear Search & Binary Search

Level 2: Program to Estimate the Time complexity of Linear Search

Lab sheet -13

Level 1: Program to Implement and Estimate the Time complexity of Selection Sort

Level 2: Program to Implement and Estimate the Time complexity of Insertion Sort

Lab sheet -14 (Beyond syllabus activity)
Level 1: Program to Construct AVL Tree
Level 2:
Lab sheet -15 (Beyond syllabus activity)
Level 1: Program to Construct RED BLACK Tree

Targeted Application & Tools that can be used

Use of PowerPoint software for lecture slides and use of Modern IDE like VS Code and Eclipse for lab programs to execute.

Project work/Assignment:

Assignment: Students should complete the lab programs by end of each practical session and module wise assignments before the deadline.

Text Book

T1 Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Edition, Universities Press, reprint 2018.

T2 Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

References

R1 Data structures and program design in C by Robert Kruse, Tondo C L, Bruce Leung, Pearson education publishers, 2017.

R2 Programming and Data Structure by Jackulin C Salini etal., Ane books publishers, 2019.

Web resources:

1. For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview
2. https://puniversity.informaticsglobal.com/login

Topics relevant to development of "Skill Development":

Linked list and stacks

Topics relevant to development of "Environment and sustainability: Queues

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: **CSE1500**	**Course Title: Computational Thinking Using Python** **Type of Course: Lab Integrated**	**L- T-P-C**	2	0	2	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course introduces students to the essential skills of **computational thinking** and their practical application through the **Python programming language**. By combining problem-solving strategies with coding, students will learn to decompose complex challenges, identify patterns, abstract general principles, and design algorithms to build functional programs					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Computational Thinking and use the Computational Thinking Principles to solve the computational Problems using Python Language					
Course Outcomes	Upon successful completion of this course, students will be able to: • Explain and apply the core principles of **computational thinking**: o Decomposition o Pattern Recognition o Abstraction o Algorithm Design • Use **Python** to implement solutions to real-world problems. • Write and debug Python code using functions, loops and conditions • Design simple programs and algorithms to automate repetitive or complex tasks. • Collaborate effectively and communicate problem-solving approaches using pseudocode and Python.					

Course Content:				
Module 1	**Pillars of Computational Thinking**	Comprehension		**9 Sessions**
What is computational thinking? Why is it important? Pillars of computational thinking: decomposition; pattern recognition; data representation and abstraction; algorithms Applying computational thinking to case studies				
Module 2	**Algorithm Design & Problem-Solving Strategies**	Application		**9 Sessions**
Introduction to Algorithms, Introduction to Problem Solving techniques: Brute Force, Divide and conquer, Common algorithms: find-max, linear search, binary search and other simple Algorithms				
Module 3	**Applied Computational Thinking using Python**	Application		**12 Sessions**
Introduction to Python, Data representation: variables, lists, Conditionals, Loops and Iteration Basic Example programs to illustrate the programming constructs				
Targeted Application & Tools that can be used: **Google Colab, Python**				
Text Book 1. "Computational Thinking for the Modern Problem Solver" – David D. Riley & Kenny A. Hunt 2. "Mastering Python 3 Programming: Ultimate Guide to Learn Python Coding Fundamentals and Real-World Applications" Subburaj Ramaswamy, BPB publications				
References 1. **Sweigart, Al.** *Automate the Boring Stuff with Python: Practical Programming for Total Beginners.* No Starch Press, 2015. https://automatetheboringstuff.com **Severance, Charles.** *Python for Everybody: Exploring Data Using Python 3.* CreateSpace Independent Publishing, 2016. https://www.py4e.com **Wing, Jeannette M.** "Computational Thinking." *Communications of the ACM*, vol. 49, no. 3, 2006, pp. 33–35. https://doi.org/10.1145/1118178.1118215 **Downey, Allen B.** *Think Python: How to Think Like a Computer Scientist.* Green Tea Press, 2015.				

http://greenteapress.com/wp/think-python-2e/

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E-Resources

https://edu.google.com/resources/programs/exploring-computational-thinking

Topics relevant to "SKILL DEVELOPMENT": Decomposition, Abstraction, Pattern recognition, Data Representation ,Algorithms

Course Code: **CSE2251**	**Course Title:** Data Communication and Computer Networks **Type of Course:** **Theory**	**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 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: CSE2257	**Course Title:** **Computer Organization and Architecture** **Type of Course:** PCC, **Theory only**	**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 principles of computer architecture and organization from basic to intermediate level. This theory based course emphasizes on understanding the interaction between computer hardware and software. It equips the students with the intuition behind assembly-level instruction set architectures. It helps the students to interpret the operational concepts of computer technology as well as performance enhancement.
Course Objective		The objective of the course is to familiarize the learners with the concepts of **Computer Organization and Architecture** and attain **Skill Development** through **Participative Learning** techniques.
Course Outcomes		On successful completion of the course the students shall be able to: 1] Describe the basic components of a computer and their interconnections. [Remember] 2] Explain Instruction Set Architecture and Memory Unit [Understand] 3] Apply appropriate techniques to carry out selected arithmetic operations [Apply] 4] Explain the organization of memory and processor sub-system [Understand]
Course Content:		

Module 1	Basic Structure of computers	Assignment	Data Analysis task		**12 Sessions**
	Topics: Computer Types, Functional Units, Basic Operational concepts, Bus Structures, Computer systems RISC & CISC, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Arithmetic Operations on Signed numbers. Instructions and Instruction Sequencing, Instruction formats, Memory Instructions.				
Module 2	Instruction Set Architecture and Memory Unit	Assignment	Analysis, Data Collection		**12 Sessions**
	Topics: **Instruction Set Architecture:** Addressing Modes, Stacks and Subroutines. **Memory System:** Memory Location and Addresses, Memory Operations, Semiconductor RAM Memories, Internal Organization of Memory chips, Cache memory mapping Techniques.				
Module 3	Arithmetic and Input/output Design	Case Study	Data analysis task		**10 Sessions**
	Topics: **Arithmetic:** Carry lookahead Adder, Signed-Operand Multiplication, Integer Division, and Floating point operations. Input/output Design: Accessing I/O Devices, I/O communication, Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits				
Module 4	BPU and Pipelining	Assignment	Analysis, Data Collection		**11 Sessions**
	Topics: **Basic Processing Unit:** Fundamental Concepts, Single Bus organization, Control sequence, Execution of a Complete Instruction, Multiple Bus Organization. **Pipelining:** Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Hazards.				
	Targeted Application & Tools that can be used: Targeted employment sector is processor manufacturing and memory chip fabrication vendors like Intel, AMD, Motorola, NVidia, Samsung, Micron Technology, western Digital etc. Targeted job profiles include Memory circuit design and verification engineers, Physical system design engineer, System programmer, Fabrication engineer etc.				

	Tools: Virtual Lab, IIT KGP Tejas – Java Based Architectural Simulator, IIT Delhi
	Project work/Assignment:
	Each batch of students (self-selected batch mates – up to 4 in a batch) will be allocated case studies/assignments
	Textbook(s): **1.** Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", Sixth Edition, McGraw-Hill Higher Education, 2023 reprint. 2. William Stallings, "Computer Organization & Architecture – Designing for Performance", 11th Edition, Pearson Education Inc., 2019.
	References 1. David A. Patterson & John L. Hennessy, "Computer Organization and Design MIPS Edition- The Hardware/Software Interface", 6th Edition, Morgan Kaufmann, Elsevier Publications, November 2020. Web References: 1. NPTEL Course on "Computer architecture and organization" IIT Kharagpur By Prof. Indranil Sengupta, Prof. Kamalika Datta. https://nptel.ac.in/courses/106105163 2. NPTEL Course on "Computer Organization", IIT Madras By Prof. S. Raman. https://nptel.ac.in/courses/106106092 3. https://puniversity.informaticsglobal.com:2229/login.aspx
	Topics relevant to "SKILL DEVELOPMENT": Generation of Computers, CISC and RISC processors, Bus Arbitration, Collaboration and Data collection for Term assignments and Case Studies for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2254	**Course Title:** Data Structures Lab **Type of Course: Lab**	**L-T- P- C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course introduces the fundamental concepts of data structures and to emphasize the importance of choosing an appropriate data structure and technique for program development. This course has theory and lab component which emphasizes on understanding the implementation and applications of data structures using Java programming language. With a good knowledge in the fundamental concepts of data structures and practical experience in implementing them, the student can be an effective designer, developer for new software applications.					
Course Objective	The objective of the course is SKILL DEVELOPMENT of student by using EXPERIENTIAL LEARNING techniques					
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1:** Describe the concept of basic data structure, stacks, queues, and arrays and their operations. **[Understand]**					

	CO2: Utilize linked lists for real-time scenarios. **[Apply]** **CO3:** Apply an appropriate non-linear data structure for a given scenario. **[Apply]** **CO4:** Demonstrate different searching and sorting techniques. **[Apply]**			
Course Content:				
Module 1	**Introduction to Data Structure and Linear Data Structure – Stacks and Queues**	Assignment	Program activity	**9 Hours**
Introduction – Introduction to Data Structures, Types and concept of Arrays. **Stack -** Concepts and representation, Stack operations, stack implementation using array and Applications of Stack. **Queues -** Representation of queue, Queue Operations, Queue implementation using array, Types of Queue and Applications of Queue.				
Module 2	**Linear Data Structure- Linked List**	Assignment	Program activity	**12 Hours**
Topics: Linked List - Singly Linked List, Operation on linear list using singly linked storage structures, Circular List, Applications of Linked list. **Recursion** - Recursive Definition and Processes.				
Module 3	**Non-linear Data Structures - Trees**	Assignment	Program activity	**12 Hours**
Topics: Trees - Introduction to Trees, Binary tree: Terminology and Properties, Use of Doubly Linked List, Binary tree traversals: Pre-Order traversal, In-Order traversal, Post - Order traversal, Binary Serach Tree, AVL Trees - Red Black Tree, Expression Tree , Heaps.				
Module 4	**Non-linear Data Structures - Graphs and Hashing**	Assignment	Program activity	**6 Hours**
Topics: Graphs: Basic Concept of Graph Theory and its Properties, Representation of Graphs . ADT, Elementary graph operations, Minimum Cost spanning trees, Shortest path and Transitive closure. **Hashing**: Introduction, Static Hashing, Dynamic Hashing				
Module 5	**Searching & Sorting**	Assignment	Program activity	**6 Hours**
Topic: Sorting & Searching - Sequential and Binary Search, Sorting – Selection and Insertion sort, Quick sort, Merge Sort, Bubble sort.				
List of Laboratory Tasks: **Lab sheet -1** **Level 1:** Prompt the user, read input and print messages.Programs using class, methods and objects **Level 2:** Programming Exercises on fundamental Data structure - Arrays based on Scenario.				

Lab sheet -2

Level 1: Programming Exercises on Stack and its operations

Level 2: Programming Exercises on Stack and its operations with condition

Lab sheet -3

Level 1: Programming on Stack application infix to postfix Conversion

Level 2: -

Lab sheet -4

Level 1: Programming on Stack application – Evaluation of postfix

Lab sheet -5

Level 1: Programming Exercises on Queues and its operations with conditions

Level 2: -

Lab sheet -6

Level 1: Programming Exercises on Linked list and its operations.

Level 2: Programming Exercises on Linked list and its operations with various positions

Lab sheet -7

Level 1: Programming Exercises on Circular Linked list and its operations.

Level 2: Programming Exercises on Circular Linked list and its operations with various positions

Lab sheet -8

Level 1: Programming Exercises on factorial of a number

Level 2: Programming the tower of Hanoi using recursion

Lab sheet -9

Level 1: -

Level 2: Programming the tower of Hanoi using recursion

Lab sheet -10

Level 1: Programming Exercise on Doubly linked list and its operations

Level 2: -

Lab sheet -11

Level 1: Program to Construct Binary Search Tree and Graph

Level 2: Program to traverse the Binary Search Tree in three ways(in-order, pre-order and post-order) and implement BFS and DFS

Lab sheet -12

Level 1: Program to Implement the Linear Search & Binary Search

Level 2: Program to Estimate the Time complexity of Linear Search

Lab sheet -13

Level 1: Program to Implement and Estimate the Time complexity of Selection Sort

Level 2: Program to Implement and Estimate the Time complexity of Insertion Sort

Lab sheet -14 (Beyond syllabus activity)
Level 1: Program to Construct AVL Tree
Level 2:
Lab sheet -15 (Beyond syllabus activity)
Level 1: Program to Construct RED BLACK Tree

Targeted Application & Tools that can be used

Use of PowerPoint software for lecture slides and use of Modern IDE like VS Code and Eclipse for lab programs to execute.

Project work/Assignment:

Assignment: Students should complete the lab programs by end of each practical session and module wise assignments before the deadline.

Text Book

T1 Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Edition, Universities Press, reprint 2018.

T2 Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

References

R1 Data structures and program design in C by Robert Kruse, Tondo C L, Bruce Leung, Pearson education publishers, 2017.

R2 Programming and Data Structure by Jackulin C Salini etal., Ane books publishers, 2019.

Web resources:

3. For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview
4. https://puniversity.informaticsglobal.com/login

Topics relevant to development of "Skill Development":

Linked list and stacks
Topics relevant to development of "Environment and sustainability: Queues

Course Code: CSE2259	**Course Title: Web Technologies Lab** **Type of Course: Lab**	**L-T- P-C**	0	0	2	1
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 Features**	Quizzes and Assignments	Quizzes on various features of XHTML, simple applications		**8 Sessions**
	Standard XHTML Document Structure, Basic Text Markup such as headings, paragraphs, lists, tables, forms, and semantic tags.				
Module 2	**CSS Styling**	Quizzes and assignments	Comprehension based Quizzes and assignments; Application of CSS in designing webpages		**10 Sessions**
	Apply CSS3 to style HTML elements, including layout techniques, color schemes, typography, and responsive design principles.				

Course Code: CSD1712	**Course Title: Statistical Foundations for Data Science** **Type of Course: Theory**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
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.

Module 3	Inference in linear regression	Assignment	Programming	**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

Module 4	Principal Component Analysis	Assignment	Programming	**No. of Classes:9**

Topics:

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.

Targeted Application & Tools that can be used:

Tools: Torch, Google Colaboratory, Spider, Jupiter Notebook

Project work/Assignment:

Text 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..**

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

Course Code: CSD1713	Course Title: Statistical Foundations for Data Science Lab Type of Course: Discipline elective Lab Integrated	**L-T-P-C**	0	0	2	1
Version No.						
Course Pre-requisites						
Anti-requisites	NIL					
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.					
Course Out Comes	On successful completion of this course, students can expect to achieve the following outcomes: CO1: Understand the rise and significance of Big Data in various fields such as Biological Sciences, Health Sciences, Computer and Information Sciences, Economics and Finance, Business and Program Evaluation, Earth Sciences, and Astronomy. [Understand] CO2: Develop a strong foundation in multiple linear regression and the Gauss-Markov theorem. [Apply] CO3: Apply linear regression with random design and partial linear regression. [Apply] CO4: Apply the power method and learn about factor models and structured covariance learning. [Apply]					

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

List of Programs

Experiment 1: Use big data to predict patient outcomes.

Experiment 2: Predict stock market trends using big data.

Experiment 3: Segment customers based on purchasing behavior.

Experiment 4: Apply statistical learning techniques to high-dimensional data.

Experiment 5: The Gauss-Markov Theorem

Experiment 6: Statistical Tests - Weighted Least-Squares

Experiment 7: Box-Cox Transformation

Experiment 8: Ridge Regression - Bias-Variance Tradeoff

Experiment 9: Ridge Regression Solution Path - Kernel Ridge Regression

Experiment 10: Debias of Regularized Regression Estimators

Experiment 11: Inference in Generalized Linear Models (GLMs)

Experiment 12: Partial Linear regression

Experiment 13: Power Method: To implement the Power Method for finding the largest eigenvalue and corresponding eigenvector.

Experiment 14: Factor model and high-dimensional PCA

Experiment 15: Hierarchical clustering

Targeted Application & Tools that can be used:

Torch, Google Colaboratory, Spider, Jupiter Notebook

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

Sentiment analysis of Facebook and Twitter data

Dataset resource link:

https://www.kaggle.com/datasets

REFERENCE MATERIALS:

Textbook(s):

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

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

Reference Book(s):

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

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

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

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

E book link

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

Web resources:

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

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

Course Code: **CSE2252**	**Course Title:** Data Communication and Computer Networks Lab **Type of Course: LAB**	**L- T-P- C**	0	**0**	2	1
Version No.	1.0					
Course Pre-requisites	NIL					
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. Analyze and troubleshoot network connectivity and performance issues using tools such as Wireshark and network simulators. Demonstrate understanding of key networking protocols (e.g., TCP/IP, ARP, ICMP, DHCP) through practical implementation and observation. 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. 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**

SEMESTER 4

Course Code: MAT2404	Course Title: Discrete Mathematics Type of Course:1] School Core	L-T- P- C	3	1	0	4

Version No.		1.0
Course Pre-requisites		MAT2302
Anti-requisites		**NIL**
Course Description		The course explores the study of mathematical structures that are fundamentally discrete (not continuous), focusing on concepts like set theory, logic, graph theory, combinatorics, and number theory, with applications primarily in computer science fields like algorithms, software development, and cryptography; it covers topics such as propositional logic, proof techniques, relations, functions, counting principles, and basic graph algorithms, providing a foundation for analyzing discrete problems and structures within computer science.
Course Objective		The main objective of the course is that students should learn a particular set of mathematical facts and how to apply them. It teaches students how to think logically and mathematically through five important themes: mathematical reasoning, combinatorial analysis, discrete structures, algorithmic thinking, and applications and modeling. A successful discrete mathematics course should carefully blend and balance all five themes.
Course Outcomes		On successful completion of the course the students shall be able to: CO1 - Explain logical sentences through predicates, quantifiers and logical connectives. CO2 - Deploy the counting techniques to tackle combinatorial problems CO3 - Comprehend the basic principles of set theory and different types of relations. CO4 - Apply different types of structures of trees for developing programming skills
Course Content:		

Module 1	**Fundamentals of Logic**		**(10 Classes)**
Basic Connectives and Truth Tables, Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.			
Module 2	**Principle of Counting**	**Assignment**	**(15 Classes)**
The Well Ordering Principle – Mathematical Induction The Basics of Counting, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Generating Permutations and Combinations			

Advanced Principle Counting: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.

Module 3	**Relations and Functions**		**(10 Classes)**

Cartesian Products and Relations, Functions, One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions.

Relations, Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders, Lattice, Hasse Diagrams, Equivalence Relations and Partitions.

Module 4	**Recurrence Relations and Generating Functions**		**(10 Classes)**

Homogeneous and inhomogeneous recurrences and their solutions - solving recurrences using generating functions - Repertoire method - Perturbation method - Convolutions - simple manipulations and tricks.

Module 5	**Graph Theory & Algorithms on Networks**	**Assignment**	**(15 Classes)**

Definitions and basic results - Representation of a graph by a matrix and adjacency list - Trees - Cycles - Properties - Paths and connectedness - Sub graphs - Graph Isomorphism - Operations on graphs - Vertex and edge cuts - Vertex and edge connectivity, Euler and Hamilton Paths, Shortest-Paths.

Tree - Definitions, Properties, and Examples, Routed Trees, Binary search tree, Decision tree, spanning tree: BFS, DFS.

Algorithms on Networks - Shortest path algorithm- Dijikstra's algorithm, Minimal spanning tree- Kruskal algorithm and Prim's algorithm.

Targeted Application & Tools that can be used:

Discrete mathematics provides the mathematical foundations for many computer science courses including data structures, algorithms, database theory, automata theory, formal languages, compiler theory, computer security, and operating systems.

Assignment:

Assignment 1: Logic Equivalences and Predicate calculus.

Assignment 2: Equivalence Relations and Lattices

Assignment 3: Recurrence Relations

Text Book

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", McGraw-Hill,s 8th Edition,2019.

2. Harary – Graph Theory, Addison-Wesley Publishing Company.

References:

1. Arthur Gill, "Applied Algebra for Computer Science", Prentice Hall.

2. K.D. Joshi, "Discrete Mathematics", Wiley Eastern Ltd.

3. Ralph. P. Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia.

E-resources/ Web links:

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

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_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.

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 design using ER-Relational mapping, Implementation of given database scenario using MYSQLDB.
Topics relevant to development of Employability: Develop, test and implement computer databases, creating sophisticated,

interactive and secure database applications
Topics relevant to “HUMAN VALUES &PROFESSIONAL ETHICS”: Nil

Course Code: CSE2261	**Course Title: Database Management Systems Lab** **Type of Course: Lab**	**L-T-P-C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites	NIL					
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.

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

Text Books:

T1. Elmasri R and Navathe S B, “Fundamentals of Database System”, Pearson Publication, 7th Edition, 2018.

T2. RamaKrishna & Gehrke, “Database Management Systems” 3rd Edition, 2018, McGraw-Hill Education.

T3. W. Lemahieu, S. vanden Broucke and B. Baesens, “Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data”, Cambridge University Press, 2018.

References

R1 Avi Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, McGraw-Hill ,7th Edition, 2019.

R2 M. Kleppmann, “Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems”, O’Reilly, 2017.

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

Course Code: CSE2262	**Course Title:** **Analysis of Algorithms** **Type of Course:** **Theory**	**L- T-P- C**	3	1	0	4
Version No.	1.0					
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 **Problem Solving** Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Compute efficiency of a given algorithm.[Apply] 2. Apply divide and conquer technique for searching and sorting Problems.[Apply] 3. Apply the Dynamic Programming technique for a given problem. [Apply] 4. Apply greedy technique for solving a Problem.[Apply] 5. Demonstrate Back tracking technique and limitations of Algorithms.[Apply]					
Course Content:						

Module 1	**Introduction**	Assignment	Simulation/Data Analysis	**10 Sessions**
Introduction, Asymptotic Notations and its properties, Best case, worst case and average case- Sequential search, Sorting; Mathematical analysis for Recursive and Non-recursive algorithms: Substitution method and Master's Theorem.				
Module 2	**Divide-and-conquer**	Assignment	Simulation/Data Analysis	**08 Sessions**
Introduction. Insertion Sort; Merge sort, Quick sort, Binary search.				
Module 3	**Dynamic programming**	Term paper/Assignment	Simulation/Data Analysis	**10 Sessions**
Introduction with examples, Principles of Memoization, 0-1 Knapsack Problem, Bellman-Ford algorithm, Floyd-Warshall's Algorithms. Chain Matrix Multiplication.				
Module 4	**Greedy technique**	Term paper/Assignment	Simulation/Data Analysis	**09 Sessions**
Introduction, Fractional Knapsack Problem, Minimal Spanning Tree: Prim's Algorithm and Kruskal's Algorithm, Single-source Shortest Path: Dijkstra's Algorithm				
Module 5	**Complexity Classes**	Term paper/Assignment	Simulation/Data Analysis	**08 Sessions**
Complexity Classes- P,NP- NP Hard and NP Complete - Boolean Satisfiability Problem (SAT). Branch and Bound: Knapsack problem; Backtracking, - N-Queens problem.				

Text Book

1. Anany Levitin, *"Introduction to the Design and Analysis of Algorithms"*, 3rd edition, Pearson Education, 2018.
2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, *"Introduction to Algorithms"*, 4th edition, MIT Press, 2022.

References

1. J. Kleinberg and E. Tardos, "*Algorithm Design*", Addison-Wesley, 2005.
2. Tim Roughgarden, *"Algorithms Illuminated"* (books 1 through 3), "Operating Systems Design and Implementation", Soundlikeyourself Publishing, 2017-2019.
3. AV Aho, J Hopcroft, JD Ullman, *"The Design and Analysis of Algorithms"*, Addison-Wesley, 1974.
4. Donald E. Knuth, "*The Art of Computer Programming"*, Volumes 1and 3 Pearson.

Web-Resources

1. NPTEL: https://onlinecourses.nptel.ac.in/noc19_cs47/preview
2. Coursera: Analysis of Algorithms by Princeton University
3. Algorithms Specialization in Coursera by Stanford University(Group of 4 courses).
4. Algorithms Coding Contest Links maintained by Prof Gerth Stølting Brodal of Aarhus University

Topics relevant to "SKILL DEVELOPMENT": knapsack, prim's, kruskal's algorithm, quick sort, binary search for **Skill Development** through **Problem Solving methodologies**. This is attained through assessment components

mentioned in course handout.

Course Code: CSE2265	**Course Title: Essentials of AI Lab** **Type of Course: Program Core Course - Lab**	**L-T-P-C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
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: **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:
1. Google Colab
2. 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.

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

Council	

Course Code:CSD1703	**Course Title: Introduction to Data Science** **Type of Course: Program Core**	**L-P-C**	3	0	0	3
Version No.	1.0					
Anti-requisites	NIL					
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						

Module 4	**Introduction to Statistics & Predictive Modeling**	**Term paper/Assignment**	**Implementation**	**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

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

References:

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

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

Course Code: CSE2269	**Course Title: Operating Systems** **Type of Course: Program Core and Theory Only**	**L-T- P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Nil					
Anti-requisites	**NIL**					
Course Description	This course introduces the concepts of operating system operations, operating system structure and its design and implementation. It covers the classical operating systems internal algorithms such as process scheduling, synchronization, deadlocks detection and recovery and memory management. The course also					

	enhances the problem solving, systems programming ability and case studies.			
Course Object	The objective of the course is to familiarize the learners with the concepts of Operating Systems and attain **Employability** through **Problem Solving** Methodologies.			
Course Out Comes	On successful completion of the course the students shall be able to: 1] Describe the fundamental concepts of operating Systems and case studies. [**Knowledge**] 2] Demonstrate various CPU scheduling algorithms. .[**Application**] 3] Apply various tools to handle synchronization problems.[**Application**] 4] Demonstrate deadlock detection and recovery methods **[Application]** 5] Illustrate various memory management techniques.[**Application**]			
Course Content:				
Module 1	Introduction to Operating System	Assignment	Programming	**9 Hours**
Topics: Introduction to OS , Operating-System Operations, Operating System Services, , System Calls and its types, Operating System Structure, System Program and its types, Linkers and Loaders, Overview of OS design and implementation, Open-source operating system				
Module 2	Process Management	Assignment/Case Study	Programming/Simulation	**11 Hours**
Topics: Process Concept, Operations on Processes, Inter Process Communication, Communication in client-server systems (sockets, RPC, Pipes), Introduction to threads - Multithreading Models, Thread Libraries, Threading Issues, Process Scheduling– Basic concepts, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, SRTF, RR and Priority.				
Module 3	Process Synchronization and Deadlocks	Assignment	Programming	**11 Hours**
Topics: The Critical-Section Problem- Peterson's Solution, Synchronization hardware, Semaphores, Classic Problems of Synchronization with Semaphore Solution- Producer-Consumer Problem, Reader-Writer problems, Dining Philosopher's Problem, . Introduction to Deadlocks, Necessary conditions for deadlock, Resource allocation Graph, Methods for handling deadlock: Deadlock Prevention and Implementation, Deadlock Avoidance and Implementation, Deadlock detection & Recovery from Deadlock.				
Module 4	Memory Management	Assignment	Programming/Simulation	**10 Hours**
Topics: Introduction to Memory Management, Basic hardware-Base and Limit Registers, Memory				

Management Unit(MMU), Dynamic loading and linking, Swapping, Contiguous and Non-Contiguous Memory Allocation, Segmentation, Paging - Structure of the Page Table – Virtual Memory and Demand Paging – Page Faults and Page Replacement Algorithms, Copy-on-write, Allocation of Frames, Thrashing

Introduction to File system management: File System Interface (access methods, directory structures), File system implementation.

Targeted Application:

Application area is traffic management system, banking system, health care and many more systems where in there are resources and entities that use and manage the resources.

Software Tools:

Oracle Virtual Box/VMWare Virtualization software [Virtual Machine Managers]. Used to install and work on multiple guest Operating Systems on top of a host OS.

Intel Processor identification utility: This software is used to explain about multi-core processors. It helps to identify the specifications of your Intel processor, like no of cores, Chipset information, technologies supported by the processor etc.

Project work/Assignment

Demonstrate process concepts in LINUX OS.

Simulation of CPU scheduling algorithms.

Develop program to demonstrate use of Semaphores in threads.

Develop program to demonstrate use of deadlock avoidance algorithms.

Develop program to demonstrate use of page replacement algorithms.

Simulation of memory allocation strategies [first fit, best fit and worst fit].

Text Book

Silberschatz A, Galvin P B and Gagne G , “Silberschatz's Operating System Concepts”, Paperback, Global Edition Wiley, 2019

References

Silberschatz A, Galvin P B and Gagne G, “Operating System Concepts”, 10th edition Wiley, 2018.

William Stallings, “Operating Systems”,Ninth Edition, By Pearson Paperback ,1 March 2018.

Sundaram RMD, Shriram K V, Abhishek S N, B Chella Prabha, “ Cracking the Operating System skills”, Dreamtech, paperback, 2020

Remzi H. Arpaci-Dusseau Andrea C. Arpaci-dusseau , “Operating Systems: Three Easy Pieces, Amazon digital Services”, September 2018.

E-resources/Weblinks

https://www.os-book.com/OS9/

https://pages.cs.wisc.edu/~remzi/OSTEP/

https://codex.cs.yale.edu/avi/os-book/OS10/index.html

Course Code: CSE2270	**Course Title: Operating Systems Lab** **Type of Course: Lab Only**	**L-T- P- C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites	Nil					
Anti-requisites	**NIL**					
Course Description	This laboratory course provides hands-on experience with the core concepts of operating systems through practical assignments, simulations, and case studies. It covers foundational aspects such as system calls, process and thread management, inter-process communication, synchronization, deadlocks, memory management, and file systems. Students will implement and simulate real-time OS components and scheduling algorithms, fostering deeper understanding of OS architecture and design. The lab also introduces modern OS tools, programming interfaces, and the basics of open-source OS environments.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Operating Systems and attain **Employability** through **Problem Solving** Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Demonstrate system-level programming using system calls and OS structures. [**Apply**] 2] Simulate process scheduling and multithreading techniques. [**Apply**] 3] Apply various tools to handle synchronization problems using semaphores and shared memory. [**Apply**] 4] Demonstrate memory management and file system concepts using simulation or scripting. **[Apply]**					
Course Content:						
Targeted Application: **Application area is traffic management system, banking system, health care and many more systems where in there are resources and entities that use and manage the resources.** **Software Tools:** Oracle Virtual Box/VMWare Virtualization software [Virtual Machine Managers]. Used to install						

and work on multiple guest Operating Systems on top of a host OS.

Intel Processor identification utility: This software is used to explain about multi-core processors. It helps to identify the specifications of your Intel processor, like no of cores, Chipset information, technologies supported by the processor etc.

List of Laboratory Tasks:

Lab sheet -1

L1: Write a program to demonstrate the use of fork() and exec() system calls in process creation.
L2: A system has limited memory and high-priority real-time processes. Design a scheduling algorithm that ensures responsiveness while preventing starvation.

Lab sheet -2

L1: Implement First-Come-First-Serve (FCFS) process scheduling using C or Python.
L2: You are designing a server that handles thousands of client connections. Compare multithreading and multiprocessing for this task and implement a basic server model.

Lab sheet -3

L1: Implement Round Robin Scheduling with a fixed time quantum.
L2: In a banking system, concurrent access to accounts leads to data corruption. Design a synchronization solution to avoid race conditions.

Lab sheet -4

L1: Write a program to create threads using Pthreads or Python's threading module.
L2: You're tasked with building a file access tracker in an OS. Implement a system to log file access patterns and identify frequent accesses.

Lab sheet -5

L1: Demonstrate inter-process communication (IPC) using pipes.
L2: A simulation tool needs to emulate process suspension and resumption. Design and implement such a mechanism using signals or condition variables.

Lab sheet -6

L1: Simulate the Producer-Consumer problem using semaphores.
L2: You're developing a system where sensor devices (producers) generate temperature readings, and data processors (consumers) store and process these readings. To prevent race conditions and ensure buffer safety, implement a synchronization mechanism

using semaphores.

Lab sheet -7

L1: Implement Dining Philosophers Problem using threads and synchronization.

L2: In a multi-threaded cafeteria simulation, five philosophers sit around a circular table, each alternating between thinking and eating. To eat, a philosopher must hold two forks (represented by shared resources). Your task is to avoid deadlock and ensure no philosopher starves using thread synchronization techniques.

Lab sheet -8

L1: Write a program to simulate First Fit, Best Fit, and Worst Fit memory allocation strategies.

L2: A system with limited memory blocks needs to allocate memory to processes arriving with various size requests. Your task is to implement three classic memory allocation strategies—First Fit, Best Fit, and Worst Fit—to allocate memory to each process efficiently. Simulate and compare how memory gets allocated in each strateg

Lab sheet -9

L1: Demonstrate paging using a simple page table simulation.

L2: A program has a logical address space divided into pages. The system's memory is divided into equal-sized frames. When a program executes, its pages are loaded into available frames in main memory. Simulate the address translation process using a page table and demonstrate how a logical address is converted to a physical address.

Lab sheet -10

L1: Write a program to simulate page replacement algorithms like FIFO and LRU.

L2: In a virtual memory system, a process accesses pages in a specific order. The memory can only hold a limited number of pages (frames). When a page is needed and the memory is full, a page replacement algorithm is used to decide which page to evict. Simulate and compare FIFO and LRU algorithms for a given page reference string.

Lab sheet -11

L1: Simulate file directory structure (single level/two level).

L2: A university campus computer lab has limited memory space available for each student login session. When students open files or run programs, memory pages are loaded into available memory frames. Due to the limited number of frames, some pages must be replaced when new ones are needed. The lab system uses page replacement algorithms to decide which pages to evict when memory is full..

Lab sheet -12

L1: Write a shell script to demonstrate file handling commands in Linux.
L2: Design a command-line mini shell that can run background and foreground processes and handle basic built-in commands like cd, pwd, exit.

Project work/Assignment

Demonstrate process concepts in LINUX OS.

Simulation of CPU scheduling algorithms.

Develop program to demonstrate use of Semaphores in threads.

Develop program to demonstrate use of deadlock avoidance algorithms.

Develop program to demonstrate use of page replacement algorithms.

Simulation of memory allocation strategies [first fit, best fit and worst fit].

Text Book

Silberschatz A, Galvin P B and Gagne G , "Silberschatz's Operating System Concepts", Paperback, Global Edition Wiley, 2019

References

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William Stallings, "Operating Systems",Ninth Edition, By Pearson Paperback ,1 March 2018.

Sundaram RMD, Shriram K V, Abhishek S N, B Chella Prabha, " Cracking the Operating System skills", Dreamtech, paperback, 2020

Remzi H. Arpaci-Dusseau Andrea C. Arpaci-dusseau , "Operating Systems: Three Easy Pieces, Amazon digital Services", September 2018.

E-resources/Weblinks

https://www.os-book.com/OS9/

https://pages.cs.wisc.edu/~remzi/OSTEP/

https://codex.cs.yale.edu/avi/os-book/OS10/index.html

SEMESTER 5

Course Code: CSE2266	**Course Title:** Theory of Computation **Type of Course:** Theory Only	**L- T-P- C**	3	**0**	0	**3**
Version No.	2.0					

Course Pre-requisites				
Anti-requisites	**NIL**			
Course Description	The course deals with introduction of formal languages and the correspondence between language classes and the automata that recognize them. Topics include: Formal definitions of grammars and acceptors, Deterministic and Nondeterministic systems, Grammar ambiguity, finite state and push-down automata; normal forms; Turing machines and its relations with algorithms.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Theory of Computation as mentioned above and attain Skill Development through Problem Solving Methodologies.			
Course Outcomes	On successful completion of the course the students shall be able to: 1. Describe various components of Automata. (Knowledge) 2. Illustrate Finite Automata for the given Language. (Application) 3. Distinguish between Regular grammar and Context free grammar. (Comprehension) 4. Construct Push down Automata. (Application) 5. Construct Turing machine for a Language. (Application)			
Course Content:				
Module 1	Introduction to automata theory	Assignment	Problems on Strings and Language operations	**6 classes**
Topics: Introduction to Automata Theory, Applications of Automata Theory, Alphabets, Strings, Languages & operations on languages, Representation of automata, Language recognizers, Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs				
Module 2	Finite Automata	Assignment	Assignment Problems on DFA, NFA's	13 Sessions
Topics: Basic concepts of Finite automata, DFA- definitions of DFA, Deterministic Accepters Transition Graphs and Languages and DFA's, Regular Languages, NFA- Definition of a Nondeterministic Accepter, Languages and NFA's Why Non- determinism? Equivalence of Deterministic and Nondeterministic Finite Accepters, Reduction of the Number of States in Finite Automata.				
Module 3	Regular Expressions & Context	Assignment	Problems on RE,	12

	Free Grammar		CFG, PT, PL and Ambiguity	Sessions

Topics:

Formal Definition of a Regular Expression, Languages Associated with Regular Expressions, Languages, Regular Languages (RL) and Non-regular Languages: Closure properties of RLs, to show some languages are not RLs, Closure Properties of Regular Context Free Grammars-Examples of Context-Free Languages, Leftmost and Rightmost Derivations, Derivation Trees, Relation Between Sentential Forms and Derivation Trees, Ambiguity in Grammars and Languages: Ambiguous Grammars, Removing Ambiguity, Chomsky Normal Form, Gribiche Normal Form.

Module 4	Push down Automata	Assignment	Problems on pushdown Automaton	08 Sessions

Topics:

Definition of a Pushdown Automaton, Language Accepted by a Pushdown Automaton, Acceptance by Final State, Acceptance by Empty Stack, From Empty Stack to Final State, From Final State to Empty Stack Equivalence of PDA's and CFG's: From Grammars to Pushdown Automata.

Module 5	Turing Machine	Assignment	Problems on Turning Machine	07 Sessions

Topics:

Definition of a Turing Machine, Turing Machines as Language Accepters, Example Languages to construct Turing

machine, Turing Machines as Transducers, Halting Programming Techniques for Turing Machines

Targeted Application & Tools that can be used:

Targeted Application:

1. Text Processing

2. Compilers

3. Text Editors

4. Robotics Applications

5. Artificial Intelligence

Tools:

1. JFLAP (Java Formal Language and Automata Package) Software simulation tool. It's interactive

educational

software written in Java to experiment topics in automata theory.

2. Turing machine Online simulators.

Text Book(s):

1. Peter Linz, “An introduction to Formal Languages and Automata”, Jones and Bartlett Publications 6th Ed, 2018.

Reference(s):

1. Aho, Ullman and Hopcroft, “Theory of Computation”, Pearson India 3rd Edition 2008.

2. Michael Sipser, “Theory of Computation”, Cengage India 3rd Ed, 2014.

E-Resources

NPTEL course – https://onlinecourses.nptel.ac.in/noc21_cs83/preview

Course Code: CSD1501	**Course Title: R Programming For Data Science** **Type of Course: Theory Only**	**L- T - P- C**	0	0	4	2
Version No.	1					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	This course is designed to provide the core concepts of data analytics in the R environment. Initially train them with basic R, then progressively increase the difficulty as they move along in the course, capping with advanced techniques through case studies. Mastering the core concepts and techniques of data analytics in R, will help the students to apply their knowledge to a wide range of Data Analytics. R is now considered one of the most popular analytics tools in the world.					
Course Objective	This lab-based course equips students with practical skills in R programming for statistical computing and data analysis. Students will work hands-on with real-world datasets to perform data preprocessing, visualization, and modeling. The course covers key machine learning algorithms including regression, classification, and dimensionality reduction using R.					

	By the end of the course, students will develop, implement, and evaluate end-to-end analytics workflows using R and RStudio.
Course Out Comes	**After successful completion of the lab course, students will be able to:** **CO1: Develop foundational R scripts to manage data types, structures, and apply basic transformations.** **CO2: Visualize and explore data using ggplot2 and dplyr, drawing meaningful insights.** **CO3: Implement and evaluate regression, classification, and dimensionality reduction models using R.** **CO4: Execute mini-projects demonstrating analytical thinking and data-driven problem-solving using real-world datasets.**
Course Content:	

List of Laboratory Tasks:

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

Data Structures in R

   a. Vectors: creating, indexing, and operations
   b. Matrices and arrays
   c. Lists and data frames
   d. Factors and character vectors
   e. Basic data manipulation and exploration
3. Data Visualization with ggplot2
   a. Installing and loading ggplot2
   b. Creating scatter plots, bar plots, line plots, and histograms
   c. Customizing plot aesthetics and themes
   d. Faceting and combining plots
4. Data Transformation with dplyr.
   a. Introduction to dplyr package
   b. Selecting, filtering, and arranging data
   c. Grouping and summarizing data
   d. Joining and merging data sets
5. Introduction to Machine Learning with R
   a. Installing and loading necessary packages
   b. Splitting data into training and testing sets
   c. Building a simple machine learning model
   d. Model evaluation and prediction
6. Correlation and covariance
   a. Find the correlation matrix.
   b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data
7. Regression model - Create a regression model for a given dataset
8. Implement the multiple regression model for the given dataset.
9. Principal Component Analysis - Perform Principal Component Analysis (PCA) using R

10. Implement k-Nearest Neighbors (kNN) classification using R 11. Evaluate the performance of Naive Bayes classifier using R. 12. Evaluate the performance of the Decision Tree classifier using R. 13. Evaluate the performance of Random Forest Classifier using R. 14. Mini Project - Applying R programming skills to a real-world dataset a. Data cleaning, visualization, analysis, and interpretation **b.** Presentation of findings
Targeted Application & Tools that can be used **Tools: RStudio / Google Colab**
Project work/Assignment:
Assignment: **During the course, students would need to do coding assignments to learn to train and use different models. Sample coding assignments include:** **Analysis of Sales Report of a Clothes Manufacturing Outlet.** **Comcast Telecom Consumer Complaints.** **Web Data Anslysis**
Text Book : **1) *Hands-On Programming with R: Write Your Own Functions and Simulations,* Author: Garrett Grolemund, Publisher: O'Reilly Media,Year: 2023** **2) *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data,*Authors: Hadley Wickham, Mine Çetinkaya-Rundel, Garrett Grolemund,Publisher: O'Reilly Media,Edition: 2nd Edition, 2023.**

Course Code: CSD2024	**Course Title:** Machine Learning Lab for Intelligent Data Science **Type of Course: Lab**	**L- P-C**	0	2	1
Version No.	1				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course 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.				
Course 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.
Course Content:	

List 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: **CSE2271**	**Course Title: Software Design and Development** **Type of Course: School Core [Theory Only]**	**L-T- P-C**	**3-0-0-3**
Version No.	1.0		
Course Pre-requisites	**NIL**		
Anti-requisites	**NIL**		
Course Description	The objective of this course is to provide the fundamentals concepts of Software Engineering process and principles. The course covers software requirement engineering processes, system analysis, design, implementation and testing aspects of software system development. The course covers software quality, configuration management and maintenance.		

Course Objectives	The objective of the course is to familiarize the learners with the concepts of Software Engineering and attain Skill Development through Participative Learning techniques.			
Course Out Comes	On successful completion of this course the students shall be able to: 1] Describe the Software Engineering principles, ethics and process models(Knowledge) 2] Identify the requirements, analysis and appropriate design models for a given application(Comprehension) 3] Understand the Agile Principles(Knowledge) 4] Apply an appropriate planning, scheduling, evaluation and maintenance principles involved in software(Application)			
Module 1	**Introduction to Software Engineering and Process Models** **(Knowledge level)**	Quiz		**10 Hours**
Introduction: Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Software Engineering Practice-Essence of Practice, General Principles Software Development Life Cycle **Models:** Waterfall Model – Classical Waterfall Model, Iterative Waterfall Model, Evolutionary model-Spiral, Prototype.				
Module 2	**Software Requirements, Analysis and Design** **(Comprehension level)**	Assignment	Development of SRS documents for a given scenario	**12 Hours**
Requirements Engineering: Eliciting requirements, Functional and non- Functional requirements, Software Requirements Specification (SRS), Requirement Analysis and validation. Requirements modelling- Introduction to Use Cases, Activity diagram and Swim lane diagram. CASE support in Software Life Cycle, Characteristics of CASE Tools, Architecture of a CASE Environment. **Design:** Design concepts, Architectural design, Component based design, User interface design.				
Module 3	**Agile Principles & Devops** **(Knowledge level)**	Quiz		**10 Hours**
Agile: Scrum Roles and activities, Sprint Agile software development methods - Scaling, User Stories, Agile estimation techniques, Product backlogs, Stake holder roles, Dynamic System Development Method. **Devops:** Introduction, definition, history, tools.				

Module 4	**Software Testing and Maintenance** **(Application Level)**	Assignment	Apply the testing concepts using Programing	**13 Hours**

Software Testing-verification and validation, Test Strategies - White Box Testing, Black box Testing. Automation Tools for Testing.

Software Quality Assurance-Elements of software quality assurance, SQA Tasks, Goals and Metrics, Software configuration management- SCM process, SCM Tools (GitHub).

Maintenance- Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models.

Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools

Text Book

1] R1. Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, VII Edition, McGraw-Hill, 2017.

2] B2. 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: **CSE7000**	**Course Title:** **Internship** **Type of Course:**	**L- T-P- C**	-	-	-	2
Version No.	**1.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation					

	necessary for the student to understand properly the nature of real-life problems.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify the engineering problems related to local, regional, national or global needs. (Understand) 2. Apply appropriate techniques or modern tools for solving the intended problem. (Apply) 3. Design the experiments as per the standards and specifications. (Analyze) 4. Interpret the events and results for meaningful conclusions. (Evaluate)
Catalogue prepared by	Mr. Md Ziaur Rahman
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Professional Elective - I

Course Code: CSD3407	**Course Title: Statistical Inference and Modeling** **Type of Course:1] Program Core**	**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.	1.0					
Course Pre-requisites	Introduction to Probability Calculus II					
Anti-requisites	**NIL**					
Course Description	This course introduces students to the principles and methods of statistical inference and modeling. Topics include estimation, hypothesis testing, confidence intervals, and both parametric and non-parametric models. Emphasis is placed on understanding theoretical foundations and applying statistical models to real-world data through computational tools. The course aims to build a strong conceptual and practical understanding of inference and modeling to prepare students for more advanced statistical and data science coursework. Students will learn how to analyze data, draw meaningful conclusions, and build predictive models using statistical techniques.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of 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: CSD3414	Course Title: Statistics-Driven Data Science 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 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		1. Apply statistical concepts and methods for data preprocessing, exploration, and analysis. 2. Construct and validate predictive models using statistical techniques. 3. Interpret data insights using visualization and statistical				

		inference to support data-driven decisions.				
Course Content:						
Module 1	Foundations of Statistics for Data Science		Assignment		Data Collection	10 Sessions
	Topics: Descriptive statistics, probability distributions, Sampling techniques, Central Limit Theorem, Estimation and confidence intervals					
Module 2	Statistical Inference and Hypothesis Testing		Quiz		Problem Solving	10 Sessions
	Topics: Parametric and non-parametric tests, p-values, t-tests, ANOVA, chi-square tests, Error types, power of tests, multiple testing corrections					
Module 3	Regression and Statistical Modeling		Assignment		Problem Solving	10Sessions
	Topics: Linear and logistic regression, Model selection and regularization (Lasso, Ridge), Assumptions diagnostics and multicollinearity					
Module 4	Advanced Topics in Statistical Data Science		Assignment		Problem Solving	10 Sessions
	Time series analysis and forecasting, Bayesian statistics and decision theory, Introduction to statistical learning and unsupervised techniques (clustering, PCA)					
	Text Book 1. **"Practical Statistics for Data Scientists"** by Peter Bruce, Andrew Bruce, and Peter Gedeck, 2nd Edition, O'Reilly Media, **2020**. 2. **"An Introduction to Statistical Learning: with Applications in R"** by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, 2nd Edition, Springer, **2021**. 3. **"The Elements of Statistical Learning"** by Trevor Hastie, Robert Tibshirani, and Jerome Friedman, 2nd Edition, Springer, **2023** (Corrected Reprint).					

	References R1 "Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python" Authors: Peter Bruce, Andrew Bruce, and Peter Gedeck, Publisher: O'Reilly Media, Edition: 2nd Edition, 2020 R2 "An Introduction to Statistical Learning: with Applications in R", Authors: Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Publisher: Springer, Edition: 2nd Edition, 2021 Additional web-based resources W1. https://onlinecourses.swayam2.ac.in/cec20_cs12/preview Text book of Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufmann Publishers, 2012. W2.https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=7&sid=e2d7362a- fd3049a98f0393e963521dbd%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=377411 &db=nlebk https://nptel.ac.in/courses/105105157
	Topics relevant to "EMPLOYABILITY SKILLS": Data Mining Techniques, FP Growth for developing Employability Skills through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

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

SEMESTER 6

Course Code: CSE2274	**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: CSE2274	**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:

31. You are given the finishing times of 'N' runners in a marathon. Write a program to find the runner who finished in the third position. **Focus:** Basic data structures (arrays), sorting algorithms (e.g., insertion sort, selection sort), and basic input/output.
32. In the same marathon, you are given the finishing times of 'N' runners and their bib numbers. Write a program to efficiently find the top 10 runners and their corresponding bib numbers. **Focus:** Efficient sorting algorithms (e.g., merge sort, quick sort), data structures like priority queues, and optimizing for large datasets.
33. A library maintains a list of books with their unique IDs. Write a program to check if a given book ID is present in the library. Focus: Searching algorithms (linear search), basic data structures (arrays or lists).
34. The library wants to implement a system to quickly find books by their titles. Suggest an efficient data structure (e.g., a hash table or a trie) and explain how to implement it to achieve fast book lookups. Focus: Understanding the trade-offs between different data structures, choosing the most appropriate data structure for a specific problem, and implementing efficient search operations.
35. An online store sells products with different prices. Write a program to calculate the total cost of a given list of products. **Focus:** Basic arithmetic operations, working with arrays or lists to store product prices.
36. The online store offers discounts based on the total purchase amount. Design an algorithm to efficiently calculate the final cost of an order, considering different discount rules

(e.g., percentage discounts, fixed amount discounts, tiered discounts). Focus: Algorithmic design, conditional statements, handling complex scenarios with multiple rules, and potentially using dynamic programming techniques for optimization.

37. You are given two integers, 'a' and 'm'. Calculate 'a' raised to the power 'm' modulo a large prime number 'p'. **Focus:** Basic modular arithmetic operations (modular exponentiation), understanding the modulo operator.

38. In a secure communication system, you need to efficiently compute the modular exponentiation for very large values of 'm'. Implement and analyze the efficiency of the binary exponentiation algorithm for this task. **Focus:** Efficient algorithms for modular exponentiation (binary exponentiation), time complexity analysis, and understanding the importance of efficient algorithms in cryptography.

39. You have a deck of 'N' cards. Calculate the total number of possible hands of size 'K' that can be drawn from the deck. **Focus:** Basic combinatorics (combinations), factorial calculations.

40. In a card game, you need to calculate the probability of drawing certain combinations of cards (e.g., a pair, a three-of-a-kind) from a shuffled deck. Design an efficient algorithm to calculate these probabilities. **Focus:** Advanced combinatorics (permutations and combinations with repetitions), probability calculations, and optimizing calculations to avoid overflows.

41. You are given a network of devices represented as a graph. Determine if there is a path between two given devices in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search).

42. In a secure network, you need to detect and isolate compromised devices. Design an algorithm that efficiently identifies devices that exhibit anomalous behavior (e.g., unusual traffic patterns) using XOR-based techniques for data comparison and pattern matching. **Focus:** Applying XOR operations for data comparison and pattern recognition, understanding the properties of XOR (e.g., commutative, associative), and designing algorithms for network anomaly detection.

43. You are given an array representing the speeds of cars on a highway. Find the minimum time required for all cars to pass a certain point. **Focus:** Basic array traversal, finding the minimum element in an array.

44. In a more realistic scenario, cars have different lengths. Implement a two-pointer approach to simulate the movement of cars and determine the minimum time for all cars to pass a given point. **Focus:** Two-pointer technique, simulating real-world scenarios with arrays, optimizing time complexity.

45. Given a string, find the number of occurrences of a specific substring within the string. **Focus:** Basic string manipulation, string matching (brute-force approach).

46. Implement the KMP (Knuth-Morris-Pratt) string matching algorithm to efficiently find all occurrences of a given pattern within a large text document. **Focus:** Advanced string matching algorithms, understanding the concept of the "next" array in KMP, optimizing for large input sizes.

47. An online auction platform receives bids for different items. Implement a data structure (e.g., a priority queue) to efficiently track the highest bid for each item. **Focus:** Priority queues, insertion and extraction operations on priority queues, basic implementation of a priority queue using an array or a suitable library.

48. The auction platform needs to handle a large number of bids concurrently. Design and implement a system that efficiently processes bids, updates the highest bid for each item, and handles potential race conditions. **Focus:** Concurrent data structures and algorithms, thread safety, handling race conditions, optimizing for high-throughput scenarios.

49. A social network can be represented as a graph where users are nodes, and connections between users are edges. Write an algorithm to find if two given users are connected in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search), basic graph representation (adjacency list or adjacency matrix).

50. In a large social network, efficiently finding the shortest path between two users is

crucial. Implement Dijkstra's algorithm to find the shortest paths between users in the network, considering edge weights (e.g., representing the strength of connections). **Focus:** Shortest path algorithms (Dijkstra's algorithm), graph algorithms with weighted edges, optimizing for large graphs.

51. A file system can be modeled as a tree structure. Implement a function to traverse the file system and print the names of all files and directories. **Focus:** Tree traversal algorithms (depth-first search or breadth-first search), basic tree representation (using nodes and pointers).

52. Design and implement a file system that supports efficient operations like creating directories, deleting files, and finding files based on their names or paths. Consider using a combination of tree structures and hash tables for efficient indexing and searching. **Focus:** Designing and implementing file system structures, using multiple data structures together, optimizing for common file system operations.

53. An online shopping cart can be represented as a tree, where each node represents an item or a category of items. Write an algorithm to calculate the total price of all items in the shopping cart. **Focus:** Tree traversal, calculating sums within a tree structure.

54. Implement a system that allows customers to apply discounts and coupons to their shopping carts. Consider using a combination of trees and other data structures (e.g., hash tables) to efficiently apply discounts and calculate the final price. **Focus:** Applying discounts and promotions to tree-like structures, efficient implementation of discount rules, optimizing for complex pricing scenarios.

55. In a social network, users can form groups. Given a list of friendships, determine if all users in a specific group are connected (directly or indirectly) through friendships. **Focus:** Disjoint set union (DSU) data structure, basic connectivity checks.

56. Design an efficient algorithm to find the minimum number of new friendships needed to connect all users in the social network into a single, connected component. **Focus:** Applying DSU for finding connected components, greedy algorithms, optimization for minimizing connections.

57. A treasure hunt involves a series of clues leading to the final treasure. Given a list of possible paths and their associated costs, find the cheapest path to reach the treasure. **Focus:** Greedy algorithms (e.g., Dijkstra's algorithm for shortest paths), basic graph representation.

58. In a more complex treasure hunt, there are time constraints associated with each path. Design an algorithm to find the fastest path to the treasure while considering both path costs and time constraints.

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

59. In a simplified chess game with only rooks, determine the minimum number of moves required for a rook to reach a specific target square on an empty board. **Focus:** Breadth-first search (BFS) on a graph (the chessboard), basic graph traversal.

60. In a more realistic chess game with multiple pieces and obstacles, implement a minimax algorithm with alpha-beta pruning to determine the best move for a player. **Focus:** Game tree search, minimax algorithm, optimization techniques like alpha-beta pruning, handling complex game states.

Targeted Application & Tools that can be used:

10. C or C++ Compiler (g++): The standard compiler for CP. Familiarize students with compilation flags (e.g., -O2 for optimization).

11. IDE (Integrated Development Environment): Code:: Blocks, Visual Studio, CLion, or similar IDEs. These provide debugging capabilities, code completion, and other helpful features.

12. Online Judges (CodeChef, Codeforces, LeetCode, HackerRank): Essential for practicing

and submitting solutions.
13. Debugger (gdb): Crucial for understanding code execution and finding bugs. Origin, excel and Mat lab soft wares for programming and data analysis.
14. Number Theory Libraries: Some libraries provide pre-built functions for number theory operations (though often it's better to implement them yourself for learning).
15. Wolfram Alpha: A useful tool for verifying number theory calculations and exploring concepts.
16. **String Libraries:** Familiarize students with the string manipulation functions available in C++.
17. **Graph Visualization Tools:** Tools like Graphviz can be helpful for visualizing graphs and understanding graph algorithms.
18. **DP Debugging Techniques:** Practice debugging DP solutions, as they can be complex. Visualizing the DP table can be helpful.

Text Books:

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

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

Reference Books:

3. Data Structures and Algorithmic Thinking with Python/C++/Java", *Narasimha Karumanchi, 5th Edition, Career Monk, 2017.*

4. Introduction to Algorithms, Thomas H. Cormen (Author), Charles E. Leiserson (Author), Ronald L. Rivest , fourth edition April 2022

Web Resources

3. https://nptel.ac.in/courses/106106231

4.

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: CSD2009	**Course Title: Data Handling and Visualization** **Type of Course:**	**L - T-P-C**	**2**	**0**	**0**	**2**
Version No.	1.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course	The purpose of the course is to install a strong					

Description	foundation of scientific process orientation that is the cornerstone of effective data handling, and creative design thinking appended with strong programming skills to create meaningful visualizations of data. The student should have prior knowledge of python programming and basic knowledge of data concepts. The associated laboratory provides an opportunity to strengthen student's skillset in the arena of Data Preprocessing and Visualization. With a good knowledge in the fundamental concepts of the various libraries for handling and visualizing data the student can gain a stronghold in Data Science enabling the student to be an effective analyst for prospective employers. **Keywords:** Visualization, Preprocessing, Data Cleaning, Data extraction.			
Course Outcomes	On successful completion of this course the students shall be able to: 1] Understand the various types of data, apply and classify the principles of data visualization- L1 & L2 2] Illustrate the visualization techniques to a problem and its associated dataset-L3 3] Implement interactive visualization for better insight using various visualization tools-L3 4] Demonstrate the visualization concepts practically using Python-L3			
Course Content:				
Module 1	**Introduction to Data Visualization (Comprehension)**	Assignment	Programming activity	**7 Sessions**
Topics: Data collection, Data Preparation Basic Models- Overview of data visualization - Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation, Interacting with Databases, Data Cleaning and Preparation, Handling Missing Data, Data Transformation. Python Libraries: NumPy, pandas, matplotlib, GGplot, Introduction to pandas Data Structures				
Module 2	**Data Visualization Techniques**	Assignment	Programming activity	**7 Sessions**
Topics: Scalar and point techniques – vector visualization techniques – matrix visualization, Visualization Techniques for Trees, Graphs, and Networks,				

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

Course Code: CSD2010	**Course Title:** CSD1718 **Data Handling and Visualization Lab** **Type of Course: Program Core**	**L- P- C**	0	0	1
Version No.	1				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
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	1. To introduce students to the fundamental concepts of data handling,				

Objective	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

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

Course Code: CSD3417	Course Title: Scientific Computing for Intelligent Systems Type of Course: Discipline Elective/ Theory Only Course		L- T-P- C	3	0	0	3
Version No.		2.0					
Course Pre-requisites							
Anti-requisites		NIL					
Course Description		This course introduces the fundamentals of scientific computing techniques tailored for intelligent systems. It covers numerical methods, data-driven modeling, optimization, and high-performance computing frameworks. Emphasis is placed on applying computational strategies to AI, machine learning, and large-scale simulation problems.					
Course Objective		The objective of the course is to familiarize the learners with the concepts of Data Mining and attain Employability through Problem Solving Methodologies					
Course Out Comes		Upon successful completion of this course, students will be able to: 4. Apply numerical techniques to solve scientific and engineering problems. 5. Develop and optimize intelligent algorithms using scientific computing methods. 6. Implement data-driven and model-based solutions in real-world intelligent systems. 7. Utilize parallel and high-performance computing tools to handle computational complexity.					
Course Content:							
Module 1	Fundamentals of Scientific Computing		Assignment		Data Collection	10 Sessions	
	Topics: Floating point arithmetic and error analysis, Matrix operations and linear algebra, Interpolation, approximation, and numerical differentiation/integration						
Module 2	Solving Scientific Problems using Numerical Methods		Quiz		Problem Solving	10 Sessions	
	Topics: Numerical solutions to linear and non-linear equations, Eigenvalue problems,						

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

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

SEMESTER 7

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: 5. Identify the engineering problems related to local, regional, national or global needs. (Understand) 6. Apply appropriate techniques or modern tools for solving the intended problem. (Apply) 7. Design the experiments as per the standards and specifications. (Analyze) 8. Interpret the events and results for meaningful conclusions. (Evaluate) 9. Appraise project findings and communicate effectively through scholarly publications. (Create)
Catalogue prepared by	Dr. Sampath A K
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Professional Elective - V

Course Code: CSD3403	**Course Title: Optimization Techniques for Data Science** **Type of Course: Theory Integrated**	**L- T-P-C**	**2**	**0**	**2**	**3**
Version No.	1.0					
Course Pre-requisites	**MAT 1001**					
Anti-requisites	**NIL**					
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]			
Course Content:				
Module 1	Foundations of Optimization	Assignment		**16 Sessions [L-8 + P-8]**
Topics: 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.				
Module 2	**Unconstrained Optimization Techniques**	Assignment		**16 Sessions [L-8 + P-8]**
Topics: 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.				
Module 3	Constrained Optimization and Duality	Quiz		**16 Sessions [L-8 + P-8]**
Topics: Lagrange 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).				
Module 4	Advanced Topics and Applications in Data Science	Mini 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:

Lab Sheet 1:
Implement objective functions and gradients using NumPy
Visualization of convex functions and gradient descent paths

Lab Sheet 2:
Optimization of logistic regression, linear regression
Comparative study of different optimizers on benchmark datasets

Lab Sheet 3:
Use of CVXPY for solving constrained optimization problems
Implementing SVM with quadratic programming

Lab Sheet 4:
Hyperparameter optimization for ML models using Optuna
Implement a basic neural network optimizer from scratch

Targeted Application & Tools that can be used: Google Colab

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

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

Text Book

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

E Book Link

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

Web Links:

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

References

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

Topics relevant to development of "Skill Development": Formulating optimization problems from real-world scenarios.	
Catalogue prepared by	Dr.S.Saravana Kumar
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Professional Elective - V

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: 8. Apply various feature engineering techniques to preprocess and transform data effectively. 9. Evaluate and optimize machine learning models using advanced tuning and selection techniques. 10. Integrate feature engineering and model optimization strategies into complete machine				

		learning pipelines.			
Course Content:					
Module 1	Introduction to Feature Engineering	Assignment		Data Collection	10 Sessions
	Topics: Understanding data types and quality, Missing value handling, outlier detection, encoding categorical variables, Feature scaling and normalization techniques				
Module 2	Feature Selection and Extraction	Quiz		Problem Solving	10 Sessions
	Topics: Filter, wrapper, and embedded methods, Principal Component Analysis (PCA), LDA, t-SNE, Feature importance and interpretability in models				
Module 3	Model Optimization Techniques	Assignment		Problem Solving	10Sessions
	Topics: Hyperparameter tuning (Grid Search, Random Search, Bayesian Optimization), Cross-validation strategies, Regularization techniques (L1, L2, ElasticNet)				
Module 4	Advanced Techniques and AutoML	Assignment		Problem Solving	11 Sessions
	Feature generation using domain knowledge and interactions, Ensemble learning and stacking, Introduction to AutoML frameworks (e.g., AutoSklearn, H2O.ai, TPOT)				
	3. Feature Engineering and Selection: A Practical Approach for Predictive Models",Author: Max Kuhn, Kjell Johnson, Publisher: CRC Press, Taylor & Francis Group, Year: 2019 **4.** "Hands-On Feature Engineering with Python", Author: Soledad Galli, Publisher: Packt Publishing, Year: 2020				
	References: **R1 "Automated Machine Learning: Methods, Systems, Challenges",** Editors: Frank Hutter, Lars Kotthoff, Joaquin Vanschoren, Publisher: Springer, Year: 2021				

	R2 "Machine Learning Engineering", Author: Andriy Burkov, Publisher: True Positive Inc., Year: 2020 **Additional web-based resources:** W1. https://onlinecourses.swayam2.ac.in/cec20_cs12/preview Text book of Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufmann Publishers, 2012. W2.https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=7&sid=e2d7362a- fd3049a98f0393e963521dbd%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=377411&db=nlebk https://nptel.ac.in/courses/105105157
	Topics relevant to "EMPLOYABILITY SKILLS": Data Mining Techniques, FP Growth for developing Employability Skills through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

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

SEMESTER 8

Course Code: CSE 7300	**Course Title: Capstone Project** **Type of Course:**	**L- T-P- C**	0	0	0	10
Version No.	**1.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					

Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify problems based on societal /research needs. (Understand) 2. Apply Knowledge and skill to solve societal problems in a group. (Apply) 3. Develop interpersonal skills to work as member of a group or leader. (Apply) 4. Analyze the inferences from available results through theoretical / Experimental / Simulations. (Analyze) 5. Analyze the impact of solutions in societal and environmental context for sustainable development. (Analyze) 6. Improve in written and oral communication. (Create) 7. Demonstrate capabilities of self-learning in a group, which leads to lifelong learning. (Understand)
Catalogue prepared by	Dr. Sampath A K
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

CSD3410	Type of Course: Theory					
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course provides an in-depth understanding of IoT and sensor data analysis, focusing on data acquisition, storage, processing, and interpretation. Students will explore scalable platforms, data flow architectures, and analytical techniques for extracting meaningful insights from sensor-generated data. Emphasis is placed on real-time processing, system integration, and the use of tools like Spark, Kafka, and NoSQL databases in IoT environments.					
Course Outcomes	On successful completion of this course the students shall be able to: • Design IoT data pipelines for efficient data acquisition and processing. *(Bloom's Level: **Create**)* • Manage sensor data using appropriate storage systems such as NoSQL and distributed databases.*(Bloom's Level: **Apply**)* • Apply real-time and historical data analysis techniques using platforms like Apache Spark and Kafka.*(Bloom's Level: **Apply**)* • Interpret sensor data to support data-driven decision-making in real-world IoT scenarios. *(Bloom's Level: **Analyze**)* • Demonstrate practical skills in using big data platforms for sensor data analytics in IoT environments.*(Bloom's Level**: Apply**)*					
Course Content:						
Module 1	**Introduction to IoT and Sensor Data**	Assignment			10 Classes	
IoT ecosystem and architecture – Types and characteristics of sensors – Sensor data acquisition and communication protocols – Data quality and preprocessing – Overview of data analysis in IoT systems.						
Module 2	**Sensor Data Storage and Management**	Assignment			13 Classes	
Sensor data modeling – Storage formats and time-series databases – NoSQL databases: Cassandra, MongoDB – Data retention and access strategies – Comparison with traditional storage systems.						
Module 3	**Data Processing and Analysis**	Assignment			10 Classes	
Batch vs. real-time analysis – Data pipelines and stream processing – Tools and platforms: Spark, Kafka – Sensor data ingestion and transformation – Data visualization and reporting.						
Module-4	**Applications and Case Studies**	Assignment			12 Classes	

Machine learning for sensor data analysis – Use cases in smart cities, healthcare, and industry – Predictive maintenance and anomaly detection – Integration with cloud and edge platforms .

Project work/Assignment:

Assignment 1 on (Module 1 and Module 2)

Assignment 2 on (Module 3 and Module 4)

REFERENCE MATERIALS:

TEXTBOOKS

1. Harry G. Perros, *An Introduction to IoT Analytics*, Chapman & Hall/CRC, 1st Edition, 2021, ISBN: 978-0367686314.
2. Hwaiyu Geng (Editor), *Internet of Things and Data Analytics Handbook*, Wiley, 1st Edition, 2017, ISBN: 978-1119173625.

REFERENCES

1. Gerard Maas and François Garillot, *Stream Processing with Apache Spark: Mastering Structured Streaming and Spark Streaming*, O'Reilly Media, 1st Edition, 2019, ISBN: 978-1491944240.
2. Pramod J. Sadalage and Martin Fowler, *NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence*, Addison-Wesley, 1st Edition, 2012, ISBN: 978-0321826626.
3. Anghel Leonard, *Data Stream Development with Apache Spark, Kafka, and Spring Boot*, Packt Publishing, 1st Edition, 2019, ISBN: 978-1789539585.

JOURNALS/MAGAZINES

1. IEEE Internet of Things Journal
2. IEEE Sensors Journal
3. IEEE Internet of Things Magazine
4. ACM Transactions on Sensor Networks (TOSN)

SWAYAM/NPTEL/MOOCs:

1. MOOCs(Udemy) –IoT Data Analytics

Web link: https://www.udemy.com/course/iot-data-analytics/?couponCode=LEARNNOWPLANS

Catalogue prepared by	Dr.K.Marimuthu
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: CSD3404	**Course Title:** E-Business and Marketing Analytics **Type of Course: Theory**	**L-T- P- C**	2	0	0	2
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	NIL					
Course Description	**This course provides an in-depth exploration of how data-driven decision-making is transforming digital marketing and e-business strategies. Students will learn to use analytical tools to measure, interpret, and optimize marketing campaigns and online business performance. The course integrates concepts of digital marketing, e-commerce, customer behavior analytics, and ROI optimization.**					
Course Objective	The objective of the course is to familiarize the learners with the concepts of E-Business and Marketing Analytics and attain **Employability** through **Participative Learning** techniques.					
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1**: Understand the foundations and business models of e-commerce and digital marketing. **CO2**: Apply analytics tools to measure and improve online customer acquisition, conversion, and retention. **CO3**: Analyze marketing campaigns using web, social media, and customer data. **CO4**: Evaluate marketing performance using KPIs, dashboards, and ROI metrics.					
Course Content:						

Module 1: Foundations of Machine Learning and Intelligent Systems	**8 Sessions**
E-business models, architecture, and trends, Introduction to digital marketing channels, Customer journey and digital touchpoints, Online consumer behavior	
Module 2: Web and Social Media Analytics	**8 Sessions**
Web analytics (Google Analytics, metrics, funnels), Traffic sources and visitor segmentation, Social media listening and engagement metrics, Sentiment analysis and trend tracking	
Module 3 Customer and Marketing Analytics	**7 Sessions**
Customer segmentation and profiling, RFM and CLV analysis, A/B testing and experimentation, Predictive modeling in marketing (churn, conversion)	
Module 4 Campaign Measurement and ROI Optimization	**7 Sessions**
Marketing KPIs and dashboards, Attribution models and ROI measurement, Marketing automation and CRM analytics, Case studies in e-commerce and digital campaigns.	

	Text Book ***Title: Marketing Analytics: A Practical Guide to Real Marketing Science,Author****: Mike Grigsby,****Publisher****: Kogan Page,****Edition****: 2nd Edition,****Year of Publication****: 2022,ISBN****: 9781398604083***
	R1 :Title :E-Commerce 2023: Business, Technology, Society,Authors: Kenneth C. Laudon, Carol Guercio Traver,**Publisher**: Pearson Education, **Edition**: 17th Global Edition,**Year**: **2023** **ISBN**: 9781292409538 R2: **Marketing Data Science: Modeling Techniques in Predictive Analytics with R and Python,Author**: Thomas W. Miller,**Publisher**: Pearson FT Press,**Edition**: 2nd Edition,**Year**: **2021, ISBN**: 9780135267042

Catalogue prepared by	Dr.Saira Banu Atham
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: CSD3407	**Course Title: Statistical Inference and Modeling** **Type of Course:1] Program Core**	**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.		1.0				
Course Pre-requisites		Introduction to Probability Calculus II				
Anti-requisites		**NIL**				
Course Description		This course introduces students to the principles and methods of statistical inference and modeling. Topics include estimation, hypothesis testing, confidence intervals, and both parametric and non-parametric models. Emphasis is placed on understanding theoretical foundations and applying statistical models to real-world data through computational tools. The course aims to build a strong conceptual and practical understanding of inference and modeling to prepare students for more advanced statistical and data science coursework. Students will learn how to analyze data, draw meaningful conclusions, and build predictive models using statistical techniques.				
Course Objective		The objective of the course is to familiarize the learners with the concepts of 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) 5. Design experiments by ANOVA and determine the existence of a statistically significant difference among several groups means. (Apply) 6. Develop appropriate regression models to predict the desired parameters. (Apply) 7. 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				

Module 2	**ANALYSIS OF VARIANCE AND EXPERIMENTAL DESIGNS**	Assignment	**10 Hours**
Analysis of variance, Completely Randomized design (One way ANOVA), Randomized Block design, Factorial Design (Two way ANOVA)			
Module 3	**REGRESSION MODELING STRATEGIES**	Assignment	**10 Hours**
Planning for modeling, Choice of the model, model formulation, Interpreting Modeling parameters, Assessment of model fit, Missing data; describing, Resampling, validating and simplifying the model; Simple and Multiple Linear Regression, residual analysis, Collinearity, Multiple regression model with two independent variables .			
Module 4	**NON-PARAMETRIC STATISTICS AND STATISTICAL DECISION THEORY**	Assignment	**11 Hours**
Runs Test, Mann-Whitney Test, Wilcoxon Test, Kruskal-Walis Test, Friedman Test, Spearman's Rank correlation. Decision making under uncertainty - Laplace, Hurwicz and Savage criteria; Decision making under risk – Expected monetary Value, Expected Opportunity Loss, Expected Value of Perfect Information; Decision trees.			
Text Book 1. Naval Bajpai, Business Statistics, Pearson, Second Edition 2013. 2. Casella and Berger, Statistical Inference, Cengage Learning, 2001.			
References 1. Frank E HarrelJr.,Regression Modeling Strategies, Springer, Second Edition, 2006 2. Andrew Gelman and Jennifer Hill, Data Analysis using Regression and multi level/hierarchical models, Cambridge, 2007 3. J K Sharma, Business Statistics, Vikas, Fifth Edition, 2020			
Catalogue prepared by	Dr. Manjunath KV		
Recommended by the Board of Studies on			
Date of Approval by the Academic Council			

Course Code: CSD3403	**Course Title: Optimization Techniques for Data Science** **Type of Course: Theory Integrated**	**L- T-P-C**	**2**	**0**	**2**	**3**
Version No.	1.0					
Course Pre-requisites	**MAT 1001**					
Anti-	**NIL**					

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]			
Course Content:				
Module 1	Foundations of Optimization	Assignment		**16 Sessions [L-8 + P-8]**
Topics: 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.				
Module 2	**Unconstrained Optimization Techniques**	Assignment		**16 Sessions [L-8 + P-8]**
Topics: 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.				
Module 3	Constrained Optimization and Duality	Quiz		**16 Sessions [L-8 + P-8]**
Topics: Lagrange 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).				
Module 4	Advanced Topics and Applications in Data Science	Mini 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: **Lab Sheet 1:** Implement objective functions and gradients using NumPy Visualization of convex functions and gradient descent paths **Lab Sheet 2:** Optimization of logistic regression, linear regression Comparative study of different optimizers on benchmark datasets **Lab Sheet 3:** Use of CVXPY for solving constrained optimization problems Implementing SVM with quadratic programming **Lab Sheet 4:** Hyperparameter optimization for ML models using Optuna Implement a basic neural network optimizer from scratch				
Targeted Application & Tools that can be used: Google Colab				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				

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

Text Book

8] Stephen Boyd and Lieven Vandenberghe "Convex Optimization" , 1st Edition (2004), Cambridge University Press.
9] Jorge Nocedal and Stephen J. Wright "Numerical Optimization" 2nd Edition (2006), Springer.
10] Sébastien Bubeck "Convex Optimization: Algorithms and Complexity", 1st Edition (2015), Now Publishers.
11] 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:

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

References

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

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

Catalogue prepared by	Dr.S.Saravana Kumar
Recommended by the	

Board of Studies on	
Date of Approval by the Academic Council	

Course Code: CSD3432	**Course Title:** **Quantum Computing and AI** **Type of Course:** **Integrated**	**L- P- C**	3	0	3
Version No.	1				
Course Pre-requisites	CSE1500				
Anti-requisites					
Course Description	This course provides an introduction to the theory and practice of quantum computation. Topics covered include: quantum mechanics to understand quantum computation. Quantum algorithms. The Shor's factorization algorithm Grover's search algorithm Mathematical models of quantum computation, Quantum Machine Learning, and to physical systems.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Quantum Computing** and attain EMPLOYABILITY SKILLS through EXPERIENTIAL LEARNING techniques				
Course Out Comes	**On successful completion of the course the students shall be able to:** • Understand the basic principles of quantum computation and quantum mechanics. • Design quantum circuits using quantum gates. • Analyze the behavior of basic quantum algorithms. • Understand the difference between classical and quantum machine learning approach.				
Course Content:					
Module 1	**INTRODUCTION**	**Quiz**	**Quiz**		**10 sessions (8 T + 2 L)**
Topics: Introduction to quantum computing. Qubits, Bloch sphere, multiple qubits, quantum states and measurements, Postulates of quantum mechanics, Classical computation vs quantum computation.					
Module 2	**QUANTUM MODEL OF COMPUTATION**	**Quiz**	**Quiz**		**12 sessions (8 T + 4 L)**

Topics:
The model of quantum computation, Quantum circuits: single qubit gates, multiple qubit gates, design of quantum circuits.

Module 3	QUANTUM ALGORITHMS	Assignment	Case Studies	12 sessions (8 T + 4 L)

Topics: Deutsch-Jozsa algorithm and Grover's search algorithm. Shor's algorithm for factoring, Quantum Fourier transform.

Module 4	QUANTUM INFORMATION THEORY & QUANTUM MACHINE LEARNING	Assignment	Case Studies	11 sessions (9 T + 2 L)

Topics: Comparison between classical and quantum information theory, Applications of quantum information, Bell states, Quantum Machine Learning, no cloning theorem.

Targeted Application & Tools that can be used

1. Framework- Qiskit
2. Language- Python
3. Applications:
   - Quantum Circuits
   - Quantum Gates
   - Quantum Machine Learning Algorithms

Project work/Assignment:

Assignment:

- Create quantum circuit functions that can compute the XOR, AND, NAND and OR gates using the NOT gate (expressed as x in Qiskit), the CNOT gate (expressed as cx in Qiskit) and the Toffoli gate (expressed as ccx in Qiskit) .
- Measure the Bloch sphere coordinates of a qubit using the Aer simulator and plot the vector on the Bloch sphere
- Investigate the relationship between the number of qubits required for the desired accuracy of the phase estimation with high probability.

Project Work:

- Create a program that builds an oracle for a given string (e.g. given 01101, will return a QuantumCircuit that inverts the phase of the state $|01101\rangle$ and leaves all other states unchanged.
- Tackle an open issue in the Qiskit Terra repo.
- Create a program that builds an oracle circuit from a problem (like the PhaseOracle class does in the previous page). Assess how the size of your circuits grow with the size of the problem.

Text Book

1. Nielsen, M., & Chuang, I. (2010). Quantum Computation and Quantum Information: 10th Anniversary Edition. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511976667
2. McMahon D. Quantum Computing Explained. Hoboken N.J: Wiley-Interscience : IEEE Computer Society; 2008.

References

1. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific. (2004)
2. Pittenger A. O., An Introduction to Quantum Computing Algorithms (2000).

E book link R1:

	http://community.qiskit.org/textbook **E book link R2** https://github.com/Qiskit
R3	**Web resources:** • Abraham Asfaw and Antonio Corcoles & et al. "Learn Quantum Computation Using Qiskit", 2020, http://community.qiskit.org/textbook • IBM Qiskit Global Summer School 2021: Quantum Machine Learning, https://qiskit.org/events/summer-school/ • https://quantum-computing.ibm.com/ • https://qiskit.org/ • https://presiuniv.knimbus.com/u

Topics relevant to development of "Employability Skills"

- Designing Quantum circuits
- Visualizing Quantum Circuit outputs
- Analyzing and Comparing Quantum Algorithm Performance for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. Jayakumar V
Recommended by the Board of Studies on	BOS NO: SoCSE01, held on 22/12/2022
Date of Approval by the Academic Council	Academic Council Meeting No.20, Dated 15/02/2023

Course Code: CSD3433	**Course TitleComputational Intelligence Research** **Type of Course: Professional Elective& Theory Only**	**L- P- C**	3	0	3
Version No.	1.0				
Course Pre-requisites	CSE1700				
Anti-requisites	-				
Course Description	This course introduces students to advanced topics and current trends in Computational Intelligence (CI), with an emphasis on research methodologies and problem-solving using intelligent systems. It covers the theoretical foundations and real-world applications of neural networks, evolutionary algorithms, swarm				

	intelligence, fuzzy logic, and hybrid systems. Students will explore research problems, conduct literature reviews, and develop mini-projects or proposals with a focus on innovation and interdisciplinary applications.		
Course Objectives	1.The objective of the course is to familiarize the learners with the concepts of To develop an in-depth understanding of advanced computational intelligence techniques. 2.To foster research skills and innovation through the exploration of emerging CI applications.		
Course Out Comes	On successful completion of the course the students shall be able to: **CO1:** Analyze the foundations and advancements in computational intelligence methods. **CO2:** Evaluate and compare various CI techniques for real-world problem-solving. **CO3:** Formulate research questions and design experimental setups using CI approaches. **CO4:** Develop research proposals or projects in emerging areas of computational intelligence.		
Course Content:			
Module 1	**Introduction to Foundations of Computational Intelligence**	Assignment	8
Overview of CI paradigms: neural networks, fuzzy systems, evolutionary computing, and swarm intelligence; History and scope of CI in research.			
Module 2	**Advanced CI Techniques and Hybrid Models**	Assignment	10
Neuro-fuzzy systems; Evolutionary-fuzzy hybrid models; Deep neuroevolution; Applications in optimization, robotics, and data analytics.			
Module 3	**Research Methodology in CI**	Assignment /Quiz	13
Problem formulation; Literature review techniques; Benchmarking and metrics; Tools for scientific computing; Reproducible research in AI.			
Module 4	**Emerging Trends and Research Applications**	Assignment	12
CI in healthcare, smart cities, cybersecurity, environmental systems; Recent research publications and project case studies; Proposal writing and peer review.			
Textbook: 1. ***"Computational Intelligence: Principles, Techniques and Applications"*** **by Jacek M. Zurada, Wiley, 2021.** **Reference Books:** 1. ***"Swarm Intelligence: From Natural to Artificial Systems"*** **by Eric Bonabeau, Marco Dorigo, Guy Theraulaz, Oxford University Press, 2023.**			

2. *"Fuzzy Logic with Engineering Applications"* by Timothy J. Ross, Wiley, 4th Edition, 2023.
3. *"Research Methods in Computer Science"* by Mannino & Leong, Springer, 2022.

Course Code: CSD3418	Course Title: Feature Engineering and Model Optimization Type of Course: Discipline Elective/ Theory Only Course	L- T-P- C	3	0	0	3
Version No.		2.0				
Course Pre-requisites						
Anti-requisites		NIL				
Course Description		This course provides a deep dive into the techniques of transforming raw data into valuable inputs for machine learning models through effective feature engineering. It explores strategies for feature selection, transformation, dimensionality reduction, and hyperparameter tuning. Emphasis is placed on model optimization techniques including regularization, ensemble methods, and automated machine learning pipelines.				
Course Objective		The objective of the course is to familiarize the learners with the concepts of Data Mining and attain Employability through Problem Solving Methodologies				
Course Out Comes		Upon successful completion of this course, students will be able to: 11. Apply various feature engineering techniques to preprocess and transform data effectively. 12. Evaluate and optimize machine learning models using advanced tuning and selection techniques. 13. Integrate feature engineering and model optimization strategies into complete machine learning pipelines.				

Course Content:					
Module 1	Introduction to Feature Engineering	Assignment		Data Collection	10 Sessions
	Topics: Understanding data types and quality, Missing value handling, outlier detection, encoding categorical variables, Feature scaling and normalization techniques				
Module 2	Feature Selection and Extraction	Quiz		Problem Solving	10 Sessions
	Topics: Filter, wrapper, and embedded methods, Principal Component Analysis (PCA), LDA, t-SNE, Feature importance and interpretability in models				
Module 3	Model Optimization Techniques	Assignment		Problem Solving	10Sessions
	Topics: Hyperparameter tuning (Grid Search, Random Search, Bayesian Optimization), Cross-validation strategies, Regularization techniques (L1, L2, ElasticNet)				
Module 4	Advanced Techniques and AutoML	Assignment		Problem Solving	12 Sessions
	Feature generation using domain knowledge and interactions, Ensemble learning and stacking, Introduction to AutoML frameworks (e.g., AutoSklearn, H2O.ai, TPOT)				
	5. Feature Engineering and Selection: A Practical Approach for Predictive Models",Author: Max Kuhn, Kjell Johnson, Publisher: CRC Press, Taylor & Francis Group, Year: 2019 **6.** "Hands-On Feature Engineering with Python", Author: Soledad Galli, Publisher: Packt Publishing, Year: 2020				
	References:				

	R1 "Automated Machine Learning: Methods, Systems, Challenges", Editors: Frank Hutter, Lars Kotthoff, Joaquin Vanschoren, Publisher: Springer, Year: 2021 **R2 "Machine Learning Engineering",** Author: Andriy Burkov, Publisher: True Positive Inc., Year: 2020 **Additional web-based resources:** W1. https://onlinecourses.swayam2.ac.in/cec20_cs12/preview Text book of Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufmann Publishers, 2012. W2.https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=7&sid=e2d7362a- fd3049a98f0393e963521dbd%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=377411&db=nlebk https://nptel.ac.in/courses/105105157
	Topics relevant to "EMPLOYABILITY SKILLS": Data Mining Techniques, FP Growth for developing Employability Skills through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

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

Course Code:	Course Title: Scientific Computing for	L- T-P- C	3	0	0	3

CSD3417	Intelligent Systems Type of Course: Discipline Elective/ Theory Only Course					
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: 14. Apply numerical techniques to solve scientific and engineering problems. 15. Develop and optimize intelligent algorithms using scientific computing methods. 16. Implement data-driven and model-based solutions in real-world intelligent systems. 17. 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	13 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					
	7. **"Numerical Analysis"** by Richard L. Burden and J. Douglas Faires, Cengage Learning, 11th Edition, 2022. 8. **"Scientific Computing: An Introductory Survey"** by Michael T. Heath, McGraw Hill Education, 2nd Edition, 2018.					
	References: **R1** "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney, O'Reilly Media, 3rd Edition, 2022**.** **R2 "**Parallel and High-Performance Computing" by Robert Robey and Yuliana Zamora, O'Reilly Media, 2021. .					

	Additional web-based resources: W1. https://onlinecourses.swayam2.ac.in/cec20_cs12/preview Text book of Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufmann Publishers, 2012. W2.https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=7&sid=e2d7362a- fd3049a98f0393e963521dbd%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=377411&db=nlebk https://nptel.ac.in/courses/105105157
	Topics relevant to "EMPLOYABILITY SKILLS": Data Mining Techniques, FP Growth for developing Employability Skills through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

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

Course Code: CSD3408	**Course Title:** Data Mining and Warehousing **Type of Course:1] Program Core**	**L-T-P-C**	**3**	**0**	**0**	**3**
Version No.	1.0					
Course Pre-requisites	CSE1510					
Anti-requisites	**NIL**					

Course Description		This course covers the fundamental concepts, techniques, and tools used in data mining and data warehousing. Students will learn how to design and implement data warehouses and how to extract meaningful patterns and knowledge from large datasets using data mining methods. Topics include data preprocessing, association rules, classification, clustering, OLAP operations, and warehouse schema design. Real-world applications and hands-on projects using industry-standard tools form an essential part of the learning experience.
Course Objective		To teach principles, concepts and applications of data warehousing and data mining To introduce the task of data mining as an important phase of knowledge recovery process To inculcate Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment. for **Employability** through **Problem Solving** Methodologies.
Course Out Comes		On successful completion of this course the students shall be able to: 1. Design a data mart or data warehouse for any organization (Understand) 8. Extract knowledge using data mining techniques. (Apply) 9. Adapt to new data mining tools. (Apply) 10. 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

3. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
4. Data Mining-Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.

References

4. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
5. Data Ware Housing Fundamentals, Pualraj Ponnaiah, Wiley Student Edition.
6. The Data Ware House Life Cycle Toolkit- Ralph Kimball, Wiley Student Edition.
7. Data Mining, Vikaram Pudi, P Radha Krishna, Oxford University

Catalogue prepared by	Dr. Manjunath KV
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: CSD3402	**Course Title:** Web Data Analytics for Data Science **Type of Course: Integrated**	**L-T- P- C**	2	0	2	3
Version No.	1.0					
Course Pre-requisites	CSE2074					
Anti-requisites	NIL					
Course Description	**This course introduces tools and techniques for extracting, processing, and analyzing data from the web. Students will gain hands-on experience with web scraping, working with APIs, analyzing web server logs, and performing sentiment analysis using social media data. The course emphasizes deriving insights for real-world applications in data science.**					
Course Objective	1.To provide practical exposure to web data extraction, preprocessing, and API handling. 2. To enable analysis of user behavior through web logs and social media trends for business and research decisions. 3. To develop visualization and reporting skills for web data-driven insights. .					

Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1**: Extract and process structured/unstructured web data using automated tools. **CO2**: Analyze user behavior patterns from web usage and clickstream data. **CO3**: Perform sentiment and trend analysis using APIs and social media platforms. **CO4**: Design dashboards and visualize web analytics results effectively.

Course Content:

Module 1: Web Data Extraction and Preprocessing	**8 Sessions**
Introduction to HTML, DOM, and web crawling, Web scraping using Python (BeautifulSoup, Scrapy), Working with REST APIs and JSON/XML data, Ethical and legal considerations in web data extraction	
Module 2: Web Usage and Log Data Analytics	**8 Sessions**
Web server log structure and preprocessing, Session identification and user behavior modelling, Clickstream analysis and heatmap interpretation, Metrics: bounce rate, session duration, conversion tracking.	
Module 3 Social Media and Open Web Analytics	**7 Sessions**
Sentiment analysis on Twitter, Reddit, etc.,Trend analysis and opinion mining, Google Trends and open web metrics,Case studies and dashboard creation with real-time data	

Exp. No.	Title
1	Extract data from static web pages using BeautifulSoup
2	Perform web scraping from paginated or dynamic content using Scrapy
3	Access and parse REST APIs (e.g., GitHub, Twitter) with JSON data
4	Clean and preprocess web server logs (Apache or Nginx formats)
5	Identify sessions and users from clickstream logs
6	Perform sentiment analysis using Twitter API and TextBlob/VADER
7	Conduct trend analysis using Google Trends and visualize it
8	Create a live dashboard using Streamlit/Plotly to present web insigh

Text Book

Title: Mining the Web: Discovering Knowledge from Hypertext Data, Author: Soumen Chakrabarti, Publisher: Morgan Kaufmann (Elsevier),Year of Publication: 2022 Reprint Edition (original concepts updated with modern tools and use cases),ISBN: 9780128164852

	R1 :Title :Mining the Web: Discovering Knowledge from Hypertext Data, Author: Soumen Chakrabarti, Publisher: Morgan Kaufmann (Elsevier),Year: 2022 Reprint Edition,ISBN: 9780128164852 R2: Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data, Authors: Bing Liu, Publisher: Springer,Edition: 2nd Edition,Year: 2020,ISBN: 9783030421568. R3: Data Wrangling with Python: Tips and Tools to Make Your Life Easier,Author: Jacqueline Kazil, Katharine Jarmul, Publisher: O'Reilly Media,Edition: 2nd Edition, Year: 2022, ISBN: 9781098102012

Course Code: **PPS 4004**	**Course Title: Aptitude Training-Intermediate** Type of Course: Practical Only Course	L- T - P- C	0	0	2	1
Version No.	1.0					
Course Pre-requisites	Students should have the basic concepts of Quantitative aptitude along with its applications in real life problems.					
Anti-requisites	NIL					
Course Description	This is a skill-based training program for the students. This course is designed to enable the students to enhance their skills in Quantitative Aptitude.					
Course Objective	**The objective of the course is to familiarize the learners with the concepts of Aptitude and attain Skill Development through Problem Solving techniques.**					

Course Out Comes	**On successful completion of this course the students shall be able to:** CO1: Recall all the basic mathematical concepts. CO2: Identify the principle concept needed in a question. CO3: Solve the quantitative and logical ability questions with the appropriate concept. CO4: Analyze the data given in complex problems.		
Course Content:			
Module 1	**Quantitative Ability 1**	Assignment	**16 Hours**
Topics: Number System, Percentage, Ratio and Proportion, Average, Mixture and Allegation, Time and Work, Profit and Loss			

Module 2	Quantitative Ability 2	Assignment	**14 Hours**
Topics: Time Speed and Distance, Boats and Streams, Simple Interest, Compound Interest, Probability, Permutation and Combination			
Targeted Application & Tools that can be used: Application area: Placement activities and Competitive examinations. Tools: LMS			
Continuous Evaluation:			
CA1 – Online Test CA2 – Online Test CA3 – Online Test Assignment			
Text Book: 1. Fast Track Objective by Rajesh Verma 2. R S Aggarwal 3. Rakesh Yadav **References:** **1. www.indiabix.com** **2. www.testbook.com** **3. www.youtube.com/c/TheAptitudeGuy/videos**			
Topics relevant to Skill Development: Quantitative aptitude for Skill Development through Problem solving Techniques. This is attained through components mentioned in course handout.			
Catalogue prepared by	Faculty of L&D		
Recommended by the Board of Studies on	**BOS held on**		
Date of Approval by the Academic Council	**Academic Council Meeting held on**		

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY

Private University Estd. in Karnataka State by Act No. 41 of 2013

Course Code: APT4026	**Course Title:** Aptitude For Employability **Type of Course:** Practical Only	**L- T-P- C**	0	0	2	0

Version No.		1.0
Course Pre-requisites		Students should have the basic concepts of Quantitative aptitude, Verbal ability along with its applications in real life problems.
Anti-requisites		Nil
Course Description		This course is designed to enable the students to enhance their skills in quantitative aptitude and verbal ability skills.
Course Objective		The objective of the course is to familiarize the learners with concepts in Quantitative Aptitude and Verbal ability through problem solving techniques suitable for their career development.
Course Outcomes		On successful completion of the course the students shall be able to: CO1] **Recall** all the basic mathematical concepts CO2] **Identify** the principle concept needed in a question CO3] **Solve** the quantitative and logical ability questions with the appropriate concept.
Course Content:		

Module 1	Quantitative Ability	Lab-10hrs		Platform Assessment-10hrs	**20 Hours**
	Topics: Number System, Percentage, Ratio and Proportion, Average, Mixture and Allegation, Time and Work, Profit and Loss, Time Speed and Distance, Simple Interest and Compound Interest, Probability, Permutation and Combination.				
Module 2	Verbal Ability	Lab-5hrs		Platform Assessment-5hrs	**10 Hours**
	Topics: - Parts of Speech, Subject Verb Agreement, Spotting Error, Cloze Test, Verbal Analogies, Reading Comprehension, Idioms & Phrases, Para Jumbles				
	Targeted Application & Tools that can be used: Application area: Placement activities and Competitive examinations. Tools: LMS				
Evaluation	**Continuous Evaluation** • Topic wise evaluation				

	Text Book 1. Fast track objective by Rajesh Verma 2. R S Aggarwal 3. S.P Bakshi
	References 1. www.indiabix.com 2. www.testbook.com 3. www.youtube.com/c/TheAptitudeGuy/videos
	Topics relevant to Skill development: Quantitative and reasoning aptitude for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.

Catalogue prepared by		Faculty of L&D
Recommended by the Board of Studies on		
Date of Approval by the Academic Council		

Course Code: APT4006	**Course Title: Logical and Critical Thinking** **Type of Course:** Audited	**L- T-P-C**	0	0	2	0
Version No.	1.0					
Course Pre-requisites	Students should have the basic concepts of Logical reasoning and Critical thinking, along with its applications in real life problems.					
Anti-requisites	Nil					
Course Description	This is a skill-based training program for the engineering students (Undergraduate). This course is designed to enable the students to enhance their skills in Logical reasoning and Critical thinking.					
Course Objective	The objective of the course is to familiarize the learners with concepts in in Logical reasoning and Critical thinking through problem solving techniques suitable for their career development.					
Course Outcomes	On successful completion of the course the students shall be able to:					
	CO1] **Understand** all the concepts.					
	CO2] **Apply** the concepts in problem solving (Bloom's taxonomy Level 3)					
	CO3] **Analyze** and structure the reasoning techniques and spatial visualization skills					
Course Content:						
Module 1	Logical Thinking	Assignment				**16 Hours**

	Topics:			
	Syllogisms, Cubes and Dices, Mirror and Water images, Paper cutting and Folding, Embedded figures & Completion of figures, Data Interpretation, Data sufficiency			
Module 2	Critical Thinking	Assignment		**14 Hours**
	Topics:			
	Analogy, Symbol and Notations, Statement and assumption, Cause of action, Statement and conclusion, Puzzles			
	Targeted Application & Tools that can be used:			
	Application area: Placement activities and Competitive examinations.			
	Tools: LMS			
Evaluation	**Continuous Evaluation**			
	· Topic wise evaluation			
	· Internal Assessments			
	Text Book			
	1. A new approach to reasoning verbal, non-verbal & analytical by BS Sijwali			
	2. R S Aggarwal			
	3. Kiran publications			
	References			
	1. www.indiabix.com			
	2. www.testbook.com			
	3. www.youtube.com/c/TheAptitudeGuy/videos			
	Topics relevant to Skill Development Logical reasoning and Critical thinking for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.			
Catalogue prepared by	L&D Department Faculty Member			
Recommended by the Board of Studies on				
Date of Approval by the Academic Council				

Course Code: PPS 4027	**Course Title: Preparedness for Interview** 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 understand soft skills concepts to be corporate ready. The modules are set to improve self-confidence, communicate effectively and Prepare for the Interview to assist in employability. It helps the students to get a glimpse of the acceptable corporate readiness and equip them with the fundamental necessities of being able to confidently deal with the highly competitive corporate environment and helps in crafting different types of resumes. The pedagogy used will be group discussions, flipped classrooms, continuous feedback, role-play and mentoring.
Course Objective		The objective of the course is to familiarize the learners with the concepts of "**Preparing for Interview**" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.
Course Out Comes		**On successful completion of this course the students shall be able to:** CO1: **Develop** professional Resumes CO2: **Illustrate** Resumes effectively CO3: **Apply** skills and knowledge learnt for active and effective Group Discussions and Interview
Course Content:		

Module 1	**Resume Building**	**Classroom activity**		10 Hours
	Topics: Resume structure, use of templates, Do's and Don'ts, ATS methods, Cover Letter and Video Resume **Activity:** Real world scenarios			

Module 2	**Group Discussion**	**Mock G D**		9 Hours
	Topics: -Group discussion as a placement process, GD techniques like Keyword. SPELT & POV of affected parties. Do & Don't of GD, Case-lets and topics for GD, practice session and evaluation **Activity:-** Real world scenarios			
Module 3	**Personal Interview**	**Grooming checks + Evaluation + Mock Interview+ Role Play**		9 Hours
	Topics: Placement process, Different interview rounds, HR interviews, Interview questions and desired answers, Different types of interviews, Do's and Don'ts. **Activity: -** Role Play & Real-world scenario			
Module 4	**Recap/Revision /Feedback Session**	**Practice sessions**		2 Hours
	Targeted Application & Tools that can be used: 1. TED Talks 2. You Tube Links 3. Role Play activities			
	Project work/Assignment: Mention the Type of Project /Assignment proposed for this course			
	Continuous Individual Assessment			
	The Topics related to Skill Development: Art Of Presentation and Group Discussion for **Skill Development** through **Participative Learning** Techniques. This is attained through assessment Component mentioned in course handout.			

Catalogue prepared by		**Faculty of L&D**
Recommended by the Board of Studies on		**BOS held on**
Date of Approval by the Academic Council		**Academic Council Meeting held on**

Course Code: **PPS 1012**	**Course Title: Enhancing Personality through Soft Skills** 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 the desire and enthusiasm to be involved, participate and learn.					
Anti-requisites	NIL					
Course Description	This course is designed to enable students to understand soft skills concepts and improve confidence, communication, and professional skills to give the students a competitive advantage and increase chances of success in the professional world. 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 "Enhancing Personality through Soft Skills" 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 **Identify the stages of** team formation (Remember) CO 2 **Demonstrate** effective presentation skills (Apply) CO3 **Prepare** professional social media profile (Apply)					
Course Content:						
Module 1	Professional Brand Building	Brand Framework Activity		**6 Hours**		

Topics: Personal brand definition, Crafting a compelling LinkedIn profile, Networking strategies, Leveraging AI tools for developing content for brand visibility.

Activity: Create a post and enhancing LinkedIn profile

Module 2	Art of Questioning	Role plays	**4 Hours**
Topics: Framing Questions, 5W1H Technique, Open-ended and Close-ended questions, Funnel technique, Probing questions, Leading questions			
Module 3	Presentation Skills	Practice and evaluation of individual/group presentation	**12 Hours**
Topics: Content development, Delivery techniques, Audience Analysis, Timing and Pacing, handling questions and challenges. **Activity:** Individual presentations or team presentation			
Module 4	Team Building	Team building activities	**6 Hours**
Topics: Importance of team, stages of Team Formation, Trust and collaboration. **Activity: Team Building Activity**			
Module 5	Recap / Revision /Feedback Session	Discussion, Quiz	**2 Hours**
Targeted Applications & 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) Presentation Evaluation 2) LinkedIn assessment			
Targeted Applications & Tools that can be used: 1. TED Talks 2. YouTube Links **3.** Videos by L&D Team shared on Edhitch/YouTube.com **4.** LMS			

Assignments proposed for this course

1. Evaluation on Presentation
2. Assignment on LinkedIn Post

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 the 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 the assessment component mentioned in the course handout.

Catalogue prepared by	Faculty of L&D
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: PPS 1001	**Course Title: Introduction to Soft Skills** **Type of Course: Practical Only Course**	L- P- C	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 understand soft skills concepts and improve confidence, communication and professional skills to give the students a competitive advantage and increase chances of success in the professional world. 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 "Soft Skills" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.**				
Course Out Comes	**On successful completion of this course the students shall be able to:** CO1: **Recognize** significance of soft skills CO2: **Illustrate** effective communication while introducing oneself and others CO3: **List** techniques of forming healthy habits				

	CO4: **Apply** SMART technique to achieve goals and increase productivity		
Course Content:			
Module 1	INTRODUCTION TO SOFT SKILLS	**Classroom activity**	**04 Hours**
Topics: Setting Expectations, Ice Breaker, Significance of soft skills, Formal grooming, punctuality			
Module 2	EFFECTIVE COMMUNICATION	**Individual Assessment**	**10 Hours**
Topics: Different styles of communication, Difference between hearing and listening, Effective communication for success, Email etiquette, Self-introduction framework, Video introduction, email- writing, Resume Building- Digital, Video, Traditional.			
Module 3	HABIT FORMATION	**Worksheets & Assignment**	**4 Hours**
Topics: Professional and personal ethics for success, Identity based habits, Domino effect, Habit Loop, Unlearning, standing up for what is right			
Module 4	Goal setting & Time Management	**Goal sheet**	**8 Hours**
A session where students will be introduced to Time management, setting SMART Goals, Introduction to OKR Techniques, Time Management Matrix, steps to managing time through outbound group activity, making a schedule, Daily Plan and calendars (To Do List), Monitoring/charting daily activity			
Targeted Application & Tools that can be used: LMS			
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course 1) Individual Assessment 2) LMS MCQ			
The topics related to Skill Development: Communication and professional grooming, Goal setting and presentation for skill development through participative learning techniques. This is attained through assessment component mentioned in course handout.			
Catalogue	L&D Department Faculty members		

prepared by	
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: PPS 1002	**Course Title: Soft skills for Engineers** Type of Course: **Practical Only Course**	L- P- C	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 develop effective communication skills and boost confidence levels. The activity-based modules cover the art of Questioning, how to ask questions, goal setting with emphasis on time and stress management, creating the first impression and introducing one self and finally culminating with the etiquettes of email writing. 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 "Soft Skills for Engineers and attain Skill Development" through Experiential Learning techniques.**				

Course Out Comes	**On successful completion of this course the students shall be able to:** CO1 **Employ** effective communication skills CO2 **Practice** questioning techniques for better decision making CO3 **Differentiate** individual strengths and weaknesses for self-awareness and stress management CO4 **Recognise** the need to set SMART GOALS		
Course Content:			
Module 1	Art of Questioning	Role plays	4 classes
Topics: Note Taking, Framing Open-ended and Close-ended questions, Funnel technique, Probing questions, Leading questions, Rhetorical questions, 5W1H Technique			
	Vocab Building		Every Class
Dedicate 5-10minutes towards vocabulary building in every session			
Module 2	Goal Setting & Time Management	Journal + Outbound training	8 Classes
Goal Setting (SMART Goals), Time Management Matrix, Steps to managing time through outbound group activity, Making a schedule, Daily Plan and calendars (To Do List), Monitoring/charting daily activity			
Module 3	Self-introduction and Creating an Impression	Grooming checks + Evaluation	8 classes
Topics: Body Language, Grooming guidelines for boys/girls, Common mistakes in Grooming at workplace and social gathering, Etiquettes at work place & social gathering, SWOT – Self-awareness analysis, Self-introduction template, evaluation of self-introduction in class			
Module 4	E-mail Etiquette	Industry expert / Trainer	4 Classes
Topics: Dos and Don'ts of professional email etiquette, practice writing emails (activity)			
REVISION	Recap & Summary		2 Classes
Revision of all the modules, overall feedback from the students with regards to the syllabus.			

The topics related to Skill Development: Communication and professional grooming, SWOT and PEST Analysis time management and goal setting, writing and the art of asking questions for Skill Development through Participative Learning Techniques. This is attained through student self-introduction as mentioned in course handout.
Targeted Application & Tools that can be used: LMS
Topics relevant to development of "SKILL": Art of Questioning, Goal Setting & Time Management, Self-introduction and Creating an Impression, E-mail Etiquette.

Catalogue prepared by	Faculty of L&D department
Recommended by the Board of Studies on	BOS NO 3 Dated 10 Feb 23
Date of Approval by the Academic Council	20 ACM dated 15 Feb 23

Course Code: PPS4002	**Course Title:** Introduction to Aptitude **Type of Course:** Practical Only Course	**L- P- C**	0	2	1
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	**02 Hours**
Topics: Introduction to Aptitude, working of Tables, Squares, Cubes				
Module 2	Logical Reasoning	Assignment	Bloom's Level : Application	**18 Hours**
Topics: Linear & Circular Arrangement Puzzle, Coding & Decoding, Blood Relations, Directions, Ordering and Ranking, Clocks and Calendars, Number Series, Wrong number series, Visual Reasoning				

Targeted Application & Tools that can be used: Application area: Placement activities and Competitive examinations. Tools: LMS
Text Book 1. Quantitative Aptitude by R S Aggarwal 2. Verbal & Non-Verbal Reasoning by R S Aggarwal
References 1. www.indiabix.com 2. www.youtube.com/c/TheAptitudeGuy/videos
Topics relevant to Skill development: Quantitative and reasoning aptitude for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	L&D Department faculty members
Recommended by the Board of Studies on	BOS No.: 3 BOS Date: 10/02/2023
Date of Approval by the Academic Council	Academic Council Meeting No.: 20 Date of the meeting: 15/02/2023

Course Code: CIV7601	Course Title: Universal Human Values and Ethics Type of Course: MAC course	L-T-P-C	-	-	-	0
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course 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.			
Course Objective	The objective of the course is 'SKILL DEVELOPMENT' of the student by using 'SELF LEARNING' techniques			
Course 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.			
Course Content:				
Module 1	Introduction to Value Education	Online Assessment	MCQ Quiz	5 Sessions
Topics: Right 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.				
Module 2	Harmony in the Human Being	Online Assessment	MCQ Quiz	5 Sessions
Topics: 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				
Module 3	Harmony in the Family and Society	Online Assessment	MCQ Quiz	5 Sessions
Topics: 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.				
Module 4	Implications of the Holistic Understanding – A Look at Professional Ethics	Online Assessment	MCQ Quiz	5 Sessions
Topics: Natural 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				
Targeted Application & Tools that can be used: Application areas are Personal life, Education and Career, Workplace , Society and Environmental Responsibility Tools: Online Tools – NPTEL and Swayam.				
Project work/Assignment:				
Assessment Type • Online exams (MCQs) will be conducted by the Department of Civil Engineering through Linways.				
Online Link*: 1) UHV II - https://www.youtube.com/watch?				

v=NhFBzn5qKIM&list=PLWDeKF97v9SO8vvjC1KyqteziTbTjN1So&pp=0gcJCWMEOCosWNin

2) Lecture by Dr. Kumar Sambhav, NPTEL course: Universal Human Values, https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
3) 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. 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
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2019.
3. Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing, New Delhi, 2022.

Reference Books

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

Resources:

1. https://onlinecourses.swayam2.ac.in/imb25_mg195/preview
2. https://onlinecourses.nptel.ac.in/noc25_mg141/preview
3. https://onlinecourses.swayam2.ac.in/ini25_hs52/preview
4. https://onlinecourses.nptel.ac.in/noc25_hs219/preview
5. https://onlinecourses.swayam2.ac.in/cec25_mg14/preview
6. https://onlinecourses.swayam2.ac.in/imb25_mg195/preview
7. https://onlinecourses.swayam2.ac.in/imb25_mg196/preview

Topics relevant to Skill Development:

1. An attitude of enquiry.
2. Write reports

The topics related to Human values and Professional ethics:

All topics in are relevant to Human values and Professional ethics.

Catalog prepared by	Mrs. Divya Nair
Recommended by the Board of Studies on	20th BoS dated 06 June 2025
Date of Approval by the	Academic Council no. 26 dated __ June 2025

Academic Council	

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: 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*:

4) Lecure by Dr. Samik Chowdhury, Dr. Sudha Goel, NPTEL course: Environmental Science, https://nptel.ac.in/courses/109105203, 2024.
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.

Text Book

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

Reference Books

11. Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022), Conservation through Sustainable Use: Lessons from India. Routledge.
12. William P. Cunningham and Mary Ann Cunningham (2020), Principles of Environmental Science: Inquiry & Applications, 9th Edition, McGraw-Hill Education, USA.
13. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.
14. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press. https://doi.org/10.1201/9781003096238
15. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press

Resources:

8. https://nptel.ac.in/courses/109105203
9. https://archive.nptel.ac.in/courses/120/108/120108004/
10. https://nptel.ac.in/courses/127105018
11. https://onlinecourses.nptel.ac.in/noc23_lw06/preview
12. https://onlinecourses.swayam2.ac.in/ini25_bt02/preview
13. https://archive.nptel.ac.in/courses/120/108/120108002/
14. https://onlinecourses.swayam2.ac.in/ini25_bt02/preview
15. https://nptel.ac.in/courses/102104088
16. https://nptel.ac.in/courses/124107165
17. https://nptel.ac.in/courses/109106200
18. https://archive.nptel.ac.in/content/storage2/courses/120108004/module1/lecture1.pdf
19. https://onlinecourses.swayam2.ac.in/nou25_ge19/preview
20. https://onlinecourses.swayam2.ac.in/ini25_hs01/preview
21. http://kcl.digimat.in/nptel/courses/video/105105184/L32.html
22. https://nptel.ac.in/courses/105105169

Topics relevant to Skill Development:

3. An attitude of enquiry.
4. Write reports

The topics related to Environment and Sustainability :

All topics in theory component are relevant to Environment and Sustainability.

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

Course Code: LAW7601	**Indian Constitution** **Type of Course: MOOC course**	**L- T- P- C**	**-**	**-**	**-**	**0**
		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 fundamentals of Indian Constitution concepts and their relevance to 75+ Years of Republic of India (https://constitution75.com/) as well as **#AzaadiKaAmrutMahotsav / Azadi Ka Amrit Mahotsav** (https://amritmahotsav.nic.in). It is designed to equip students with the knowledge about the Constitution of India. This course aims to introduce the constitutional law of India to students from all walks of life and help them understand the constitutional principles as applied and understood in everyday life. The objective of making the Constitution of India, familiar to all students, and not only to law students, this course aims and objectifies legal understanding in the simplest of forms. **This course is designed to cater to Constitutional Studies.**			
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 basic understanding of the Indian Constitution and the concepts and issues relevant to day-to-day life of the nation and to equip the Citizen with the zeal of capacity building. Recognizing and identify the values of the Constitution of India. 2. Enabling the Citizen-centric Awareness of Rights and Responsibilities of the State 3. Explain the role of the State actors in building India. 4. Understanding the Gandhian vision over the power of the LSG (Local Self-Governance)			
Course Content:				
Module 1	**Understanding the Making of the Constitution: The Constituent Assembly & The Constitution of India**			
Topics: Historical Context of Constituent Assembly - Compositions & Functions of Constituent Assembly What is a Constitution? – Why have a Constitution? – Constitutional Change - Features of Indian Constitution – Preamble of Indian Constitution				
Module 2	**Citizen's Fundamental Rights and State's Responsibilities (Directive Principles)**			
Topics: Introduction to Fundamental Rights - Right to Equality – Facets of Right to				

Equality - Right to Freedom - Constitutional Position of Some Democratic Rights - Right Against Exploitation - Right to Freedom of Religion - Right to Constitutional Remedies

Directive Principles of the State Policy

Module 3	**Organs Of the Government**			

Topics:

Executive: The President of India - Powers and Functions of President of India - Emergency Powers and the Position of the President

Legislature: Union Council of Ministers - Prime Minister - The Rajya Sabha - The Lok Sabha - Relation between the Lok Sabha & Rajya Sabha - Office of the Speaker – Important Parliamentary Committees

Judiciary: The Structure and Organization of the Judiciary & the High Court - The Supreme Court - Role of The Supreme Court - Judicial Activism in India - Basic Structure Doctrine & PIL

Module 4	**Federalism & Decentralization**		

Topics:

What is Federalism? - Centre-State Legislative Relations - Centre-State Administrative Relations - Centre-State Financial Relations
The 5th & 6th Schedules - Municipality- (History of Indian Municipality, Organization & Functions) – Panchayat 1 (Idea of Panchayat, Organization and Powers of Panchayats in India)

Targeted Application & Tools that can be used:

Application areas to familiarize students with fundamentals of Indian Constitutional concepts.

Tools: Online Tools – NPTEL and Swayam.

Project work/Assignment:

Assessment Type

- Online end term exam will be conducted as notified by the Presidency University.

Online Link*:

1) Prof. Amitabha Ray, SWAYAM Course: "Constitutional Government & Democracy in India"
https://onlinecourses.swayam2.ac.in/cec19_hs13/preview

* Other source links are available in below Resources link.

Text Book

1. Durga Das Basu --- Introduction to the Constitution of India, 23rd Edition (Gurgaon; LexisNexis, 2018).
2. MP Jain's Constitutional Law of India, Lexis Nexis
3. V.N Shukla's Indian Constitutional Law, M.P Singh 13th Edition
4. MV Pylee's Constitution of India
5. J.C.Johari -- The Constitution of India: A Politico-Legal Study (Greater Noida: Sterling Publishers Pvt. Ltd. 2013).
6. Himangshu Roy and M.P.Singh – Indian Political System, 4th Edition

(Bengaluru; Pearson Education, 2018)
7. Vidya Bhushan & Vishnoo Bhagwan--- Indian Administration (S. Chand, 2011)
8. S.R.Maheswari --- Indian Administration (Orient Blackswan, 2001)
9. Dr. A.Avasthi & A.P. Avasthi --- Indian Administration (L.N. Agarwal Educational Publishing, 2017).
10. B. L. Fadia --- Indian Government and Politics (Sahitya a. Bhawan, 13th Revised Edition, 2017).
11. P.M.Bakshi – The Constitution of India (Prayagraj, UP; a. Universal Law Publishing, January, 2018)

Reference Books

12. HM Seervai, Constitutional Law of India, 4th Ed. Vol I, II, & III
13. Uday Raj Rai, Constitutional Law-I
14. Democracy and Constitutionalism in India, Oxford University Press 2009

Resources:

1. https://onlinecourses.nptel.ac.in/noc20_lw03/course?&force_user=true
2. https://onlinecourses.swayam2.ac.in/cec19_hs13/course?&force_user=true
3. https://nptel.ac.in/courses/129106003
4. https://nptel.ac.in/courses/129106411
5. https://nptel.ac.in/courses/129105608
6. https://nptel.ac.in/courses/129106002

Topics relevant to Skill Development:

1. An attitude of inquiry.
2. Write reports

The topics related to Constitutional Studies and its application :

All topics in theory component are relevant to Indian Constitution.

Catalog prepared by	Faculty members of the Department of Law.
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				1
Course Pre-requisites	Students should know the basic Mathematics & aptitude along with understanding of English				

Anti-requisites	Nil			
Course Description	The objective of this course is to prepare the trainees to tackle the questions on various topics and various difficulty levels based on Quantitative Ability, and Logical Reasoning asked during the placement drives. There will be sufficient focus on building the fundamentals of all the topics, as well as on solving the higher order thinking questions. The focus of this course is to teach the students to not only get to the correct answers, but to get there faster than ever before, which will improve their employability factor.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Aptitude and attain Skill Development through Problem Solving techniques.			
Course Outcomes	On successful completion of the course the students shall be able to: CO1] **Recall** all the basic mathematical concepts they learnt in high school. CO2] **Identify** the principle concept needed in a question. CO3] **Solve** the quantitative and logical ability questions with the appropriate concept. CO4] **Analyze** the data given in complex problems. CO5] **Rearrange** the information to simplify the question			
Course Content:				
Module 1	Quantitative Ability	Assignment	Bloom's Level : Application	**12 Hours**
Topics: Introduction to Aptitude, working of Tables, Squares, Cubes				
Module 2	Logical Reasoning	Assignment	Bloom's Level : Application	**18 Hours**
Topics: Linear & Circular Arrangement Puzzle, Coding & Decoding, Blood Relations, Directions, Ordering and Ranking, Clocks and Calendars, Number Series, Wrong number series, Visual Reasoning				
Targeted Application & Tools that can be used: Application area: Placement activities and Competitive examinations. Tools: LMS				
Text Book 1. Quantitative Aptitude by R S Aggarwal 2. Verbal & Non-Verbal Reasoning by R S Aggarwal				

References 1. www.indiabix.com 2. www.youtube.com/c/TheAptitudeGuy/videos
Topics relevant to Skill development: Quantitative and reasoning aptitude for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	L&D Department faculty members
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: **APT4004**	**Course Title: Aptitude Training-Intermediate** Type of Course: Practical Only Course	L- T - P- C	0	0	2	0
Version No.	1.0					
Course Pre-requisites	Students should have the basic concepts of Quantitative aptitude along with its applications in real life problems.					
Anti-requisites	NIL					
Course Description	This is a skill-based training program for the students. This course is designed to enable the students to enhance their skills in Quantitative Aptitude.					
Course Objective	**The objective of the course is to familiarize the learners with the concepts of Aptitude and attain Skill Development through Problem Solving techniques.**					

Course Out Comes	**On successful completion of this course the students shall be able to:** CO1: Recall all the basic mathematical concepts. CO2: Identify the principle concept needed in a question. CO3: Solve the quantitative and logical ability questions with the appropriate concept. CO4: Analyze the data given in complex problems.		
Course Content:			
Module 1	**Quantitative Ability 1**	Assignment	**16 Hours**
Topics: Number System, Percentage, Ratio and Proportion, Average, Mixture and Allegation, Time and Work, Profit and Loss			

Course Code: APT4006	**Course Title: Logical and Critical Thinking** **Type of Course:** Audited	**L- T-P-C**	0	0	2	0
Version No.	1.0					
Course Pre-requisites	Students should have the basic concepts of Logical reasoning and Critical thinking, along with its applications in real life problems.					
Anti-requisites	Nil					
Course Description	This is a skill-based training program for the engineering students (Undergraduate). This course is designed to enable the students to enhance their skills in Logical reasoning and Critical thinking.					
Course Objective	The objective of the course is to familiarize the learners with concepts in in Logical reasoning and Critical thinking through problem solving techniques suitable for their career development.					
Course Outcomes	On successful completion of the course the students shall be able to:					
	CO1] **Understand** all the concepts.					
	CO2] **Apply** the concepts in problem solving (Bloom's taxonomy Level 3)					

	CO3] **Analyze** and structure the reasoning techniques and spatial visualization skills			
Course Content:				
Module 1	Logical Thinking	Assignment		**16 Hours**
	Topics:			
	Syllogisms, Cubes and Dices, Mirror and Water images, Paper cutting and Folding, Embedded figures & Completion of figures, Data Interpretation, Data sufficiency			
Module 2	Critical Thinking	Assignment		**14 Hours**
	Topics:			
	Analogy, Symbol and Notations, Statement and assumption, Cause of action, Statement and conclusion, Puzzles			
	Targeted Application & Tools that can be used:			
	Application area: Placement activities and Competitive examinations.			
	Tools: LMS			
Evaluation	**Continuous Evaluation**			
	· Topic wise evaluation			
	· Internal Assessments			
	Text Book			
	1. A new approach to reasoning verbal, non-verbal & analytical by BS Sijwali			
	2. R S Aggarwal			
	3. Kiran publications			
	References			
	1. www.indiabix.com			
	2. www.testbook.com			
	3. www.youtube.com/c/TheAptitudeGuy/videos			
	Topics relevant to Skill Development Logical reasoning and Critical thinking for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.			
Catalogue prepared by	L&D Department Faculty Member			
Recommended by the Board of Studies on				
Date of Approval by the Academic Council				

Course Code: APT4026	**Course Title:** Aptitude For Employability **Type of Course:** Practical Only	**L- T-P- C**	0	0	2	0

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 i quantitative aptitude and verbal ability skills.
Course Objective		The objective of the course is to familiarize the learners with concepts Quantitative Aptitude and Verbal ability through problem solvi 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 Hou**
	Topics: Number System, Percentage, Ratio and Proportion, Average, Mixture and Allegation, Time and Wor Profit and Loss, Time Speed and Distance, Simple Interest and Compound Interest, Probabilit Permutation and Combination.				
Module 2	Verbal Ability	Lab-5hrs		Platform Assessment-5hrs	**10 Hou**
	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				

Course Code: PPS 4027	**Course Title: Preparedness for Interview** 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 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			

Course Code: PPS 1001	**Course Title: Introduction to Soft Skills** **Type of Course: Practical Only Course**	L- P- C	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 understand soft skills concepts and improve confidence, communication and professional skills to give the students a competitive advantage and increase chances of success in the professional world. 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 "Soft Skills" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.**				
Course Out Comes	**On successful completion of this course the students shall be able to:** CO1: **Recognize** significance of soft skills CO2: **Illustrate** effective communication while introducing oneself and others CO3: **List** techniques of forming healthy habits CO4: **Apply** SMART technique to achieve goals and increase productivity				
Course Content:					
Module 1	INTRODUCTION TO SOFT SKILLS	**Classroom activity**		**04 Hours**	
Topics: Setting Expectations, Ice Breaker, Significance of soft skills, Formal grooming, punctuality					

Module 2	EFFECTIVE COMMUNICATION	**Individual Assessment**	**10 Hours**
Topics: Different styles of communication, Difference between hearing and listening, Effective communication for success, Email etiquette, Self-introduction framework, Video introduction, email- writing, Resume Building- Digital, Video, Traditional.			
Module 3	HABIT FORMATION	**Worksheets & Assignment**	**4 Hours**
Topics: Professional and personal ethics for success, Identity based habits, Domino effect, Habit Loop, Unlearning, standing up for what is right			
Module 4	Goal setting & Time Management	**Goal sheet**	**8 Hours**
A session where students will be introduced to Time management, setting SMART Goals, Introduction to OKR Techniques, Time Management Matrix, steps to managing time through outbound group activity, making a schedule, Daily Plan and calendars (To Do List), Monitoring/charting daily activity			
Targeted Application & Tools that can be used: LMS			
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course			
3) Individual Assessment 4) LMS MCQ			
The topics related to Skill Development: Communication and professional grooming, Goal setting and presentation for skill development through participative learning techniques. This is attained through assessment component mentioned in course handout.			
Catalogue prepared by	L&D Department Faculty members		
Recommended by the Board of Studies on			
Date of Approval by the Academic Council			