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 2023-2027

BACHELOR OF TECHNOLOGY (B.Tech.) in COMPUTER SCIENCE AND TECHNOLOGY DEVOPS (CDV)

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

Regulation Number: PU/AC-21.5/SoCSE2/CDV/2023-2027

Resolution No. 5 of the 21st Meeting of the Academic Council held on 06th Sept 2023, and ratified by the Board of Management in its 22nd Meeting held on 02nd Nov 2023.

(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)

September 2023

Table of Contents

PART A – PROGRAM REGULATIONS

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

1.1 Vision of the University

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

1.2 Mission of the University

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

1.3 Vision of Presidency School of Computer Science and Engineering

To be a value-based, practice-driven Presidency School of Computer Science and Engineering, committed to developing globally competent engineers, dedicated to developing cutting-edge technology to enhance the 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 Social Project Based 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 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, 2024-2028;*

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

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

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

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

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

5.3 The effect of periodic amendments or changes in the Program Regulations, on the students admitted in earlier years, shall be dealt with appropriately and carefully, so as to ensure that those students are not subjected to any unfair situation whatsoever, although they are required to conform to these revised

Program Regulations, without any undue favour or considerations

6. Minimum and Maximum Duration

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

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

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

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

6.5 The enrolment of the student who fails to complete the mandatory requirements for the award of the concerned Degree (refer Section: 19.0**.** of Academic Regulations) in the prescribed maximum duration (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 success as Computer Engineering and Engineering with innovative skills, 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 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:

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

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

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

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

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

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

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

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

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

PO10. Communication: Communicate effectively on complex engineering

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

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

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

8.2 Program Specific Outcomes (PSOs):

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

PSO1: Problem Analysis: Identify, formulate, research literature, and analysis complex engineering problems related to software development & project management methodologies, Computing, DevOps tools and practices for substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PSO2: Design/development of Solutions: Design solutions for complex engineering problems related to software development & project management methodologies, Computing, DevOps tools and practices 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.

PSO3: Modern Tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities related to software development & project management methodologies.

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. /BE/BS 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. Computer Science and Technology Dev Ops) Degree as prescribed by the Regulations for B.Tech. in (Computer Science and Technology Dev Ops)is "N" Credits, and, if the total credits prescribed in the 1st Year (total credits of the 1st and 2nd Semesters) of the Program concerned is "M" Credits, then the *Minimum Credit Requirements* for the award of the B.Tech. in CST- DevOps 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:

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)

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

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

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

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

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

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

Grading shall be done at the end of the Academic Term by considering the aggregate performance of the student in all components of Assessments prescribed for the Course. Letter Grades (Clause 8.10 of Academic Regulations) 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.

12.1 **Minimum Performance Criteria:**

12.1.1 **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.

12.1.2 **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.

12.1.3 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-Clause 12.1.1, 12.1.2 of Academic Regulations) in the "Make-Up Examinations" of the concerned Course. Further, the student has an option to re-register for the Course and clear the same in the summer term/ subsequent semester if he/she wishes to do so, provided the Course is offered.

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

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

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

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

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

13.3.1 A student may complete SWAYAM/NPTEL/other approved MOOCs as mentioned in Clause 13.3(As per Academic Regulations) and transfer equivalent credits to partially or fully complete the mandatory credit requirements of Discipline Elective Courses and/or the mandatory credit requirements of Open Elective Courses as prescribed in the concerned Curriculum Structure. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective Courses and the Open Elective Courses as prescribed by

the Curriculum Structure of the concerned Program.

13.3.2 SWAYAM/NPTEL/ other approved MOOCs as mentioned in Clause 13.3 (As per Academic Regulations) shall be approved by the concerned Board of Studies and placed (as Annexures) in the concerned PRC.

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

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

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

13.3.2 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.

13.3.3 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.

13.3.4 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

13.3.5 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.

13.3.6 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 Technology DevOps) Program Structure (2023-2027) totaling 160 credits. Table 3 summarizes the type of baskets, number of courses under each basket and the associated credits that are mandatorily required for the completion of the Degree.

Table 3:0 B.Tech. (Computer Science and Technology DevOps) 2023-2027: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets

Sl. No.	Baskets	Credit Contribution
1	School Core	**68**
2	Program Core	**65**
3	Discipline Elective	**18**
4	Open Elective	**9**
	Total Credits	**160 (Minimum)**

In the entire Program, the practical and skill based course component contribute to an extent of approximately 60% out of the total credits of 160 for B.Tech. (Computer Science and Technology DevOps) 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.

PART C – CURRICULUM STRUCTURE

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

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

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

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

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

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

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

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

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 List of School Core Courses

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill
1	MAT1001	Calculus and Linear Algebra	3	0	2	4	5	EM
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	S
9	MAT1003	Applied Statistics	1	0	2	2	3	EM
10	ECE2007	Digital Design	2	0	2	3	4	F
11	CIV1008	Basic Engineering Sciences	2	0	0	2	2	F
12	MEC1006	Engineering Graphics	2	0	0	2	2	F
13	CSE1001	Problem Solving using JAVA	2	0	2	3	4	S
14	ENG2001	Advanced English	1	0	2	2	3	S
15	PPS1012	Enhancing Personality Through Soft Skills	0	0	2	1	2	S
16	ECE2010	Innovative Projects using Arduino	-	-	-	1	0	S
17	MAT1002	Transform Techniques, Partial Differential Equations and Their Applications	3	0	0	3	3	EM
18	CSE2001	Data Structures and Algorithms	3	0	2	4	5	S
19	MAT2004	Discrete Mathematical Structures	3	0	0	3	3	S
20	ECE2011	Innovative Projects Using Raspberry Pi	-	-	-	1	0	S
21	PPS4002	Introduction to Aptitude	0	0	2	1	2	S
22	MAT2003	Numerical Methods for Engineers	1	0	2	2	6	EM
23	PPS4004	Aptitutde Training Intermediate	0	0	2	1	3	S
24	CSE3216	Mastering Object-Oriented Concepts in Python	0	0	2	1	3	S
25	CSE7000	Internship	-	-	-	2	0	S
26	CSE2274	Competitive Programming and Problem Solving	0	0	4	2	4	S
27	CSE7101	Mini Project	0	0	0	5	0	S
28	CSE7300	Capstone Project	0	0	0	10	0	S/EM
29	APT4006	Logical and Critical Thinking	0	0	2	0	2	AT
30	APT4026	Aptitude for Employability	0	0	2	0	2	AT
31	PPS4027	Preparedness for Interview	0	0	2	0	2	SS
32	CIV7601	Universal Human Values and Ethics	0	0	0	0	-	S
33	LAW7601	Indian Constitution	0	0	0	0	-	S
		TOTAL				68		

Table 3.2 List of Program Core Courses

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill
1	CSE3155	Data Communications and Computer Networks	3	0	2	4	5	S
2	CSE2009	Computer Organization and Architecture	3	0	0	3	3	S
3	CSE3190	Fundamentals of Data Analytics	2	0	2	3	4	S
4	CSE2014	Software Engineering	3	0	0	3	3	S

5	CSE1005	Programming in Python	1	0	4	3	5	S
6	CSE2007	Design and Analysis of Algorithms	3	0	0	3	6	S
7	CSE3156	Database Management Systems	3	0	2	4	9	S
8	CSE3120	Operating System with Linux Internals	2	0	2	3	7	S
9	CSE3078	Cryptography and Network Security	3	0	0	3	6	S
10	CDV2001	Agile Structures and Frameworks	3	0	0	3	3	S
11	CDV2501	DevOps Tools Internals	3	0	0	3	3	S
12	CDV2502	DevOps Tools Internals Lab	0	0	2	1	2	S
13	CDV2503	Software Testing	3	0	0	3	3	S
14	CDV2504	Software Testing Lab	0	0	2	1	2	S
15	CSE2264	Essentials of AI	3	0	0	3	3	S
16	CSE2265	Essentials of AI Lab	0	0	2	1	2	S
17	CSE2266	Theory of Computation	3	0	0	3	3	S
18	CDV2507	Kubernetes and Container Orchestration	3	0	0	3	3	S
19	CDV2508	Continuous Integration and Continuous Delivery (CI/CD) Pipelines	3	0	0	3	3	S
20	CDV2509	Continuous Integration and Continuous Delivery (CI/CD) Pipelines Lab	0	0	2	1	2	S
21	CDV2510	Edge Computing and DevOps	3	0	0	3	3	S
22	CDV2511	DevSecOps	3	0	0	3	3	S
23	CSE2262	Analysis of Algorithms	3	1	0	4	4	S
24	CSE2263	Analysis of Algorithms Lab	0	0	2	1	2	S
		Total				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 4th and 5th semesters, subject to the following conditions:

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

18.1.2 Internship: student shall undergo internship, either in industry / company, academic / research organizations, government bodies, or international institutions. The objective is to provide practical exposure, industry insights, and real-world experience relevant to the student's field of study.

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

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

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

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

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

18.1.8 A student may opt for Internship / In-plant Training / IM / RPL in an industry

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

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

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

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

18.2 Mini Project

A student may opt to do a Mini Project for a period of 6-8 weeks in an Industry / Company or academic / research institution or the University Department(s) 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 project work will be conducted in accordance with the Program Regulations and requirements of the University.

18.3 Capstone Project

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

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

18.3.2 The selection criteria (minimum CGPA, pass in all Courses as on date,

and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Capstone Project to a student;

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

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

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

18.4 Research Project / Dissertation

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

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

The student may do the Research Project / Dissertation in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.4.1). 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 Specializations / Stream Basket

Minor Stream: Minimum Credits to be earned from this basket = 18 Credits

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

credits. (12 credits from specialization basket remaining 6 credits from other basket)									
	TRACK 1 : DevOps with Cloud Computing								
	Course Code	**Course Name**	**L**	**T**	**P**	**C**			
1	CDV3400	Fundamentals of Cloud Computing	3	0	0	3	3	S/ EM	
2	CDV3401	Version Control with Git & GitHub/GitLab	3	0	0	3	3	S/ EM	
3	CDV3402	Serverless Computing	3	0	0	3	3	S/ EM	
4	CDV3403	Infrastructure as Code (IaC) with Terraform & Ansible	3	0	0	3	3	S/ EM	
5	CDV3404	Cloud Automation & Orchestration	3	0	0	3	3	S/ EM	
6	CDV3405	Cloud Infrastructure and Systems Software	3	0	0	3	3	S/ EM	
7	CSE2021	Data Mining	3	0	0	3	3	S/ EM	MAT1001
8	CSE3352	Information Visualization	3	0	0	3	3	S/EM	CSE2027
9	CSE3082	Object Oriented Analysis and Design	3	0	0	3	3	S/EM	
	TRACK 2	**DevOps with AI**	L	T	P	C			
1	CDV3406	AI-Powered Chatbots & Automation in DevOps	3	0	0	3	3	S/ EM	
2	CDV3407	AIOps – AI-Driven DevOps & IT Operations	3	0	0	3	3	S/ EM	
3	CDV3408	Predictive Analytics for System Monitoring & Performance Optimization	3	0	0	3	3	S/ EM	
4	CDV3409	AI-Enabled Cloud Cost Optimization	3	0	0	3	3	S/ EM	
5	CDV3410	AI-Powered Incident Management & Root Cause Analysis	3	0	0	3	3	S/ EM	
6	CDV3411	Reinforcement Learning for Self-Healing DevOps Pipelines	3	0	0	3	3	S/ EM	
	TRACK 3	**DevOps with Fin Tech**	L	T	P	C			
1	CDV3412	DevOps Fundamentals for Financial Services	3	0	0	3	3	S/ EM	

2	CDV3413	Introduction to FinTech & Digital Banking	3	0	0	3	3	S/ EM	
3	CDV3414	Microservices Architecture for Banking Applications	3	0	0	3	3	S/ EM	
4	CDV3415	Automated Testing & Monitoring in FinTech	3	0	0	3	3	S/ EM	
5	CDV3416	DevSecOps in Financial Services	3	0	0	3	3	S/ EM	
6	CDV3417	Blockchain & Smart Contracts for Financial Transactions	3	0	0	3	3	S/ EM	

20. **List of Open Electives to be offered by the School / Department (Separately for ODD and EVEN Semesters.: Minimum Credits to be earned from this basket = 9 Credits**

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 List of Open Elective Courses
Minimum Credits to be earned from this basket = 9 Credits

Sl. No.	Course Code	Course Name	L	T	P	C	Contact Hours	Prerequisites/ Corequisites	Type of Skill/ Focus
Chemistry Basket									
1	CHE1003	Fundamentals of Sensors	3	0	0	3	3	-	S
2	CHE1004	Smart materials for IOT	3	0	0	3	3	-	S
3	CHE1005	Computational Chemistry	2	0	0	2	2	-	S
4	CHE1006	Introduction to Nano technology	3	0	0	3	3	-	S
5	CHE1007	Biodegradable electronics	2	0	0	2	2	-	S
6	CHE1008	Energy and Sustainability	2	0	0	2	2	-	S
7	CHE1009	3D printing with Polymers	2	0	0	2	2	-	S
8	CHE1010	Bioinformatics and Healthcare IT	2	0	0	2	2	-	S
9	CHE1011	Chemical and Petrochemical catalysts	3	0	0	3	3	-	S
10	CHE1012	Introduction to Composite materials	2	0	0	2	2	-	S
11	CHE1013	Chemistry for Engineers	3	0	0	3	3	-	S
12	CHE1014	Surface and Coatings technology	3	0	0	3	3	-	S
13	CHE1015	Waste to Fuels	2	0	0	2	2	-	S
14	CHE1016	Forensic Science	3	0	0	3	3	-	S
Civil Engineering Basket									
1	CIV1001	Disaster mitigation and management	3	0	0	3	3	-	S
2	CIV1002	Environment Science and Disaster Management	3	0	0	3	3	-	FC
3	CIV2001	Sustainability Concepts in Engineering	3	0	0	3	3	-	S
4	CIV2002	Occupational Health and Safety	3	0	0	3	3	-	S
5	CIV2003	Sustainable Materials and Green Buildings	3	0	0	3	3	-	EM
6	CIV2004	Integrated Project Management	3	0	0	3	3	-	EN
7	CIV2005	Environmental Impact Assessment	3	0	0	3	3	-	EN
8	CIV2006	Infrastructure Systems for Smart Cities	3	0	0	3	3	-	EN

9	CIV2044	Geospatial Applications for Engineers	2	0	2	3	4	-	EM
10	CIV2045	Environmental Meteorology	3	0	0	3	3	-	S
11	CIV3046	Project Problem Based Learning	3	0	0	3	3	-	S
12	CIV3059	Sustainability for Professional Practice	3	0	0	3	3	-	EN
Commerce Basket									
1	COM2001	Introduction to Human Resource Management	2	0	0	2	2	-	F
2	COM2002	Finance for Non Finance	2	0	0	2	2	-	S
3	COM2003	Contemporary Management	2	0	0	2	2	-	F
4	COM2004	Introduction to Banking	2	0	0	2	2	-	F
5	COM2005	Introduction to Insurance	2	0	0	2	2	-	F
6	COM2006	Fundamentals of Management	2	0	0	2	2	-	F
7	COM2007	Basics of Accounting	3	0	0	3	3	-	F
Computer Science Basket									
1	CSE2002	Programming in Java	2	0	2	3	4	-	S/EM
2	CSE2003	Social Network Analytics	3	0	0	3	3	-	S
3	CSE2004	Python Application Programming	2	0	2	3	4	-	S/ EM
4	CSE2005	Web design fundamentals	2	0	2	3	4	-	S/ EM/EN
5	CSE3111	Artificial Intelligence : Search Methods For Problem Solving	3	0	0	3	3	-	S/ EM/EN
6	CSE3112	Privacy And Security In Online Social Media	3	0	0	3	3	-	S/ EM/EN
7	CSE3113	Computational Complexity	3	0	0	3	3	-	S/ EM/EN
8	CSE3114	Deep Learning for Computer Vision	3	0	0	3	3	-	S/ EM/EN
9	CSE3115	Learning Analytics Tools	3	0	0	3	3	-	S/ EM/EN
Design Basket									
1	DES1001	Sketching and Painting	0	0	2	1	2	-	S
2	DES1002	Innovation and Creativity	2	0	0	2	2	-	F
3	DES1121	Introduction to UX design	1	0	2	2	3	-	S
4	DES1122	Introduction to Jewellery Making	1	0	2	2	3	-	S
5	DES1124	Spatial Stories	1	0	2	2	3	-	S
6	DES1125	Polymer Clay	1	0	2	2	3	-	S
7	DES2001	Design Thinking	3	0	0	3	3	-	S
8	DES1003	Servicability of Fashion Products	1	0	2	2	3	-	F
9	DES1004	Choices in Virtual Fashion	1	0	2	2	3	-	F
10	DES1005	Fashion Lifestyle and Product Diversity	1	0	2	2	3	-	F
11	DES1006	Colour in Everyday Life	1	0	2	2	3	-	F
12	DES2080	Art of Design Language	3	0	0	3	3	-	S
13	DES2081	Brand Building in Design	3	0	0	3	3	-	S
14	DES2085	Web Design Techniques	3	0	0	3	3	-	S
15	DES2089	3D Modeling for Professionals	1	0	4	3	5	-	S
16	DES2090	Creative Thinking for Professionals	3	0	0	3	3	-	S
17	DES2091	Idea Formulation	3	0	0	3	3	-	S
Electrical and Electronics Basket									
1	EEE1002	IoT based Smart Building Technology	3	0	0	3	3	-	S
2	EEE1003	Basic Circuit Analysis	3	0	0	3	3	-	S

3	EEE1004	Fundamentals of Industrial Automation	3	0	0	3	3	-	S
4	EEE1005	Electric Vehicles & Battery Technology	3	0	0	3	3	-	S
5	EEE1006	Smart Sensors for Engineering Applications	3	0	0	3	3	-	S
Electronics and Communication Basket									
1	ECE1003	Fundamentals of Electronics	3	0	0	3	3	-	F
2	ECE1004	Microprocessor based systems	3	0	0	3	3	-	F
3	ECE1005	Journey of Communication systems	3	0	0	3	3		F
4	ECE3089	Artificial Neural Networks	3	0	0	3	3	-	S
5	ECE3090	Digital System Design using VERILOG	3	0	0	3	3		F/EM
6	ECE3091	Mathematical Physics	3	0	0	3	3		F
7	ECE3092	Photonic Integrated Circuits	3	0	0	3	3		F
8	ECE3093	Machine learning for Music Information Retrieval	3	0	0	3	3		F/EM
9	ECE3094	Video Processing and Computer Vision	3	0	0	3	3		F/EM
10	ECE3095	Blockchain and Cryptocurrency Technologies	3	0	0	3	3		S/EM/ EN
11	ECE3096	Natural Language Processing	3	0	0	3	3		S/EM/ EN
12	ECE3097	Smart Electronics in Agriculture	3	0	0	3	3	-	F/EM
13	ECE3098	Environment Monitoring Systems	3	0	0	3	3	-	F/EM
14	ECE3099	Modern Wireless Communication with 5G	3	0	0	3	3		F/EM/ EN
15	ECE3100	Underwater Communication	3	0	0	3	3		F/EM/ EN
16	ECE3101	Printed Circuit Board Design	3	0	0	3	3		S/F/E M
17	ECE3102	Consumer Electronics	3	0	0	3	3	-	F/EM
18	ECE3103	Product Design of Electronic Equipment	3	0	0	3	3	-	S/F/ EM / EN
19	ECE3104	Vehicle to Vehicle Communication	3	0	0	3	3		F/EM/ EN
20	ECE3105	Wavelets and Filter Banks	3	0	0	3	3		F/EM
21	ECE3106	Introduction to Data Analytics	3	0	0	3	3	-	F/EM
22	ECE3107	Machine Vision for Robotics	3	0	0	3	3	-	F/EM
English Basket									
1	ENG1008	Indian Literature	2	0	0	2	2	-	-
2	ENG1009	Reading Advertisement	3	0	0	3	3	-	S
3	ENG1010	Verbal Aptitude for Placement	2	0	2	3	4	-	S
4	ENG1011	English for Career Development	3	0	0	3	3	-	S
5	ENG1012	Gender and Society in India	2	0	0	2	2	-	-
6	ENG1013	Indian English Drama	3	0	0	3	3	-	-
7	ENG1014	Logic and Art of Negotiation	2	0	2	3	4	-	-
8	ENG1015	Professional Communication Skills for Engineers	1	0	0	1	1	-	-
Fitness and Wellness Basket									
1	DSA2001	Spirituality for Health	2	0	0	2	2	-	F
2	DSA2002	Yoga for Health	2	0	0	2	2	-	S
3	DSA2003	Stress Management and Well Being	2	0	0	2	2	-	F

Kannada Basket									
1	KAN1003	Kannada Kaipidi	3	0	0	3	3	-	S
2	KAN2003	Pradharshana Kale	1	0	2	2	3	-	S
3	KAN2004	Sahithya Vimarshe	2	0	0	2	2	-	S
4	KAN2005	Anuvadha Kala Sahithya	3	0	0	3	3	-	S
5	KAN2006	Vichara Manthana	3	0	0	3	3	-	S
6	KAN2007	Katha Sahithya Sampada	3	0	0	3	3	-	S
7	KAN2008	Ranga Pradarshana Kala	3	0	0	3	3	-	S
Foreign Language Basket									
1	FRL1004	Introduction of French Language	2	0	0	2	2	-	S
2	FRL1005	Fundamentals of French	2	0	0	2	2	-	S
3	FRL1009	Mandarin Chinese for Beginners	3	0	0	3	3	-	S
Law Basket									
1	LAW1001	Introduction to Sociology	2	0	0	2	2	-	F
2	LAW2001	Indian Heritage and Culture	2	0	0	2	2	-	F
3	LAW2002	Introdcution to Law of Succession	2	0	0	2	2	-	F
4	LAW2003	Introduction to Company Law	2	0	0	2	2	-	2
5	LAW2004	Introduction to Contracts	2	0	0	2	2	-	F
6	LAW2005	Introduction to Copy Rights Law	2	0	0	2	2	-	F
7	LAW2006	Introduction to Criminal Law	2	0	0	2	2	-	F
8	LAW2007	Introduction to Insurance Law	2	0	0	2	2	-	F
9	LAW2008	Introduction to Labour Law	2	0	0	2	2	-	F
10	LAW2009	Introduction to Law of Marriages	2	0	0	2	2	-	F
11	LAW2010	Introduction to Patent Law	2	0	0	2	2	-	F
12	LAW2011	Introduction to Personal Income Tax	2	0	0	2	2	-	F
13	LAW2012	Introduction to Real Estate Law	2	0	0	2	2	-	F
14	LAW2013	Introduction to Trademark Law	2	0	0	2	2	-	F
15	LAW2014	Introduction to Competition Law	3	0	0	3	3	-	F
16	LAW2015	Cyber Law	3	0	0	3	3	-	F
17	LAW2016	Law on Sexual Harrassment	2	0	0	2	2	-	F
18	LAW2017	Media Laws and Ethics	2	0	0	2	2	-	F
Mathematics Basket									
1	MAT2008	Mathematical Reasoning	3	0	0	3	3	-	S
2	MAT2014	Advanced Business Mathematics	3	0	0	3	3	-	S
3	MAT2041	Functions of Complex Variables	3	0	0	3	3	-	S
4	MAT2042	Probability and Random Processes	3	0	0	3	3	-	S
5	MAT2043	Elements of Number Theory	3	0	0	3	3	-	S
6	MAT2044	Mathematical Modelling and Applications	3	0	0	3	3	-	S
Mechanical Engineering Basket									
1	MEC1001	Fundamentals of Automobile Engineering	3	0	0	3	3	-	F
2	MEC1002	Introduction to Matlab and Simulink	3	0	0	3	3	-	S/EM
3	MEC1003	Engineering Drawing	1	0	4	3	5	-	S
4	MEC2001	Renewable Energy Systems	3	0	0	3	3	-	F
5	MEC2002	Operations Research & Management	3	0	0	3	3	-	F
6	MEC2003	Supply Chain Management	3	0	0	3	3	-	S/ EM/ EN
7	MEC2004	Six Sigma for Professionals	3	0	0	3	3	-	S/EM

8	MEC2005	Fundamentals of Aerospace Engineering	3	0	0	3	3	-	F
9	MEC2006	Safety Engineering	3	0	0	3	3	-	S/EM
10	MEC2007	Additive Manufacturing	3	0	0	3	3	-	F/EM
11	MEC3069	Engineering Optimisation	3	0	0	3	3	-	S/EM
12	MEC3070	Electronics Waste Management	3	0	0	3	3	-	F/S
13	MEC3071	Hybrid Electric Vehicle Design	3	0	0	3	3	-	S/EM
14	MEC3072	Thermal Management of Electronic Appliances	3	0	0	3	3	-	S/EM
15	MEC3200	Sustainable Technologies and Practices	3	0	0	3	3	-	S/EM
16	MEC3201	Industry 4.0	3	0	0	3	3	-	S/EM
Petroleum Engineering Basket									
1	PET1005	Geology for Engineers	2	0	0	2	2		
2	PET1006	Overview of Energy Industry	2	0	0	2	2		ES / HP
3	PET1007	Introduction to Energy Trading and Future Options	2	0	0	2	2		ES / HP
4	PET1008	Sustainable Energy Management	2	0	0	2	2		ES / HP
5	PET2026	Introduction to Computational Fluids Dynamics	3	0	0	3	3		HP
6	PET2028	Polymer Science and Technology	3	0	0	3	3		ES / HP
7	PET2031	Overview of Material Science	3	0	0	3	3		ES / HP
8	PET2032	Petroleum Economics	3	0	0	3	3		ES / HP
Physics Basket									
1	PHY1003	Mechanics and Physics of Materials	3	0	0	3	3		FC / SD
2	PHY1004	Astronomy	3	0	0	3	3		FC
3	PHY1005	Game Physics	2	0	2	3	4		FC / SD
4	PHY1006	Statistical Mechanics	2	0	0	2	2		FC
5	PHY1007	Physics of Nanomaterials	3	0	0	3	3		FC
6	PHY1008	Adventures in nanoworld	2	0	0	2	2		FC
7	PHY2001	Medical Physics	2	0	0	2	2		FC
8	PHY2002	Sensor Physics	1	0	2	2	3		FC / SD
9	PHY2003	Computational Physics	1	0	2	2	3		FC
10	PHY2004	Laser Physics	3	0	0	3	3		FC
11	PHY2005	Science and Technology of Energy	3	0	0	3	3		FC
12	PHY2009	Essentials of Physics	2	0	0	2	2		FC
Management Basket									
1	MGT1001	Introduction to Psychology	3	0	0	3	3	-	F
2	MGT1002	Business Intelligence	3	0	0	3	3	-	EN
3	MGT1003	NGO Management	3	0	0	3	3	-	S
1	MGT1004	Essentials of Leadership	3	0	0	3	3	-	EM/EN
2	MGT1005	Cross Cultural Communication	3	0	0	3	3	-	S/EM/ EN
3	MGT2001	Business Analytics	3	0	0	3	3	-	S/EM/ EN
4	MGT2002	Organizational Behaviour	3	0	0	3	3	-	F
5	MGT2003	Competitive Intelligence	3	0	0	3	3	-	S
6	MGT2004	Development of Enterprises	3	0	0	3	3	-	S/ EM/EN
7	MGT2005	Economics and Cost Estimation	3	0	0	3	3	-	S/EM
8	MGT2006	Decision Making Under Uncertainty	3	0	0	3	3	-	S

9	MGT2007	Digital Entrepreneurship	3	0	0	3	3	-	S/EM/ EN
10	MGT2008	Econometrics for Managers	3	0	0	3	3	-	S
11	MGT2009	Management Consulting	3	0	0	3	3	-	S/EM/ EN
12	MGT2010	Managing People and Performance	3	0	0	3	3	-	S/EM/ EN
13	MGT2011	Personal Finance	3	0	0	3	3	-	F
14	MGT2012	E Business for Management	3	0	0	3	3	-	S/EM
15	MGT2013	Project Management	3	0	0	3	3	-	EN/EM
16	MGT2014	Project Finance	3	0	0	3	3	-	EN/EM
17	MGT2015	Engineering Economics	3	0	0	3	3	-	S
18	MGT2016	Business of Entertainment	3	0	0	3	3	-	EN / EM
19	MGT2017	Principles of Management	3	0	0	3	3	-	S/EM/ EN
20	MGT2018	Professional and Business Ethics	3	0	0	3	3	-	S/EM/ EN
21	MGT2019	Sales Techniques	3	0	0	3	3	-	S/EM/ EN
22	MGT2020	Marketing for Engineers	3	0	0	3	3	-	S/EM/ EN
23	MGT2021	Finance for Engineers	3	0	0	3	3	-	S/EM/ EN
24	MGT2022	Customer Relationship Management	3	0	0	3	3	-	S/EM/ EN
25	MGT2023	People Management	3	0	0	3	3	-	S/EM/ EN
Media Studies Basket									
1	BAJ3050	Corporate Filmmaking and Film Business	0	0	4	2	4	-	EM
2	BAJ3051	Digital Photography	2	0	2	3	4	-	EM
Research URE Basket									
1	URE2001	University Research Experience	-	0	-	3	0		S/EM/ EN
2	URE2002	University Research Experience	-	0	-	0	0		S/EM/ EN

21.List of MOOC Courses

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

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

21.1.2 Massive Open Online Course (MOOC) courses maybe given for Open Elective and Discipline Elective Courses. These courses need to be approved by the concerned BOS and Academic Council from time to time.

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

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

21.1.5 For these MOOC courses faculty coordinators are identified. These faculty should have undergone similar MOOC courses and therefore should be familiar with the mode of class conduction, types of assessments and evaluation procedures.

21.1.6 Study materials shall be provided to the students as video lectures shared by the MOOCs Coordinator(s), or the students may access the approved MOOCs Portal directly. The mode of class conduction is determined by the MOOCs coordinator(s) as detailed in the Course Catalogue and Course Plan.

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

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

21.1.9 Results are evaluated by School and given to the Office of the Controller of Examinations (CoE).

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

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

21.2 MOOC - Discipline Elective Courses for B. Tech. Computer Science and Technology DevOps

Table 3.5 : MOOC Discipline Elective Courses

Sl.No	Course Code	Course Name	Credits	L-T-P-C
1	CSE3111	Artificial Intelligence: Search Methods for Problem Solving	3	3-0-0-3
2	CSE3112	Privacy and Security in Online Social Media	3	3-0-0-3
3	CSE3113	Computational Complexity	3	3-0-0-3
4	CSE3114	Deep Learning for Computer Vision	3	3-0-0-3
5	CSE3115	Learning Analytics Tools	3	3-0-0-3
6	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	CSE3430	Deep Learning for Natural Language Processing	3	3-0-0-3
27	CSE3431	Machine Learning for Engineering and Science Applications	3	3-0-0-3
28	CSE3432	Algorithms in Computational Biology and Sequence Analysis	3	3-0-0-3
29	CSE3433	Introduction to Large Language Models (LLMs)	3	3-0-0-3
30	CSE3434	Quantum Algorithms and Cryptography	3	3-0-0-3
31	CAI3430	Responsible & Safe AI Systems	3	3-0-0-3
32	CCS3416	Practical Cyber Security for Cyber Security Practitioners	3	3-0-0-3
33	IST3409	Design & Implementation of Human-Computer Interfaces	3	3-0-0-3

21.3 MOOC - Open Elective Courses for B. Tech. Computer Science and Technology DevOps

Table 3.6: MOOC Open Elective Courses
Courses duration is 4 weeks (01 credit)/ 8 weeks (02 credits)/ 12 weeks (03 credits)

Sl. No.	Course Code	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 Decisions	3	3-0-0-3
4	BBB2015	Artificial Intelligence for Investments	3	3-0-0-3
5	MEC3001	Design and Development of Product	1	1-0-0-1
6	ENG3004	Perspectives of Neurolinguistics	1	1-0-0-1
7	PPS4009	Working in Contemporary Teams	1	1-0-0-1
8	MGT3001	Data Analysis and Decision Making	3	3-0-0-3
9	MEC3001	Design and Development of Product	1	1-0-0-1
10	EEE3105	Microsensors and Nanosensors	3	3-0-0-3

11	CIV3065	Drone Systems and Cont¯rol	3	3-0-0-3
12	ECE3183	Neural Networks for Signal Processing - I	3	3-0-0-3
13	CIVXXXX	Disaster Management	3	3-0-0-3

Semester wise Grid 2023-2027 CST-DevOps

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill	Basket
Semester 1 - PHY Cycle			11	1	16	17	28		
1	MAT1001	Calculus and Linear Algebra	3	0	2	4	5	EM	School Core
2	PHY1002	Optoelectronics and Device Physics	2	0	2	3	4	F	School Core
3	ECE1001	Elements of Electronics Engineering	3	0	2	4	5	F	School Core
4	ENG1002	Technical English	1	0	2	2	3	S	School Core
5	PPS1001	Introduction to soft skills	0	0	2	1	2	S	School Core
6	CSE1004	Problem Solving Using C	1	0	4	3	5	S	School Core
7	CHE1018	Environmental Science	1	0	2	0	3	F	School Core
8	PPS1011	Introduction to Verbal Ability	0	1	0	0	1	S	School Core
Semester 2 - CHE Cycle			10	0	10	16	20		
1	MAT1003	Applied Statistics	1	0	2	2	3	EM	School Core
2	ECE2007	Digital Design	2	0	2	3	4	F	School Core
3	CIV1008	Basic Engineering Sciences	2	0	0	2	2	F	School Core
4	MEC1006	Engineering Graphics	2	0	0	2	2	F	School Core
5	CSE1001	Problem Solving using JAVA	2	0	2	3	4	S	School Core
6	ENG2001	Advanced English	1	0	2	2	3	S	School Core
7	PPS1012	Enhancing Personality Through Soft Skills	0	0	2	1	2	S	School Core
8	ECE2010	Innovative Projects using Arduino	-	-	-	1	0	S	School Core
Semester 1 - Engineering Scince Cycle (Cycle 2)			12	1	12	18	25		
1	MAT1001	Calculus and Linear Algebra	3	0	2	4	5	F	School Core
2	ECE1001	Elements of Electronics Engineering	3	0	2	4	5	F	School Core
3	ENG1002	Technical English	1	0	2	2	3	S	School Core
4	PPS1001	Introduction to soft skills	0	0	2	1	2	S	School Core

5	CSE1004	Problem Solving Using C	1	0	4	3	5	S	School Core
6	PPS1011	Introduction to Verbal Ability	0	1	0	0	1	S/ EM	School Core
7	CIV1008	Basic Engineering Sciences	2	0	0	2	2	S	School Core
8	MEC1006	Engineering Graphics	2	0	0	2	2	S	School Core
Semester 2 - Physics Cycle			8	0	16	15	24		
1	MAT1003	Applied Statistics	1	0	2	2	3	EM	School Core
2	ECE2007	Digital Design	2	0	2	3	4	F / S	School Core
3	CSE1006	Problem Solving using JAVA	1	0	4	3	5	S	School Core
4	ENG2001	Advanced English	1	0	2	2	3	S	School Core
5	PPS1012	Enhancing Personality Through Soft Skills	0	0	2	1	2	S	School Core
6	CHE1018	Environmental Science	1	0	2	0	3	F	School Core
7	PHY1002	Optoelectronics and Device Physics	2	0	2	3	4	F	School Core
8	ECE2010	Innovative Projects Using Arduino	-	-	-	1	0	S	School Core
Semester 3			21	0	28	28	33		
1	MAT1002	Transform Techniques, Partial Differential Equations and Their Applications	3	0	0	3	3	EM	School Core
2	CSE2001	Data Structures and Algorithms	3	0	2	4	5	S	School Core
3	CSE3155	Data Communications and Computer Networks	3	0	2	4	5	S	Program Core
4	CSE2009	Computer Organization and Architecture	3	0	0	3	3	S	Program Core
5	MAT2004	Discrete Mathematical Structures	3	0	0	3	3	S	School Core
6	CSE3190	Fundamentals of Data Analytics	2	0	2	3	4	S	Program Core
7	CSE2014	Software Engineering	3	0	0	3	3	S	Program Core
8	ECE2011	Innovative Projects Using Raspberry Pi	-	-	-	1	0	S	School Core
9	CSE1005	Programming in Python	1	0	4	3	5	S	Program Core
10	PPS4002	Introduction to Aptitude	0	0	2	1	2	S	School Core
Semester 4			20	0	8	23	52		

1	MAT2003	Numerical Methods for Engineers	1	0	2	2	6	EM	School Core
2	CSE2007	Design and Analysis of Algorithms	3	0	0	3	6	S	Program Core
3	CSE3156	Database Management Systems	3	0	2	4	9	S	Program Core
4	CSE3120	Operating System with Linux Internals	2	0	2	3	7	S	Program Core
5	CSE3078	Cryptography and Network Security	3	0	0	3	6	S	Program Core
6	CBCXXXX	Discipline Elective - I	3	0	0	3	6	S	Discipline Elective
7	XXXXXXX	Open Elective – I (Management Basket)	3	0	0	3	6	S	Open Elective
8	PPS4004	Aptitutde Training Intermediate	0	0	2	1	3	S	School Core
9	CSE3216	Mastering Object-Oriented Concepts in Python	0	0	2	1	3	S	School Core
Semester 5			21	0	8	26	29		
1	CDV2001	Agile Structures and Frameworks	3	0	0	3	3	S	Program Core
2	CDV2501	DevOps Tools Internals	3	0	0	3	3	S	Program Core
3	CDV2502	DevOps Tools Internals Lab	0	0	2	1	2	S	Program Core
4	CDV2503	Software Testing	3	0	0	3	3	S	Program Core
5	CDV2504	Software Testing Lab	0	0	2	1	2	S	Program Core
6	CSE2264	Essentials of AI	3	0	0	3	3	S	Program Core
7	CSE2265	Essentials of AI Lab	0	0	2	1	2	S	Program Core
8	CSE2266	Theory of Computation	3	0	0	3	3	S	Program Core
9	CDV2507	Kubernetes and Container Orchestration	3	0	0	3	3	S	Program Core
10	CDVXXXX	Discipline Elective - II	3	0	0	3	3	S	Discipline Elective
11	APT4006	Logical and Critical Thinking	0	0	2	0	2	S	School Core
12	CIV7601	Universal Human Values and Ethics	0	0	0	0	-	S	School Core
13	CSE7000	Internship	-	-	-	2	0	S	School Core
Semester 6			16	0	12	23	29		
1	CDV2508	Continuous Integration and Continuous Delivery (CI/CD) Pipelines	3	0	0	3	3	S	Program Core
2	CDV2509	Continuous Integration and Continuous Delivery (CI/CD) Pipelines Lab	0	0	2	1	2	S	Program Core
3	CDV2510	Edge Computing and DevOps	3	0	0	3	3	S	Program Core
4	CDV2511	DevSecOps	3	0	0	3	3	S	Program Core
5	CSE2262	Analysis of Algorithms	3	1	0	4	4	S	Program Core
6	CSE2263	Analysis of Algorithms Lab	0	0	2	1	2	S	Program Core
7	CDVXXXX	Discipline Elective - III	3	0	0	3	3	S	Discipline Elective
8	XXXXXXX	Open Elective – II	3	0	0	3	3	S	Open Elective
9	PPSXXXX	Industry Preparedness Program	2	0	0	0	2	S	MAC

10	CSE2274	Competitive Programming and Problem Solving	0	0	4	2	4	S	School Core
11	LAW7601	Indian Constitution	0	0	0	0	-	S	School Core
Semester 7			12	0	0	17	12		
1	CSEXXXX	Professional Elective – IV	3	0	0	3	3	S	Discipline Elective
2	CSEXXXX	Professional Elective – V	3	0	0	3	3	S	Discipline Elective
3	CSEXXXX	Professional Elective – VI	3	0	0	3	3	S	Discipline Elective
4	XXXXXXX	Open Elective – III	3	0	0	3	3	S	Open Elective
5	CSE7101	Mini Project	0	0	0	5	0	S	School Core
Semester 8			0	0	0	10	0		
1	CSE7300	Capstone Project	0	0	0	10	0	S/EM	School Core
			117	5	54	160	203		

IV. Course Catalogues:

Each course shall have a course catalogue with the following details:

i) Pre –Requisites of the course
ii) Course Description
iii) Course Outcome
iv) Course Content
iv) Reference Resources.

The Course Catalogues for the Courses offered in each basket are attached below:

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				10 CLASSES	

	Derivatives			
Review: 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 eax, sinax, cosax, eaxf(x), xnf(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				

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problem formulations, Problem Solution and system Design. Tools Used: MatLab, Zylink.
Assignment:
List at least 3 sets of Matrix Applications concerning the respective branch of Engineering and obtain the solution using MATLAB. 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 Sankara Rao, Introduction to Partial differential equations, Prentice Hall of India, edition, 2011 B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.
References: Victor Henner, Tatyana Belozerova, Mickhail Khenner, Ordinary and Partial Differential Equations, CRC Press, Edition, 2013. Walter Ledermann, Multiple integrals, Springer, 1st edition Lay, Linear Algebra ansd its applications, 3rd Ed., 2002, Pearson Education India. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition 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: ECE1001	Course Title: Elements of Electronics Engineering Type of Course: School Core Theory & Integrated Laboratory	L-T-P-C	3	0	2	4
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	Nil					
Course Description	The purpose of this course is to enable the students to learn the fundamental concepts of electronic devices and circuits. The course aims at nurturing the students with the fundamental principles of electronics engineering, prevailing in various engineering applications. The nature of the course is conceptual and analytical which imparts knowledge of electronic components and their behavior under various operating					

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	conditions. The course develops thinking skills of the students, encouraging their quest for knowledge about electronic devices and their usage in higher semester courses. The associated laboratory provides an opportunity to validate the concepts taught in theory classes and enable the students to work with basic electronic circuits using electronics components.			
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Elements of Electronics Engineering and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING .			
Course Outcomes	On successful completion of this course the students shall be able to: Identify various electrical and electronic components and basic electrical laws. Explainapplications of Diodes and BJTs. Summarize the concepts of Digital Electronics and Communication Systems. Discuss the basic concepts of microprocessorand computer organization. Perform experiments to familiarizevarious Electrical & Electronic components and equipment. Verify Basic Electrical Circuit configurations and Laws.			
Course Content:				
Module 1	Basic Electrical and Electronic Components	Assignment / Quiz	Identification of Practical electronic and electrical components / Memory Recall based Quizzes	10 Sessions
Topics: ELECTRICAL CIRCUITS AND LAWS:DC Circuits: Classification of Electrical Elements, Ohm's law, Series and Parallel Circuits, Kirchhoff's Voltage and Current laws, Power and Energy, Transformers and their types. ELECTRONIC MATERIALS AND COMPONENTS: Conductors, Insulators, Semi-Conductor Material, P-N Junction diode, Characteristics and Parameters, Ideal Diode approximations, DC load line.				
Module 2	Applications of Diodes and Introduction to BJT	Assignment / Quiz	Simulation Task/ Memory Recall based Quizzes	12 Sessions
Topics: RECTIFIERS: Half-wave rectifier, Two-diode Full-wave rectifier, Bridge rectifier, Capacitor filter circuit (only qualitative approach). ZENER DIODE: Zener diode, Zener Characteristics, Zener diode as a voltage regulator. BIPOLAR JUNCTION TRANSISTORS: BJT Construction and Operation, BJT Voltages and Currents, Common Base, Common Emitter Configuration and Characteristics, Current amplification Factor alpha and beta, DC Load line w.r.t. fixed bias circuit (Q-Point), AC Analysis.				
Module 3	Digital Electronics and Communication System	Assignment / Quiz	Simulation Task / Memory Recall based Quizzes	13 Sessions
Topics: NUMBER SYSTEMS: Decimal Number System, Binary Number System, Hexadecimal Number System, Conversions: Binary to and from Hexadecimal; Hexadecimal to and from Decimal;1's and 2's Complement of Binary Numbers, Binary Addition. BOOLEAN ALGEBRA: Boolean Laws and Theorems, De Morgan's theorem. Digital Circuits: Logic gates, NOT Gate, AND Gate, OR Gate, XOR Gate, X-NOR Gate, NAND Gate, NOR Gate. COMMUNICATION SYSTEM: Block diagram of communication system, Modulation: Definition of Modulation, Need of Modulation, Types of Modulation: Amplitude Modulation and Frequency Modulation (Waveforms only).				
Module 4	Microprocessors and	Assignment / Quiz	Memory recall based Quizzes	10

	Computer Organization			Sessions

Topics:
INTEL 8085 MICROPROCESSOR: Basic Architecture and features of 8085 Microprocessor.
COMPUTER ORGANISATION:Basic structure of Computer Organisation describing the various Computer types, Functional Units, Basic Operational concepts, Bus Structures, Memory System: RAM and ROM.

List of Laboratory Tasks:

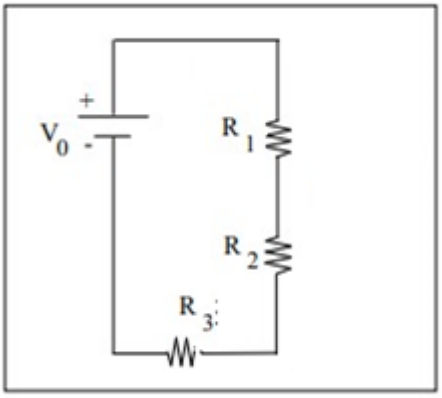
Experiment No. 1:Study of Resistors, Measuring instruments and DC Power Supply.
Level 1:Identification of resistor values from color bands and verification with Multimeter.
Level 2:Connecting a resistive circuit to a DC Power Supply and observing the input and output values using Voltmeters, Ammeters and hence calculate resistance values.

Experiment No. 2:Study of Reactive components, Multimeter, CRO and Function Generator.
Level 1:Identification of various types of capacitive and inductive components and verification with Multimeter.
Level 2:Connecting a reactive circuit to a function generator and observing the input and output waveform on CRO and calculation of Reactance and Impedance.

Experiment No. 3: Study of Ohm's Law.
Level 1:Rig up the circuit and verify Ohm's Law.
Level 2: Connect a 100Ω Resistor to a Voltage source of 0-5V. Plot a V- I graph by tabulating the Voltage Vs Current Values accordingly. Repeat the experiment for 1KΩ resistor and compare the results.

Experiment No. 4:Study of Series and Parallel Resistor Connections.
Level 1:Carry out the equivalent resistance of given four resistors 100Ω each connected in series and parallel combination using breadboard.
Level 2:Rig up a Current Divider Circuit and a Voltage Divider Circuit and verify the results.

Experiment No. 5:Study of Kirchhoff's Voltage Law and Kirchhoff's Current Law.
Level 1:Verify KVLand KCL with circuit(a) and circuit(b) with #values.



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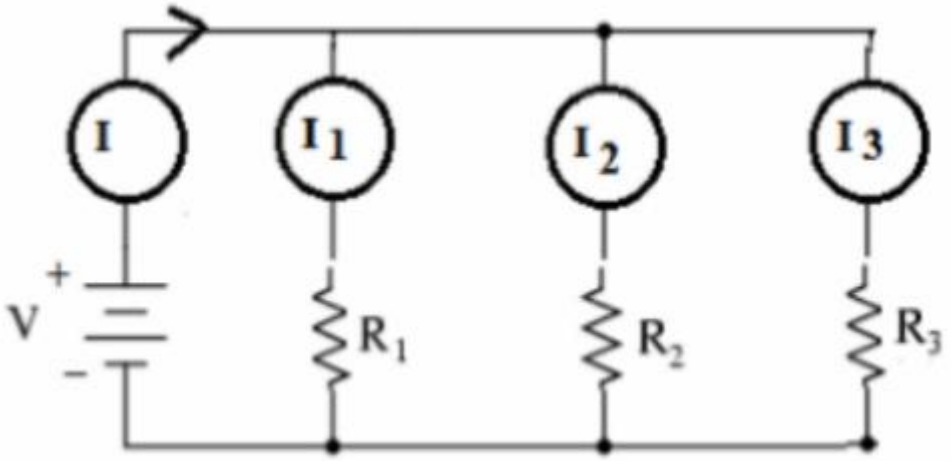
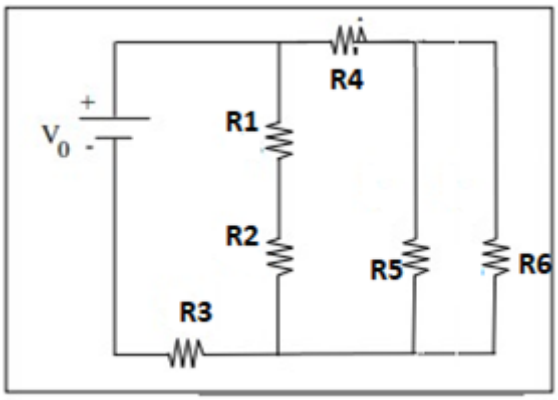


(b)

Level 2: Verify KCL with the help of given circuit having # values and carry out the equivalent resistance of the circuit by experimental and analytical methods.



Experiment No. 6: Study of PN-Junction Diode Characteristics in Forward and Reverse Bias Conditions.
Level 1:Carry out the experiment to find cut-in voltage on forward characteristics for Silicon P-N Junction diode.
Level 2: Carry out experiment to plot VI Characteristics of Silicon P-N Junction Diode in both forward and reverse biased conditions for Si P-N Junction diode.

Experiment No. 7: Study of Bipolar Junction Transistor in different regions of operation.
Level 1:Carry out the experiment to understand the importance of active, cut off and saturation regions.
Level 2: Carry out the experiment to design and analyze the operation of transistor as switch.

Experiment No. 8: Study of basic Digital Logic Gates using Integrated Chips IC's: NOT, AND, OR, XOR, NAND and NOR Gates
Level 1:Carry out the experiment to study and verify the truth table of logic gates using Digital ICs.
Level 2:Implementation of operation of a basic Boolean expression using basic gates.

Experiment No. 9: Study of Computer Organization: Identification of Components on Motherboard: CPU: Processor Chips (Processor Socket), PCI, Parallel Ports, Universal Serial Bus: USB, I/O Connectors, RAM Slots.
Level 1:Carry out the experiment to familiarize a computer system layout and mark the positions of

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SMPS, Motherboard, FDD, HDD, CD / DVD drive and add on cards.
Level 2:Study of a Desktop PC and its assembling.

Targeted Application & Tools that can be used:
Student will be able to find career opportunities in various domains such asAnalog Electronics, Digital Electronics, Microprocessors, VLSI Design, Telecommunication, Computers andWireless Communication. The students will be able to join a profession which involves basics to high level of electronic circuit design.

Professionally Used Software: MultiSim/ PSpice
Besides these software tools hardware equipment such as Multimeters, Function Generators, Power Supplies, Oscilloscopes etc., can be used to perform component/circuit testing and analysis.

Textbook(s):
T1. John Hiley, Keith Brown and Ian McKenzie Smith, "Hughes Electrical and Electronic Technology", Pearson,12th Edition
T2.William Stallings,"Computer Organization and Architecture Designing for Performance", Pearson Education, 10th Edition.

Reference(s):
Reference Book(s):
R1. Smarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", PHI, 2nd Edition
R2. D.P. Kothari, I. J. Nagrath, "Basic Electronics", McGraw Hill Education, 1st Edition
R3. Rajendra Prasad, "Fundamentals of Electronics Engineering", Cengane Learning, 3rd Edition

Online Resources (e-books, notes, ppts, video lectures etc.):
Video lectures on "BASIC ELECTRONICS" by Prof. Dr. Chitralekha Mahanta, Department of Electronics and communication Engineering, IIT Guwahati": https://nptel.ac.in/courses/117/103/117103063/
Lecture Series on " Useful Laws in Basic Electronics" by Prof. T.S.Natarajan, Department of physics, IIT Madras: https://www.youtube.com/watch?v=vfVVF58FtCc
Lecture Series on "Introduction to Bipolar Junction Transistors BJT " by All About Electronics Youtube Channel: https://www.youtube.com/watch?v=-VwPSDQmdjM&list=PLwjK_iyK4LLDoFG8FeiKAr3IStRkPSxqq
Lecture Series on " PN Junction Diode " by All About Electronics Youtube Channel: https://www.youtube.com/watch?v=USrY0JspDEg
Lecture Series on "Introduction to Digital Electronics" by All About Electronics Youtube Channel: https://www.youtube.com/watch?v=DBTna2ydmC0&list=PLwjK_iyK4LLBC_so3odA64E2MLgIRKafl
Lecture Series on "Introduction to Microprocessors" by Bharat Acharya Education :https://www.youtube.com/watch?v=0M74z5jEAyA
Lecture Notes on : "Electronic Devices", Bipolar Junction Transistors, 2nd Chapter, by Shree Krishna Khadka (PDF) Bipolar Junction Transistor (researchgate.net)https://www.researchgate.net/publication/323384291_Bipolar_Junction_Transistor
E-content:
V. Milovanovic, R. van der Toorn, P. Humphries, D. P. Vidal and A. Vafanejad, "Compact model of Zener tunneling current in bipolar transistors featuring a smooth transition to zero forward bias current," 2009 IEEE Bipolar/BiCMOS Circuits and Technology Meeting, 2009, pp. 99-102, doi: 10.1109/BIPOL.2009.5314134. https://ieeexplore.ieee.org/document/5314134
M. Oueslati, H. Garrab, A. Jedidi and K. Besbes, "The advantage of silicon carbide material in designing of power bipolar junction transistors," 2015 IEEE 12th International Multi-Conference on Systems, Signals & Devices (SSD15), 2015, pp. 1-6. https://ieeexplore.ieee.org/document/7348149
H. Luo, F. Iannuzzo, F. Blaabjerg, X. Wang, W. Li and X. He, "Elimination of bus voltage impact on

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temperature sensitive electrical parameter during turn-on transition for junction temperature estimation of high-power IGBT modules," 2017 IEEE Energy Conversion Congress and Exposition (ECCE), 2017, pp. 5892-5898 https://ieeexplore.ieee.org/document/8096974 F. Bauer, I. Nistor, A. Mihaila, M. Antoniou and F. Udrea, "Super junction IGBT Filling the Gap Between SJ MOSFET and Ultrafast IGBT," in IEEE Electron Device Letters, vol. 33, no. 9, pp. 1288-1290, Sept. 2012 https://ieeexplore.ieee.org/document/6246672 https://presiuniv.knimbus.com/user#/home
Topics relevant to "SKILL DEVELOPMENT": Electrical & Electronic component and laws, Fundamentals of Digital Electronics, Communication Systems, Microprocessors and Computer Organization for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

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: 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. 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 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: https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=553045&site=ehost-live https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=833068&site=ehost-live https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=323988&site=ehost-live https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1530910&site=ehost-live https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=486032&site=ehost-live
	Topics relevant to "SKILL DEVELOPMENT": Fundamentals of materials, Lasers and optical fibers. for Skill Development through Participative Learning Techniques. This is attained through the Assignment/ Presentation as mentioned in the assessment component in course handout.

Course Code: ECE1001	Course Title: Elements of Electronics Engineering Type of Course: School Core Theory & Integrated Laboratory	L-T-P-C	3	0	2	4
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	Nil					
Course Description	The purpose of this course is to enable the students to learn the fundamental concepts of electronic devices and circuits. The course aims at nurturing the students with the fundamental principles of electronics engineering, prevailing in various engineering applications. The nature of the course is conceptual and analytical which imparts knowledge of electronic components and their behavior under various operating conditions. The course develops thinking skills of the students, encouraging their quest for knowledge about electronic devices and their usage in higher semester courses. The associated laboratory provides an opportunity to validate the concepts taught in					

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	theory classes and enable the students to work with basic electronic circuits using electronics components.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Elements of Electronics Engineering and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING .				
Course Outcomes	On successful completion of this course the students shall be able to: Identify various electrical and electronic components and basic electrical laws. Explainapplications of Diodes and BJTs. Summarize the concepts of Digital Electronics and Communication Systems. Discuss the basic concepts of microprocessorand computer organization. Perform experiments to familiarizevarious Electrical & Electronic components and equipment. Verify Basic Electrical Circuit configurations and Laws.				
Course Content:					
Module 1	Basic Electrical and Electronic Components	Assignment / Quiz	Identification of Practical electronic and electrical components / Memory Recall based Quizzes		10 Sessions
Topics: ELECTRICAL CIRCUITS AND LAWS:DC Circuits: Classification of Electrical Elements, Ohm's law, Series and Parallel Circuits, Kirchhoff's Voltage and Current laws, Power and Energy, Transformers and their types. ELECTRONIC MATERIALS AND COMPONENTS: Conductors, Insulators, Semi-Conductor Material, P-N Junction diode, Characteristics and Parameters, Ideal Diode approximations, DC load line.					
Module 2	Applications of Diodes and Introduction to BJT	Assignment / Quiz		Simulation Task/ Memory Recall based Quizzes	12 Sessions
Topics: RECTIFIERS: Half-wave rectifier, Two-diode Full-wave rectifier, Bridge rectifier, Capacitor filter circuit (only qualitative approach). ZENER DIODE: Zener diode, Zener Characteristics, Zener diode as a voltage regulator. BIPOLAR JUNCTION TRANSISTORS: BJT Construction and Operation, BJT Voltages and Currents, Common Base, Common Emitter Configuration and Characteristics, Current amplification Factor alpha and beta, DC Load line w.r.t. fixed bias circuit (Q-Point), AC Analysis.					
Module 3	Digital Electronics and Communication System	Assignment / Quiz		Simulation Task / Memory Recall based Quizzes	13 Sessions
Topics: NUMBER SYSTEMS: Decimal Number System, Binary Number System, Hexadecimal Number System, Conversions: Binary to and from Hexadecimal; Hexadecimal to and from Decimal;1's and 2's Complement of Binary Numbers, Binary Addition. BOOLEAN ALGEBRA: Boolean Laws and Theorems, De Morgan's theorem. Digital Circuits: Logic gates, NOT Gate, AND Gate, OR Gate, XOR Gate, X-NOR Gate, NAND Gate, NOR Gate. COMMUNICATION SYSTEM: Block diagram of communication system, Modulation: Definition of Modulation, Need of Modulation, Types of Modulation: Amplitude Modulation and Frequency Modulation (Waveforms only).					
Module 4	Microprocessors and	Assignment / Quiz	Memory recall based Quizzes		10

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	Computer Organization			Sessions

Topics:
INTEL 8085 MICROPROCESSOR: Basic Architecture and features of 8085 Microprocessor.
COMPUTER ORGANISATION:Basic structure of Computer Organisation describing the various Computer types, Functional Units, Basic Operational concepts, Bus Structures, Memory System: RAM and ROM.

List of Laboratory Tasks:

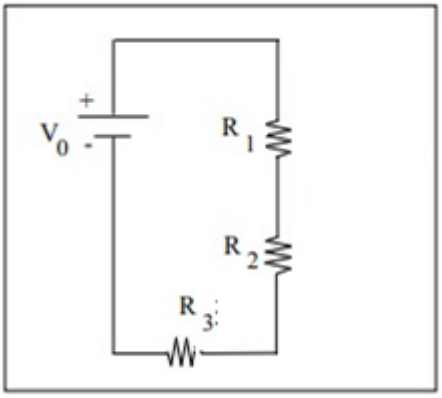
Experiment No. 1:Study of Resistors, Measuring instruments and DC Power Supply.
Level 1:Identification of resistor values from color bands and verification with Multimeter.
Level 2:Connecting a resistive circuit to a DC Power Supply and observing the input and output values using Voltmeters, Ammeters and hence calculate resistance values.

Experiment No. 2:Study of Reactive components, Multimeter, CRO and Function Generator.
Level 1:Identification of various types of capacitive and inductive components and verification with Multimeter.
Level 2:Connecting a reactive circuit to a function generator and observing the input and output waveform on CRO and calculation of Reactance and Impedance.

Experiment No. 3: Study of Ohm's Law.
Level 1:Rig up the circuit and verify Ohm's Law.
Level 2: Connect a 100Ω Resistor to a Voltage source of 0-5V. Plot a V- I graph by tabulating the Voltage Vs Current Values accordingly. Repeat the experiment for 1KΩ resistor and compare the results.

Experiment No. 4:Study of Series and Parallel Resistor Connections.
Level 1:Carry out the equivalent resistance of given four resistors 100Ω each connected in series and parallel combination using breadboard.
Level 2:Rig up a Current Divider Circuit and a Voltage Divider Circuit and verify the results.

Experiment No. 5:Study of Kirchhoff's Voltage Law and Kirchhoff's Current Law.
Level 1:Verify KVLand KCL with circuit(a) and circuit(b) with #values.



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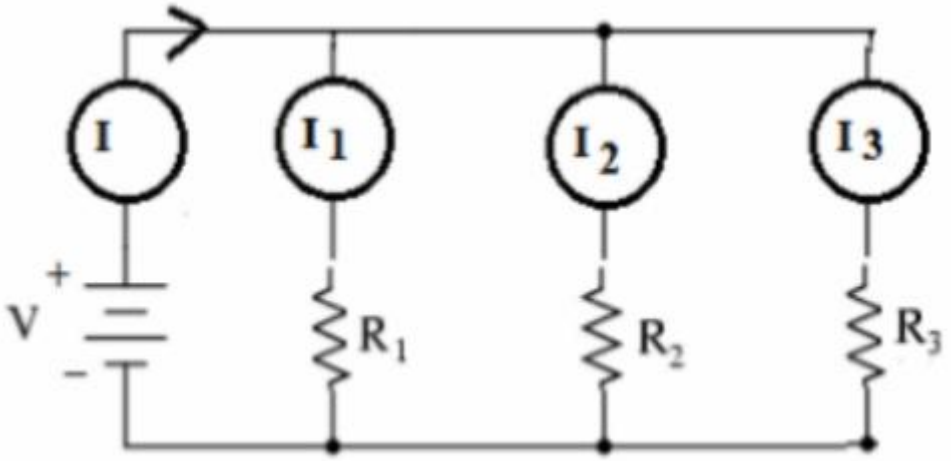
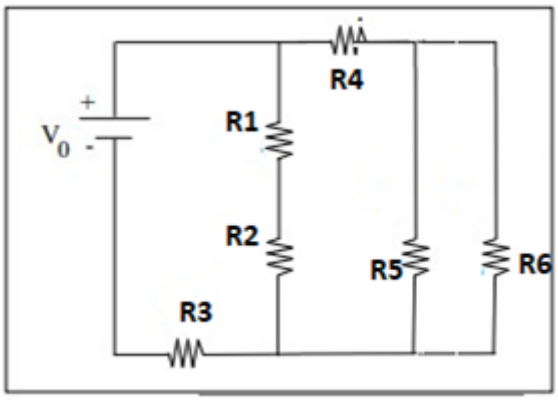


(b)

Level 2: Verify KCL with the help of given circuit having # values and carry out the equivalent resistance of the circuit by experimental and analytical methods.



Experiment No. 6: Study of PN-Junction Diode Characteristics in Forward and Reverse Bias Conditions.
Level 1:Carry out the experiment to find cut-in voltage on forward characteristics for Silicon P-N Junction diode.
Level 2: Carry out experiment to plot VI Characteristics of Silicon P-N Junction Diode in both forward and reverse biased conditions for Si P-N Junction diode.

Experiment No. 7: Study of Bipolar Junction Transistor in different regions of operation.
Level 1:Carry out the experiment to understand the importance of active, cut off and saturation regions.
Level 2: Carry out the experiment to design and analyze the operation of transistor as switch.

Experiment No. 8: Study of basic Digital Logic Gates using Integrated Chips IC's: NOT, AND, OR, XOR, NAND and NOR Gates
Level 1:Carry out the experiment to study and verify the truth table of logic gates using Digital ICs.
Level 2:Implementation of operation of a basic Boolean expression using basic gates.

Experiment No. 9: Study of Computer Organization: Identification of Components on Motherboard: CPU: Processor Chips (Processor Socket), PCI, Parallel Ports, Universal Serial Bus: USB, I/O Connectors, RAM Slots.
Level 1:Carry out the experiment to familiarize a computer system layout and mark the positions of

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SMPS, Motherboard, FDD, HDD, CD / DVD drive and add on cards.
Level 2:Study of a Desktop PC and its assembling.

Targeted Application & Tools that can be used:
Student will be able to find career opportunities in various domains such asAnalog Electronics, Digital Electronics, Microprocessors, VLSI Design, Telecommunication, Computers andWireless Communication. The students will be able to join a profession which involves basics to high level of electronic circuit design.

Professionally Used Software: MultiSim/ PSpice
Besides these software tools hardware equipment such as Multimeters, Function Generators, Power Supplies, Oscilloscopes etc., can be used to perform component/circuit testing and analysis.

Textbook(s):
T1. John Hiley, Keith Brown and Ian McKenzie Smith, "Hughes Electrical and Electronic Technology", Pearson,12th Edition
T2.William Stallings,"Computer Organization and Architecture Designing for Performance", Pearson Education, 10th Edition.

Reference(s):
Reference Book(s):
R1. Smarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", PHI, 2nd Edition
R2. D.P. Kothari, I. J. Nagrath, "Basic Electronics", McGraw Hill Education, 1st Edition
R3. Rajendra Prasad, "Fundamentals of Electronics Engineering", Cengane Learning, 3rd Edition

Online Resources (e-books, notes, ppts, video lectures etc.):
Video lectures on "BASIC ELECTRONICS" by Prof. Dr. Chitralekha Mahanta, Department of Electronics and communication Engineering, IIT Guwahati": https://nptel.ac.in/courses/117/103/117103063/
Lecture Series on " Useful Laws in Basic Electronics" by Prof. T.S.Natarajan, Department of physics, IIT Madras: https://www.youtube.com/watch?v=vfVVF58FtCc
Lecture Series on "Introduction to Bipolar Junction Transistors BJT " by All About Electronics Youtube Channel: https://www.youtube.com/watch?v=-VwPSDQmdjM&list=PLwjK_iyK4LLDoFG8FeiKAr3IStRkPSxqq
Lecture Series on " PN Junction Diode " by All About Electronics Youtube Channel: https://www.youtube.com/watch?v=USrY0JspDEg
Lecture Series on "Introduction to Digital Electronics" by All About Electronics Youtube Channel: https://www.youtube.com/watch?v=DBTna2ydmC0&list=PLwjK_iyK4LLBC_so3odA64E2MLgIRKafl
Lecture Series on "Introduction to Microprocessors" by Bharat Acharya Education :https://www.youtube.com/watch?v=0M74z5jEAyA
Lecture Notes on : "Electronic Devices", Bipolar Junction Transistors, 2nd Chapter, by Shree Krishna Khadka (PDF) Bipolar Junction Transistor (researchgate.net)https://www.researchgate.net/publication/323384291_Bipolar_Junction_Transistor
E-content:
V. Milovanovic, R. van der Toorn, P. Humphries, D. P. Vidal and A. Vafanejad, "Compact model of Zener tunneling current in bipolar transistors featuring a smooth transition to zero forward bias current," 2009 IEEE Bipolar/BiCMOS Circuits and Technology Meeting, 2009, pp. 99-102, doi: 10.1109/BIPOL.2009.5314134. https://ieeexplore.ieee.org/document/5314134
M. Oueslati, H. Garrab, A. Jedidi and K. Besbes, "The advantage of silicon carbide material in designing of power bipolar junction transistors," 2015 IEEE 12th International Multi-Conference on Systems, Signals & Devices (SSD15), 2015, pp. 1-6. https://ieeexplore.ieee.org/document/7348149
H. Luo, F. Iannuzzo, F. Blaabjerg, X. Wang, W. Li and X. He, "Elimination of bus voltage impact on

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temperature sensitive electrical parameter during turn-on transition for junction temperature estimation of high-power IGBT modules," 2017 IEEE Energy Conversion Congress and Exposition (ECCE), 2017, pp. 5892-5898 https://ieeexplore.ieee.org/document/8096974 F. Bauer, I. Nistor, A. Mihaila, M. Antoniou and F. Udrea, "Super junction IGBT Filling the Gap Between SJ MOSFET and Ultrafast IGBT," in IEEE Electron Device Letters, vol. 33, no. 9, pp. 1288-1290, Sept. 2012 https://ieeexplore.ieee.org/document/6246672 https://presiuniv.knimbus.com/user#/home
Topics relevant to "SKILL DEVELOPMENT": Electrical & Electronic component and laws, Fundamentals of Digital Electronics, Communication Systems, Microprocessors and Computer Organization for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: ENG1002	Course Title: Technical English Type of Course:1] School Core 2] Laboratory integrated		L-T-P-C	1-0-2-2
Version No.	V. 3			
Course Pre-requisites	Intermediate Level English			
Course Anti-requisites	NIL			
Course Description	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.			
Course Objectives	The objective of this course is to develop the learners' EMPLOYABILITY SKILLS by using EXPERIENTIAL LEARNING and PARTICIPATIVE LEARNING TECHNIQUES.			
Course Outcomes	On successful completion of the course, the students shall be able to: Develop proficiency in using technical vocabulary and terminology. Apply language skills for better speaking skills in technical fields. Write technical descriptions Demonstrate writing skills in writing technical documents such as reports, manuals, and articles.			
Course Content:				
Module 1	Fundamentals of Technical Communication	Worksheets& Quiz	Vocabulary building	9 Classes

Introduction to Technical English Differences between Technical English and General English Technical Writing Basics Technical Vocabulary				
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: Module-1 Level 1: Worksheets Level 2: Worksheets Module 2 Level 1: Preparing Presentation Level 2: Giving Presentation (Individual) Module-3 Level 1: Product Description & User Manual Level 2: Process Description & Transcoding Module 4 Level 1: Email Writing Level 2: Report Writing				
Targeted Applications & Tools that can be used: Flipgrid Quizzes Youtube Videos				

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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. Presentation Describing a product/process Individual Reports
Text Books Kumar, Sanjay; Pushpalatha. English Language and Communication Skills for Engineers. Oxford University Press. 2018. 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: CSE1004	Course Title: Problem Solving Using C Type of Course: School Core Lab Integrated.	L-T-P-C	1	0	4	3

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Version No.	1.0			
Course Pre-requisites	NIL			
Anti-requisites	NIL			
Course Description	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. ACAlso by learning the basic programming constructs they can easily switch over to any other language in future.			
Course Object	The objective of the course is to familiarize the learners with the concepts of Problem Solving Using C and attain Employability through Problem Solving Methodologies.			
Course Outcomes	On successful completion of this course the students shall be able to: 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.			
Course Content:				
Module 1	Introduction to C Language	Quiz	Problem Solving	9 Hrs.
Topics: Introduction to Programming – Algorithms – Pseudo Code - Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.				
Module 2	Introduction to Arrays and Strings	Quiz	Problem Solving	9 Hrs.
Topics: Arrays: Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs – Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs – Matrix operations. Strings: Introduction – Declaring and Initializing String Variables – Reading Strings from Terminal – Writing String to Screen – String Handling Functions.				
Module 3	Functions and Pointers	Quiz	Problem Solving	9 Hrs.
Topics: Functions: Introduction – Need for User-defined functions – Elements of User-Defined Functions: declaration, definition and function call–Categories of Functions – Recursion. Pointers: Introduction – Declaring Pointer Variables – Initialization of Variables – Pointer Operators – Pointer Arithmetic – Arrays and Pointers – Parameter Passing: Pass by Value, Pass by Reference.				
Module 4	Structures and Union	Quiz	Problem Solving	9 Hrs.

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Topics: Structures: Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Members – Array of Structures – Arrays within Structures – Union: Introduction – Defining and Declaring Union – Difference Between Union and Structure.				
Module 5	File handling	Case Study	Problem Solving	9 Hrs.
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) Programs using IO Statements, Conditional Statements and Looping Statements 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): Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015 Schildt Herbert, “C: The Complete Reference”, Tata McGraw Hill Education, 4th Edition, 2014. 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						

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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

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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.

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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 G. 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.

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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=DO AB_1_06082022_18126

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AB_1_06082022_8761

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AJ_1_02082022_3333

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AB_1_06082022_3063

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AB_1_06082022_20719

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AB_1_06082022_16824

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AB_1_06082022_3954

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AB_1_06082022_491

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CU STOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_488

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CU STOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_583

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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=TE XTBOOK_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.

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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				
Individual Assessment 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.				

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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.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Problem Solving Using C and attain Employability through Problem Solving Methodologies.					
Course Outcomes	On successful completion of this course the students shall be able to: 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.					
Course Content:						
Module 1	Introduction to C Language	Quiz	Problem Solving	9 Hrs.		
Topics: Introduction to Programming – Algorithms – Pseudo Code - Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.						
Module 2	Introduction to Arrays and Strings	Quiz	Problem Solving	9 Hrs.		
Topics: Arrays: Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs – Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs – Matrix operations. Strings: Introduction – Declaring and Initializing String Variables – Reading Strings from Terminal – Writing String to Screen – String Handling Functions.						
Module 3	Functions and Pointers	Quiz	Problem Solving	9 Hrs.		
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.						

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Module 4	Structures and Union	Quiz	Problem Solving	9 Hrs.
Topics: Structures: Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Members – Array of Structures – Arrays within Structures – Union: Introduction – Defining and Declaring Union – Difference Between Union and Structure.				
Module 5	File handling	Case Study	Problem Solving	9 Hrs.
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): Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015 Schildt Herbert, “C: The Complete Reference”, Tata McGraw Hill Education, 4th Edition, 2014. 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: PPS 1011	Course Title: Introduction to Verbal Ability Type of Course: Theory Only Course	L- T- P- C	0	1	0	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					

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Course Description	This course is designed to enable students understand the importance of Verbal Ability and improve confidence, communication and professional skills to give them a competitive advantage and increase chances of success in the professional world. The course will benefit learners in presenting themselves effectively through various worksheets and learning methodologies.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of "Verbal Ability" 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 verbal ability CO2: Utilize the rules of communication CO3: Apply techniques of vocabulary buildingto showcase effective communication		
Course Content:			
Module 1	INTRODUCTION TO VERBAL ABILITY	Individual Assessment	01 Hour
Topics: Setting Expectations, Ice Breaker, Significance of verbal ability, pre-assessment			
Module 2	EFFECTIVE VERBAL COMMUNICATION	Practice Worksheets	06 Hours
Topics: Different rules of grammar and application, Subject-Verb Agreement, Tenses			
Module 3	VOCABULARY BUILDING	Practice Worksheets	04 Hours
Topics: Root words, Synonyms and antonyms, analogies, para-jumbles			
Module 4	READING COMPREHENSION	Individual Assessment	02 Hours
A session where students will be introduced to speed reading and comprehension, post-assessment			
Targeted Application & Tools that can be used: LMS			
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course			
Individual Assessment LMS MCQ			

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The topics related to Skill Development: Communication, grammar rules, vocabulary building, effective presentation for skill development through participative learning techniques. This is attained through learning and practicing the rules of effective communication through worksheets as mentioned in the assessment component.

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						

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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 Ronald E Walpole, Raymond H Myers, Sharon L Myers, and Keying E Ye, Probability and Statistics for Engineers and Scientists, Pearson Education, 2016.				
References James T. McClave, P. George Benson and Terry Sincich, Statistics for Business and Economics, 2018. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Essentials of Modern Business Statistics with Microsoft Excel, 2020. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Essentials of Statistics for Business and Economics, 2019. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, John Wiley and Sons, 2018. Richard A. Johnson, Miller and Freund's Probability and Statistics for Engineers, 2018. 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: ECE2007	Course Title: Digital Design Type of Course: Theory &Integrated Laboratory	L- T-P- C	2	0	2	3
Version No.	2.0					
Course Pre-requisites	[1] Elements of Electronics/Electrical Engineering, 2] Basic concepts of number representation, Boolean Algebra					
Anti-requisites	NIL					

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<table>
<tr><td>Course Description</td><td colspan="4">The purpose of this course is to enable the students to appreciate the fundamentals of digital logic circuits and Boolean algebra focusing on both combinational and sequential logic circuits. The course emphasizes on minimization techniques for making canonical and low-cost digital circuit implementations. This course deals with analysis and design of digital electronic circuits. The course also creates a foundation for future courses which includes Computer Architecture, Microprocessors, Microcontrollers, and Embedded Systems etc.
The course enhances the Design, Implementation and Programming abilities through laboratory tasks. The associated laboratory provides an opportunity to verify the theoretical knowledge.</td></tr>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of Digital Design and attain the SKILL DEVELOPMENT through EXPERIENTIAL LEARNING.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">On successful completion of this course the students shall be able to:
Describe the concepts of number systems, Boolean algebra and logic gates.
Apply minimization techniques to simplify Boolean expressions.
Demonstrate the Combinational circuits for a given logic
Demonstrate the Sequential and programmable logic circuits
Implement various combinational and sequential logic circuits using gates.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Fundamentals of Number systems- Boolean algebra and digital logic</td><td>Application Assignment</td><td>Data Analysis task</td><td>06 classes</td></tr>
<tr><td colspan="5">Topics:
Review of Number systems and logic gates, Number base conversions, Overview of Boolean functions and simplifications, two, three, four variable K-Maps- Don’t care conditions- Both SOP and POS- Universal Gates (NAND & NOR) Implementations. Introduction to HDL.</td></tr>
<tr><td>Module 2</td><td>Boolean function simplification</td><td>Application Assignment</td><td>Data Analysis task</td><td>08 Classes</td></tr>
<tr><td colspan="5">Topics:
Introduction to Combinational circuits, Analysis, Design procedure, Binary Adder and Subtractor, Magnitude comparator, Parity generator and checker, Multiplexers-Demultiplexers, Decoders, Encoders and Priority Encoders, HDL Models of combinational circuits.</td></tr>
<tr><td>Module 3</td><td>Combinational Logic circuits:</td><td>Application Assignment</td><td>Programming Task & Data Analysis task</td><td>08 Classes</td></tr>
<tr><td colspan="5">Topics:
Introduction to sequential circuits, Storage elements: latches and flip flops, Characteristic tables and equations, excitation table, Analysis of clocked sequential circuits, Mealy & Moore Models of finite state machines - Registers & Counters. HDL Models of Sequential circuits.</td></tr>
<tr><td colspan="5">List of Laboratory Tasks:
Experiment N0 1: Verify the Logic Gates truth table
Level 1: By using Digital Logic Trainer kit
Level 2: By using Analog devices like RPS, Volt meter, Resistors and ICs

Experiment No. 2: Verify the Boolean Function and Rules
Level 1: By using Digital Logic Trainer kit</td></tr>
</table>

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Level 2: By using Analog devices like RPS, Volt meter, Resistors and ICs

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

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

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

Experiment No. 6: Study of Flip flops

Experiment No. 7: Design and Implementations of sequential logic circuit for specifications
Level 1: Specifications given in the form of Truth table
Level 2: Specification should be extracted from the given scenario

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

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

Targeted Application & Tools that can be used:

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

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

Text Book(s):
Mano, M. Morris and Ciletti Michael D., "Digital Design", Pearson Education, 6th edition

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

Reference(s):
Reference Book(s):
R1. Jain, R. P., "Modern Digital Electronics", McGraw Hill Education (India), 4th Edition

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

Online Resources (e-books, notes, ppts, video lectures etc.): Book Free Download (studymaterialz.in)
eBook1: Mano, M. Morris and Ciletti Michael D., "Digital Design", Pearson Education.
{[PDF] Digital Design By M. Morris Mano, Michael D Ciletti Book Free Download
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eBook2:Floyd “DIGITAL LOGIC DESIGN” fourth edition- ePub, eBook- [PDF] DIGITAL LOGIC DESIGN FOURTH EDITION FLOYD | abri.engenderhealth.org. NPTEL Course- NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits Digital Logic Design PPT Slide 1 (iare.ac.in) Lab Tutorial: Multisim Tutorial for Digital Circuits - Bing video CircuitVerse - Digital Circuit Simulator online Learn Logisim➠ Beginners Tutorial | Easy Explanation! - Bing video Digital Design 5: LOGISIM Tutorial & Demo 7. https://presiuniv.knimbus.com/user#/home E-content: Z. Xin-Li and W. Hong-Ying, "The Application of Digital Electronics in Networking Communication," 2016 Eighth International Conference on Measuring Technology and Mechatronics Automation (ICMTMA), 2016, pp. 684-687, doi: 10.1109/ICMTMA.2016.168. An encoding technique for design and optimization of combinational logic circuit DipayanBhadra;Tanvir Ahmed Tarique;Sultan Uddin Ahmed;Md. Shahjahan;KazuyukiMurase2010 13th International Conference on Computer and Information Technology (ICCIT) A. Matrosova and V. Provkin, "Applying Incompletely Specified Boolean Functions for Patch Circuit Generation," 2021 IEEE East-West Design & Test Symposium (EWDTS), 2021, pp. 1-4, doi: 10.1109/EWDTS52692.2021.9581029. A. Matrosova, V. Provkin and E. Nikolaeva, "Masking Internal Node Faults and Trojan Circuits in Logical Circuits," 2019 IEEE East-West Design & Test Symposium (EWDTS), 2019, pp. 1-4, doi: 10.1109/EWDTS.2019.8884434.
Topics relevant to “SKILL DEVELOPMENT”: Adders, Multiplexers, Decoders / Encoders; Flip-Flops, Counters and Registers for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: 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.					

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<table>
<tr><td>Course Outcomes</td><td colspan="4">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.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to various fields in Civil Engineering</td><td>Assignment</td><td>Case studies on different Civil Engineering Projects</td><td>6 Sessions</td></tr>
<tr><td colspan="5">Topics: Introduction to Civil Engineering: Definition, scope and branches of Civil Engineering, Role of Civil Engineer, Overview of Infrastructure.</td></tr>
<tr><td>Module 2</td><td>Current Trends and Evolution in Civil Engineering</td><td>Assignment</td><td>Article Review</td><td>6 Sessions</td></tr>
<tr><td colspan="5">Topics: Mechanization in Construction, Application of Digital Technologies in Planning, Design, execution, monitoring and maintenance of Construction. Overview of Smart Cities.</td></tr>
<tr><td>Module 3</td><td>Power Production and Consumption Machinery</td><td>Assignment & Quiz</td><td>Data Collection</td><td>6 Sessions</td></tr>
<tr><td colspan="5">Topics: Energy and its types, Engines and their applications, Pumps-Compressors and their applications.</td></tr>
<tr><td>Module 4</td><td>Overview of Petroleum Engineering</td><td>Assignment & Quiz</td><td>Article Review</td><td>6 Sessions</td></tr>
<tr><td colspan="5">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</td></tr>
<tr><td>Module 5</td><td>Industry 4.0</td><td>Assignment & Quiz</td><td>Data Collection</td><td>6 Sessions</td></tr>
<tr><td colspan="5">Topics: Conventional manufacturing process: Metal forming, metal removal and metal joining process.
Modern Manufacturing process: 3D Printing / Additive Manufacturing.</td></tr>
<tr><td colspan="5">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</td></tr>
<tr><td colspan="5">Project work/Assignment:</td></tr>
<tr><td colspan="5">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)</td></tr>
</table>

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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 K.P. Roy, S.K. Hajra Choudhury, Nirjhar Roy, "Elements of Mechanical Engineering", Media Promoters and Publishers Pvt Ltd, Mumbai. Nontechnical Guide to Petroleum Geology, Exploration, Drilling & Production by Norman J. Hyne, PennWell Books; 3rd Revised edition Web-resources: Basic Civil Engineering https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2706932&site=ehost-live Post-parametric Automation in Design and Construction https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1155197&site=ehost-live Smart Cities : Introducing Digital Innovation to Cities https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1993146&site=ehost-live 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 Mechanical Engineering https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO106_REDO_1705 Additive Manufacturing: Opportunities, Challenges, Implications https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1134464&site=ehost-live Society of Petroleum Engineers (SPE) https://www.spe.org/en/ 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 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

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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: Demonstrate competency of Engineering Graphics as per BIS conventions and standards. Comprehend the theory of projection for drawing projections of Points, Lines and Planes under different conditions. Prepare multiview orthographic projections of Solids by visualizing them in different positions. 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

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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:
K.R. Gopalakrishna, “Engineering Graphics”, Subhash Publishers, Bangalore.

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

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.

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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”: Static Polymorphism Method overloading, constructors constructor overloading this keyword static keyword and Inner classes 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-requisites	ENG1002 Technical English					
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: Develop a critical and informed response reflectively, analytically, discursively, and creatively to their reading. Communicate effectively, creatively, accurately and appropriately in their writing. Deliver technical presentations 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						

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Writing Effective Application Letter Creating a Professional Portfolio		
Course Content: Practical Sessions		
Module 1	Critical Reasoning and Writing	8 Classes
Reading and Analyzing Level 1 – Annotation Level 2 - Assumptions Writing Narrative Essays Level 1 – Draft 1 Level 2 – Draft 2		
Module 2	Technical Presentation	10 Classes
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 Technical Group Presentation		
Module 3	Writing Reviews	Classes
Practice Worksheets Level 1 – Eliminating the Passive Voice Level 2 – Simple, compound and complex sentences Writing Short Film Reviews		
Module 4	Starting your Career	Classes
Collaborative Project Job search and writing report Writing Resume		
Module 1-4	Academic Journal	2 Classes
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 Hering, Heik. How to Write Technical Reports: Understanding Structure, Good Design, Convincing Presentation. Springer. Johnson, Richard. (2010) Technical Communication Today. Pearson, 2015		

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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. The Princeton Review. (2010) MCAT Verbal Reasoning & Writing. The Princeton Review, Inc. https://www.hitbullseye.com/Strong-and-Weak-Arguments.php Accessed on 10 Dec 2021 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: ECE2010	Course Title: Innovative Projects using Arduino	L- T-P- C	-	-	-	1
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 Explain the main features of the Arduino prototype board Demonstrate the hardware interfacing of the peripherals to Arduino system. Understand the types of sensors and its functions 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 Sessions
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				

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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.):

Arduino trending Projects < https://www. https://projecthub.arduino.cc/>

Introduction to Arduino < https://onlinecourses.swayam2.ac.in/aic20_sp04/preview>

Case studies on Wearable technology< https://www.hticiitm.org/wearables>

E-content:

Cattle Health Monitoring System Using Arduino and IOT (April 2021| IJIRT | Volume 7 Issue 11 | ISSN: 2349-6002)

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.

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.

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: **PPS1012**	**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					

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<table>
<tr><td>Course Description</td><td colspan="3">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.</td></tr>
<tr><td>Course Objective</td><td colspan="3">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.</td></tr>
<tr><td>Course Out Comes</td><td colspan="3">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)</td></tr>
<tr><td>Course Content:</td><td colspan="3"></td></tr>
<tr><td>Module 1</td><td>Professional Brand Building</td><td>Brand Framework Activity</td><td>6 Hours</td></tr>
<tr><td colspan="4">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</td></tr>
<tr><td>Module 2</td><td>Art of Questioning</td><td>Role plays</td><td>4 Hours</td></tr>
<tr><td colspan="4">Topics: Framing Questions, 5W1H Technique, Open-ended and Close-ended questions, Funnel technique, Probing questions, Leading questions</td></tr>
<tr><td>Module 3</td><td>Presentation Skills</td><td>Practice and evaluation of individual/group presentation</td><td>12 Hours</td></tr>
<tr><td colspan="4">Topics: Content development, Delivery techniques, Audience Analysis, Timing and Pacing, handling questions and challenges.

Activity: Individual presentations or team presentation</td></tr>
<tr><td>Module 4</td><td>Team Building</td><td>Team building activities</td><td>6 Hours</td></tr>
</table>

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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			

Course Code: MAT1002	Course Title: Transform Techniques, Partial Differential Equations and Their Applications Type of Course: School Core	L-T-P- C	3	0	0	3
Version No.	2.0					
Course Pre-requisites	MAT1001 - Linear Algebra and Calculus					
Anti-requisites	NIL					
Course Description	This course aims to introduce various transform techniques such as Laplace transform, Fourier transform and Z transform in addition to expressing functions in terms of Fourier series. The course covers applications of Laplace transform to LCR circuits and solution of difference equations using z-transform. The course also deals with the analytical methods for solving partial differential equations and the classical applications of partial differential equations.					

Course Objective	The objective of the course is Skill Development of student by using Problem Solving Techniques.			
Course Outcomes	On successful completion of this course the students shall be able to: CO-1: Express functions in terms of uniformly convergent Fourier series. CO-2: Apply Laplace transform technique to solve differential equations. CO-3: Employ z-transform technique to solve difference equations. CO-4: Solve a variety of partial differential equations analytically.			
Course Content:				
Module 1	Fourier Series			10 CLASSES
Fourier series: Fourier series - Euler's formulae - Dirichlet's conditions - Change of Interval - half range series – RMS value – Parseval's identity – Computation of harmonics. Engineering Applications of Fourier series.				
Module 2	Integral Transforms			15 Classes
Laplace Transform: Definition and Laplace transforms of elementary functions. Properties of Laplace transform. Laplace transform of periodic function, unit-step function and impulse function and the related problems. Inverse Laplace transform of standard functions and problems, initial and final value theorems. Convolution theorem, solution of linear ordinary differential equations, LCR circuit problems. Fourier Transform: Integral transforms, infinite Fourier transforms, Fourier sine and cosine transforms, inverse Fourier transforms. Engineering Applications of Fourier transform.				
Module 3	Z Transform and Difference Equations			8 Classes
Definition of Z-transform, Z transforms of standard functions and the related problems, standard inverse Z transforms and problems, computation of inverse Z-transform by partial fraction and convolution methods, solution of difference equations using Z-transforms. Business and Engineering Applications of Z transform.				
Module 4	Partial Differential Equations			12 Classes
Partial Differential Equations: Formation of PDEs, solution of non-homogeneous PDEs by direct integration, solution of homogeneous PDEs involving derivatives with respect to only one independent variable, method of separation of variables, solution of the Lagrange's PDE of the type Pp + Qq = R. Applications of PDEs: Various possible solutions of the one dimensional wave and heat equations by the method of separation of variables, D'Alembert's solution of the wave equation, solution of related boundary value problems.				
Targeted Applications & Tools that can be used: Applications to electrical engineering, vibrational analysis, acoustics, optics, signal processing, image processing, quantum mechanics, econometrics and shell theory by means of Fourier Series and integral transforms. Opens up new approaches in terms of Z-transform to solving one of the central problems				

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of modern science involving difference equations. Finding the solutions of boundary value problems involving PDEs with reference to wave, heat, and Laplace equations.
Assignment: Mention the Type of Project /Assignment proposed for this course
Two Assignments based on the applications of the concepts leading to a minimum of 5 engineering problems from a common pool of problems.
Text Book Erwin Kreyszig, 2017: " Advanced Engineering Mathematics", 10th Edition, John Wiley.
References: B. S. Grewal, 2017: "Higher Engineering Mathematics" 45th Edition, Khanna Publishers. Peter V O'Neil, 2015: "Advanced Engineering Mathematics", 7th Edition, Cengage Learning. Glyn James, 2016: "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education. Michael D. Greenberg, 2018: "Advanced Engineering Mathematics", 2nd Edition, Pearson Education.
Topics relevant to the development of Foundation Skills: All the solution methods. Topics relevant to development of Employability skills: Use of relevant scientific application packages.

Course Code: CSE2001	Course Title: Data Structures and Algorithms Type of Course: Integrated	L- T-P- C	3-0-2-4
Version No.	1.0		
Course Pre-requisites	Problem Solving Using Java		
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 to familiarize the learners with the concepts of Data Structures and Algorithms and attain Skill Development through Experiential Learning techniques.		
Course Out C omes	On successful completion of the course the students shall be able to: CO1: Implement program for given problems using fundamentals of data structures. [Application] CO2: Apply an appropriate linear data structure for a given scenarios. [Application] CO3: Apply an appropriate non-linear data structure for a given scenarios. [Application] CO4: Explain the performance analysis of given searching and sorting algorithms.		

Course Content:				
Module 1	Introduction to Data Structure and Linear Data Structure – Stacks and Queues	Assignment	Program activity	18 Sessions
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	17 Sessions
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, Programming examples.				
Module 3	Non-linear Data Structures - Trees and Graph	Assignment	Program activity	15 Sessions
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. Graph - Basic Concept of Graph Theory and its Properties, Representation of Graphs.				
Module 4	Searching & Sorting Performance Analysis	Assignment	Program activity	14sessions
Topic: Sorting & Searching - Sequential and Binary Search, Sorting – Selection and Insertion sort. Performance Analysis - Time and space analysis of algorithms – Average, best and worst case analysis.				
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 Exercises on Queues and its operations with conditions Level 2: - Lab sheet -5 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 -6 Level 1: - Level 2: Programming scenario based application using Linked List Lab sheet -7				

Level 1: Programming Exercises on factorial of a number
Level 2: Programming the tower of Hanoi using recursion
Lab sheet -8
Level 1: -
Level 2: Programming the tower of Hanoi using recursion
Lab sheet -9
Level 1: Programming Exercise on Doubly linked list and its operations
Level 2: -
Lab sheet -10
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 -11
Level 1: Program to Implement the Linear Search & Binary Search
Level 2: Program to Estimate the Time complexity of Linear Search
Lab sheet -12
Level 1: Program to Implement and Estimate the Time complexity of Insertion Sort
Level 2: Program to Implement and Estimate the Time complexity of Insertion Sort
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 Selection Sort

Targeted Application & Tools that can be used
Use of PowerPoint software for lecture slides and use of Ubuntu for lab programs to execute. Tool is Codetantra tool.

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 Narasimha Karumanchi: "Data Structures and Algorithms Made Easy in Java", 5th Edition, CareerMonk Publications, 2017.

References
R1 Mark Allen Weiss: "Data Structures and Algorithm Analysis in Java", 4th Edition, Pearson Educational Limited, 2014.
R2 Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser: "Data Structures and Algorithms in Java", 6th Edition, John Wiley & Sons, Inc., ISBN: 978-1-118-77133-4, 2014.
R3 Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, 2017: "Introduction to Algorithms", 3rd Edition, PHI Learning Private Limited.
Web resources:
For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview
For Lab : codetantra tool
https://puniversity.informaticsglobal.com/login

Topics relevant to "SKILL DEVELOPMENT": Linked list and its type, Tree traversal and hashing tables for Skill Development through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.

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Course Code: CSE3155	Course Title: Data Communications and Computer Networks Type of Course: Program Core Theory–Laboratory integrated		L-T-P-C 3-0-2-4	3	0	2	4
Version No.	1.0					
Course Pre-requisites	Digital Design					
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 Out Comes	On successful completion of the course, the students shall be able to: 1] I llustrate 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	07 Classes		

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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 Classes
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 – CO 3	Assignment	Problem Solving	10 Classes
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 Classes
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.				
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				

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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.

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Text Book Behrouz A. Forouzan, “Data Communications and Networking 5E”, 5th Edition, Tata McGraw-Hill, 2017. Andrew S Tanenbaum, Nick Feamster & David J Wetherall, “Computer Networks” Sixth Edition, Pearson Publication, 2022
References “Computer Networking: A Top-Down Approach”, Eighth Edition, James F. Kurose, Keith W. Ross, Pearson publication, 2021. William Stallings, Data and Computer Communication, 8th Edition, Pearson Education, 2007. 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 https://puniversity.informaticsglobal.com/login

Course Code: CSE2009	Course Title: Computer Organization and Architecture	L-T- P- C	3-0-0-3
Version No.	2.0		
Course Pre-requisites	CSE 2015 Digital Design		
Anti-requisites	NIL		

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<table>
<tr><td>Course Description</td><td colspan="4">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.</td></tr>
<tr><td>Course Objective</td><td colspan="4">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.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">On successful completion of the course the students shall be able to:
1] Describe the basic components of a computer, their interconnections, and instruction set architecture [Comprehension]
2] Apply appropriate techniques to carry out selected arithmetic operations
3] Explain the organization of memory and processor sub-system</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Basic Structure of computers</td><td>Assignment</td><td>Data Analysis task</td><td>12 Classes</td></tr>
<tr><td colspan="5">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.</td></tr>
<tr><td>Module 2</td><td>Instruction Set Architecture and Memory Unit</td><td>Assignment</td><td>Analysis, Data Collection</td><td>12 Classes</td></tr>
<tr><td colspan="5">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.</td></tr>
<tr><td>Module 3</td><td>Arithmetic and Input/output Design</td><td>Case Study</td><td>Data analysis task</td><td>10 Classes</td></tr>
<tr><td colspan="5">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</td></tr>
<tr><td>Module 4</td><td>BPU and Pipelining</td><td>Assignment</td><td>Analysis, Data Collection</td><td>11 Classes</td></tr>
<tr><td colspan="5">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.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:</td></tr>
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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

Text Book
Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", Fifth Edition, McGraw-Hill Higher Education, 2016 reprint.

References

William Stallings, "Computer Organization & Architecture – Designing for Performance", 11th Edition, Pearson Education Inc., 2019

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:
NPTEL Course on "Computer architecture and organization" IIT Kharagpur By Prof. Indranil Sengupta, Prof. Kamalika Datta. https://nptel.ac.in/courses/106105163
NPTEL Course on "Computer Organization", IIT Madras By Prof. S. Raman. https://nptel.ac.in/courses/106106092
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: MAT2004	Course Title: Discrete Mathematical Structures Type of Course: Program Core	L-T- P-C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Nil					
Anti-requisites	Nil					
Course Description	The course provides insights into the fundamental aspects of mathematical logic and predicate calculus. The course delves deeply into the concepts of algebraic structures, lattices and Boolean algebras which are widely used in computer science and engineering. It also highlights the principles of counting techniques and their applications.					

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Course Objective	The objective of the course is Skill Development of student by using Problem Solving Techniques.			
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: Comprehend the basic principles of set theory and different types of relations. CO3: Elucidate the concepts of lattices and Boolean algebra. CO4: Deploy the counting techniques to tackle combinatorial problems.			
Course Content:				
Module 1	Mathematical Logic and Predicate Calculus			12 classes
Propositional Logic, Propositional Logic Equivalences, Normal forms, Inference rules, Introduction to Proofs, Conversion to clausal form, Predicate calculus, The Statement function, Inference theory of the Predicate Calculus.				
Module 2	Algebraic Structures			10 classes
Sets and set-operations, functions, relations and their properties & representations of relation by matrix, closure of different type of relations, equivalence relations, primitive recursive function.				
Module 3	Lattices and Boolean Algebra			11 classes
Partial ordering, Posset, Lattices & Algebraic structures, Sub lattice, Basic properties of algebraic systems by lattices, Distributive lattices, complement of an element in a lattice, Boolean lattice & Boolean algebra, cancellation laws and unique complement theorem.				
Module 4	Principles of Counting Techniques			12 classes
Chinese Remainder Theorem, pigeonhole principle, generalized pigeonhole principle, Generalized Permutations and Combinations, Recurrence Relations.				
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.				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
Assignment 1: Logic Equivalences and Predicate calculus. Assignment 2: Equivalence Relations and Lattices Assignment 3: Recurrence Relations				

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Text Books Kenneth H. Rosen, “Discrete Mathematics and its Applications”, McGraw-Hill’s 7th Edition, 2011. Kolman, Bernard; Busby, Robert C; Ross, Sharon Cutler,” Discrete mathematical structures”, Pearson India, 6th Edition, 2015. Liu, C L Mohapatra, D P.,” Elements of Discrete Mathematics a Computer oriented approach”, New Delhi McGraw Hill Education, 4th Edition, 2015. Mott, Joe L; Kandel, Abraham; Baker, Theodore P, ”Discrete Mathematics for Computer Scientists and Mathematicians”, Pearson India, 2nd Edition, 2015. Epp, Susanna S, “Discrete Mathematics with applications”, New Delhi Cengage Learing, 4th Edition, 2016.
References: Tremblay, J.P. and Manohar.R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011. Grimaldi, R.P. “Discrete and Combinatorial Mathematics: An Applied Introduction”, 4th Edition, Pearson Education Asia, Delhi, 2007. Discrete Mathematics, Richard Johnsonbaugh, 8th Edition, Prentice Hall, 2017.

Course Code: CSE3190	Course Title: Fundamentals of Data Analytics Type of Course: Theory-embedded Lab	L-T- P- C	2	0	2	3
Version No.	3.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	Fundamentals of Data Analytics is designed for inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, and supports in decision-making. The course begins by covering Data extraction, pre-processing, and transformation. It delivers the basic statistics and taught in an intuitive way to analysis the data. This course will help the students to apply the knowledge on data analysis to a wide range of applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Fundamentals of Data Analytics and attain SKILL DEVELOPMENT through PROBLEM SOLVING Methodologies.					

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<table>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:
Explain different types of data and variables.
Interpret data using appropriate statistical methods.
Demonstrate the collection, processing and analysis of data for any given application and Illustrate various charts using visualization methods.
Apply the Data Analysis techniques by R Programming</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to Data Analysis</td><td>Assignment</td><td>Data Collection, data analysis, Programming</td><td>8 Sessions</td></tr>
<tr><td colspan="5">Topics: Introducing Data, overview of data analysis: Data in the Real World, Data vs. Information, The Many “Vs” of Data, Structured Data and Unstructured Data, Types of Data, Data Analysis Defined, Types of Variables, Central Tendency of Data, Scales of Data, Sources of Data. Data preparation.
R Studio: Base R-R Studio IDE-Introduction to R Projects and R Markdown. Basic R: R as a Calculator-Scripts and Comments-R Variables. Data I/O: Working Directories-Importing Data Exporting Data-More ways to save-Data I/O in Base R.</td></tr>
<tr><td>Module 2</td><td>Data Analysis and Visualization</td><td>Case studies</td><td>Programming</td><td>8 Sessions</td></tr>
<tr><td colspan="5">Topics: Data Summarization: One Quantitative and Categorical Variable. Data Classes: One Dimensional Data Classes-Data Frames and Matrices-Lists. Data Cleaning: Dealing with Missing Data-Strings and Recoding Variables. Manipulating Data in R: Reshaping Data-Merging Datasets. Data Visualizations: Plotting with ggplot2- Plotting with Base R</td></tr>
<tr><td>Module 3</td><td>Statistical Analysis</td><td>Case studies</td><td>R programming</td><td>7 Sessions</td></tr>
<tr><td colspan="5">Topics: Proportion tests-Chi squared test-Fisher exact test-Correlation-T test-Wilcoxon Rank sum tests-Wilcoxon signed rank test- one-way ANOVA test- Kruskal Wallis test</td></tr>
<tr><td>Module 4</td><td>Predictive Analysis</td><td>Case studies</td><td>Programming</td><td>8 Sessions</td></tr>
<tr><td colspan="5">Topics: Linear least-squares – implementation – the goodness of fit – testing a linear model – weighted resampling. Regression using Stats models – multiple regression – nonlinear relationships – logistic regression – estimating parameters – accuracy. Time series analysis – moving averages – missing values – serial correlation – autocorrelation. Introduction to survival analysis</td></tr>
<tr><td colspan="5">List of Laboratory Tasks:
Experiment No. 1: Introduction to R and RStudio
Level 1: Getting Started with R and RStudio
Installing R and RStudio.
Basic R syntax and commands.
Level 2: Working with RStudio
Understanding the RStudio interface.
Creating and managing R scripts.
Experiment No. 2: Basic Data Handling in R
Level 1: Data Types and Structures in R
Vectors, matrices, and data frames.
Lists and factors.
Level 2: Data Import and Export
Reading data from CSV, Excel, and text files.
Exporting data to different formats.
Level 3: Exploring Datasets
Using functions like head(), summary(), and str().</td></tr>
</table>

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Experiment No. 3: Basic Data structure in R
Level 1: a. Demonstrate a program to join columns and rows in a data frame using cbind() and rbind() in R.
b.Implement different data structures in R (Vectors, Lists, Data Frames)
Level 2: R AS CALCULATOR APPLICATION a. Using with and without R objects on console
Using mathematical functions on console
Write an R script, to create R objects for the calculator application
Experiment No. 4: Data Cleaning and Preprocessing
Level 1: Handling Missing Data in R
Identifying missing values.
Imputing missing values using mean, median, or other methods.
Level 2: Data Transformation in R
Standardizing and normalizing data.
Log-transformations and scaling.
Experiment No. 5: Exploratory Data Analysis (EDA) with R
Level 1: Descriptive Statistics
Calculating mean, median, and standard deviation.
Visualizing data using histograms, box plots, and scatter plots.
Experiment No. 6: Data Visualization with ggplot2
Level 1: Demonstrate various graphs that can be made and altered using the ggplot2 package.
Level 2: Create 500 random temperature readings for six cities over a season and then plot the generated data using ggplot2 packages in R
Experiment No. 7: Perform Tests of Hypotheses hypothesis test (parametric)
Level 1: How to perform tests of hypotheses about the mean when the variance is known. How to compute the p-value. Explore the connection between the critical region, the test statistic, and the p-value.
Level 2: A teacher claims that people who work for only five hours per week will score significantly lower than people who work for ten hours per week on a quantitative abilities test. He brings twenty people and randomly assigned them to one or two groups. In one group he has participants who work for ten hours and in another group, he has participants who work for five hours. He conducts the test for all participants. Scores on the test range from one to ten with higher scores representing better performance. Test if there is any significant difference between those who work for five hours per week versus those who work for ten hours per week based on the test performance.
Experiment No 8: Hypothesis – Non-Parametric Test
Level 1: A car manufacturing company like to find the sales of three types of cars produced by them in three regions and is given. Test if there is an association between the regions and types of cars purchased.
Experiment No 9: Correlation and Covariance
Level 1: Using the iris data set in R
Find the correlation matrix.
Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.
Level 2 : Ramesh is doing a statistics paper in his post-graduation course. He met his friend Amal who is a textile engineer. Ramesh, who is doing his internship at ABC Researchers, is interested in a question. He poses this question to Amal and tries to find if he can answer. The question is as follows: The data regarding sales of soft- drinks and sales of cotton clothes in a place during the last 12 months are given. Find if there is any association between sales of soft drinks and sales of cotton clothes. Also explain the reason if there is any relationship.

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Experiment No 11: Regression Model Level 1: Import data from web storage (http://www.ats.ucla.edu/stat/data/binary.csv). Name the dataset and now do Logistic Regression to find out the relation between variables that are affecting the admission of a student in an institute based on his or her GRE score, GPA obtained, and rank of the student. Also check the model is fit or not. Require (foreign), require (MASS). Level 2: Demonstrate multiple regressions, if data have a continuous Independent variable. Apply on the above dataset Experiment No. 12: Time Series Analysis in R Level 1: Demonstrate Time series analysis using Time Series Data Library at http://robjhyndman.com/TSDL/.
Targeted Application & Tools that can be used: Application Area are Decision making in business, health care, financial sector, Medical diagnosis etc.
Text Books Glenn J. Myatt and Wayne P. Johnson, "Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining Paperback", Import, 22 July 2014. Introduction to statistics and Data analytics, Christian H, Michael S, Springer,2016 Introduction to R- Robert Parker, John Mushcelli and Andrew Jaffe, Johns Hopkins University, 2020 (E-resource) Introduction to Time Series and Forecasting (Springer Texts in Statistics), Peter Brockwell, Richard A. Davis, Springer, 2016.
References Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining Paperback, Glenn J. Myatt and Wayne P. Johnson, Import, 22 July 2014. The R Software-Fundamentals of Programming and Statistical Analysis -Pierre Lafaye de Micheaux, Remy Drouilhet, Benoit Liquet, Springer 2013. Online resources: http://www.modernstatisticswithr.com/solutions.html#solutionsch3 https://johnmuschelli.com/intro_to_r/ https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/
Topics relevant to development of "FOUNDATION SKILLS": Statistical Concepts for data, visualization techniques. Data collection for project based assignments. Inferential Statistics (T test, Z test) Probability Calculation for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE2014	Course Title: Software Engineering 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.		

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	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		09 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	11 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		09 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	12 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.				

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Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools
Text Book 1] Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, VII Edition, McGraw-Hill, 2017. 2] Bob Hughes, Mike Cotterell, Rajib Mall, “Software Project Management”, VI Edition, McGraw-Hill, 2018.
References Rajib Mall, “Fundamentals of Software Engineering”, VI Edition, PHI learning private limited, 2015. Ian Sommerville, “Software Engineering”, IX Edition, Pearson Education Asia, 2011. 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: ECE2001	Course Title: Innovation Project-Raspberry Pi Using Python Type of Course: School Core & Practical Only.	L- T-P-C	0	4 This includes few lecture sessions	2
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The Raspberry Pi is an amazing single board computer (SBC) capable of running Linus and a whole host of applications. Python is a beginner-friendly programming language that is used in schools, web development, scientific research, and in many other industries. This course will enable students in writing own programs with Python to blink lights, respond to button pushes, read sensors, log data on the Raspberry Pi and many more. The course also offers in-depth knowledge of designing, developing, coding and implementing projects using Raspberry Pi.				
Course Outcomes	On successful completion of this course the students shall be able to: Write a program in Python. Explain the main features of the Raspberry Pi board Demonstrate the hardware interfacing of the peripherals to Raspberry Pi system. Demonstrate the functioning of live various projects carried out using Raspberry Pi system.				
Course Content:					
Module 1	Basics of Python, functions	Quiz	Problem Solving	4 Lab Sessions	
Topics: Introduction, Structure of Python Program, Data Types and Variables, Input and Output, Operators, Importing libraries, Functions, Development Tool. Concepts will be taught by solving problems through programs.					
Module 2	Python	Quiz	Problem Solving	4 Lab Sessions	

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	Programming			
Control statements, Lists and Dictionaries, Problem solving using Python. Concepts will be taught by solving problems through programs.				
Module 3	Overview of Raspberry Pi	Project Development	System Design Task and Analysis	4 Lab Sessions
Topics: An exploration of GPIO pins, LED and switch control. Installation of libraries, PuTTY SSH. Raspberry Pi to interface with more complicated sensors and actuators like Pi Camera, servo motor ADS51115 through PIP libraries. Arduino with Raspberry-pi				
Module 4	Interaction with API Services	Project Development	Modeling and Simulation task	3 Lab Sessions
Topics: Raspberry Pi interact with online API services through the use of public APIs and SDKs using Firebase, Gspread API. Node-RED – a programming tool for wiring together hardware devices, MQTT. Android/Case study.				
Targeted Application & Tools that can be used: Making it a reality (Raspberry Pi Projects) : Projects will include but not limited to : 1) Intelligent home locking system. 2) Intelligent water level management system. 3) Home automation using RFID. 4) Real time clock-based home automation. 5) Intelligent Automatic Irrigation System Professionally Used Software: Raspberry Pi.				
Project work/Python Lab Test:				
Project work Python test.				
Text Book(s): 1) Ashok Namdev Kamthane, Amit Ashok Kamthane, “Problem Solving and Python Programming”, Mc Graw Hill Education, 2018.				
Reference(s): https://github.com/thibmaek/awesome-raspberry-pi MagPi magazine				
Topics relevant to development of “Foundation Skills”: Basic Concepts of Python-Programming, and Raspberry Pi. Topics related to development of “Employability Skills”: Problem solving, Creative Thinking, Team work, Prototype Development. Topics related to development of “Entrepreneurship”: Effective Communication, Strategic Thinking, Creative Thinking.				
Evaluation:	Review-1-20%, Review-2-25%, Python test-25%, Project Expo-30%			

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Course Code: CSE1005	Course Title: Programming in Python Type of Course: School Core Lab Integrated		L- T-P-C	1	0	4	3
Version No.	1.0					
Course Pre-requisites	Basic knowledge of Computers and Mathematics					
Anti-requisites	NIL					
Course Description	The purpose of this course is to enable the students to develop python scripts using its basic programming features and also to familiarize the Python IDLE and other software's. This course develops analytical skills to enhance the programming abilities. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to build real time applications.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Programming in Python and attain Employability through Problem Solving Methodologies.					
Course Outcomes	On successful completion of this course the students shall be able to: Summarize the basic Concepts of python. 2. Demonstrate proficiency in using data structures. 3. Illustrate user-defined functions and exception handling. 4. Identify the various python libraries.					
Course Content:						
Module 1	Basics of Python programming	Assignment	Programming	14 Classes		
Topics: Data types, operators and Expressions, Input and Output Statements. Control Structures – Selective and Repetitive structures						
Module 2	Indexed and Associative Data Structures	Simple applications	Programming	20 Classes		
Topics: Strings, Lists, Sets, Tuples, Dictionaries						
Module 3	Functions, Exception handling and libraries	Case study	Programming	10 Classes		
Topics: User defined functions, exception handling, Introduction to python built-in libraries						
Targeted Application & Tools that can be used: Targeted Application : Web application development, AI, Operating systems Tools: Python IDLE, ANACONDA Application Areas:						

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Web Development Game Development Scientific and Numeric Applications Artificial Intelligence and Machine Learning Software Development Enterprise-level/Business Applications Education programs and training courses Language Development Operating Systems Web Scrapping Applications Image Processing and Graphic Design Applications Professionally Used Software: Python IDLE, Spyder, Jupyter Notebook, Google Colab
Project work/Assignment:
Project Assignment: Developing python scripts using built in methods and functions
Text Books: Martin C. Brown, “Python: The Complete Reference”, McGraw Hill Education, Forth edition (20 March 2018). Alex Campbell, “Python for Beginners: Comprehensive Guide to the Basics of Programming, Machine Learning, Data Science and Analysis with Python”, August 29, 2021. Charles Dierbach, “Introduction to Computer Science Using Python”, Wiley India Edition,2015.
References: E. Balagurusamy, “Introduction to Computing and Problem Solving Using Python”, Tata McGraw-Hill, 2016 Y. Daniel Liang, “Introduction to Programming Using Python”, Pearson, 2017 Brady Ellison, “Python for Beginners: A crash course to learn Python Programming in 1 Week (Programming Languages for Beginners)”, August 25, 2021. Python Tutor - Visualize Python, Java, C, C++, JavaScript, TypeScript, and Ruby code execution https://practice.geeksforgeeks.org/courses/Python-Foundation
Topics relevant to development of “FOUNDATIONS SKILLS”- Solve the real time problems by analyzing and visualizing the data. Topics relevant to “HUMAN VALUES & PROFESSIONAL ETHICS”- Data collection and its arrangement

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				

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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 Quantitative Aptitude by R S Aggarwal Verbal & Non-Verbal Reasoning by R S Aggarwal				
References www.indiabix.com www.youtube.com/c/TheAptitudeGuy/videos				

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Topics relevant to Skill development: Quantitative and reasoning aptitude for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.

Course Code: MAT2003	Course Title: NUMERICAL METHODS FOR ENGINEERS Type of Course: School Core	L-T- P-C	1	0	2	2
Version No.	1.0					
Course Pre-requisites	MAT1002 – Transform Techniques, Partial Differential Equations and Their Applications					
Anti-requisites	Nil					
Course Description	The course focuses on formulating and solving problems concerning real-world engineering applications numerically as well as statistically. This course provides an introduction to basic numerical methods to deal with algebraic and transcendental equations, system of equations, interpolation, differentiation and integration. This course also deals with numerical solution of ordinary differential equations by means of Taylor's series method, modified Euler's method and Runge-Kutta methods.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of " NUMERICAL METHODS FOR ENGINEERS" and attain Skill Development Through Problem Solving.					
Course Outcomes	On successful completion of the course the students shall be able to: 1] Solve algebraic and transcendental equations numerically. 2] Adopt numerical techniques to differentiate and integrate functions. 3] Apply numerical methods to solve ordinary differential equations.					
Course Content:						
Module 1	Numerical solution of Algebraic and Transcendental Equations					15 Classes
Algebraic and Transcendental Equations, Regula - Falsi method, Bisection method (Self study), Secant method, Newton-Raphson method, and NR method for non-linear Equations, Fixed-point iteration method. System of Linear Equations: Introduction, LU decomposition method, Gauss-Jacobi method, Gauss-Seidel iteration method, Largest Eigen value and corresponding Eigen vector by Power method & Jacobi Method.						
Module 2	Numerical Interpolation, differentiation and Integration					15 Classes
Numerical Interpolation: Newton's forward and backward interpolation method, Newton's divided difference method, Lagrange's method, numerical differentiation. Numerical integration: Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Weddle's Rule.						

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Area between the two curves.				
Module 3	Numerical solution of ODEs and PDEs			15 Classes
Solution of ordinary differential equations: Initial Value problems: Taylor's series method, Picard's method, Euler's Method, Modified Euler's method, Runge-Kutta method, Milne's predictor-corrector formula. Adams -Bashforth method, Boundary value problems - Finite difference methods for ODE. Numerical solution for LCR & damped forced oscillatory equations. Solution of partial differential equations: Schmidt Explicit Formula for Heat Equation, Crank-Nicolson method. Numerical solution to Wave, Laplace & Heat Equation.				
Targeted Application & Tools that can be used: The objective of the course is to familiarize students with a variety of numerical techniques and the theoretical concepts of probability and statistics so as to equip them with the necessary numerical approaches and basic statistical tools to tackle engineering and real-life problems.				
Assignment: Gauss-Jacobi iteration method. Numerical differentiation. Gaussian quadrature rule for numerical integration. Taylor series method for ODEs. Implicit and explicit schemes for PDEs.				
Text Books T1: M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computations, 6th Edition, New age Publishing House, 2015. T2: Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley& Sons (India), 2014.				
References: R1: B.S. Grewal, Numerical methods in engineering and science, 10th Edition, Khanna publishers, 2016. R2: B.S. Grewal, "Higher Engineering Mathematics", 44th edition, Khanna Publishers. R3: Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers," 7th Ed., McGraw-Hill Edition, 2015. R4: C. Ray Wylie and Louis C Barrett, "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill, 2012.				
Topics relevant to SKILL DEVELOPMENT: This course focuses on formulating and solving problems concerning real-world engineering applications numerically as well as statistically. This course provides an introduction to basic numerical methods to deal with algebraic and transcendental equations, system of equations, interpolation, differentiation and integration with numerical solution of ordinary differential equations by means of Taylor's series method, modified Euler's method and Runge-Kutta methods for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.				

Course Code: CSE2007	Course Title: Design and Analysis of Algorithms Type of Course: Program Core & Theory only	L- T- P- C	3	0	0	3

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Version No.		2.1
Course Pre-requisites		CSE2001, Data Structure and Algorithms
Anti-requisites		NIL
Course Description		This intermediate course enables students to design and analyze efficient algorithms to solve problems. This course covers typical design methods such as divide-and-conquer, dynamic programming and greedy method to solve problems. The students shall develop strong analytical skills as part of this course.
Course Objectives		This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.
Course Outcomes		On successful completion of the course the students shall be able to: 1] Identify the efficiency of a given algorithm. [Comprehension] 2] Employ divide and conquer approach to solve a problem. [Application] 3] Illustrate dynamic programming approach to solve a given problem. [Application] 4] Solve a problem using the greedy method. [Application] 5] Discuss the techniques to solve a real-world problem based on its complexity classes. [Comprehension]
Course Content:		

Module 1	Introduction to Algorithms	Assignment		Problem Solving	06 Sessions
	Topics: Algorithm Design and efficiency, measuring of running time of algorithms. Insertion sort and merge sort, Asymptotic Growth and Notations. Recurrences--Masters method. Assignment: Comparatively evaluate bubble sort, insertion sort and mergesort.				
Module 2	Review of Searching and Sorting techniques	Assignment		Programming/ Problem Solving	12 Sessions
	Topics: Divide and Conquer: Examples. Strassen's Matrix multiplication. Sorting: Quicksort, Heapsort, Lower bound of comparison-based sorting, non-comparison-based sorting: Radix sort. Search: Review of Linear Search and Binary Search, Hashing and hash tables. Assignment: Design and develop an algorithm using Divide and Conquer technique for a given scenario.				
Module 3	Greedy Algorithms	Assignment		Programming/ Problem Solving	09 Sessions
	Topics: Introduction, Fractional Knapsack Problem, Minimal Spanning Tree: Prim's Algorithm and Kruskal's Algorithm, Single-source Shortest Path: Dijkstra's Algorithm. Huffman Codes. Assignment: Design and Develop a solution to a given scenario using greedy method.				
Module 4	Dynamic Programming	Assignment		Programming/ Problem Solving	09 Sessions
	Topics:				

	Introduction with examples, Principles of Memoization, 0-1 Knapsack Problem, Bellman-Ford algorithm, Floyd-Warshall's Algorithms. Optimal Binary Search Trees, Chain Matrix Multiplication. Assignment: For a given scenario, attempt the three design paradigms learned so far and argue the best approach to solve the problem				
Module 5	Complexity Classes and Heuristics	Assignment		Programming/ Problem Solving	09 Hours
	Topics: Complexity classes: P, NP, and NP-Complete Problems. Backtracking: n-Queens. Branch and bound: Travelling Salesman Problem. Assignment: Apply backtracking algorithmic designing technique for solving queen's problems for 4, 8 and 16 inputs.				
	Targeted Application & Tools that can be used: Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers. Professionally Used Software: GCC compiler.				
	Project work/Assignment:				
	Problem Solving: Design of Algorithms and implementation of programs. Programming: Implementation of given scenario using Java.				
	Text Book: T1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, 'Introduction to Algorithms', MIT Press, 2022. T2. J. Kleinberg and E. Tardos, 'Algorithm Design', Addison-Wesley, 2005.				
	References R1. Anany Levitin, 'Introduction to the Design and Analysis of Algorithms', Pearson Education, 2003. R2. Tim Roughgarden, 'Algorithms Illuminated' (books 1 through 3), Soundlikeyourself Publishing, 2017,18,19 respectively. R3. AV Aho, J Hopcroft, JD Ullman, 'The Design and Analysis of Algorithms', Addison-Wesley, 1974.				

Course Code: CSE3156	Course Title: Database Management Systems Type of Course: 1) School Core 2) Laboratory Integrated	L-T-P-C	3	0	2	4
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					

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Course Description	This course introduces the core principles and techniques required in the design and implementation of database systems. It covers concepts of relational database systems (RDBMS). More emphasis is set on how to design, develop, organize, maintain and retrieve information efficiently. It helps the students to learn and practice data modeling and database designs. The course also introduces the concept of object oriented and object relational databases. The associated laboratory is designed to implement database design using MySQL DATABASE in information technology applications. All the exercises will focus on the fundamentals for creating, populating, sophisticated, interactive way of querying, and simultaneous execution of the transactions of database.			
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] Demonstrate a database system using ER model and relational algebra. [Understanding] 2] Build databases using SQL queries query processing. [Applying] Apply the functional dependencies and design the database using normalization. [Applying] Interpret the concept of object-oriented databases and object-relational databases. [Understanding]			
Course Content:				
Module 1	Introduction to Database Modelling and Relational Algebra (Understanding)	Assignment	Problem Solving	8 Classes
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 (Applying)	Assignment	Programming	8 Classes
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 (Applying)	Assignment	Problem Solving	12 Classes

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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 (Understanding)	Assignment	Case Study	8 Classes

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.

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]
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]
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]
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]
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

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scenario. [Airline Database]

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Labsheet-3 [2 Practical Sessions] Experiment No. 5: [2 sessions]
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]
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]
To implement the concept of forms and reports. Level 1: Implement the concept of forms and reports. Level 2: Analyze the schema relationship.

Labsheet-6 [2 Practical Sessions] Experiment No. 8: [2 Sessions]
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.

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

Text Book
RamaKrishna & Gehrke, “Database Management Systems” 3rd Edition, 2018, McGraw-Hill Education.
Avi Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, McGraw-Hill ,7th Edition, 2019. 3] 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
Elmasri R and Navathe S B, “Fundamentals of Database System”, Pearson Publication, 7th Edition, 2018.
M. Kleppmann, “Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems”, O’Reilly, 2017.

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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: CSE3351	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	CSE2009- Computer Organization, Problem solving using C Students should have basic knowledge on computers, computer software & hardware, and Computer Organization. Prior programming experience in C is recommended.					
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:						

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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

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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: CSE 3078	Course Title: Cryptography and Network Security Type of Course: Program Core & Theory only	L- T-P-C	3	0	0	3
Version No.	1					
Course Pre-requisites	“Data Communications and Computer Networks”.					
Anti-requisites	NIL					
Course Description	The Course covers the principles and practice of cryptography and network security, focusing in particular on the security aspects of the web and Internet. Topics: The cryptographic tools such as shared key encryption, public key encryption, key exchange, and digital signature are explored. The use and utilization of the internet protocols and applications such as SSL/ TLS, IPSEC, Kerberos, PGP, and S/ MIME, SET are reviewed. System security issues such as viruses, intrusion and firewalls are also explored.					
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: CO1: Identifies the basic concept of Cryptography (Knowledge) CO2: Express the different types of Cryptographic Algorithms. (Comprehension) CO3: Recognize the Public key Cryptographic Techniques for various applications. (Comprehension) CO4: Apply the network security concepts during their implementation of network security application developments. (Application)					
Course Content:						
Module 1	Introduction to Cryptography	Assignment	Identify the Concepts	08 Sessions		
Topics: Introduction to Cryptography, Model of Network Security, OSI Security architecture, Security Attacks: active attacks, passive attacks, services: Authentication, Access Control, Data Confidentiality, Data Integrity, Nonrepudiation, Substitution Ciphers : Caesar, Mono alphabetic, Polyalphabetic, Play-fair and Hill Cipher, Introduction to Block Cipher and Stream Cipher, Festal Structure.						
Module 2	Private Key Cryptography and Number Theory	Assignment	Analysis of requirement of complexity in cryptography	13 Sessions		
Topics: Symmetric Encryption Algorithms : Data Encryption Standard, Introduction to Galois Field, Advanced Encryption Standard, Modular Arithmetic, Prime numbers, Fermat’s little theorem, brief about primality testing and factorization, Discrete Logarithmic Problem, Euclidean and Extended						

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Euclidean Algorithm, Euler Totient Function, Chinese Remainder Theorem				
Module 3	Public Key Cryptography and its Applications	Assignment	Recognize the importance of various security concepts to achieve sufficient solutions	10 Sessions
Topics: Overview of Public Key Cryptography, RSA, Diffie - Helman Key exchange, Man in the middle attack, Cryptographic Hash functions, Secure Hash Algorithm, Message Authentication Codes – HMAC, Digital Signature, Discussion on real time practices of Cryptography.				
Module 4	Network Security	Assignment	Implement the advanced network security algorithms in recent applications.	07 Sessions
Topics: Network Security fundamentals, Network Security applications: Authentication: Kerberos, PKI, Network Security applications: e-mail security: PGP, MIME, Network Security applications: IP Security: IP Sec architecture, Network Security applications: Web Security.				
Targeted Application & Tools that can be used: Students get the knowledge about cryptography techniques followed, the algorithms used for encryption and decryptions & the techniques for authentication and confidentiality of messages.				
Assignment:				
Assignment 1: Solve the problems of basic encryption techniques. Assignment 2: Solve and analyze the problems on symmetric and asymmetric encryption.				
Textbooks: 1.William Stallings, "Cryptography and Network Security - Principles and Practices", Prentice Hall, 8th Edition, 2019. 2. Wade Trappe and Lawrence C Washington, “Introduction to Cryptography with Coding Theory”, Pearson, 2020. Reference Books: 1.Behrouz A Forouzan, Debdeep Mukhopadhyay, “Cryptography and Network Security”, McGraw Hill, third edition, 2010. 2. R.Rajaram, “Network Security and Cryptography” SciTech Publication.3rd Edition, 2014. 3. AtulKahate, "Cryptography and Network Security", Tata McGraw-Hill, 2nd Edition, 2019. 4. BruceSchneier, “Applied Cryptography", John Wiley and Sons Inc. Second Edition, 2015.				
Web references: 1.https://onlinecourses.nptel.ac.in/noc22_cs90/preview 2.e-pgpathshala UGC lecture series : E-Series and Self learning Materials. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQKJvP3a/8Vd3L08tQ== 3. http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=10133&query_desc=kw%2Cwrdl%3A%20Cryptography%20and%20Network%20Security 4.http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=5875&query_desc=kw%2Cwrdl%3A%20Cryptography%20and%20Network%20Security.				
Topics relevant to “Skill Development”: Symmetric and Asymmetric Encryption Algorithms and its problems.				

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Course Code: PPS4004	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 (Undergraduate). 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 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)					
Course Content:						
Module 1	Quantitative Ability	Assignment			24 Hours	
Topics: Number System, Percentage, Ratio and Proportion, Average, Mixture and Allegation, Time and Work, Profit and Loss, Time Speed and Distance, Boats and Streams, Simple Interest and Compound Interest, Probability, Permutation and Combination.						
Targeted Areas Application area: Placement activities and Competitive examinations. Tools: LMS						
Text Book Fast Track Objective by Rajesh Verma R S Aggarwal Rakesh Yadav						
References www.indiabix.com www.testbook.com www.youtube.com/c/TheAptitudeGuy/videos						
Topics relevant to Skill development: Quantitative aptitude for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.						
Evaluation – Continuous Evaluation (Topic wise evaluation Mid-Term & End term)						

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Course Code: CSE3216	Course Title: Mastering Object- Oriented Concepts in Python Type of Course: Lab		L- T- P- C	0-0-2-1
Version No.	1			
Course Pre-requisites	CSE1005 – Programming in Python			
Anti-requisites	NIL			
Course Description	This course covers mastering object-oriented concepts in Python, including classes, inheritance, polymorphism, and encapsulation. Students will learn to design and implement robust, reusable code using real-world examples. Ideal for those with basic Python knowledge, it enhances problem-solving skills and software development proficiency.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Mastering Object Oriented Concepts in Python and attain Skill Development through Experiential Learning.			
Course Out Comes	CO1: Explain features of Oops along with creation of Python classes and objects to represent real world Objects. [Understand] CO2: Demonstrate inheritance, polymorphism, and abstraction in Python to build maintainable and extendable software systems.[Apply] CO3: Demonstrate exception handling in Python to build robust error-handling mechanisms and debugging tool and Assess various file handling techniques in Python. [Apply]			
Course Content:				
Module 1	Introduction to OOPS, Classes and Objects	MCQ	Assignment	10 Sessions
Topics: Introduction to OOPs: Problems in Procedure Oriented Approach, Specialty of Python Language, Features of OOPS - Classes and Objects, Encapsulation, Abstraction, Inheritance and Polymorphism. Classes and Objects: Creating a Class, The Self Variable, Constructor, Destructors, Types of Variables, Namespaces, Types of Methods - Instance Methods, Class Methods, Static Methods, Passing Members of One Class to Another Class, Inner Classes.				
Module 2	Inheritance and Polymorphism	MCQ	Assignment	10 Sessions
Constructors in Inheritance, Overriding Super Class Constructors and Methods, The Super() Method, Types of Inheritance – Single Inheritance, Multiple Inheritance, Method Resolution Order(MRO), Polymorphism, Duck Typing Philosophy of Python, Operator Overloading, Method Overloading, Method Overriding. Abstract Classes and Interfaces: Abstract Method and Abstract Class, Interfaces in Python, Abstract Classes vs. Interfaces.				
Module 3	Exceptions and Files in Python	MCQ	Assignment	10 Sessions
Exceptions: Errors in a Python Program – Compile-Time Errors, Runtime Errors, Logical Errors. Exceptions, Exception Handling, Types of Exceptions, The Except Block, The assert Statement, User-Defined Exceptions, Logging the Exceptions.				

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Files in Python: Files, Types of Files in Python, Opening a File, Closing a File, Working with Text Files Containing Strings, Knowing whether a File Exists or Not, Working with Binary Files, The with Statement, Pickle in Python, The seek() and tell() Methods.
Targeted Application & Tools that can be used: Python, PyCharm
Project work/Assignment:
Assignment: Module 1 Assignment: Design and implement a Python application that simulates a banking system using classes and methods for customers and accounts. Module 2 Assignment: Develop a Python application that simulates Library management system that demonstrates inheritance, polymorphism and abstraction concepts. Module 3 Assignment: Develop a Python program that handles different types of exceptions while processing user input for a movie ticket booking system showcasing exception handling and File handling concepts.
Text Book Dr. R Nageshwara Rao, “Core Python Programming”, Dreamtech Press, 3rd Edition, 2021.
References Alex Martelli, Anna Ravenscroft & Steve Holden, “Python in a Nutshell The Definitive Reference”, O'Reilly Media, 3rd edition, 2017. Luciano Ramalho, “Fluent Python Clear, Concise, and Effective Programming”, O'Reilly Media, 2nd edition, 2022. Mark Lutz, “Learning Python: Powerful Object-Oriented Programming”, O'Reilly Media, 5th edition, 2013. David Beazley, Brian K. Jones, “Python Cookbook: Recipes for Mastering Python 3”, O'Reilly Media, 3rd edition, 2013. Weblinks: www.learnpython.org https://realpython.com/python3-object-oriented https://www.tutorialspoint.com/python/python_oops_concepts.htm
Topics relevant to “SKILL DEVELOPMENT”: Building Real-World Applications Using OOPS Concepts, Error Handling and Debugging Techniques, Concurrency in Python, Advanced File Handling Techniques, Creating and Managing Python Packages and Modules, Designing and Implementing Python Interfaces This is attained through assessment component mentioned in course handout.

Course Code: CSE3120	**Course Title: Operating System with Linux Internals** **Type of Course: Discipline Elective in Information Science & Engineering Basket** **Theory & Integrated Laboratory**	**L- P- C**	2	2	3
Version No.	1.0				
Course Pre-requisites	**[1] C Programming [2] Unix shell programming [3] Data Structure**				
Anti-requisites	**NIL**				

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Course Description	The purpose of this course is to enable the students to understand the need for Operating systems and to develop the basic concepts of process management, synchronization and memory management. The course will expose students to Linux OS internals, its design and features. The course is both conceptual and analytical in nature towards managing the process and memory and needs fair knowledge of programming fundamentals, C programming and data structures. The course develops the critical thinking and analytical skills on allocating and
Course Objective	The objective of the course is to familiarize the learners with the concepts of Operating System with Linux Internals and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.
Course Outcomes	**On successful completion of this course the students shall be able to:** **(1) Explain** the structure and functions of OS **(2) Solve** problems on various CPU Scheduling Algorithms **(3) Apply** different techniques to various synchronization problems **(4) Discuss** various memory management techniques **(5)Apply** appropriate Linux commands for memory management and directory management
Course Content:	

Module 1	**Introduction**	Quiz	Programming	**09 Classes**
Topics: Introduction to OS – Computer System Architecture , Operating System Structure, Operations – Different management activities handled by the OS, Computing environments, Operating System Services, User and OS interface, System Calls and its types, System Programs[loaders, linkers...], Overview of OS design and implementation. **Linux Operating System:** Introduction to Linux OS, Basic Commands of Linux OS				
Module 2	**Process Management**	Quizzes and assignments	Pseudocode/Programming	**9 Classes**
Topics: Process Concept, Operations on Processes, Inter Process Communication, Introduction to threads - Multithreading Models, Process Scheduling– Basic concepts, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, SRTF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue. **Linux Operating System:** Process Management Commands and System Calls.				
Module 3	**Process Synchronization and Deadlocks**	Coding Assignment/Case Study	Pseudocode/Programming	**9 Classes**
Topics: The Critical-Section Problem - Peterson's Solution, Synchronization hardware, Mutex locks, Semaphores, Classic Problems of Synchronization, Monitors. Introduction to Deadlocks, Deadlock Characterization, Methods for handling deadlock: Deadlock Prevention- Deadlock Avoidance- Deadlock detection & Recovery from Deadlock **Linux Operating System: P**ipe, semaphore and message queue				

List of Laboratory Tasks:

Experiment No. 1: Basic UNIX Commands
Level 1: Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, file handling utilities, security by file permissions, process utilities
Level 2: Text Processing utilities and backup utilities , tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio

Experiment No. 2: Programs using system calls of UNIX operating system
Level 1 Programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir
Level 2 Simulate UNIX commands like cp, ls, grep.

Experiment No. 3: Programs to demonstrate process creation and termination
Level 1: Program to demonstrate creating new processes and waiting for a process
Level 2: Program to demonstrate creation of zombie processes and orphan process

Experiment No. 4: Programs to demonstrate inter process communication using Pipe
Level 1: Programs to illustrate execution of two commands concurrently with a command pipe and communication between two unrelated processes
Level 2: Program to demonstrate inter process communication using mkfifo, open, read, write and close APIs

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Experiment No. 5: Programs to demonstrate inter process communication using message queues
Level 1: Program to create a message queue with read and write permissions and to write messages with different priority numbers
Level 2: Program to receive messages of different priorities from the message queue and display them

Experiment No. 6: Programs to demonstrate process synchronization using Semaphores
Level 1: Program that illustrates suspending and resuming processes using signals
Level 2: Program that illustrates access of shared memory using counting semaphore

Experiment No. 7: Programs to demonstrate the event of a deadlock and its avoidance
Level 1: Using POSIX Semaphores demonstrate the scenario where in deadlock happens due to incorrect use of semaphores
Level 2: Program to implement a solution to the Dining Philosopher problem using Monitors

Targeted Application & Tools that can be used:
Targeted Application:
Real time Applications such as traffic management system, banking system, health care and many more systems where there are entities that use and manage the resources.
Software Tools:
Linux Environment

Project work/Assignment:

Each batch of students (self-selected batch mates) will identify projects and implement with the most suitable 2 or 3 antecedents.

Textbook(s):
1. Silberschatz A, Galvin P B and Gagne G, "Operating System Concepts", 9th edition Wiley, 2013
2. Sumitabha Das, "Unix concept and Programming", McGraw Hill education, 4th Edition, 2015

References
1. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, Linux in a Nutshell, O'Reilly Media, Inc, 2009
2. Operating Systems | Internals and Design Principles | Ninth Edition | By Pearson Paperback – 1 March 2018. by William Stallings (Author)

Topics relevant to " **SKILL DEVELOPMENT** ": Linux OS commands and programming for **SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.**. This is attained through assessment component mentioned in the course handout.

Course Code: CDV2001	**Course Title: Agile Structures and FrameworksType of Course: School Core**	**L- P- C**	**3**	**0**	**3**
Version No.	1.0				
Course Pre-requisites	Software Engineering				
Anti-requisites	NIL				
Course Description	This course imparts knowledge to students in the basic concepts of Agile Software Process, methodology and its development The objective of this course is to provide the fundamentals concepts of Agile and its Significance. This course covers the Agile and its methodologies. The objective of the course is to understand the Agility and Assurance.				

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Course Objectives	The objective of the course is to familiarize the learners with the concepts of **Agile Structures and Frameworks** and attain **Skill Development** through **Participative Learning** techniques.			
Course Out Comes	On successful completion of this course the students shall be able to: **1]** Understand the basic concepts of Agile Software Process. **(Knowledge level)** **2]** Comprehend the various Agile Methodologies. **(Comprehension level)** **3]** Develop Agile Software Process. **(Knowledge level)** **4]** Apply principles of Agile Testing. **(Application level)**			
Module 1	**Introduction**	Assignment	Agile Estimation	**08 Sessions**
Introduction to Agile technology, Iterative and Evolutionary Methods, Agile – Agile Development. Agile Values, Agile Principles, Compare and Contrast the agile with traditional methods. Agile Benefits. Agile Estimation Techniques. Case Study				
Module 2	**Agile and Its Significance**	Assignment	Comparison of Agile technologieswith traditional methods	**09 Sessions**
Agile Story : Evolutionary delivery ,Scrum Demo, Planning game, Sprint back log, adaptive planning. Agile Motivation – Problems With The Waterfall - Research Evidence. Scrum : Method Overview ,Life cycle phases and Work productroles and practices.				
Module 3	**Agile methodology**		Case Study	**12 Sessions**
Extreme Programming: Method Overview ,Life cycle phases and Work product roles and practices. Unified process : Method Overview ,Life cycle phases and Work product roles and practices. EVO : Method Overview ,Life cycle phases and Work product roles and practices. Case Study.				
Module 4	**Agility and Quality Assurance**	Assignment	Apply the testing concepts usingPrograming	**09 Sessions**
Agile product development – Agile Metrics – Feature Driven Development (FDD). Agile approach to Quality Assurance. Test Driven Development – Agile approach in Global Software Development. Agile Technology Tools.				
Targeted Application & Tools that can be used: JIRA				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
Agile Estimation Comparison of Agile technologies with traditional methods 3. Case Study: Student group must collaborate and report together along with assigned batch members. Collect the requirements from the client and adopt the suitable agile practice method for your project Installation and features of JIRA tool.				

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Text Book 1]Craig Larman, "Agile and Iterative Development – A Manager's Guide", Pearson Education – 2006 2] Edward Scatter "Brilliant Agile Project Management: A Practical Guide to Using Agile, Scrum and Kanban, 2015
References 1] Chetankumar Patel, Muthu Ramachandran, Story Card Maturity Model (SMM): A Process Improvementework for Agile Requirements Engineering Practices, Journal of Software, Academy Publishers, Vol 4, No 5 (2009), 435, Jul 2009. 2] Hazza& Dubinsky, Agile Software Engineering, Series: Undergraduate Topics in Computer Science, nger 2009 3] Kevin C. Desouza, Agile information systems: conceptualization, construction, and management, erworth-Heinemann, 2007. **Web resources:** https://presiuniv.knimbus.com/user#/home
Topics relevant to "SKILL DEVELOPMENT": Agile Estimation techniques for **skill development** through **Participative Learning techniques.** This is attained through the assessment component mentioned in the course handout.

Course Code: CDV2501	**Course Title: DevOps Tools InternalsType of Course: Theory**	**L-T-P-C**	**3-0-0-3**	
Version No.	1.2			
Course Pre-requisites	**Fundamentals of Devops**			
Anti-requisites	**NIL**			
Course Description	This course is designed to offer profound perceptions and knowledge in various tools like Git, Ansible, Selenium and Jekins. With the proficient learning of DevOps course, a student will be able to work in all the above tools and become a trained practitioner in the integration and monitoring of software. **DevOps Tool** is an application that helps the software development process to industrialize. It mainly focuses on communication and collaboration between product management, software development, and operations professionals. The objective of this course is to discuss and implementthe various tools usage and internals practically.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of **DevOps ToolsAnd Internals** and attain **Skill Development** through **Experiential Learning** techniques.			
Course OutComes	On successful completion of this course the students shall be able to: **1]Apply** the features and common Git workflow. [Application] **2] Practice** the filters and plugins to populate, manipulate, and manage data used by Ansible Playbooks. [Application] **3] Compute** the features of selenium IDE. [Application]4] **Interpret** the installation and features of Jenkins and build jobs. [Application]			
Course Content:				
Module 1	**Git**	Quiz	Quiz on Git commands	**5L +4P Classes**

Topics:
Introduction to Git, Features of Git, Benefits, Workflow, Git vs GitHub, Installation of Git on Windows/Linux and Environment set up, All Git Commands-Working with local and remote repositories, Running first Git command,
Fundamentals of Repository structure and file status
life cycle, Working locally with staging, unstaging and commit.

Module 2	Containerization Usin gDocker	Quiz	Quiz on Ansible tool usage	**5L +4P Classes**

Topics:
Docker Life Cycle,Docker Installation, Docker Operations,Docker Concepts - Registry, Repository, Tag, Image and Containers, Create A Docker Hub Account, Docker Images and Containers, Pushing Docker To Container Hub, Docker File.

Module 3	**Ansible**	Assignm ent	Assignments on Selenium tool usage and test case	**5L +4P Classes**

Topics:
Ansible Workflow, Architecture, Installation in Linux/Windows, ad-hoc Commands, Playbooks, Tower, Roles ,Variables open link, Tags, Galaxy, Commands Cheat Sheets, Modules, Shell, Templates, YAML, Inventory, Debug, Apt,
Lineinfile, Copy, Command, File, Vault, Windows, Yum, AWX, Unarchive, Ansible Pip

Module 4	**Jenkins**	Assignment	Assignments on Jenkins tool usage and Build jobs	**5L +4P Classes**

Topics:
Introduction To Continuous Integration, Jenkins Architecture, Managing Nodes On Jenkins, Jenkins Master Node Connection, Jenkins Integration With Devops Tools, Understanding CI/CD Pipelines, Creating A CI/CD Pipeline

Text Book

1. Craig Berg, "*DevOps For Beginners: A Complete Guide to DevOps Best Practices (Including How You Can Create World-Class Agility, Reliability, And Security In Technology Organizations With DevOps) (Code tutorials)*", Paperback – June 12, 2020.

Ferdinando Santacroce, "*Git Essentials*", Packt Publishing, April 2015, ISBN: 9781785287909

John Ferguson Smart. "*Jenkins: The Definitive Guide*", O'Reilly Media, Inc., July 2011, ISBN: 9781449305352

References

1. Jeff Geerling, "*Ansible for DevOps: Server and configuration management for humans*", Leanpub, August 5, 2020

. Unmesh Gundecha, Carl Cocchiaro, "*Learn Selenium*", Packt Publishing, July 2019, ISBN: 9781838983048

3. Gaurav Agarwal, "*Modern DevOps Practices: Implement and secure DevOps in the public cloud with cutting-edge tools, tips, tricks, and techniques*", July 2021.

4. Mikael Krief, "*Learning DevOps: The complete guide to accelerate collaboration with Jenkins, Kubernetes, Terraform and Azure DevOps*", October 2019

Weblinks:

. https://git-scm.com/book/en/v2
. https://www.simplilearn.com/tutorials/git-tutorial/git-tutorial-for-beginner
. **https://www.javatpoint.com/selenium-tutorial**
. **https://www.javatpoint.com/ansible**
. https://www.tutorialspoint.com/jenkins/jenkins_managing_plugins.htm
. https://nptel.ac.in/courses/128106012

Topics relevant to "SKILL DEVELOPMENT": Git&Junit, Ansible, Selenium, Jenkins for Skill Development throughExperiential Learning techniques. This is attained through assessment component mentioned in course handout.

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Course Code: CDV2502	**Course Title: DevOps Tools Internals Laboratory Type of Course: Laboratory**	**L-T-P-C**	**0-0-2-1**
Version No.	1.2		
Course Pre-requisites	**Fundamentals of Devops**		
Anti-requisites	**NIL**		
Course Description	This course is designed to offer profound perceptions and knowledge in various tools like Git, Ansible, Selenium and Jekins. With the proficient learning of DevOps course, a student will be able to work in all the above tools and become a trained practitioner in the integration and monitoring of software. **DevOps Tool** is an application that helps the software development process to industrialize. It mainly focuses on communication and collaboration between product management, software development, and operations professionals. The objective of this course is to discuss and implementthe various tools usage and internals practically.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of **DevOps ToolsAnd Internals** and attain **Skill Development** through **Experiential Learning** techniques.		
Course OutComes	On successful completion of this course the students shall be able to: 4]**Apply** the features and common Git workflow. [Application] **5] Practice** the filters and plugins to populate, manipulate, and manage data used by Ansible Playbooks. [Application] **6] Compute** the features of selenium IDE. [Application]4] **Interpret** the installation and features of Jenkins and build jobs. [Application]		
Course Content:			
Module 1	**Git**	Quiz	Quiz on Git commands	**5L +4P Classes**
Topics: Introduction to Git, Features of Git, Benefits, Workflow, Git vs GitHub, Installation of Git on Windows/Linux and Environment set up, All Git Commands-Working with local and remote repositories, Running first Git command, Fundamentals of Repository structure and file status life cycle, Working locally with staging, unstaging and commit.				
Module 2	Containerization Usin gDocker	Quiz	Quiz on Ansible tool usage	**5L +4P Classes**

Topics: Docker Life Cycle,Docker Installation, Docker Operations,Docker Concepts - Registry, Repository, Tag, Image and Containers, Create A Docker Hub Account, Docker Images and Containers, Pushing Docker To Container Hub, Docker File.				
Module 3	**Ansible**	Assignment	Assignments on Selenium tool usage and test case	**5L +4P Classes**
Topics: Ansible Workflow, Architecture, Installation in Linux/Windows, ad-hoc Commands, Playbooks, Tower, Roles ,Variables open link, Tags, Galaxy, Commands Cheat Sheets, Modules, Shell, Templates, YAML, Inventory, Debug, Apt, Lineinfile, Copy, Command, File, Vault, Windows, Yum, AWX, Unarchive, Ansible Pip				
Module 4	**Jenkins**	Assignment	Assignments on Jenkins tool usage and Build jobs	**5L +4P Classes**

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Topics:
Introduction To Continuous Integration, Jenkins Architecture, Managing Nodes On Jenkins, Jenkins Master Node Connection, Jenkins Integration With Devops Tools, Understanding CI/CD Pipelines, Creating A CI/CD Pipeline

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List of Laboratory Tasks:

Git

1. Level 1: Installation of Git on windows Level 2: Git commands-Local repositories Level 2: Git commands-Remote repositories

2. How Git can handle automatically file modifications when they are not related to the same lines of text. Level 1: You are in a new repository located in C:\Repos\Exercises\Ch2-1.
   Level 1: You have a master branch with two previous commits: the first commit with a file1.txt file and thesecond commit with a file2.txt file.
   Level 2: After the second commit, you created a new branch called File2Split. You realized that file2.txt is too big,and you want to split its content by creating a new file2a.txt file. Do it, and then commit the modifications.

3. How to resolve conflicts when Git cannot merge files automatically.
   Level 1: You are in the same repository used earlier, C:\Repos\Exercises\Ch2-1. On the master branch, you add the file3.txt file and commit it.
   Level 2: Then, you realize that it is better to create a new branch to work on file3.txt, so you create the File3Work branch. You move in this branch, and you start to work on it, committing modifications.
   Level 2: The day after, you accidentally move to the master branch and make some modifications on the file3.txtfile, committing it. 5. Then, you try to merge it.

4. Level 1: Installation of Ansible
   Level 2: Create a basic inventory file
   Level 2: Running your first Ad-Hoc Ansible command.

Ansible

5. Ansible Archive
   Level 1: Compressing the Directory with TAR and tar and gz
   Level 1: Compress the file – Default File Compress format and Remove the Source files after archivingLevel 2: Create a ZIP file archive – File and Directory
   Level 2: Create a BZIP archive – File and Directory

6. A Quick Syntax of Ansible Shell module – ADHOC
   Level 1: A Quick Syntax of Ansible Shell module in a PlaybookLevel 1: Ansible Shell Examples
   Level 2: Execute a Single Command with Ansible Shell Level 2: Execute a Command with Pipe and Redirection

. Level 1: Run playbook
   Level 2: Create the file on the target machines or servers as mentioned in the inventory file and the webserver'sgroup, save the below code with .yml extension and run the playbook.
   Level 2: Create multiple directories. To create multiple directories with one single task you can use the loop **with_items** statement. So when you run the below playbook it is interpreted as 3 different tasks.

Selenium

. Level 1: Selenium IDE Download and Install
   Level 2: Selenium IDE - First Test Case, Login Test and command usage

. Level 1: Write a script to open google.co.in using chrome browser (ChromeDriver).
   Level 2: Write a script to open google.com and verify that title is Google and also verify that it is redirected togoogle.co.in.

10. Level 1: Write a script to open google.co.in using internet explorer (InternetExplorerDriver).Level 2: Write a script to create browser instance based on browser name.

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11. Level 1: Write a script to close all the browsers without using quit() method.Level 2: Write a script to search for specified option in the listbox

Jenkins

12. Level 1:
Environment Setup
Level 2:
Jenkins downloading and installation

13. Level 1:
. Setup a Jenkins Job with Apache Ant Build Tool
2. Setup a Jenkins Job with Apache MavenLevel 2 :
1. Setup a Jenkins Job with Batch Script.

14. Level 1: Add a Linux Node (Also Check SSH Slaves plugin plugins)Level 1: Add a Windows Node
Level 2: Assign a Java Based Job to Linux and Build it Level 2: Assign a MSBuild Based to Windows and Build it

Targeted Application & Tools that can be used:

Tracking changes in the source code and source code managementAutomates web browsers
Configuration Management and IT automation. Integration of Individual Jobs and Effortless Auditing
Tools: Git, Ansible, Selenium and Jekins

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

Each batch of students (self-selected batch mates) will identify projects from searching on Google and implementwith the most suitable 2 or 3 antecedents.

Text Book

4. Craig Berg, "*DevOps For Beginners: A Complete Guide to DevOps Best Practices (Including How You Can Create World-Class Agility, Reliability, And Security In Technology Organizations With DevOps) (Code tutorials)*", Paperback – June 12, 2020.

Ferdinando Santacroce, "*Git Essentials*", Packt Publishing, April 2015, ISBN: 9781785287909

John Ferguson Smart. "*Jenkins: The Definitive Guide*", O'Reilly Media, Inc., July 2011, ISBN: 9781449305352

References

5. Jeff Geerling, "*Ansible for DevOps: Server and configuration management for humans*", Leanpub, August 5, 2020

. Unmesh Gundecha, Carl Cocchiaro, "*Learn Selenium*", Packt Publishing, July 2019, ISBN: 9781838983048

7. Gaurav Agarwal, "*Modern DevOps Practices: Implement and secure DevOps in the public cloud with cutting-edge tools, tips, tricks, and techniques*", July 2021.

8. Mikael Krief, "*Learning DevOps: The complete guide to accelerate collaboration with Jenkins, Kubernetes, Terraform and Azure DevOps*", October 2019

Weblinks:

. https://git-scm.com/book/en/v2
. https://www.simplilearn.com/tutorials/git-tutorial/git-tutorial-for-beginner
. https://www.javatpoint.com/selenium-tutorial
0. https://www.javatpoint.com/ansible
1. https://www.tutorialspoint.com/jenkins_managing_plugins.htm
2. https://nptel.ac.in/courses/128106012

Topics relevant to "SKILL DEVELOPMENT": Git&Junit, Ansible, Selenium, Jenkins for Skill Development throughExperiential Learning techniques. This is attained through assessment component mentioned in course handout.

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Course Code: CDV2503	**Software Testing**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	CDV1700 DevOps Foundations					
Anti-requisites	NIL					
Course Description	This course introduces students to fundamental principles and practices of software testing. It emphasizes various testing techniques including black-box and white-box testing, test case design, test automation, debugging, and reliability assessment. The course provides insights into the role of testing in software quality assurance and equips students to apply systematic testing strategies in real-world software projects.					
Course Objectives	To understand the importance of software testing in the software development lifecycle. To learn various testing techniques and their applications in software quality assurance. To analyze testing outcomes and debugging strategies. To explore tools and methodologies for automated testing and test management.					
Course Out Comes	CO1: Understand various software testing levels, techniques, and models used in industry. (Understand Level) CO2: Analyze software testing strategies and defect tracking mechanisms. (Analyze Level) CO3: Apply white-box and black-box testing techniques to evaluate software functionality and performance. (Apply Level) CO4: Implement and manage automated test scripts using industry tools. (Apply Level)					
Module 1	**Fundamentals of Software Testing**		**Understand**		**No. of Sessions: 11**	
Software Development Life Cycle, Role of Testing in SDLC, Verification vs Validation, Static vs Dynamic Testing, Levels of Testing, Types of Testing – Unit, Integration, System, Acceptance, Regression.						
Module 2	**Test Case Design Techniques and Defect Management**		**Analyse**		**No. of Sessions: 11**	
Black Box Testing: Equivalence Class Partitioning, Boundary Value Analysis, Decision Tables; White Box Testing: Statement, Branch, Path, and Condition Coverage; Defect Lifecycle, Bug Tracking Systems, Test Reporting.						

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Module 3	**Test Management and Automation**		**Apply**	**No. of Sessions: 11**
Test Planning, Test Metrics, Traceability Matrix, Test Environment Setup; Automation Testing Concepts, Selenium, JUnit/NUnit, Script Writing, Continuous Testing in CI/CD.				
Module 4	**Advanced Testing and Tools**		**Apply**	**No. of Sessions: 12**
Performance Testing (JMeter), Load Testing, Security Testing (OWASP overview), Mutation Testing, Test Data Generation, Model-Based Testing, Introduction to AI-driven Testing Tools.				

Textbooks

T1: Paul Ammann, Jeff Offutt, Introduction to Software Testing, Cambridge University Press, 2016.
T2: Srinivasan Desikan, Gopalaswamy Ramesh, Software Testing: Principles and Practices, Pearson Education, 2006.

Reference Books

R1: Ron Patton, *Software Testing*, Pearson Education, 2nd Edition, 2005.
R2: Aditya P. Mathur, *Foundations of Software Testing*, Pearson Education, 2008.
R3: Ilene Burnstein, *Practical Software Testing*, Springer, 2003.
R4: Boris Beizer, *Software Testing Techniques*, Dreamtech Press, 2nd Edition, 2003.

Web Resources

Course Code: CDV2504	**Software Testing Lab**	**L-T-P-C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites	CBD 1700 Introduction to Big Data					
Anti-requisites	NIL					
Course Description	This course provides practical exposure to various software testing techniques and tools used in industry. It enables students to design, develop, and execute test cases for functional and non-functional software systems. The lab sessions emphasize both manual and automated testing environments using open-source tools and frameworks.					
Course Objectives	To introduce the fundamental concepts of software testing life cycle and test management. To provide hands-on training in writing effective test cases and executing them on various software systems. To expose students to automated testing tools like Selenium, JUnit, and bug-					

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	tracking tools. To develop skills in identifying, documenting, and reporting software defects and ensuring software quality.
Course Out Comes	Upon successful completion of this course, the students will be able to: CO1: Understand various software testing techniques, strategies, and levels of testing. CO2: Apply manual and automated testing tools to evaluate the functionality and performance of software applications. CO3: Analyze test outcomes and identify bugs using defect tracking systems. CO4: Design and implement comprehensive test plans and interpret results to improve software quality.

List of Tools:

1. Manual Testing Tools

- **TestLink** – Test management and documentation
- **Bugzilla** – Bug reporting and tracking
- **MantisBT** – Lightweight issue tracker

2. Unit Testing Tools

- **JUnit** – Unit testing for Java
- **TestNG** – Advanced unit testing for Java
- **PyTest** – Unit testing for Python
- **NUnit** – Unit testing for .NET applications

3. Automation Testing Tools

- **Selenium IDE** – Record-and-playback for browser testing
- **Selenium WebDriver** – Code-based automation for web apps
- **Katalon Recorder** – Selenium-based test recorder (Chrome plugin)

4. Mobile Application Testing

- **Appium** – Automation for Android and iOS apps

5. Integration / CI Tools

- **Jenkins** – Continuous integration, pipeline integration
- **GitHub Actions** – Cloud-based CI/CD automation

6. Performance and Load Testing Tools

- **Apache JMeter** – Load, stress, and performance testing for web applications
- **Gatling** – High-performance load testing

7. Code Coverage Tools

- **JaCoCo** – Java code coverage

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- **Coverage.py** – Python code coverage
- **Clover** – Code coverage for Java/Groovy

🧹 8. Code Quality & Static Analysis

- **SonarQube** – Code quality and security analysis
- **PMD** – Java source code analyzer
- **FindBugs / SpotBugs** – Bug detection in Java

🌐 9. Cross-Browser Testing

- **Selenium Grid** – Parallel testing on different browsers/machines
- **Browsershots** – Web design testing in various browsers

List of Experiments

1. **Introduction to software testing, SDLC vs STLC, writing simple test cases**
2. **Manual testing – Functional and Non-functional test case design for a sample application**
3. **Boundary Value Analysis (BVA) and Equivalence Class Partitioning**
4. **Decision Table and State Transition testing techniques**
5. **Path coverage and control flow graph-based white-box testing**
6. **JUnit testing for Java programs – Unit Testing**
7. **Writing automation test scripts using Selenium IDE**
8. **Developing automated test cases using Selenium WebDriver**
9. **Cross-browser testing using Selenium Grid**
10. **Integration of Selenium with JUnit/TestNG for automation testing**
11. **Bug reporting and tracking using Bugzilla or Mantis**
12. **Test case execution and defect tracking on sample project**
13. **Performance testing using Apache JMeter**
14. **Preparing test plans, test suites, and test summary reports**
15. **Mini-project: Complete test life cycle on a web/mobile application including documentation**

Textbooks

T1: William Stallings, Cryptography and Network Security: Principles and Practice, Pearson, 7th Edition, 2017.
T2: Behrouz A. Forouzan, Cryptography and Network Security, McGraw-Hill Education, 2nd Edition, 2011.

Reference Books

R1: Bruce Schneier, *Applied Cryptography: Protocols, Algorithms, and Source Code in C*, Wiley, 2nd Edition, 1996.
R2: Douglas R. Stinson, *Cryptography: Theory and Practice*, CRC Press, 4th Edition, 2018.
R3: Charlie Kaufman, Radia Perlman, and Mike Speciner, *Network Security: Private Communication in a Public World*, Prentice Hall, 2nd Edition, 2002.
R4: Christof Paar, Jan Pelzl, *Understanding Cryptography: A Textbook for Students and Practitioners*,

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Springer, 2010.

Web Resources

W1: https://cryptography.io/ – Python cryptographic library and resources.
W2: https://nvlpubs.nist.gov/ – NIST publications on cryptographic standards.
W3: https://www.owasp.org/ – Open Web Application Security Project for best practices.
W4: https://www.tutorialspoint.com/cryptography/index.htm – Cryptography basics and tutorials.
W5: https://www.coursera.org/learn/crypto – Stanford's free online cryptography course on Coursera.

Course Code: CSE2264	**Course Title:** Essentials of AI **Type of Course:** Theory		**L- T-P-C**	3	**0**	0	**3**
Version No.	2.0					
Course Pre-requisi Dates	Basic knowledge of programming, mathematics, understanding of data handling					
Anti-requisites	**NIL**					
Course Description	This course is a comprehensive introductory course designed to equip learners with the fundamental Python programming skills necessary to work with artificial intelligence (AI) technologies. This course is aimed at individuals who are new to AI but have a basic understanding of programming concepts. It combines Python programming fundamentals with hands-on experience in implementing AI techniques such as machine learning, neural networks, and natural language processing.					
Course Objective	The objective of the course is to Understand Python Programming Fundamentals, Manipulate and Process Data with Python, Implement Machine Learning Algorithms and Build and Train Neural Networks for AI Applications.					
Course Outcomes	On successful completion of the course the students shall be able to: CO 1: Apply Python Programming to AI Projects CO 2: Build and Train Machine Learning Models CO 3: Develop Deep Learning Models with Neural Networks CO 4: Deploy AI Solutions and Understand Ethical Implications					
Course Content:						
Module 1	Introduction to Python Programming for AI	Assignment	Implementation			**10 Sessions**
Topics: Python Basics: Variables, Data Types, Operators, and Control Flow Functions, Loops, and Conditionals statements, Data Structures: Lists, Tuples, Dictionaries, Sets ,Introduction to Libraries: NumPy and Pandas for data manipulation, Basic Input/Output and File Handling Introduction to Python for AI: Libraries and Frameworks Overview						

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Module 2	Data Processing, Visualization	Assignment	Implementation	10 Sessions
Topics: cleaning and preprocessing with Pandas,Handling missing data, outliers, and duplicates, Data transformation (Normalization, Encoding), Introduction to Matplotlib and Seaborn for Data Visualization, Exploratory Data Analysis (EDA), Visualizing datasets to understand patterns and relationships.				
Module 3	Introduction to Machine Learning	Mini - Project	Implementation	10 Sessions
Topics: What is Machine Learning? Types of ML algorithms Supervised Learning: Regression, Classification, Unsupervised Learning: Clustering, Key ML Algorithms: Linear Regression, Decision Trees, K-Means ,Introduction to Scikit-learn library Model evaluation (Accuracy, Precision, Recall, Confusion Matrix)				
Module 4	Neural Networks and Deep Learning	Quiz	Implementation	10 Sessions
Topics: Introduction to Neural Networks and Deep Learning, Perceptron Model and Backpropagation Deep Neural Networks and Activation Functions, Introduction to TensorFlow and Keras, Building and Training Neural Networks for Image and Text Classification, Overview of Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs)				

Targeted Application & Tools that can be used:

Applications:

1. **Data Preprocessing**: Clean and manipulate data from various sources such as CSV, Excel, SQL databases, and APIs.
2. **Exploratory Data Analysis (EDA)**: Gain insights into datasets by identifying trends, patterns, and outliers.
3. **Predictive Modeling**: Build models for classification (e.g., spam detection) and regression (e.g., house price prediction).
4. **Clustering**: Group data into clusters for unsupervised learning tasks (e.g., customer segmentation).
5. **Model Evaluation**: Assess model performance using appropriate metrics such as accuracy, precision, recall, and F1-score.

Tools:

- **Pandas**: For data manipulation and cleaning (e.g., handling missing values, merging datasets).
- **NumPy**: For numerical operations and working with arrays and matrices.
- **Matplotlib**: For creating static, animated, and interactive visualizations.
- **Seaborn**: For advanced data visualizations (e.g., heatmaps, pair plots).
- **Plotly**: For creating interactive visualizations, especially useful for large datasets.
- **Scikit-learn**: The go-to library for implementing machine learning algorithms (e.g., linear regression, decision trees, k-means clustering).
- **XGBoost**: For advanced gradient boosting models, particularly for large-scale machine learning tasks.
- **TensorFlow** (for deep learning in Module 4): A powerful open-source library for building machine learning and deep learning models.
- **Keras**: High-level neural network API, built on top of TensorFlow, to easily create deep learning models.

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NLTK: The Natural Language Toolkit for various text processing tasks like tokenization, stemming, and part-of-speech tagging. **spaCy**: A fast NLP library for advanced NLP tasks such as named entity recognition and dependency parsing. **Transformers (by Hugging Face)**: A powerful library for using pre-trained Transformer-based models like BERT, GPT, and others for advanced NLP tasks.
Text Book(s): T1: **Essentials of Python for Artificial Intelligence and Machine Learning** by Pramod Gupta and Anupam Bagchi
Reference(s): ● "Artificial Intelligence with Python" – Prateek Joshi ● "Python Machine Learning" – Sebastian Raschka & Vahid Mirjalili ● "Hands-On Artificial Intelligence with Python" – Teet Straus ● "Deep Learning for Coders with Fastai and PyTorch" – Jeremy Howard & Sylvain Gugger

Course Code: **CSE2265**	**Course Title:** Essentials of AI LAB **Type of Course:** Lab	**L- T- P- C**	0	0	4	2
Version No.	2.0					
Course Prerequisites	Basic Java Programming Knowledge, Mathematics: Linear Algebra and Probability, Basic Data Structures and Algorithms, Familiarity with Libraries and Tools, Understanding of Basic Machine Learning Concepts.					
Anti-requisites	**NIL**					
Course Description	This course introduces students to the essential concepts and techniques of Artificial Intelligence (AI) with a focus on practical implementation using Python. Students will explore core AI topics such as search algorithms, knowledge representation, machine learning, and neural networks, while gaining proficiency in using popular Python libraries like NumPy, pandas, scikit-learn, and TensorFlow. Through a series of lab exercises and projects, students will apply AI principles to solve real-world problems, develop intelligent applications, and understand how AI systems function at a foundational level.					
Course Objective	The primary objectives of the course are to Gain Proficiency in AI Concepts and Python Implementation, Develop and Implement Machine Learning Models, Understand and Build Neural Networks, Apply AI to Real-World Problems					
Course Outcomes	On successful completion of the course the students shall be able to: 1. Proficiency in Implementing AI Algorithms Using Python 2. Ability to Build and Evaluate Machine Learning Models 3. Hands-on Experience with Neural Networks and Deep Learning 4. Practical Application of AI to Solve Real-World Problems					
Course Content:						

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Module 1	Introduction to AI and Python for AI	Assignment	Implementation	**8 Sessions** I

Lab Assignment 1: Setting Up the Python Environment

- **Objective:** Get familiar with setting up a Python environment for AI projects.
- **Tasks:**

1. Install Python, Anaconda, and Jupyter Notebook.
2. Set up a virtual environment for AI development.
3. Install essential Python libraries: numpy, pandas, matplotlib, and scikit-learn.
4. Write and execute simple Python code to verify installation (e.g., print a "Hello AI" message).

Lab Assignment 2: Basic Python Programming for AI

- **Objective:** Understand and practice the basic Python syntax and data structures used in AI.
- **Tasks:**

1. Write Python code to work with basic data types (integer, float, string, boolean).
2. Implement and manipulate Python lists, tuples, sets, and dictionaries.
3. Create basic control flow structures: if-else, for loops, while loops.
4. Use functions and lambda functions to solve small AI-related problems, such as calculating factorial or Fibonacci numbers.

Lab Assignment 3: Data Exploration and Preprocessing

- **Objective:** Learn how to work with data for AI models.
- **Tasks:**

1. Load a dataset (e.g., Titanic or Iris dataset) using pandas.
2. Clean the dataset by handling missing values, removing duplicates, and converting data types if needed.
3. Explore the dataset by visualizing it using matplotlib and seaborn.
4. Perform basic data preprocessing tasks such as feature scaling, encoding categorical variables, and splitting data into training and testing sets.

Module 2	Data Processing, Visualization	Assignment	Implementation	8 Sessions

Lab Assignment 1: Data Preprocessing with Pandas

Objective:
Learn the fundamentals of data preprocessing, including cleaning, handling missing values, and performing basic transformations using **Pandas**.
Tasks:

1. **Load and Inspect the Dataset:**
   - Load a dataset (e.g., **Iris**, **Titanic**, **Wine Quality** dataset) using pandas.read_csv() or pandas.read_excel().
   - Inspect the first few rows of the dataset using .head() and check basic information using .info().
2. **Handle Missing Values:**
   - Identify missing values in the dataset using .isnull() or .isna().
   - Handle missing data by imputing with mean, median, or mode using SimpleImputer from sklearn, or remove rows with missing data using .dropna().
3. **Data Transformation:**
   - Convert categorical variables to numerical values using one-hot encoding or label encoding.
   - Normalize/standardize numerical columns using StandardScaler or MinMaxScaler from sklearn.
4. **Subset and Filter Data:**

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○ Create subsets based on certain conditions (e.g., select rows where a specific feature value is greater than a threshold).
○ Filter outliers from numerical data using interquartile range (IQR).

Lab Assignment 2: Data Aggregation and Grouping with Pandas

Objective:
Master aggregation and grouping techniques using **Pandas** for summarizing data.
Tasks:

1. **Group Data by Category:**
○ Group data by one or more categorical features (e.g., "class" in the Iris dataset or "embarked" in Titanic dataset).
○ Use .groupby() to calculate aggregate statistics such as mean, median, sum, and count.
2. **Pivot Tables:**
○ Create a pivot table to summarize data (e.g., aggregate the average age of passengers in the Titanic dataset by class and gender).
○ Use .pivot_table() to perform multi-dimensional aggregation.
3. **Data Aggregation and Custom Functions:**
○ Apply custom aggregation functions to the grouped data (e.g., calculate custom metrics or perform complex transformations within each group).
4. **Sorting and Ranking Data:**
○ Sort the dataset by multiple columns (e.g., sorting by "age" or "fare").
○ Rank data based on specific metrics (e.g., assign ranks to passengers by fare in the Titanic dataset).

Lab Assignment 3: Data Visualization with Matplotlib and Seaborn

Objective:
Learn to visualize datasets using **Matplotlib** and **Seaborn** for better understanding and insights.
Tasks:

1. **Basic Plotting with Matplotlib:**
○ Create simple plots like line plots, bar plots, and histograms using **Matplotlib**.
○ Customize the plots by setting titles, labels, and legends.
○ Create scatter plots to visualize relationships between two variables.
2. **Advanced Plotting with Seaborn:**
○ Use **Seaborn** to create advanced visualizations like pair plots, heatmaps, box plots, and violin plots.
○ Customize visualizations with color palettes, styling, and themes.
○ Create a correlation heatmap to visualize correlations between features in the dataset.
3. **Distribution Visualizations:**
○ Plot distributions of continuous variables using **Seaborn's** distplot() or kdeplot().
○ Create bar plots for categorical variables to understand their frequency distribution.
4. **Multi-Plot Grid Layouts:**
○ Use **Matplotlib's** subplots() function to create multiple plots in a grid layout for comparison (e.g., scatter plot and histogram in the same figure).

Lab Assignment 4: Visualizing Relationships and Feature Importance

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Objective:
Understand how to visualize relationships between features and evaluate feature importance for predictive models.
Tasks:

1. **Scatter Plot Matrix:**
   - Use **Seaborn's** pairplot() to create a scatter plot matrix to visualize the relationships between multiple features.
   - Analyze the pairwise relationships between features and identify any patterns or correlations.
2. **Heatmap of Correlation Matrix:**
   - Use **Pandas** to calculate the correlation matrix of numeric features.
   - Visualize the correlation matrix using **Seaborn's** heatmap() to understand feature correlations and multicollinearity.
3. **Feature Importance from Models:**
   - Train a decision tree or random forest model using **scikit-learn** on a dataset (e.g., **Iris** or **Titanic**).
   - Visualize feature importance using a bar chart to understand which features have the most impact on the model.
4. **Visualizing Predictions vs. Actual Values:**
   - For regression tasks, visualize the predicted values against the actual values using a scatter plot.
   - For classification tasks, visualize the classification results with a confusion matrix.

Lab Assignment 5: Time Series Data Visualization and Processing

Objective:
Learn how to process and visualize time series data, which is common in AI applications like forecasting and trend analysis.
Tasks:

1. **Load and Preprocess Time Series Data:**
   - Load a time series dataset (e.g., stock market data, weather data).
   - Parse dates properly and set the date column as the index using pd.to_datetime() and .set_index().
2. **Plot Time Series Data:**
   - Plot a time series line chart using **Matplotlib** to visualize trends over time.
   - Create rolling averages (e.g., 7-day, 30-day) to smooth out short-term fluctuations in the time series data.
3. **Seasonal Decomposition of Time Series:**
   - Use **statsmodels** to decompose a time series into seasonal, trend, and residual components.
   - Visualize the decomposed components to understand seasonal variations.
4. **Forecasting with Simple Models:**
   - Use simple forecasting models (e.g., moving average, ARIMA) to predict future values.
   - Visualize the forecasted data along with actual historical data.

Module 3	Introduction to Machine Learning	Assignments	Implementation	8 Sessions

Lab Assignment 3: Implementing Linear Regression

- **Tasks:**

1. Load a real-world dataset (e.g., **Boston Housing Price** dataset).
2. Train a **Linear Regression** model using LinearRegression() from scikit-learn.

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3. Evaluate the model using **Mean Squared Error (MSE)** and **R-squared Score**.
4. Visualize the regression line using Matplotlib.

Lab Assignment 4: Logistic Regression for Classification

- **Tasks:**

1. Load the **Iris** or **Breast Cancer** dataset.
2. Preprocess the dataset (handle missing values, encode categorical variables, scale data).
3. Train a **Logistic Regression** model using LogisticRegression().
4. Evaluate performance using **Accuracy, Precision, Recall, F1-score**.
5. Plot the **Confusion Matrix** and **ROC Curve**.

Lab Assignment 5: Implementing K-Nearest Neighbors (KNN)

- **Tasks:**

1. Load the **Iris dataset** and split it into training and testing sets.
2. Train a **KNN classifier** using KNeighborsClassifier().
3. Experiment with different values of **K** and evaluate performance.
4. Visualize decision boundaries using a **scatter plot**.

Lab Assignment 6: Decision Trees and Random Forests

- **Tasks:**

1. Train a **Decision Tree classifier** on the Titanic dataset.
2. Visualize the tree structure using plot_tree().
3. Train a **Random Forest classifier** and compare performance with the decision tree.
4. Determine the **feature importance** using feature_importances_.

Module 4	Neural Networks and Deep Learning	Quiz	Implementation	6 Sessions

Lab Assignment 7: Introduction to Perceptron and Activation Functions

Tasks:

1. Implement a **single-layer perceptron** using NumPy.
2. Train the perceptron to classify **AND, OR, XOR** gates.
3. Experiment with different **activation functions** (Sigmoid, ReLU, Tanh).
4. Visualize decision boundaries.

Lab Assignment 8: Building a Simple Neural Network with Keras

Tasks:

1. Load the **MNIST dataset** from keras.datasets.
2. Preprocess the data (normalize pixel values, reshape input).
3. Create a **fully connected neural network** using Sequential API.

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4. Train and evaluate the model using **categorical cross-entropy loss** and **accuracy**.

Lab Assignment 9: Implementing CNN from Scratch

Tasks:

1. Load the **CIFAR-10 dataset**.
2. Build a CNN with **Conv2D, MaxPooling2D, Flatten, Dense, Dropout** layers.
3. Use **Adam optimizer** and **categorical cross-entropy loss**.
4. Train and visualize loss/accuracy curves.

Lab Assignment 10: Image Augmentation & Regularization

Tasks:

1. Apply **data augmentation** (rotation, zoom, flipping) using ImageDataGenerator.
2. Add **dropout and batch normalization** to prevent overfitting.
3. Compare model performance with and without augmentation.

Lab Assignment 11: Transfer Learning with Pre-trained Models

Tasks:

1. Use **VGG16 or ResNet50** pre-trained on ImageNet.
2. Replace the output layer to classify **new images**.
3. Freeze earlier layers and fine-tune deeper layers.
4. Evaluate the model on a custom **dataset (e.g., Cats vs. Dogs)**.

Lab Assignment 12: Implementing RNN for Text Classification

Tasks:

1. Load **IMDB movie reviews dataset** from keras.datasets.
2. Preprocess text (tokenization, padding sequences).
3. Build an **RNN** with **Embedding, SimpleRNN, Dense** layers.
4. Train and evaluate the model.

Lab Assignment 13: Building an LSTM for Time Series Prediction

Tasks:

1. Load a **time series dataset** (e.g., stock prices, temperature data).
2. Preprocess the data (normalize, reshape).
3. Build an **LSTM-based model**.
4. Predict future values and visualize trends.

Targeted Application & Tools that can be used:

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Applications:

1. **Data Preprocessing**: Clean and manipulate data from various sources such as CSV, Excel, SQL databases, and APIs.
- **Exploratory Data Analysis (EDA)**: Gain insights into datasets by identifying trends, patterns, and outliers.
- **Predictive Modeling**: Build models for classification (e.g., spam detection) and regression (e.g., house price prediction).
- **Clustering**: Group data into clusters for unsupervised learning tasks (e.g., customer segmentation).
- **Model Evaluation**: Assess model performance using appropriate metrics such as accuracy, precision, recall, and F1-score.

Tools:

- **Pandas**: For data manipulation and cleaning (e.g., handling missing values, merging datasets).
- **NumPy**: For numerical operations and working with arrays and matrices.
- **Matplotlib**: For creating static, animated, and interactive visualizations.
- **Seaborn**: For advanced data visualizations (e.g., heatmaps, pair plots).
- **Plotly**: For creating interactive visualizations, especially useful for large datasets.
- **Scikit-learn**: The go-to library for implementing machine learning algorithms (e.g., linear regression, decision trees, k-means clustering).
- **XGBoost**: For advanced gradient boosting models, particularly for large-scale machine learning tasks.
- **TensorFlow** (for deep learning in Module 4): A powerful open-source library for building machine learning and deep learning models.
- **Keras**: High-level neural network API, built on top of TensorFlow, to easily create deep learning models.

NLTK: The Natural Language Toolkit for various text processing tasks like tokenization, stemming, and part-of-speech tagging.

spaCy: A fast NLP library for advanced NLP tasks such as named entity recognition and dependency parsing.

Transformers (by Hugging Face): A powerful library for using pre-trained Transformer-based models like BERT, GPT, and others for advanced NLP tasks.

Text Book(s):

T1: ***Essentials of Python for Artificial Intelligence and Machine Learning*** *by Pramod Gupta and Anupam Bagchi*

Reference(s):

1. "Artificial Intelligence with Python" – Prateek Joshi
2. "Python Machine Learning" – Sebastian Raschka & Vahid Mirjalili
3. "Hands-On Artificial Intelligence with Python" – Teet Straus
4. "Deep Learning for Coders with Fastai and PyTorch" – Jeremy Howard & Sylvain Gugger

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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	NIL					
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 Out Comes	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	**06 Sessions**		
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	Problems on DFA, NFA's	**13 Sessions**		
Topics: Basic concepts of Finite automata, DFA- definitions of DFA, Deterministic Accepters Transition Graphs and Languages and DFA's, Regular Languages, NFA- Definition of a Nondeterministic Accepter, Languages and NFA's Why Non-determinism? Equivalence of Deterministic and Nondeterministic Finite Accepters, Reduction of the Number of States in Finite Automata.						
Module 3	**Regular Expressions & Context Free Grammar**	Assignment	Problems on RE, CFG, PT, PL and Ambiguity	**12 Sessions**		
Topics: Formal Definition of a Regular Expression, Languages Associated with Regular Expressions, Languages, Regular Languages (RL) and Non-regular Languages: Closure properties of RLs, to show some languages are not RLs, Closure Properties of Regular Context Free Grammars-Examples of Context-Free Languages, Leftmost and Rightmost Derivations, Derivation Trees, Relation Between Sentential Forms and Derivation Trees, Ambiguity in Grammars and Languages: Ambiguous Grammars, Removing Ambiguity, Chomsky Normal Form, Gribiche Normal Form.						
Module 4	**Push down Automata**	Assignment	Problems on pushdown Automaton	**08 Sessions**		
Topics: Definition of a Pushdown Automaton, Language Accepted by a Pushdown Automaton, Acceptance						

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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 1. Peter Linz, "An introduction to Formal Languages and Automata", Jones and Bartlett Publications 6th Ed, 2018.				
References 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				
Topics relevant to "SKILL DEVELOPMENT": Deterministic and Non-Deterministic Automaton, Regular Expressions, CFGs, Turning Machine and Pushdown automaton for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.				

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Course Code: CDV2507
Course Title: Kubernetes and Container Orchestration
L:T:P:C – 3:0:0:3
Total Hours: 45
Prerequisite: CDV2000

Course Description
This course focuses on container orchestration using Kubernetes, one of the most widely adopted tools in cloud-native application deployment. Students will learn to design, deploy, and manage containerized applications at scale, along with key concepts in orchestration, networking, scaling, and observability.

Course Objectives
- Understand the core concepts of Kubernetes architecture and components
- Learn to deploy and manage containerized applications using Kubernetes
- Explore networking, services, and ingress in Kubernetes
- Study scaling, monitoring, and rolling updates in production environments
- Examine orchestration techniques for high availability and resiliency

Course Outcomes
- **CO1 (Understand):** Describe the architecture and functioning of Kubernetes components
- **CO2 (Apply):** Deploy and manage applications using Kubernetes clusters
- **CO3 (Analyze):** Evaluate orchestration strategies including scaling, upgrades, and fault tolerance
- **CO4 (Apply):** Configure networking, storage, and observability features in a Kubernetes environment

Course Content (Total: 45 Hours)
Module 1: Introduction to Containers and Kubernetes – 10 Hours
Containerization concepts, Docker review, Need for orchestration, Kubernetes architecture (master & nodes), Core components (etcd, kube-apiserver, kube-scheduler, kubelet, kube-proxy), Kubernetes vs other orchestrators.
Module 2: Kubernetes Core Concepts – 12 Hours
Pods, ReplicaSets, Deployments, Namespaces, ConfigMaps, Secrets, Labels & Selectors, Lifecycle of a pod, Health checks (Liveness and Readiness probes).
Module 3: Networking, Storage & Scaling – 11 Hours
Kubernetes Networking model, ClusterIP, NodePort, LoadBalancer, Ingress controllers, Volumes and Persistent Volumes (PV/PVC), StatefulSets, Horizontal Pod Autoscaler (HPA), Rolling updates and rollbacks.
Module 4: Observability and Advanced Orchestration – 12 Hours
Logging and monitoring in Kubernetes (Prometheus, Grafana), Resource management and quotas, Helm charts for application packaging, Service Mesh overview (Istio), Security in Kubernetes (RBAC, Network Policies), CI/CD integration.

Textbooks
- **T1**: Brendan Burns, *Designing Distributed Systems*, O'Reilly Media
- **T2**: Kelsey Hightower et al., *Kubernetes: Up and Running*, O'Reilly Media

Reference Books
- **R1**: Nigel Poulton, *The Kubernetes Book*, 2023
- **R2**: Jonathan Baier, *Getting Started with Kubernetes*, Packt
- **R3**: Marko Luksa, *Kubernetes in Action*, Manning Publications
- **R4**: Oleg Chunikhin, *Cloud Native DevOps with Kubernetes*, O'Reilly

Web Resources

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- https://kubernetes.io/docs
- https://helm.sh/docs
- https://prometheus.io/docs
- https://istio.io/latest/docs
- https://grafana.com/docs

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)					

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<table>
<tr><td>Course Code: APT4006</td><td colspan="3">Course Title: Logical and Critical Thinking

Type of Course: Audited</td><td>L- T-P-C</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
<tr><td>Version No.</td><td colspan="8">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">Students should have the basic concepts of Logical reasoning and Critical thinking, along with its applications in real life problems.</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">Nil</td></tr>
<tr><td>Course Description</td><td colspan="8">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.</td></tr>
<tr><td>Course Objective</td><td colspan="8">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.</td></tr>
<tr><td rowspan="4">Course Outcomes</td><td colspan="8">On successful completion of the course the students shall be able to:</td></tr>
<tr><td colspan="8">CO1] Understand all the concepts.</td></tr>
<tr><td colspan="8">CO2] Apply the concepts in problem solving (Bloom’s taxonomy Level 3)</td></tr>
<tr><td colspan="8">CO3] Analyze and structure the reasoning techniques and spatial visualization skills</td></tr>
<tr><td colspan="9">Course Content:</td></tr>
<tr><td>Module 1</td><td colspan="3">Logical Thinking</td><td>Assignment</td><td colspan="3"></td><td>16 Hours</td></tr>
<tr><td rowspan="2"></td><td colspan="8">Topics:</td></tr>
<tr><td colspan="8">Syllogisms, Cubes and Dices, Mirror and Water images, Paper cutting and Folding, Embedded figures & Completion of figures, Data Interpretation, Data sufficiency</td></tr>
<tr><td>Module 2</td><td colspan="3">Critical Thinking</td><td>Assignment</td><td colspan="3"></td><td>14 Hours</td></tr>
<tr><td rowspan="2"></td><td colspan="8">Topics:</td></tr>
<tr><td colspan="8">Analogy, Symbol and Notations, Statement and assumption, Cause of action, Statement and conclusion, Puzzles</td></tr>
<tr><td rowspan="3"></td><td colspan="8">Targeted Application & Tools that can be used:</td></tr>
<tr><td colspan="8">Application area: Placement activities and Competitive examinations.</td></tr>
<tr><td colspan="8">Tools: LMS</td></tr>
<tr><td rowspan="3">Evaluation</td><td colspan="8">Continuous Evaluation</td></tr>
<tr><td colspan="8">· Topic wise evaluation</td></tr>
<tr><td colspan="8">· Internal Assessments</td></tr>
</table>

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	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.

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	Online	MCQ Quiz	5 Sessions		

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	Education	Assessment		
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.				

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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.

Semester: 6

Course Code: CDV2508
Course Title: Continuous Integration and Continuous Delivery (CI/CD) Pipelines
L:T:P:C – 3:0:0:3
Total Hours: 45
Prerequisite: CDV2501 – DevOps Tools and Internals

Course Description

This course provides in-depth knowledge of CI/CD principles, tools, and practices used in modern software development. It covers the entire pipeline from code commit to deployment, enabling faster, reliable, and automated software delivery.

Course Objectives

- Understand the principles and lifecycle of CI/CD in DevOps
- Learn to design, implement, and monitor CI/CD pipelines

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- Explore popular CI/CD tools such as Jenkins, GitLab CI, GitHub Actions, and others
- Implement build automation, test integration, and secure deployments
- Integrate code quality checks, containerization, and orchestration into pipelines

Course Outcomes

- **CO1 (Understand):** Explain the role and benefits of CI/CD in modern DevOps practices
- **CO2 (Apply):** Construct automated CI/CD pipelines using industry-standard tools
- **CO3 (Analyze):** Evaluate pipeline performance and optimize for speed and reliability
- **CO4 (Apply):** Integrate testing, security, and monitoring in deployment pipelines

Course Content (Total: 45 Hours)

Module 1: CI/CD Fundamentals and Pipeline Architecture – 10 Hours

Introduction to CI/CD, Benefits and challenges, CI/CD lifecycle, Stages in a pipeline: source, build, test, release, deploy, feedback loops, Pipeline architecture patterns.

Module 2: Tools and Technologies for CI/CD – 12 Hours

Overview of Jenkins, GitLab CI, GitHub Actions, CircleCI, TravisCI, Azure DevOps, YAML pipelines, Webhooks and triggers, Version control integration (GitHub/GitLab/Bitbucket).

Module 3: Pipeline Design, Automation, and Testing – 12 Hours

Scripting build stages, Static code analysis tools (SonarQube), Automated testing: unit, integration, functional, Performance testing integration, Secrets management and credential handling.

Module 4: Containerization, Security, and Monitoring in Pipelines – 11 Hours

Docker and Kubernetes integration, Deployment strategies (Blue/Green, Canary), Security practices in pipelines (SAST/DAST), Pipeline observability: logging, metrics, alerts, Case studies: GitOps, CI/CD in cloud-native environments.

Textbooks

- **T1**: Jez Humble & David Farley, *Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation*, Addison-Wesley
- **T2**: Nikhil Pathania, *CI/CD Pipeline with Jenkins*, Packt Publishing

Reference Books

- **R1**: Mohamed Labouardy, *Hands-On Continuous Integration and Delivery*, Packt
- **R2**: Stephen Fleming, *Mastering Jenkins*, 2023 Edition
- **R3**: Viktor Farcic, *The DevOps Toolkit: Building the DevOps Pipeline*, DevOps Toolkit Series
- **R4**: Brent Laster, *Jenkins 2: Up and Running*, O'Reilly

Web Resources

- https://www.jenkins.io/doc
- https://docs.gitlab.com/ee/ci
- https://docs.github.com/actions
- https://circleci.com/docs
- https://azure.microsoft.com/en-us/services/devops

Course Code: CDV2509
Course Title: Continuous Integration and Continuous Delivery (CI/CD) Pipelines Lab
L:T:P:C – 0:0:4:2
Duration: 15 Weeks
Prerequisite: CDV2508 – Continuous Integration and Continuous Delivery (CI/CD) Pipelines

Course Description

This lab course offers hands-on experience in building, testing, and deploying software through CI/CD pipelines. It reinforces theoretical knowledge with practical implementations using tools like Jenkins, GitLab

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CI, GitHub Actions, and Docker. Students will learn to automate the software development lifecycle with a focus on continuous integration, automated testing, delivery pipelines, and deployment.

Lab Objectives

- Set up and configure CI/CD pipelines using industry-standard tools
- Automate build, test, and deployment stages
- Integrate code quality, security scans, and monitoring into pipelines
- Use containerization tools and orchestrators in the pipeline process
- Troubleshoot and optimize pipeline performance

Lab Outcomes

- **LO1 (Apply):** Configure and implement CI/CD pipelines using Jenkins, GitLab CI, or GitHub Actions
- **LO2 (Apply):** Automate build, test, and deployment processes with version control integration
- **LO3 (Analyze):** Evaluate pipeline logs, identify bottlenecks, and ensure successful deployments
- **LO4 (Create):** Design and execute complete CI/CD workflows integrating containerization and cloud deployment tools

List of Lab Experiments (Sample – Extendable to 15 Weeks)

1. **Introduction to CI/CD tools and Git integration**
2. **Install and configure Jenkins for pipeline setup**
3. **Create a freestyle Jenkins job for a basic Java project**
4. **Build a multistage pipeline using Jenkins (Build → Test → Deploy)**
5. **Integrate static code analysis (SonarQube) with CI pipeline**
6. **Automate unit and integration testing with JUnit and Maven**
7. **Containerize a sample application using Docker and deploy via Jenkins**
8. **Use GitLab CI/CD to build and deploy a web application**
9. **Implement CI/CD pipeline using GitHub Actions with YAML**
10. **Setup secrets and environment variables in CI/CD pipelines securely**
11. **Deploy to staging environment using Docker Compose/Kubernetes**
12. **Implement Blue/Green deployment strategy using Jenkins pipeline**
13. **Monitor pipeline status and generate build/test reports**
14. **Simulate failure and rollback strategies in CI/CD workflows**
15. **Mini project: Design a full pipeline from code commit to deployment (Cloud Optional)**

Tools and Platforms

- Jenkins, GitHub Actions, GitLab CI
- Docker, Docker Compose, Kubernetes
- SonarQube, JUnit, Selenium
- AWS/GCP/Azure (optional for cloud-based deployments)
- VS Code, Git, Postman

Web Resources

- https://www.jenkins.io/doc/
- https://docs.gitlab.com/ee/ci/
- https://docs.github.com/en/actions
- https://hub.docker.com/
- https://kubernetes.io/docs/

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Course Code: CDV2510
Course Title: Edge Computing and DevOps
L:T:P:C – 3:0:0:3
Total Hours: 45
Prerequisite: CDV2000

Course Description
This course explores the convergence of Edge Computing and DevOps practices to build scalable, real-time, low-latency applications. Students will learn how DevOps tools and automation can be applied to edge infrastructure for faster deployment, continuous integration, and robust performance in distributed environments.

Course Objectives

- Understand the fundamentals and architecture of edge computing
- Explore use cases of edge computing in modern systems
- Analyze the integration of DevOps practices in edge deployments
- Study orchestration, monitoring, and automation in edge environments
- Design DevOps pipelines tailored for edge applications

Course Outcomes

- **CO1 (Understand):** Explain the architecture, characteristics, and use cases of edge computing
- **CO2 (Analyze):** Analyze how DevOps principles apply in distributed and edge environments
- **CO3 (Apply):** Implement DevOps workflows for edge-based applications
- **CO4 (Apply):** Assess edge DevOps strategies with respect to scalability, latency, and reliability

Course Content (Total: 45 Hours)
Module 1 – Introduction to Edge Computing (10 Hours)
Definition, characteristics, and architecture of edge computing, comparison with cloud computing, edge-to-cloud continuum, real-world applications (IoT, AR/VR, autonomous vehicles), edge computing challenges.
Module 2 – DevOps Fundamentals Refresher (8 Hours)
DevOps lifecycle, CI/CD concepts, Infrastructure as Code (IaC), monitoring and logging, containerization (Docker), introduction to orchestration tools (Kubernetes, K3s).
Module 3 – DevOps at the Edge (14 Hours)
CI/CD pipeline adaptations for edge, lightweight orchestration tools (K3s, MicroK8s), edge AI/ML model deployment, GitOps for edge, security concerns in edge DevOps, OTA (over-the-air) updates.
Module 4 – Use Cases, Tools, and Future Directions (13 Hours)
Case studies in smart cities, healthcare, industrial IoT, EdgeOps platforms (AWS IoT Greengrass, Azure IoT Edge, NVIDIA Jetson, Open Horizon), future trends: 5G + Edge, edge-native applications.

Textbooks

- **T1**: Mung Chiang & Tao Zhang, *Fog and Edge Computing: Principles and Paradigms*, Wiley
- **T2**: Len Bass, Ingo Weber, Liming Zhu, *DevOps: A Software Architect's Perspective*, Addison-Wesley

Reference Books

- **R1**: Amir Vahid Dastjerdi, *Internet of Things: Principles and Paradigms*, Morgan Kaufmann
- **R2**: Kelsey Hightower, Brendan Burns, and Joe Beda, *Kubernetes: Up and Running*, O'Reilly
- **R3**: Stephen Fleming, *Edge Computing: A Primer*, Independently Published

Web Resources

- https://www.lfedge.org/
- https://azure.microsoft.com/en-us/services/iot-edge/
- https://aws.amazon.com/greengrass/
- https://k3s.io/
- https://kubernetes.io/

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Course Code: CDV2511
Course Title: DevSecOps
L:T:P:C – 3:0:0:3
Total Hours: 45
Prerequisite: CDV2000

Course Description

This course introduces students to **DevSecOps** – the integration of security practices into the DevOps pipeline. It covers secure coding, automated security testing, compliance, container and cloud security, and the application of security as code. Students will learn to embed security from the start of the development lifecycle to ensure continuous and automated protection.

Course Objectives

- Understand the principles and practices of DevSecOps
- Explore tools and techniques for integrating security in CI/CD pipelines
- Analyze security risks in cloud-native and containerized environments
- Implement security automation and monitoring
- Ensure compliance and governance in modern software delivery

Course Outcomes

- **CO1 (Understand):** Explain the need and role of security in DevOps environments
- **CO2 (Apply):** Integrate security checks and tools into CI/CD pipelines
- **CO3 (Analyze):** Evaluate threats and implement security controls in cloud/container platforms
- **CO4 (Apply):** Develop a secure DevOps workflow incorporating automation, compliance, and monitoring

Course Content (Total: 45 Hours)

Module 1 – Introduction to DevSecOps (10 Hours)

DevOps vs. DevSecOps, shift-left security, security challenges in agile and DevOps, DevSecOps lifecycle, secure SDLC (sSDLC), roles and responsibilities.

Module 2 – Security Integration in CI/CD Pipelines (12 Hours)

Static Application Security Testing (SAST), Dynamic Application Security Testing (DAST), Software Composition Analysis (SCA), Secrets management, Secure image scanning (e.g., Trivy, Clair), vulnerability scanning tools (e.g., SonarQube, Snyk).

Module 3 – Container and Cloud Security (12 Hours)

Security in container environments (Docker, Kubernetes), Pod security policies, network policies, runtime security (Falco, AppArmor), cloud-native security tools (AWS GuardDuty, Azure Security Center), compliance as code (OpenSCAP, Chef InSpec).

Module 4 – Security Automation and Monitoring (11 Hours)

Infrastructure as Code (IaC) security (Terraform, Ansible), logging and monitoring for security, intrusion detection systems (IDS), SIEM integration, DevSecOps best practices and case studies.

Textbooks

- **T1**: Glenn Wilson, *DevSecOps: A leader's guide to producing secure software without compromising flow, feedback and continuous improvement*, IT Revolution Press
- **T2**: Jim Bird, *DevOpsSec: Securing Software through Continuous Delivery*, O'Reilly Media

Reference Books

- **R1**: Mark Miller et al., *Modern Cybersecurity Practices*, Packt Publishing
- **R2**: Liz Rice, *Container Security*, O'Reilly
- **R3**: Julian Kosanke, *DevSecOps: Integrating Security into DevOps*, Apress

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Web Resources
• https://owasp.org/ • https://snyk.io/ • https://docs.docker.com/engine/security/ • https://kubernetes.io/docs/concepts/security/ • https://cheatsheetseries.owasp.org/

Course Code: CSE2262	**Course Title: Analysis of Algorithms** **Type of Course: THEORY Only**	**L- T-P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	**CSE2001**					
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.[Applying] 2. Apply divide and conquer technique for searching and sorting Problems.[Applying] 3. Apply the Dynamic Programming technique for a given problem. [Applying] 4. Apply greedy technique for solving a Problem.[Applying] 5. Demonstrate Back tracking technique and limitations of Algorithms.[Applying]					
Course Content:						
Module 1	**Introduction**	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.						

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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 component mentioned in course handout.

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Course Code: CSE2263	**Course Title:** **Analysis of Algorithms Lab** **Type of Course: Integrated**	**L- T-P- C**	0	0	2	1
Version No.	1					
Course Pre-requisites	**nil**					
Anti-requisites	NIL					
Course Description	This course introduces techniques for the design and analysis of efficient algorithms and methods of applications. This course discusses the classic approaches for algorithm design such as Divide and Conquer, Dynamic Programming, Greedy method. This course also describes other basic strategies searching solution space. The core concepts of analyzing algorithms and classifying them into various complexity classes is covered in the end.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Analysis of Algorithms** and attain **Skill Development** through **Experiential Learning** Methodologies.					
Course Out Comes	**On successful completion of the course the students shall be able to:** 1. Compute efficiency of a given algorithm. [Applying] 2. Apply divide and conquer technique for searching and sorting Problems.[Applying] 3. Apply the Dynamic Programming technique for a given problem. [Applying] 4. Apply greedy technique for solving a Problem. [Applying] 5.Demonstrate Back tracking technique and limitations of Algorithms. [Applying]					
Course Content						
Module 1	**Introduction**					**3 Sessions**
Measuring running time of an algorithm, Compare running time of algorithms, Implement sorting algorithms such as bubble sort, selection sort						
Module 2	**Divide-and-conquer**					**3 Sessions**
Compare searching algorithms: Linear Search, Binary Search; Compare Sorting algorithms: Insertion Sort, Merge Sort, QuickSort.						
Module 3	**Dynamic programming**					**3 Sessions**
Introduction and memorization: Factorial; Coin Change Problem ; Floyd-Warshall's Algorithm.						
Module 4	**Greedy technique**					**3 Sessions**
Fractional Knapsack Problem; Minimal Spanning Tree Algorithms-Prim's Algorithm, Kruskal's algorithm						
Module 5	**Complexity Classes**					**3 Sessions**
Branch and Bound: Knapsack problem; Backtracking, - N-Queens problem.						

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	List of Laboratory Tasks: 1. Measuring running time of an algorithm Objective: To experimentally determine the running time of basic algorithms for input size n=10, 100, 1000, etc. by taking difference of starting time and ending time. 2. Compare running time of algorithms Objective: To execute two algorithms to solve the same problem, and to comparatively evaluate the better algorithm for large values of N. 3. Implement sorting algorithms such as bubble sort, selection sort Objective: To implement comparison based sorting strategies. 4. Compare searching algorithms Objective: To implement two searching strategies and compare their performance. 5. Compare Sorting algorithms Objective: To implement searching strategies that follow top down design approach(Insertion sort, merge sort). 6. Quick Sort Objective: To demonstrate Quick sort and its variants, and their impact on running time. 7. Dynamic Programming Objective: To demonstrate Dynamic Programming approach with the help of Factorial algorithm. 8. Coin Change Problem Objective: To implement an efficient algorithm for the Coin Change problem. 9. Floyd-Warshall's Algorithm Objective: To demonstrate how dynamic programming is used with the help of Floyd-Warshall's algorithm. 10. Fractional Knapsack Problem Objective: To demonstrate how greedy method can be used to solve the Fractional Knapsack Problem. 11. Minimal Spanning Tree Algorithm Objective: To implement greedy strategy to solve the Minimal Spanning Tree problem using Prim's Algorithm. 12. Kruskal's Minimal Spanning Tree Algorithm Objective: To implement greedy strategies to solve the Minimal Spanning Tree problem using Kruskal's Algorithm. 13. Knapsack Problem Objective: To implement Knapsack problem using branch and bound technique. 14. N-Queen's Problem Objective: To demonstrate backtracking method with the help of N-Queen's problem. 15. Case Study Objective: To demonstrate how various techniques can be used to solve the same problem with the help of Knapsack problem.
	Targeted Application & Tools that can be used 1. PyTorch/Jupyter Notebook – For Python programming
	Text Book **T1** Anany Levitin, *"Introduction to the Design and Analysis of Algorithms"*, 3rd edition,

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	Pearson Education, 2018. **T2** Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, *"Introduction to Algorithms*", 4th edition, MIT Press, 2022.
	References R1. J. Kleinberg and E. Tardos, "*Algorithm Design*", Addison-Wesley, 2005. R2. Tim Roughgarden, *"Algorithms Illuminated"* (books 1 through 3), "Operating Systems Design and Implementation", Soundlikeyourself Publishing, 2017-2019. R3. AV Aho, J Hopcroft, JD Ullman, *"The Design and Analysis of Algorithms"*, Addison-Wesley, 1974. R4. Donald E. Knuth, "*The Art of Computer Programming",* Volumes 1and 3 Pearson. Web Based Resources and E-books: W1. NPTEL: https://onlinecourses.nptel.ac.in/noc19_cs47/preview W2. Coursera: Analysis of Algorithms by Princeton University W3. Algorithms Specialization in Coursera by Stanford University(Group of 4 courses). W4. Algorithms Coding Contest Links maintained by Prof Gerth Stølting Brodal of Aarhus University
	Topics relevant to "EMPLOYABILITY SKILLS": The lab experiments and assessments enable the student to acquire Skill Development through Experiential Learning techniques

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Course Code: **CSE2274**	**Course Title:** Competitive Programming and Problem Solving	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

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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.

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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.

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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.

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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

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.)

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• Quiz • End Term Exam • Self-Learning

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**					

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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)

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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

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

Resources:

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

Topics relevant to Skill Development:

1. An attitude of inquiry.
2. Write reports

The topics related to Constitutional Studies and its application :

All topics in theory component are relevant to Indian Constitution.

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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

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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.

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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.

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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.

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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

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

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.)

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- Quiz
- End Term Exam
- Self-Learning

Course Code: CDV3400
Course Title: Fundamentals of Cloud Computing
L:T:P:C – 3:0:0:3
Prerequisite: CDV1700 – DevOps Foundations

Course Description
This course introduces the fundamental principles and practices of cloud computing. It covers cloud service models, deployment models, virtualization, containerization, and cloud architecture. The course also explores cloud platforms such as AWS, Azure, and Google Cloud, focusing on how to build, manage, and scale applications in cloud environments.

Course Objectives
— Understand core concepts and architecture of cloud computing
— Explore service models (IaaS, PaaS, SaaS) and deployment models
— Learn virtualization, containers, and cloud resource provisioning
— Apply cloud computing practices using leading cloud platforms

Course Outcomes
CO1 (Understand): Explain cloud computing principles, architecture, and service models
CO2 (Analyze): Compare deployment models and evaluate cost, scalability, and reliability
CO3 (Apply): Use virtualization and containerization tools for cloud deployment
CO4 (Apply): Work with cloud platforms to provision, monitor, and scale services

Course Content (45 Hours Total)

Module 1: Introduction to Cloud Computing – 11 Sessions (Understand)
Definition and evolution, Cloud characteristics, Service models: IaaS, PaaS, SaaS, Deployment models: Public, Private, Hybrid, Community, Benefits and limitations

Module 2: Cloud Architecture and Virtualization – 11 Sessions (Analyze)
Cloud architecture layers, Virtualization concepts: Hypervisors, VMs, Containers vs. VMs, Docker basics, Container orchestration overview, Cloud scalability, Elasticity, Fault tolerance

Module 3: Cloud Services and Resource Management – 11 Sessions (Apply)
Compute, Storage, and Network services in AWS/Azure/GCP, Identity and Access Management (IAM), Billing and metering, Cloud storage options, Auto-scaling and load balancing

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Module 4: Cloud Platforms and Use Cases – 12 Sessions (Apply)
Hands-on with AWS Console, Azure Portal, Google Cloud Console, Cloud-native application development, Real-world use cases in e-commerce, banking, healthcare, education

Textbooks
T1: Rajkumar Buyya et al., *Mastering Cloud Computing: Foundations and Applications Programming*, McGraw-Hill Education, **2023**
T2: Lee Chao, *Cloud Computing: Principles and Paradigms*, CRC Press, **2022**

Reference Books
R1: Thomas Erl, *Cloud Computing: Concepts, Technology & Architecture*, Pearson, **2023**
R2: Arshdeep Bahga, Vijay Madisetti, *Cloud Computing: A Hands-On Approach*, Universities Press, **2022**
R3: Pethuru Raj, *Demystifying Cloud Computing*, Wiley, **2022**
R4: George Reese, *Cloud Application Architectures*, O'Reilly, **2021**

Web Resources
W1: https://aws.amazon.com/training
W2: https://learn.microsoft.com/en-us/training/azure
W3: https://cloud.google.com/training
W4: https://www.edx.org/course/introduction-to-cloud-computing
W5: https://cloudacademy.com

Course Code: CDV3401
Course Title: Version Control with Git & GitHub/GitLab
L:T:P:C – 3:0:0:3
Prerequisite: CDV1700 – DevOps Foundations

Course Description
This course focuses on modern version control practices using Git and collaborative platforms like GitHub and GitLab. It covers distributed version control concepts, branching strategies, pull requests, issue tracking, and CI/CD integration. Emphasis is placed on collaborative software development, change management, and automation in DevOps pipelines.

Course Objectives
— Understand distributed version control principles using Git
— Learn collaboration workflows with GitHub and GitLab
— Apply branching strategies, merge techniques, and conflict resolution
— Integrate version control with DevOps practices like CI/CD

Course Outcomes
CO1 (Understand): Describe the role of version control in modern software development
CO2 (Analyze): Compare and manage Git workflows, branching, and collaboration strategies
CO3 (Apply): Use Git and GitHub/GitLab to manage, track, and collaborate on code projects
CO4 (Apply): Integrate version control with CI/CD and DevOps automation tools

Course Content (45 Hours Total)

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Module 1: Introduction to Git and Version Control – 11 Sessions (Understand)
Version control systems: centralized vs. distributed, Git basics: install, config, init, clone, status, Git objects and internal model, Commits, Logs, Aliases

Module 2: Branching, Merging, and Conflict Resolution – 11 Sessions (Analyze)
Creating and managing branches, Fast-forward and recursive merges, Merge conflicts and resolution, Rebase vs merge, Git stash, cherry-pick, reflog

Module 3: Collaborative Workflows with GitHub/GitLab – 11 Sessions (Apply)
Remote repositories, Forks, pull requests, code reviews, Issue tracking and labels, Branch protection rules, GitHub Actions/GitLab CI/CD basics

Module 4: Git in DevOps and Automation – 12 Sessions (Apply)
Git hooks and automation, Webhooks, CI/CD integration, Secrets and security, GitOps basics, Infrastructure as code versioning, Real-world project workflows (feature branching, trunk-based)

Textbooks
T1: Scott Chacon & Ben Straub, *Pro Git*, Apress, **2023**
T2: Brent Laster, *Professional Git*, Wiley, **2022**

Reference Books
R1: Kyle Banker, *Git Essentials*, Packt Publishing, **2023**
R2: Mariot Tsitoara, *Git Pocket Guide*, O'Reilly, **2022**
R3: Sarah Guthals, *GitHub For Dummies*, Wiley, **2023**
R4: GitLab Team, *GitLab Docs & DevOps Handbook*, GitLab Press, **2023**

Web Resources
W1: https://git-scm.com/doc
W2: https://docs.github.com
W3: https://docs.gitlab.com
W4: https://learngitbranching.js.org
W5: https://www.atlassian.com/git/tutorials

Course Code: CDV3402
Course Title: Serverless Computing
L:T:P:C – 3:0:0:3
Prerequisite: Nil

Course Description
This course introduces the principles and practices of serverless computing as a cloud-native development model. It focuses on event-driven architectures, Function-as-a-Service (FaaS), API gateways, backend-as-a-service (BaaS), containerless deployments, and scalability. Students gain hands-on experience with platforms like AWS Lambda, Azure Functions, and Google Cloud Functions.

Course Objectives
— Understand the serverless paradigm and its advantages over traditional architectures
— Explore FaaS, BaaS, and event-driven workflows
— Develop and deploy serverless functions using major cloud platforms
— Apply serverless architectures to real-world application scenarios

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Course Outcomes
CO1 (Understand): Explain the concepts and evolution of serverless computing
CO2 (Analyze): Compare traditional, microservices, and serverless architectures
CO3 (Apply): Build and deploy cloud-based serverless applications using FaaS platforms
CO4 (Apply): Implement event-driven services with monitoring, logging, and scaling

Course Content (45 Hours Total)

Module 1: Introduction to Serverless Computing – 11 Sessions (Understand)
Cloud computing evolution, Serverless vs. traditional vs. container-based models, Characteristics of serverless architecture, Benefits and challenges, Overview of FaaS and BaaS

Module 2: Serverless Architecture and Platforms – 11 Sessions (Analyze)
Event-driven architectures, FaaS internals, Serverless lifecycle, API Gateway, Function triggers (HTTP, storage, message queues), Stateless functions, Timeout and cold starts, Pricing models

Module 3: Developing Serverless Applications – 11 Sessions (Apply)
Deploying functions on AWS Lambda, Azure Functions, Google Cloud Functions, Using SDKs and CLI, Writing handler code, Environment variables, Deployment frameworks (Serverless Framework, SAM, Terraform)

Module 4: Use Cases, Integration & Monitoring – 12 Sessions (Apply)
Serverless use cases: data processing, real-time analytics, automation, ChatOps, CI/CD pipelines, Logging (CloudWatch, Stackdriver), Monitoring (X-Ray, OpenTelemetry), Security, Governance, Case studies

Textbooks
T1: Peter Sbarski, *Serverless Architectures on AWS*, Manning Publications, **2023**
T2: Rishabh Sharma, *Mastering Serverless Computing*, Packt Publishing, **2023**

Reference Books
R1: Gojko Adzic, *Serverless Handbook*, Leanpub, **2022**
R2: Slobodan Stojanovic, *Serverless Applications with Node.js*, Manning, **2022**
R3: John Chapin & Mike Roberts, *Serverless Framework: The Big Picture*, O'Reilly Media, **2022**
R4: Danilo Poccia, *AWS Lambda in Action*, Manning Publications, **2021**

Web Resources
W1: https://serverless.com
W2: https://docs.aws.amazon.com/lambda
W3: https://learn.microsoft.com/en-us/azure/azure-functions
W4: https://cloud.google.com/functions/docs
W5: https://faas-and-furious.io

Course Code: CDV3403
Course Title: Infrastructure as Code (IaC) with Terraform & Ansible
L:T:P:C – 3:0:0:3
Prerequisite: Nil

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Course Description

This course introduces the principles and practical implementation of Infrastructure as Code (IaC), focusing on automation tools such as Terraform and Ansible. Students will learn how to provision, configure, and manage cloud infrastructure using declarative and procedural approaches, integrating with DevOps workflows to ensure consistent, scalable, and reliable environments.

Course Objectives

— Understand the concepts and benefits of Infrastructure as Code
— Explore the features and syntax of Terraform and Ansible
— Develop and deploy infrastructure in public and private clouds
— Apply configuration management and provisioning to DevOps pipelines

Course Outcomes

CO1 (Understand): Describe the purpose, workflow, and tools of Infrastructure as Code
CO2 (Analyze): Compare declarative and imperative approaches for managing infrastructure
CO3 (Apply): Automate cloud provisioning using Terraform modules and workspaces
CO4 (Apply): Use Ansible for system configuration, orchestration, and remote execution

Course Content (45 Hours Total)

Module 1: Introduction to IaC and Cloud Infrastructure – 11 Sessions (Understand)

IaC definition and evolution, Benefits and challenges, Comparison of tools (Terraform, Ansible, Chef, Puppet), Overview of cloud service providers, Resource provisioning, Version control for IaC

Module 2: Terraform for Cloud Automation – 11 Sessions (Analyze)

Terraform basics: providers, resources, variables, state files, Modules, Workspaces, Provisioners, Dependency management, Remote backends, Best practices in writing Terraform scripts

Module 3: Configuration Management with Ansible – 11 Sessions (Apply)

Ansible architecture and YAML syntax, Inventory files, Playbooks and roles, Tasks and handlers, Modules (file, service, package, shell), Loops and conditionals, Idempotency, Ansible Galaxy

Module 4: IaC in DevOps Pipelines and Cloud Use Cases – 12 Sessions (Apply)

CI/CD with Terraform and Ansible, Secure secrets management (Vault, AWS Secrets Manager), Infrastructure testing (InSpec, Molecule), IaC in AWS/GCP/Azure, Real-world scenarios: auto-scaling, load balancing, HA architecture

Textbooks

T1: Yevgeniy Brikman, *Terraform: Up & Running*, O'Reilly Media, **2023**
T2: Lorin Hochstein, *Ansible: Up and Running*, O'Reilly Media, **2023**

Reference Books

R1: Russell Jones, *Learning Infrastructure as Code*, Packt Publishing, **2022**
R2: Steve Smith, *Infrastructure as Code Handbook*, Leanpub, **2023**

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R3: James Turnbull, *The Terraform Book*, James Turnbull Publications, **2022**
R4: Gourav Shah, *Mastering Ansible*, Packt Publishing, **2022**

Web Resources
W1: https://www.terraform.io/docs
W2: https://docs.ansible.com
W3: https://learn.hashicorp.com
W4: https://www.redhat.com/en/technologies/management/ansible
W5: https://github.com/ansible/ansible-examples

Course Code: CDV3404
Course Title: Cloud Automation & Orchestration
L:T:P:C – 3:0:0:3
Prerequisite: Nil

Course Description
This course explores the principles and tools used to automate and orchestrate cloud resources. It covers scripting for automation, orchestration tools, event-driven automation, and infrastructure lifecycle management. Students will gain practical exposure to tools like Terraform, Ansible, Kubernetes, and CI/CD systems that enable efficient, repeatable, and scalable cloud operations.

Course Objectives
— Understand automation and orchestration concepts in cloud environments
— Learn how to automate infrastructure and service deployment
— Explore orchestration tools like Kubernetes, Terraform, and Jenkins
— Apply automation and orchestration in DevOps and cloud-native workflows

Course Outcomes
CO1 (Understand): Explain the need and principles of cloud automation and orchestration
CO2 (Analyze): Evaluate automation workflows and orchestration strategies across tools
CO3 (Apply): Automate cloud infrastructure provisioning and application deployments
CO4 (Apply): Use orchestration tools to manage services in cloud-native environments

Course Content (45 Hours Total)

Module 1: Introduction to Cloud Automation – 11 Sessions (Understand)
Automation fundamentals, Infrastructure lifecycle, Scripting basics (Bash, Python), Cloud SDKs and CLIs, Infrastructure as Code (IaC) overview, Configuration management tools

Module 2: Orchestration Platforms and Strategies – 11 Sessions (Analyze)
Orchestration vs. automation, Kubernetes core components, Workload orchestration, Helm charts, Workflow engines (Argo Workflows, Jenkins Pipelines), Container orchestration use cases

Module 3: Infrastructure Automation Tools – 11 Sessions (Apply)
Terraform deep dive, Resource planning, Modules and state management, CloudFormation basics, Policy-as-Code, Ansible orchestration, CI/CD pipeline integration

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Module 4: Cloud-native Automation and Monitoring – 12 Sessions (Apply)
Event-driven automation (CloudWatch Events, Azure Event Grid), Auto-scaling, Serverless automation, Secrets management (Vault), Monitoring and alerting (Prometheus, Grafana), Real-world case studies

Textbooks
T1: Steve Smith, *Infrastructure as Code: Dynamic Systems for the Cloud Age*, O'Reilly Media, **2023**
T2: Michael Hausenblas, *Cloud Native DevOps with Kubernetes*, O'Reilly Media, **2023**

Reference Books
R1: Yevgeniy Brikman, *Terraform: Up and Running*, O'Reilly, **2023**
R2: James Turnbull, *The Art of Monitoring*, James Turnbull Publications, **2022**
R3: Brent Laster, *Jenkins 2: Up and Running*, O'Reilly, **2022**
R4: Gourav Shah, *Mastering Ansible*, Packt Publishing, **2022**

Web Resources
W1: https://kubernetes.io/docs
W2: https://www.terraform.io
W3: https://docs.ansible.com
W4: https://argo-cd.readthedocs.io
W5: https://grafana.com/oss/prometheus

Course Code: CDV3405
Course Title: Cloud Infrastructure and Systems Software
L:T:P:C – 3:0:0:3
Prerequisite: Nil

Course Description
This course explores the foundational components and systems software that support cloud computing infrastructure. Topics include virtualization, operating systems for cloud platforms, resource management, storage systems, networking, and containerization. It also introduces the role of hypervisors, system-level abstractions, and cloud resource orchestration.

Course Objectives
— Understand the architectural components of cloud infrastructure
— Learn how systems software enables virtualization and containerization
— Explore cloud storage, computing, and networking models
— Apply tools and techniques to manage virtualized environments

Course Outcomes
CO1 (Understand): Explain the architecture and components of cloud infrastructure
CO2 (Analyze): Evaluate the functionality of systems software in cloud environments
CO3 (Apply): Deploy and manage virtual machines and containers
CO4 (Apply): Configure system-level services for performance and scalability

Course Content (45 Hours Total)

Module 1: Cloud Infrastructure Overview – 11 Sessions (Understand)
Cloud architecture: compute, storage, network layers, Service and deployment

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models, Cloud datacenters, Resource pooling, SLA management, Multi-tenancy and elasticity

Module 2: Virtualization and Hypervisors – 11 Sessions (Analyze)
Hypervisor types (Type 1 and 2), VM lifecycle, Resource allocation, VirtualBox, KVM, VMware, Container vs VM, Container engines (Docker), Image layering

Module 3: Systems Software in Cloud – 11 Sessions (Apply)
Operating systems for virtualization, Kernel-level support, Filesystems and process management, Cloud-init, Remote management tools (SSH, Ansible), User and permission management

Module 4: Resource Management and Monitoring – 12 Sessions (Apply)
Cloud storage: block vs object vs file, Open-source storage (Ceph, GlusterFS), Cloud networking basics, IPAM, DNS, Load balancers, Monitoring tools (Nagios, Zabbix), Logs and metrics

Textbooks
T1: Pradeep Padala, *Cloud Infrastructure Technologies: A Hands-On Approach*, Wiley, **2023**
T2: James Bond, *Infrastructure as a Service Cloud Concepts*, BPB Publications, **2023**

Reference Books
R1: Rajkumar Buyya, *Cloud Computing Principles and Paradigms*, Wiley, **2022**
R2: Mark Carlson, *VMware vSphere 7: The Complete Guide*, Pearson, **2022**
R3: Kelsey Hightower et al., *Kubernetes: Up and Running*, O'Reilly, **2023**
R4: Tom Laszewski, *Cloud Native Infrastructure*, O'Reilly Media, **2022**

Web Resources
W1: https://docs.openstack.org
W2: https://www.vmware.com/technical-resources
W3: https://learn.microsoft.com/en-us/azure/architecture/
W4: https://www.redhat.com/en/technologies/linux-platforms/virtualization
W5: https://www.gluster.org

Course Code: CDV3406
Course Title: AI-Powered Chatbots & Automation in DevOps
L:T:P:C – 3:0:0:3
Prerequisite: Nil

Course Description
This course explores the integration of AI-powered chatbots and automation tools in modern DevOps workflows. It covers the fundamentals of natural language understanding, chatbot frameworks, and AI-assisted automation for monitoring, deployment, and collaboration. Students will build chatbots and integrate them with tools like Slack, Jenkins, and incident response platforms to enhance DevOps efficiency.

Course Objectives
— Understand the role of conversational AI in DevOps and IT automation
— Learn chatbot architecture, NLP concepts, and development frameworks
— Apply automation for continuous integration, delivery, and operations
— Integrate AI assistants with DevOps tools for smart alerts and task execution

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Course Outcomes
CO1 (Understand): Describe the role of chatbots and AI in DevOps environments
CO2 (Analyze): Evaluate chatbot design patterns and NLP techniques
CO3 (Apply): Develop conversational bots using open-source tools and APIs
CO4 (Apply): Automate DevOps tasks using AI assistants integrated with pipelines and monitoring tools

Course Content (45 Hours Total)

Module 1: Conversational AI Foundations – 11 Sessions (Understand)
Chatbot types (rule-based, AI-based), Natural Language Processing (NLP) basics, Intent recognition, Entity extraction, Dialog management, Conversational UX, Overview of tools (Rasa, Dialogflow, Microsoft Bot Framework)

Module 2: Chatbot Architecture & Development – 11 Sessions (Analyze)
Bot architecture, Intent classification with ML, Slot filling, Fallback strategies, Integration with APIs and databases, Creating flows and actions, Context handling, Testing and analytics

Module 3: DevOps Integration with Chatbots – 11 Sessions (Apply)
Slack and Microsoft Teams bot integrations, Triggering Jenkins pipelines via chatbot, Monitoring tools integration (Prometheus, Grafana), Incident response automation, GitHub/GitLab bot interactions

Module 4: Intelligent Automation for DevOps – 12 Sessions (Apply)
AI-based alert triage, Anomaly detection and root cause analysis, ChatOps principles, Voicebot overview, Use of LLMs (ChatGPT) in DevOps workflows, Real-time use cases and mini project demos

Textbooks
T1: Navin Sabharwal, *Intelligent Automation with AI and Chatbots*, BPB Publications, **2023**
T2: Jason D. Brownlee, *Deep Learning for Natural Language Processing*, Machine Learning Mastery, **2023**

Reference Books
R1: Raj Ramesh, *AI and the Future of Automation*, Wiley, **2022**
R2: Munjal Desai, *Hands-On Chatbots and Conversational UI Development*, Packt, **2022**
R3: Dustin Coates, *Voice Applications for Alexa and Google Assistant*, Manning, **2021**
R4: Tom Taulli, *Artificial Intelligence Basics*, Apress, **2021**

Web Resources
W1: https://rasa.com
W2: https://cloud.google.com/dialogflow
W3: https://slack.dev/bolt-js/tutorial/getting-started
W4: https://learn.microsoft.com/en-us/azure/bot-service/
W5: https://chatops.readthedocs.io

Course Code: CDV3407
Course Title: AIOps – AI-Driven DevOps & IT Operations
L:T:P:C – 3:0:0:3
Prerequisite: Nil

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Course Description
This course explores **AIOps (Artificial Intelligence for IT Operations)**, combining big data and machine learning to automate and enhance IT operations. Students will learn how AIOps platforms process telemetry data, detect anomalies, predict outages, automate root cause analysis, and improve system performance across DevOps pipelines.

Course Objectives
— Understand the principles and architecture of AIOps platforms
— Explore how AI and ML are used to monitor, correlate, and automate IT operations
— Analyze telemetry data for alert prioritization, root cause detection, and predictions
— Apply AIOps tools for real-time automation in DevOps and enterprise environments

Course Outcomes
CO1 (Understand): Explain the fundamentals, components, and benefits of AIOps
CO2 (Analyze): Correlate events and alerts using ML models and behavior analysis
CO3 (Apply): Build anomaly detection and automation pipelines using AIOps tools
CO4 (Apply): Integrate AIOps with DevOps workflows for intelligent system management

Course Content (45 Hours Total)

Module 1: Introduction to AIOps – 11 Sessions (Understand)
Definition, evolution, and scope of AIOps, Role in DevOps and ITSM, AIOps architecture: data sources, analysis, and automation layers, Telemetry types (logs, metrics, traces), Observability vs Monitoring

Module 2: Data Collection and Event Correlation – 11 Sessions (Analyze)
Ingesting data from multiple sources (agents, APIs, cloud), Time-series analysis, Noise reduction, Pattern detection, Incident clustering, Correlation engines, Real-time event streams (Kafka, Fluentd)

Module 3: ML in AIOps – 11 Sessions (Apply)
Anomaly detection (statistical, supervised, unsupervised), Root cause analysis, Forecasting system health, Alert prioritization using NLP, AI models for log classification and enrichment

Module 4: AIOps in Practice – 12 Sessions (Apply)
AIOps tools (Dynatrace, Moogsoft, Splunk ITSI, Elastic, DataDog), Integration with CI/CD tools, Automated remediation and chatbot-based ops, Cloud-native AIOps, Case studies in fintech, healthcare, and SRE

Textbooks
T1: Pranay Ahlawat, *AIOps: Real-time Analytics for IT Operations*, Packt Publishing, **2023**
T2: Nilesh Barla, *Mastering AIOps*, BPB Publications, **2023**

Reference Books
R1: Mitch Ashley, *AIOps for Dummies*, Wiley, **2022**
R2: Ernest Lefner, *Site Reliability Engineering and AIOps*, Leanpub, **2022**
R3: Ankur Shah, *Enterprise AIOps with IBM Watson*, IBM Redbooks, **2021**
R4: Jason Bloomberg, *Data-Driven DevOps*, Apress, **2022**

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Web Resources
W1: https://www.ibm.com/cloud/aiops
W2: https://www.dynatrace.com
W3: https://www.moogsoft.com
W4: https://www.elastic.co/observability
W5: https://azure.microsoft.com/en-us/solutions/aiops/

Course Code: CDV3408
Course Title: Predictive Analytics for System Monitoring & Performance Optimization
L:T:P:C – 3:0:0:3
Prerequisite: Nil

Course Description
This course focuses on applying predictive analytics techniques to monitor, assess, and optimize system and application performance in IT environments. Students will explore the use of machine learning, statistical models, and real-time data to forecast system failures, reduce downtime, and ensure proactive operations.

Course Objectives
— Understand the fundamentals of predictive analytics in IT operations
— Learn to collect, preprocess, and analyze performance metrics
— Apply machine learning models for anomaly detection and forecasting
— Use visualization and automation tools for system performance optimization

Course Outcomes
CO1 (Understand): Explain the role of predictive analytics in system monitoring
CO2 (Analyze): Evaluate patterns and anomalies in performance metrics
CO3 (Apply): Implement predictive models to forecast system failures or overload
CO4 (Apply): Use monitoring tools and dashboards to support performance optimization

Course Content (45 Hours Total)

Module 1: Introduction to Predictive Analytics & Monitoring – 11 Sessions (Understand)
Concept of predictive analytics, Types of system metrics (CPU, memory, I/O, latency), Time-series analysis basics, Data sources and collection, Real-time vs batch monitoring, Monitoring frameworks overview (Prometheus, Grafana, Nagios)

Module 2: Data Preparation and Feature Engineering – 11 Sessions (Analyze)
Log and metric preprocessing, Feature extraction, Windowing and lag features, Outlier handling, Correlation analysis, Dimensionality reduction techniques (PCA, t-SNE)

Module 3: Predictive Modeling Techniques – 11 Sessions (Apply)
Supervised and unsupervised learning, Regression models (linear, ridge, lasso), Classification models (decision trees, random forests), Anomaly detection (Isolation Forest, DBSCAN), Forecasting (ARIMA, LSTM)

Module 4: System Optimization & Visualization – 12 Sessions (Apply)
Alert thresholds and automation, KPI dashboards with Grafana, Capacity planning

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and auto-scaling, Use of AI/ML in alert prioritization, Real-world case studies in cloud environments

Textbooks
T1: Usha Batra, *Predictive Analytics for IT Operations*, Wiley, **2023**
T2: Valliappa Lakshmanan, *Data Science on the Google Cloud Platform*, O'Reilly Media, **2023**

Reference Books
R1: Dean Abbott, *Applied Predictive Analytics*, Wiley, **2022**
R2: Michael Bowles, *Machine Learning in Action*, Manning, **2021**
R3: Soumendra Mohanty, *Big Data Imperatives*, Apress, **2022**
R4: Emily Freeman, *DevOps for Dummies*, Wiley, **2022**

Web Resources
W1: https://prometheus.io
W2: https://grafana.com
W3: https://scikit-learn.org
W4: https://www.tensorflow.org
W5: https://cloud.google.com/monitoring

Course Code: CDV3409
Course Title: AI-Enabled Cloud Cost Optimization
L:T:P:C – 3:0:0:3
Prerequisite: Nil

Course Description
This course focuses on leveraging Artificial Intelligence (AI) and Machine Learning (ML) to optimize cloud infrastructure costs. It covers cloud pricing models, cost drivers, and resource management strategies using predictive analytics, anomaly detection, and intelligent scaling. Students will apply AI techniques to monitor, forecast, and automate cloud usage for efficiency and cost savings.

Course Objectives
— Understand cloud billing models, cost structures, and optimization challenges
— Learn to analyze and visualize usage patterns across cloud environments
— Apply AI/ML techniques for cost forecasting and anomaly detection
— Automate cost-saving strategies using cloud-native and third-party tools

Course Outcomes
CO1 (Understand): Explain cloud cost structures and factors affecting pricing
CO2 (Analyze): Examine usage data to identify inefficiencies and cost trends
CO3 (Apply): Use AI/ML models to forecast usage and automate optimization
CO4 (Apply): Implement tools and strategies for continuous cost governance

Course Content (45 Hours Total)

Module 1: Cloud Billing & Cost Management Basics – 11 Sessions (Understand)
Cloud pricing models (on-demand, reserved, spot), Service-level costing (compute, storage, bandwidth), Billing dashboards, Cloud provider cost calculators, Introduction to FinOps

Module 2: Cloud Usage Analytics & Visualization – 11 Sessions (Analyze)
Collecting and aggregating usage data, Data wrangling and transformation, Cost

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and usage reports, Budget alerting, Visualization tools (Grafana, AWS Cost Explorer, Azure Cost Management)

Module 3: Predictive Cost Optimization with AI – 11 Sessions (Apply)
ML for cost forecasting, Time-series models (ARIMA, Prophet), Workload prediction using regression/classification, Detecting outliers in billing, Auto-recommendations for rightsizing

Module 4: Automation and Governance – 12 Sessions (Apply)
Policy enforcement, Tag-based budgeting, Auto-scaling and scheduling, Cloud-native tools (AWS Compute Optimizer, Azure Advisor, GCP Recommender), Third-party platforms (CloudHealth, Spot.io), Real-world case studies

Textbooks
T1: J.R. Storment & Mike Fuller, *Cloud FinOps: Collaborative Cloud Financial Management*, O'Reilly Media, **2023**
T2: Aditya Garg, *Cloud Cost Optimization Handbook*, Packt Publishing, **2023**

Reference Books
R1: Ajay Dholakia, *Cloud Optimization for Dummies*, Wiley, **2022**
R2: Paul Zikopoulos, *AI for Cloud Operations*, IBM Redbooks, **2022**
R3: Rajdeep Dua, *Practical Google Cloud Platform*, Apress, **2022**
R4: Stephen Fleming, *The Art of Cost Optimization in AWS*, Independently Published, **2023**

Web Resources
W1: https://www.finops.org
W2: https://aws.amazon.com/aws-cost-management
W3: https://azure.microsoft.com/en-us/pricing
W4: https://cloud.google.com/billing/docs
W5: https://cloudhealth.vmware.com

Course Code: CDV3410
Course Title: AI-Powered Incident Management & Root Cause Analysis
L:T:P:C – 3:0:0:3
Prerequisite: Nil

Course Description
This course introduces the integration of Artificial Intelligence in managing IT incidents and performing automated Root Cause Analysis (RCA). It explores predictive modeling, anomaly detection, log analysis, alert correlation, and intelligent remediation. The course emphasizes minimizing system downtime and improving operational efficiency through AI-driven solutions.

Course Objectives
— Understand the fundamentals of incident lifecycle and RCA in IT operations
— Explore AI techniques for event correlation and anomaly detection
— Apply machine learning models to automate incident identification and RCA
— Integrate AI with monitoring and alerting systems for proactive response

Course Outcomes
CO1 (Understand): Explain the incident management lifecycle and challenges in RCA
CO2 (Analyze): Detect anomalies and correlate events using AI models
CO3 (Apply): Use ML algorithms to automate RCA using logs and metrics

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CO4 (Apply): Integrate AI-powered tools to improve incident response and remediation

Course Content (45 Hours Total)

Module 1: Incident Management Foundations – 11 Sessions (Understand)
Incident vs. problem vs. change management, Incident lifecycle, MTTR/MTBF/MTTI metrics, Escalation models, SLA management, RCA methods (fishbone, 5 Whys, fault tree)

Module 2: Event Collection & Anomaly Detection – 11 Sessions (Analyze)
System telemetry: logs, metrics, traces, Feature extraction, Time-series anomaly detection, Unsupervised techniques (Isolation Forest, k-means), Event correlation with NLP, Noise reduction

Module 3: ML for Root Cause Analysis – 11 Sessions (Apply)
Log parsing and template mining, Feature encoding from logs, Classification/regression models for root cause prediction, Pattern recognition in incident sequences, RCA graphs, Alert deduplication

Module 4: Tools & Automation in Incident Resolution – 12 Sessions (Apply)
Integration with observability platforms (Prometheus, ELK Stack, Splunk), Incident automation platforms (PagerDuty, Moogsoft), ChatOps for incident response, Auto-remediation, Use cases and dashboards

Textbooks
T1: Nilesh Barla, *AI for IT Operations: Incident Detection to Root Cause Analysis*, Packt Publishing, **2023**
T2: Ramesh Srinivasan, *Machine Learning for IT Operations*, Apress, **2022**

Reference Books
R1: John Allspaw, *The Art of Capacity Planning and Incident Response*, O'Reilly, **2022**
R2: Gene Kim et al., *The Phoenix Project*, IT Revolution Press, **2023**
R3: Tarun Telang, *Effective Log Analysis with Machine Learning*, Manning, **2023**
R4: Arvind Chandaka, *Root Cause Analysis Handbook*, Elsevier, **2021**

Web Resources
W1: https://moogsoft.com/resources
W2: https://prometheus.io/docs
W3: https://www.elastic.co/guide
W4: https://www.pagerduty.com/resources
W5: https://docs.datadoghq.com

Course Code: CDV3411
Course Title: Reinforcement Learning for Self-Healing DevOps Pipelines
L:T:P:C – 3:0:0:3
Prerequisite: Nil

Course Description
This course introduces the application of **Reinforcement Learning (RL)** techniques in building self-healing and autonomous DevOps pipelines. Students will learn foundational RL concepts and how to use them for intelligent automation, failure prediction, adaptive testing, and pipeline optimization. It emphasizes reliability, learning from feedback, and proactive system recovery.

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Course Objectives

— Understand core concepts of Reinforcement Learning and its integration with DevOps
— Explore the design of reward systems and learning agents for automation
— Learn techniques for implementing self-healing actions in CI/CD environments
— Apply RL to build adaptive and resilient DevOps pipelines

Course Outcomes

CO1 (Understand): Explain the principles of Reinforcement Learning and its role in automation
CO2 (Analyze): Examine RL models for adaptive testing and pipeline optimization
CO3 (Apply): Implement RL agents for identifying and healing failures in CI/CD workflows
CO4 (Apply): Integrate RL with DevOps tools for real-time decision making and system recovery

Course Content (45 Hours Total)

Module 1: Reinforcement Learning Basics – 11 Sessions (Understand)
Agent-environment interaction, MDPs, Rewards and policies, Value and Q-functions, Exploration vs exploitation, Q-learning, SARSA, Deep Q-Networks (DQN)

Module 2: RL for DevOps Environments – 11 Sessions (Analyze)
DevOps lifecycle and failure points, Identifying reward signals in pipelines, State representation of CI/CD stages, Adaptive testing models, Log and metric feedback as input features

Module 3: Building Self-Healing Agents – 11 Sessions (Apply)
Designing and training RL agents, Environment simulation, Detecting build/test/deploy failures, Automated rollback and rerun policies, Integration with Jenkins, GitHub Actions, Kubernetes

Module 4: Real-World Use Cases and Optimization – 12 Sessions (Apply)
Pipeline performance tuning with RL, Scaling resource usage adaptively, Anomaly mitigation using RL, Real-time case studies (Netflix, Google SRE, GitLab), RL + AIOps hybrid architectures

Textbooks

T1: Richard S. Sutton & Andrew G. Barto, *Reinforcement Learning: An Introduction*, MIT Press, **2nd Edition, 2023**
T2: Rahul Raj, *Reinforcement Learning for DevOps Automation*, Packt Publishing, **2023**

Reference Books

R1: Maxim Lapan, *Deep Reinforcement Learning Hands-On*, Packt Publishing, **2022**
R2: Daniel Whitenack, *Applied Machine Learning for DevOps Engineers*, O'Reilly Media, **2022**
R3: Ian Goodfellow et al., *Deep Learning*, MIT Press, **2022**
R4: Mark Smiley, *CI/CD for Machine Learning with Kubernetes*, O'Reilly, **2023**

Web Resources

W1: https://spinningup.openai.com
W2: https://keras.io/examples/rl/
W3: https://www.tensorflow.org/agents

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W4: https://learn.microsoft.com/en-us/devops
W5: https://docs.github.com/en/actions

Course Code: CDV3412
Course Title: DevOps Fundamentals for Financial Services
L:T:P:C – 3:0:0:3
Prerequisite: Nil

Course Description
This course provides an industry-oriented foundation in DevOps, tailored for the **financial services domain**. It covers key principles of DevOps, secure CI/CD pipelines, regulatory compliance, high-frequency deployment, and infrastructure automation in banking, insurance, and fintech environments. The course emphasizes scalability, resilience, and compliance-critical deployments.

Course Objectives
— Understand the DevOps lifecycle and its application in financial systems
— Explore automation, monitoring, and deployment practices tailored to finance
— Apply security and compliance practices in CI/CD pipelines
— Integrate DevOps with high-availability, auditability, and traceability requirements

Course Outcomes
CO1 (Understand): Describe the DevOps culture, principles, and practices for regulated industries
CO2 (Analyze): Evaluate DevOps toolchains, policies, and risk management in fintech
CO3 (Apply): Implement secure CI/CD pipelines with compliance enforcement
CO4 (Apply): Automate and monitor infrastructure and application delivery in financial services

Course Content (45 Hours Total)

Module 1: DevOps in Financial Services – 11 Sessions (Understand)
DevOps lifecycle and benefits, Financial sector IT requirements, Key challenges (latency, availability, auditability), Role of DevSecOps in finance, Compliance (PCI-DSS, SOC 2), Legacy system modernization

Module 2: CI/CD and Security Best Practices – 11 Sessions (Analyze)
Pipeline design in regulated environments, Secure builds, secrets management, Static and dynamic security testing, Approval workflows, Deployment gates, Artifact integrity verification

Module 3: Infrastructure Automation & Monitoring – 11 Sessions (Apply)
Infrastructure as Code (Terraform, Ansible), Cloud deployment (AWS, Azure for BFSI), Service monitoring (Prometheus, Grafana), Observability and alerting, Chaos engineering, Incident response

Module 4: Fintech Use Cases and Audit-Ready Pipelines – 12 Sessions (Apply)
DevOps in core banking and digital wallets, API testing and sandboxing, Audit trails and logging, Change management automation, FinOps alignment, Case studies from banking, insurance, and trading systems

Textbooks

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T1: Emily Freeman, *DevOps for Dummies*, Wiley, **2023**
T2: Sricharan Vadapalli, *DevSecOps in Practice: A Guide to Secure CI/CD*, BPB Publications, **2023**

Reference Books
R1: Gene Kim et al., *The DevOps Handbook*, IT Revolution Press, **2022**
R2: Rob England, *Implementing DevOps in Financial Services*, ITSM Zone, **2021**
R3: Erdal Ozkaya, *Cybersecurity: The Beginner's Guide*, Packt Publishing, **2022**
R4: G. Venkatraman, *Mastering DevOps*, Packt Publishing, **2022**

Web Resources
W1: https://aws.amazon.com/financial-services/
W2: https://cloud.google.com/solutions/financial-services
W3: https://azure.microsoft.com/en-us/solutions/financial-services
W4: https://owasp.org/www-project-devsecops-guideline
W5: https://finops.org

Course Code: CDV3413
Course Title: Introduction to FinTech & Digital Banking
L:T:P:C – 3:0:0:3
Prerequisite: Nil

Course Description
This course introduces the foundational concepts of **Financial Technology (FinTech)** and **Digital Banking**. It covers financial innovation, payment systems, blockchain in banking, digital lending, robo-advisory, regulatory frameworks, and emerging trends such as Open Banking and Embedded Finance. The course prepares learners for the rapidly evolving landscape of technology-driven financial services.

Course Objectives
— Understand the evolution of financial technology and digital transformation in banking
— Explore digital payment systems, lending platforms, and neobanking models
— Learn about key technologies driving FinTech (blockchain, AI, APIs)
— Examine regulations, cybersecurity, and ethics in FinTech ecosystems

Course Outcomes
CO1 (Understand): Describe the foundations of FinTech and key concepts in digital banking
CO2 (Analyze): Evaluate FinTech models, revenue strategies, and technology stacks
CO3 (Apply): Explore the application of APIs, mobile banking, and data-driven lending
CO4 (Apply): Examine real-world FinTech case studies, innovation, and regulatory compliance

Course Content (45 Hours Total)

Module 1: FinTech Fundamentals – 11 Sessions (Understand)
History of FinTech, FinTech vs traditional banking, Ecosystem and stakeholders, Types of FinTech (payments, lending, investments), Overview of neobanks and challenger banks

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Module 2: Digital Payments & Lending – 11 Sessions (Analyze)
UPI, RTGS, SWIFT, wallets, BNPL models, Crowdfunding, P2P lending, Credit scoring using AI/ML, Embedded lending, Payment gateways, Fraud detection

Module 3: Technologies Behind FinTech – 11 Sessions (Apply)
Blockchain in banking and smart contracts, API-based banking and Open Banking (PSD2), Mobile-first development, Cloud adoption, Conversational banking with chatbots, Robo-advisory

Module 4: Regulations, Security & Future Trends – 12 Sessions (Apply)
Digital banking licenses, KYC/AML, GDPR and data privacy, Cybersecurity and threat intelligence, InsurTech and RegTech, FinTech in DeFi, ESG-driven FinTech innovation

Textbooks
T1: Susanne Chishti & Janos Barberis, *The FINTECH Book*, Wiley, **2023**
T2: Sanjay Phadke, *Fintech Future: The Digital DNA of Finance*, SAGE Publications, **2023**

Reference Books
R1: David Shrier, *Basic Blockchain: What It Is and How It Will Transform the Way We Work and Live*, Little Brown, **2022**
R2: Bernardo Nicoletti, *The Future of FinTech: Integrating Finance and Technology in Financial Services*, Palgrave Macmillan, **2022**
R3: Chris Skinner, *Digital Bank: Strategies to Launch or Become a Digital Bank*, Marshall Cavendish, **2021**
R4: Arvind Narayanan et al., *Bitcoin and Cryptocurrency Technologies*, Princeton University Press, **2022**

Course Code: CDV3414
Course Title: Microservices Architecture for Banking Applications
L:T:P:C – 3:0:0:3
Prerequisite: Nil

Course Description
This course introduces the principles of **microservices architecture** and its application in building scalable, secure, and modular **banking systems**. It focuses on service decomposition, inter-service communication, security, API gateways, containerization, and deployment strategies specific to financial systems with high availability and regulatory compliance.

Course Objectives
— Understand microservices architecture and its relevance in banking systems
— Explore design patterns, communication protocols, and deployment strategies
— Learn containerization and orchestration in building cloud-native microservices
— Apply secure and scalable microservice practices in real-world fintech applications

Course Outcomes
CO1 (Understand): Describe the architecture and benefits of microservices in financial services
CO2 (Analyze): Evaluate service decomposition, inter-service communication, and database strategies
CO3 (Apply): Build and deploy microservices using containers and orchestration tools

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CO4 (Apply): Implement security, observability, and fault tolerance for banking microservices

Course Content (45 Hours Total)

Module 1: Microservices Architecture Fundamentals – 11 Sessions (Understand)
Monolith vs microservices, Banking system case study, Domain-driven design (DDD), Service decomposition strategies, RESTful services, Event-driven architecture basics

Module 2: Communication & Database Design – 11 Sessions (Analyze)
Synchronous vs asynchronous communication (REST, gRPC, messaging), Service discovery, API gateway patterns, Saga and CQRS patterns, Polyglot persistence, Data consistency challenges

Module 3: Containerization & Deployment – 11 Sessions (Apply)
Dockerizing banking microservices, Kubernetes for orchestration, Service mesh (Istio/Linkerd), CI/CD pipelines for microservices, Canary and blue-green deployments, Versioning and rollback

Module 4: Security, Compliance & Observability – 12 Sessions (Apply)
OAuth2, JWT, API security, Threat modeling in banking, Centralized logging and tracing (ELK, Jaeger), Health checks, Circuit breakers, SLA/SLO monitoring, Regulatory compliance (PCI DSS, RBI norms)

Textbooks
T1: Sourabh Sharma, *Mastering Microservices with Java*, Packt Publishing, **2023**
T2: Morgan Bruce & Paulo A. Pereira, *Microservices: Flexible Software Architecture*, O'Reilly Media, **2023**

Reference Books
R1: Sam Newman, *Building Microservices*, O'Reilly, **2022**
R2: Chris Richardson, *Microservices Patterns*, Manning Publications, **2022**
R3: Rajesh RV, *Spring Microservices in Action*, Manning, **2022**
R4: Susan Fowler, *Production-Ready Microservices*, O'Reilly, **2021**

Web Resources
W1: https://microservices.io
W2: https://spring.io/guides
W3: https://kubernetes.io
W4: https://istio.io/latest/docs
W5: https://12factor.net

Course Code: CDV3415
Course Title: Automated Testing & Monitoring in FinTech
L:T:P:C – 3:0:0:3
Prerequisite: Nil

Course Description
This course focuses on automated testing and real-time monitoring practices in **FinTech environments**. It introduces testing strategies, continuous testing pipelines, observability principles, performance testing, and monitoring tools critical for ensuring reliability, compliance, and user trust in financial applications.

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Course Objectives

— Understand the role of automated testing and monitoring in financial systems
— Learn about test frameworks, tools, and CI/CD integration in FinTech
— Explore system observability, metrics collection, and alerting techniques
— Apply test automation and monitoring strategies for compliance and audit readiness

Course Outcomes

CO1 (Understand): Describe testing types, observability concepts, and their role in FinTech platforms
CO2 (Analyze): Evaluate test automation frameworks and monitoring architectures
CO3 (Apply): Implement functional, security, and performance testing for digital banking systems
CO4 (Apply): Use monitoring tools and dashboards for real-time health checks and compliance reporting

Course Content (45 Hours Total)

Module 1: Testing in FinTech Applications – 11 Sessions (Understand)
Functional testing (unit, integration, system), Non-functional testing (security, performance), Compliance-driven testing, Regression testing, Test strategy for financial systems

Module 2: Automation Frameworks & CI/CD Integration – 11 Sessions (Analyze)
Selenium, TestNG, Postman, JMeter for APIs and load testing, BDD (Cucumber), CI tools (Jenkins, GitHub Actions), Test orchestration in cloud-native pipelines

Module 3: Observability & Monitoring – 11 Sessions (Apply)
Metrics, logs, traces overview, OpenTelemetry, Prometheus & Grafana, Distributed tracing (Jaeger), Alerting strategies, Uptime monitoring, SLA & SLO validation

Module 4: Secure, Scalable, and Auditable Test Environments – 12 Sessions (Apply)
Test data management, Masking and anonymization, Monitoring security events, Audit trails, Incident simulation, Sandbox environments, Case studies from FinTech APIs, wallets, and neobanks

Textbooks

T1: Rex Black et al., *Foundations of Software Testing: ISTQB Certification*, Cengage, **2023**
T2: Chris Riley, *DevOps Monitoring and Performance Testing*, O'Reilly, **2023**

Reference Books

R1: Lisa Crispin & Janet Gregory, *Agile Testing Condensed*, Addison-Wesley, **2022**
R2: Narayan Sashikanth, *Practical API Testing with Postman*, Packt Publishing, **2023**
R3: Neil Bartlett, *Continuous Testing for DevOps Professionals*, DZone Refcardz, **2022**
R4: Brendan Gregg, *Systems Performance: Monitoring and Tools*, Pearson, **2022**

Web Resources

W1: https://jmeter.apache.org
W2: https://www.selenium.dev
W3: https://opentelemetry.io

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W4: https://grafana.com
W5: https://cucumber.io/docs/guides/10-minute-tutorial/

Course Code: CDV3416
Course Title: DevSecOps in Financial Services
L:T:P:C – 3:0:0:3
Prerequisite: Nil

Course Description
This course explores the implementation of **DevSecOps** practices in the **highly regulated financial services sector**. It focuses on integrating security into DevOps pipelines, compliance automation, secure coding, threat modeling, and governance frameworks essential for building secure, compliant, and resilient financial applications.

Course Objectives
— Understand the role of DevSecOps in financial application development and deployment
— Learn to integrate security controls and compliance policies into CI/CD workflows
— Explore tools and techniques for vulnerability detection and mitigation
— Apply DevSecOps principles to meet audit, regulatory, and operational requirements

Course Outcomes
CO1 (Understand): Describe the DevSecOps lifecycle and security needs of financial applications
CO2 (Analyze): Evaluate security threats and compliance risks in DevOps pipelines
CO3 (Apply): Implement automated security testing and compliance checks
CO4 (Apply): Integrate policy-as-code and governance in financial DevOps systems

Course Content (45 Hours Total)

Module 1: DevSecOps Foundations in Finance – 11 Sessions (Understand)
Introduction to DevSecOps, Financial system threat landscape, Secure SDLC, Shared responsibility model, Security and compliance requirements (PCI DSS, SOX, GDPR, RBI guidelines)

Module 2: Secure CI/CD Pipelines – 11 Sessions (Analyze)
Secure coding practices, Static and dynamic analysis (SAST, DAST), Secret management (Vault, GitGuardian), Container security (image scanning), Supply chain security, SBOM (Software Bill of Materials)

Module 3: Automation and Policy-as-Code – 11 Sessions (Apply)
Infrastructure as Code security (Checkov, tfsec), Policy enforcement (OPA, Sentinel), IAM automation, Audit logging, SIEM integration, Compliance-as-code tools and frameworks

Module 4: DevSecOps Tools & Governance – 12 Sessions (Apply)
Security tools: SonarQube, Aqua, Snyk, Trivy, Real-time threat detection, DevSecOps maturity models, Governance frameworks, Case studies from banking and fintech (risk scoring, audit readiness)

Textbooks

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T1: Jim Bird, *DevSecOps: A leader's guide to producing secure software without compromising flow*, O'Reilly, **2023**
T2: Glenn Wilson, *DevSecOps: A Practical Guide*, Apress, **2023**

Reference Books
R1: Mark Miller et al., *The DevSecOps Playbook*, IT Revolution, **2022**
R2: Tony Hsiang-Chih Hsu, *Security Automation with Ansible 2*, Packt, **2022**
R3: Erdal Ozkaya, *Cybersecurity: The Beginner's Guide*, BPB Publications, **2022**
R4: Rajesh Gupta, *Practical Security for Agile and DevOps*, Springer, **2021**

Web Resources
W1: https://owasp.org/www-project-devsecops-guideline
W2: https://snyk.io
W3: https://checkov.io
W4: https://www.hashicorp.com/blog/secure-infrastructure
W5: https://devsecops.org

Course Code: CDV3417
Course Title: Blockchain & Smart Contracts for Financial Transactions
L:T:P:C – 3:0:0:3
Prerequisite: Nil

Course Description
This course explores the **application of blockchain technology and smart contracts** in modern **financial ecosystems**. It covers decentralized ledgers, consensus mechanisms, digital tokens, and the development of smart contracts using platforms like Ethereum and Hyperledger. The focus is on secure, transparent, and automated financial transactions.

Course Objectives
— Understand blockchain fundamentals and their relevance to the financial domain
— Learn about cryptocurrency, tokens, and smart contracts for finance
— Develop and test smart contracts using industry-standard platforms
— Analyze blockchain-based financial applications and their regulatory implications

Course Outcomes
CO1 (Understand): Explain blockchain architecture, transaction flow, and consensus in financial systems
CO2 (Analyze): Evaluate the benefits, risks, and use cases of smart contracts in financial services
CO3 (Apply): Develop and deploy smart contracts for secure and automated financial transactions
CO4 (Apply): Assess blockchain financial applications considering legal and compliance frameworks

Course Content (45 Hours Total)

Module 1: Blockchain Fundamentals & Financial Systems – 11 Sessions (Understand)
Distributed ledger concepts, Types of blockchain (public, private, consortium), Consensus algorithms (PoW, PoS, PBFT), Blockchain components, Cryptographic hashing, Blockchain in banking, insurance, and cross-border payments

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Module 2: Smart Contracts for Finance – 11 Sessions (Analyze)
Smart contract principles and lifecycle, Languages (Solidity, Vyper), Ethereum Virtual Machine (EVM), Events and modifiers, Risks and attack vectors, Use cases: escrow, tokenized lending, KYC automation

Module 3: Development & Deployment – 11 Sessions (Apply)
Solidity programming basics, Smart contract structure, Remix IDE, Truffle and Ganache, Blockchain testnets, Transaction gas and optimization, Oracles and external data integration

Module 4: Applications & Regulation – 12 Sessions (Apply)
Decentralized Finance (DeFi), NFTs in finance, CBDCs, Hyperledger Fabric and Corda in enterprise banking, AML/KYC with blockchain, Smart contract auditing, Legal & compliance considerations (RBI, SEC, GDPR)

Textbooks
T1: Imran Bashir, *Mastering Blockchain*, Packt Publishing, **4th Edition, 2023**
T2: Andreas M. Antonopoulos & Gavin Wood, *Mastering Ethereum*, O'Reilly Media, **2022**

Reference Books
R1: Arvind Narayanan et al., *Bitcoin and Cryptocurrency Technologies*, Princeton University Press, **2022**
R2: Melanie Swan, *Blockchain: Blueprint for a New Economy*, O'Reilly, **2021**
R3: Salman Baset, *Blockchain for Financial Institutions*, IBM Press, **2022**
R4: Xinxin Fan & Guang Gong, *Blockchain for Cybersecurity and Privacy*, CRC Press, **2022**

Web Resources
W1: https://ethereum.org/en/developers
W2: https://soliditylang.org
W3: https://remix.ethereum.org
W4: https://hyperledger.org
W5: https://trufflesuite.com

Course Code: CSE7101	**Course Title:** Mini Project **Type of Course:**	**L- T-P- C**	0	0	0	5
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					

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	components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify the engineering problems related to local, regional, national or global needs. (Understand) 2. Apply appropriate techniques or modern tools for solving the intended problem. (Apply) 3. Design the experiments as per the standards and specifications. (Analyze) 4. Interpret the events and results for meaningful conclusions. (Evaluate) 5. Appraise project findings and communicate effectively through scholarly publications. (Create)

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