R23 ACADEMIC REGULATIONS

COURSE STRUCTURE AND SYLLABI

of

I & II B.TECH. CSE (DATA SCIENCE)

B.TECH. REGULAR FOUR YEAR DEGREE PROGRAM

(For the batches admitted from 2023-24)

&

B.TECH. LATERAL ENTRY PROGRAM

(For the batches admitted from 2024-25)

CHOICE BASED CREDIT SYSTEM



DEPARTMENT OF CSE (DATA SCIENCE)

SRI VENKATESWARA COLLEGE OF ENGINEERING

(AUTONOMOUS)

(Affiliated to J.N.T. University Anantapur, Ananthapuramu, Accredited by NBA & NAAC "A")

Karakambadi Road, Tirupati - 517 507

Vision

To be a centre of excellence focusing on high quality technical education, research and technical services with global leadership competence to succeed in employment and higher education with ethical, social, entrepreneurial aspects updating to the real time requirements.

Mission

M 1: To impart high quality technical education by providing the state-of-the art infrastructure, core instruction.

M 2: Advanced research and technical consultancy services with qualified and senior faculty.

M 3: To prepare the students professionally deft and intellectually adept possessing excellent skill, knowledge and behavior with global competence.

Department of Computer Science and Engineering (Data Science)

Vision

To become a centre of excellence in producing highly competent Data Science Engineers with strong ethical values to serve the society and nation through quality education and research.

Mission

M 1: To impart high quality technical education in CSE (Data Science) Engineering through well-equipped infrastructure, state-of-art laboratories and qualified faculty.

M 2: To improve the quality of technological education through training, consultancy, research, and innovation.

M 3: To equip the graduate with necessary skills and leadership qualities along with strong ethical and moral values to serve the society and nation.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1: Graduates will excel in the professional practices of CSE (DATA SCIENCE) Engineering by utilizing the acquired knowledge and technical skills.

PEO2: Graduates will pursue higher study or research in CSE (DATA SCIENCE) Engineering domain in any institute of repute across the nations.

PEO3: Graduates will exhibit professionalism, ethical attitude, communication and managerial skills, team work and social responsibility in their profession and adapt to current trends in CSE (DATA SCIENCE) Engineering industry by engaging in lifelong learning.

PROGRAM OUTCOMES

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

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

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

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

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES

PSO 1: Graduates can apply data science principles, methodologies, and tools to analyze large, complex datasets, extracting meaningful insights and making data-driven decisions.

PSO 2: Graduates will be able to design, implement, and apply diverse data-centric techniques, including machine learning, data mining, and statistical analysis, to solve real-world problems across various domains.

PSO 3: Graduates will understand the ethical implications of data science and be able to apply best practices in data privacy, security, and responsible AI.

PRELIMINARY DEFINITIONS AND NOMENCLATURE

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as Autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (**Jawaharlal Nehru Technological University Anantapur**).

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programmes granted by UGC for promoting excellence.

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Branch: Means specialization in a programme like B.Tech. degree programme in Civil Engineering, B.Tech. degree programme in Computer Science and Engineering etc.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programmes offered by a department.

Backlog Course: A course is considered to be a backlog course, if the student has obtained a failure grade in that course.

Commission: Means University Grants Commission (UGC), New Delhi.

Certificate Course: It is a course that makes a student to have hands-on expertise and skills required for holistic development in a specific area/field.

Internal Examination: It is an examination conducted towards sessional assessment.
Core: The courses that are the essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Course: A course is a subject offered by a department for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value.

Credit Point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student overall the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials & resources.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff, and other resources in the process of study for a degree.

Detention in a Semester: Student who does not obtain minimum prescribed attendance in a Semester shall be detained in that particular Semester. A Student can also be detained for lack of required number of credits at the end of IV semester or VI semester respectively.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal examinations and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 - point scale.

Institute: Represents Sri Venkateswara College of Engineering, Tirupati unless indicated otherwise by the context.

Massive Open Online Courses (MOOC): MOOCs inculcate the habit of self-learning. MOOCs would be additional choices in all the elective group courses.

Minor: Minor are coherent sequences of courses which may be taken in addition to the courses required for the B.Tech. degree.

Pre-requisite: A specific course or subject, the knowledge of which is required to complete before student register another course at the next grade level.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the programme will lead to a degree with specialization.

Programme: Denotes UG degree programme: Bachelor of Technology (B.Tech.).

Project work: It is a design or research-based work to be taken up by a student during his / her VIII semester to achieve a particular aim. It is a credit-based course and is to be planned carefully by the student.

Registration: Process of enrolling into a set of courses in a semester of a programme.

Regulations: The regulations, common to all B.Tech. programmes offered by Institute, are designated as "SVCE – R23" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 90 working days. Odd semester commences usually in July and even semester in December of every year.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

University: Represents Jawaharlal Nehru Technological University Anantapur (JNTUA), Ananthapuramu.

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1. About the College

Sri Venkateswara College of Engineering (SVCE) is a part of **SV Colleges** group established in the year 2007 with a vision to become a leader in providing quality educational services.

College is affiliated to JNTUA & approved by AICTE, recognized under **section 2(f)** & **12(B)** of UGC act 1956. Accredited by NAAC with A grade. Six B. Tech. Programmes CSE, ECE, EEE, IT, ME & CE are accredited by NBA New Delhi. The Campus is equipped with state of art laboratories of centre of excellence through advanced tools and technologies.

Learning at **Sri Venkateswara College of Engineering** has a pragmatic approach with a clear focus, valuing individual vision, intellectual discipline, and a sense of teamwork. We aim at developing our students to their full potential, preparing them to take the next step towards career success.

Sri Venkateswara College of Engineering is committed to its role in creating leaders through its innovative programmes, outstanding faculty and effective leadership. **Sri Venkateswara College of Engineering** nurtures global leaders who can speak their minds and work well with others in a wide range of cultural contexts. It will develop their ability to manage a career successfully in the global economy.

Our teaching modes and methods of assessment vary between courses to ensure that you gain the most benefit from the interactive course content, faculty members, fellow students, and invited guests. Lectures comprise only a portion of course delivery, with the remaining taken up by discussions, seminars, case analysis, simulation, individual and group projects, and presentations.

1.1 Applicability

All the rules specified herein, approved by the Academic Council, shall be in force and applicable to students admitted from the academic year 2023 – 24 onwards. Any reference to "College" in these rules and regulations stands for Sri Venkateswara College of Engineering.

1.2 Extent

All the rules and regulations, specified hereinafter shall be read as a whole for the purpose of interpretation and as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. It shall be ratified by the Academic Council in the forthcoming meeting. As per the requirements of statutory bodies, Principal, **Sri Venkateswara College of Engineering** shall be the Chairman, Academic Council.

2. Vision& Mission:

VISION

To be a centre of excellence focusing on high quality technical education, research and technical services with global leadership competence to succeed in employment and higher education with ethical, social, entrepreneurial aspects updating to the real time requirements.

MISSION

To impart high quality technical education by providing the state-of-the art infrastructure, core instruction. Advanced research and technical consultancy services are carried with qualified and senior faculty to prepare the students professionally deft and intellectually adept possessing excellent skill, knowledge and behaviour with global competence.

3. Programmes Offered:

Following programmes are offered in various branches at **Sri Venkateswara College of Engineering** leading to the award of B.Tech. Degree

S. No.	Branch
1	Civil Engineering
2	Computer Science and Engineering
3	Computer Science and Engineering (Artificial Intelligence and Machine Learning)
4	Computer Science and Engineering (Cyber Security)
5	Computer Science and Engineering (Data Science)
6	Electronics and Communication Engineering
7	Electrical and Electronics Engineering
8	Information Technology
9	Mechanical Engineering

4. Award of the Degree

a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:
   (i) Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).
   (ii) Registers for 160 credits and secures all 160 credits.

b) Award of B.Tech. degree with Honors if he/she fulfils the following:
   (i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 160 credits.
   (ii) Registering for Honors is optional.
   (iii) Honors is to be completed simultaneously with B.Tech. programme.

c) Students, who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. This clause shall be read along with **clause 4 a) i)**.

5. Admissions:

Admission to the B. Tech Program shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either based on the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

6. Program related terms

Credit: A unit by which the course work is measured. It determines the number of hours of instruction required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

Credit Definition:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit
2 Hrs. Practical (Lab) per week	1 credit

a) Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year.
b) Choice Based Credit System (CBCS): The CBCS provides a choice for students to select from the prescribed courses.

7. Semester/Credits:

i. A semester comprises 90 working days and an academic year is divided into two semesters.
ii. The summer term is for eight weeks during summer vacation. Internship/ apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.
iii. Regular courses may also be completed well in advance through MOOCs satisfying prerequisites.

8. Structure of the Undergraduate Programme

All courses offered for the undergraduate program (B. Tech.) are broadly classified as follows:

S.No	Category	Breakup of Credits (Total 160)	Percentage of Total Credits	AICTE Recommendations
1	Humanities and Social Science including Management (HS)	13	8%	8-9%
2	Basic Sciences (BS)	20	13%	12-16%
3	Engineering Sciences (ES)	23.5	14%	10-18%
4	Professional Core (PC)	54.5	34%	30-36%
5	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC)	33	21%	19-23%
6	Internships & Project work (PR)	16	10%	8-11%
7	Mandatory Courses (MC)	Non-Credit	Non-Credit	-

9. Course Classification:

All subjects/ courses offered for the undergraduate programme in Engineering & Technology (B.Tech. degree programmes) are broadly Classified as follows:

S. No.	Broad Course Classification	Course Category	Description
1	Foundation Course	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and management courses
2	Core Courses	Professional Core Courses (PC)	Includes subjects related to the parent discipline/ department/ branch of Engineering
3	Elective Courses	Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline/department/ branch of Engineering
		Open Elective Courses (OE)	Elective subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering

S. No.	Broad Course Classification	Course Category	Description
		Domain specific skill enhancement courses (SEC)	interdisciplinary/job-oriented/domain courses which are relevant to the industry
4	Project & Internships	Internships	Summer Internships – Community based and Industry Internships; Industry
5	Audit Courses	Mandatory non-credit courses	Covering subjects of developing desired attitude among the learners

10. Programme Pattern:

i. Total duration of the of B. Tech (Regular) Programme is four academic years.
ii. Each academic year of study is divided into two semesters.
iii. Minimum number of instruction days in each semester is 90 days.
iv. There shall be mandatory student induction program for fresher's, with a three-week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, visits to local Areas, Familiarization to Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.
v. Health/wellness/yoga/sports and NSS /NSS /Scouts & Guides / Community service activities are made mandatory as credit courses for all the under graduate students.
vi. Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.
vii. Design Thinking for Innovation & Tinkering Labs are made mandatory as credit courses for all the undergraduate students.
viii. Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.
ix. Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective courses can lead to students specializing in emerging areas within the chosen field of study.
x. A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for B.Tech. Degree with a Minor within the 160 credits by opting for the courses offered through various verticals/tracks under Open Electives.
xi. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.
xii. A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.
xiii. Students shall undergo mandatory summer internships, for a minimum of eight weeks' duration at the end of second and third year of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year.
xiv. There shall also be mandatory full internship in the final semester of the programme along with the project work.
xv. Undergraduate degree with Honors is introduced by the college for the students having good academic record.
xvi. Each college shall take measures to implement Virtual Labs (https://www.vlab.co.in) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.

xvii. Each college shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/other competitive exams etc.

xviii. Preferably 25% of course work for the theory courses in every semester shall be conducted in the blended mode of learning.

11. Evaluation Process: -

i. The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. Summer Internships shall be evaluated for 50 marks, Full Internship & Project work in final semester shall be evaluated for 200 marks, mandatory courses with no credits shall be evaluated for 30 mid semester marks.

ii. A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end examination marks taken together for the theory, practical, design, drawing subject or project etc. In case of a mandatory course, he/she should secure 40% of the total marks.

11.1 Theory Courses:

Assessment Method	**Marks**
Continuous Internal Assessment	30
Semester End Examination	70
Total	**100**

i. For theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.

ii. For practical subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.

iii. If any course contains two different branch subjects, the syllabus shall be written in two parts with 3 units each (Part-A and Part-B) and external examination question paper shall be set with two parts each for 35 marks.

a) Continuous Internal Evaluation

i. For theory subjects, during the semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective paper (20 minutes duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment.

ii. Objective paper shall contain for 05 short answer questions with 2 marks each or maximum of 20 bits for 10 marks. Subjective paper shall contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer one from each either-or type of questions. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

iii. The internal evaluation for the course on **"Design Thinking and Innovation"** shall be activity based, in the form of presentations / reports as per the curriculum and shall be evaluated for 15 marks by the concerned teacher and 15 marks for internal tests. There shall be two internal tests. The internal test shall be of 20 marks for subjective paper and 10 marks for objective paper, total shall be condensed to 15 marks.

Note:

i. The objective paper shall be prepared in line with the quality of competitive examinations questions.

ii. The subjective paper shall contain 3 either or type questions of equal weight age of 10 marks. Any fraction shall be rounded off to the next higher mark.

iii. The objective paper shall be conducted by the respective institution on the day of subjective paper test.

iv. Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the semester and the average marks shall be considered.
v. If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.
vi. First midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.
vii. Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weight age given to the better mid exam and 20% to the other.

For Example:

Marks obtained in first mid: 25
Marks obtained in second mid: 20
Final mid semester Marks: (25x0.8) + (20x0.2) = 24

If the student is absent for any one midterm examination, the final mid semester marks shall be arrived at by considering 80% weight age to the marks secured by the student in the appeared examination and zero to the other. For Example:

Marks obtained in first mid: Absent
Marks obtained in second mid: 25
Final mid semester Marks: (25x0.8) + (0x0.2) =20

b) End Examination Evaluation:

End examination of theory subjects shall have the following pattern:

i. There shall be 6 questions and all questions are compulsory.
ii. Question I shall contain 10 compulsory short answer questions for a total of 20marks such that each question carries 2 marks.
iii. There shall be 2 short answer questions from each unit. In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
iv. The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.
v. End examination of theory subjects consisting of two parts of different subjects, for Example: Basic Electrical & Electronics Engineering shall have the following pattern:
    a. Question paper shall be in two parts viz., Part A and Part B with equal weight age of 35 marks each.
    b. In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1mark.
    c. In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
    d. The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

11.2 Practical Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

i. For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.

ii. Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the record/viva and 15 marks for the internal test.

iii. The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.
- Procedure: 20 marks
- Experimental work & Results: 30 marks
- Viva voce: 20 marks.

In a practical subject consisting of two parts (Eg: Basic Electrical & Electronics Engineering Lab), the end examination shall be conducted for 70 marks as a single laboratory in 3 hours. Mid semester examination shall be evaluated as above for 30 marks in each part and final mid semester marks shall be arrived by considering the average of marks obtained in two parts.

iv. For the subject having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for end examination.

Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 15 marks with weight age of 80% to better mid marks and 20% for the other. The subjective paper shall contain 3 either or type questions of equal weight age of 5 marks. There shall be no objective paper in mid semester examination. The sum of day- to-day evaluation and the mid semester marks will be the final sessional marks for the subject.

The end examination pattern for Engineering Graphics, shall consists of 5 questions, either/or type, of 14 marks each. There shall be no objective type questions in the end examination. However, the end examination pattern for other subjects related to design/drawing, multiple branches, etc is mentioned along with the syllabus.

v. There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.

vi. The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

vii. Evaluation Guidelines for the courses like HEALTH AND WELLNESS, YOGA & SPORTS AND NSS/NCC/SCOUT & GUIDES/ COMMUNITY SERVICE is
- Evaluated for a total of 100 marks.
- A Student can select 6 activities of his/her choice with a minimum of 1 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totally to 90 marks.
- The student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

12. Skill Oriented Courses.

i. There shall be five skill-oriented courses offered during III to VII semesters.

ii. Out of the five skill courses two shall be skill-oriented courses from the same domain. Of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain/Interdisciplinary/Job oriented.

iii. The course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.

iv. The Head of the Department shall identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The marks/grades shall be assigned to the students by the above committee based on their performance.
v. The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.
vi. The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the College at the beginning of the semester.
vii. If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the College.

13. Massive Open Online Courses (MOOCs):
A Student has to pursue and complete one course compulsorily through MOOCs approved by the College. A student can pursue courses other than core through MOOCs and it is mandatory to complete one course successfully through MOOCs for awarding the degree. A student is not permitted to register and pursue core courses through MOOCs.

A student shall register for the course (Minimum of either 8 weeks or 12 weeks) offered through MOOCs with the approval of Head of the Department. The Head of the Department shall appoint one mentor to monitor the student's progression. The student needs to earn a certificate by passing the exam. The student shall be awarded the credits assigned in the curriculum only by submission of the certificate. Examination fee, if any, will be borne by the student.

Students who have qualified in the proctored examinations conducted through MOOCs platform can apply for credit transfer as specified and are exempted from appearing internal as well as external examination (for the specified equivalent credit course only) conducted by the College.

Necessary amendments in rules and regulations regarding adoption of MOOC courses would be proposed from time to time.

14. Credit Transfer Policy:
Adoption of MOOCs is mandatory, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the College shall allow up to a maximum of 20% of the total courses being offered in a particular programme i.e., maximum of **32** credits through MOOCs platform.

i. The College shall offer credit mobility for MOOCs and give the equivalent credit weight age to the students for the credits earned through online learning courses.
ii. Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information with the department.
iii. Credit transfer policy will be applicable to the Professional & Open Elective courses only.
iv. The concerned department shall identify the courses permitted for credit transfer.
v. The College/institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.
vi. The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.

vii. The College shall ensure no overlap of MOOC exams with that of the College examination schedule. In case of delay in results, the College will re-issue the marks sheet for such students.
viii. Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.
ix. The departments shall submit the following to the examination section of the College:
    a) List of students who have passed MOOC courses in the current semester along with the certificate of completion.
    b) Undertaking form filled by the students for credit transfer.
x. The College shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

Note: Students shall be permitted to register for MOOCs offered through online platforms approved by the College from time to time.

15. Academic Bank of Credits (ABC):

The College has implemented Academic Bank of Credits (ABC) to promote flexibility in curriculum as per NEP 2020 to

i. Provide option of mobility for learners across the universities of their choice.
ii. Provide option to gain the credits through MOOCs from approved digital platforms.
iii. Facilitate award of certificate/diploma/degree in line with the accumulated credits in ABC.
iv. Execute Multiple Entry and Exit system with credit count, credit transfer and credit acceptance from students' account.

16. Mandatory Internships:

16.1 Summer Internships: Two summer internships either onsite or virtual each with a minimum of 08 weeks' duration, done at the end of second and third years, respectively are mandatory. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries in the areas of concerned specialization of the Undergraduate program. One of the two summer internships at the end of second year (Community Service Project) shall be society oriented and shall be completed in collaboration with government organizations/NGOs & others. The other internship at the end of third year is Industry Internship and shall be completed in collaboration with Industries. The student shall register for the internship as per course structure after commencement of academic year. The guidelines issued by the APSCHE / College shall be followed for carrying out and evaluation of Community Service Project and Industry Internship. Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior faculty member of the department. A Certificate of successful completion from industry shall be included in the report. The report and the oral presentation shall carry 50% weight age each. It shall be evaluated for 50 external marks. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the College.

16.2 Full Semester Internship and Project work: In the final semester, the student should mandatorily register and undergo internship (onsite/virtual) and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship.

The project report shall be evaluated with an external examiner. The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external

evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the College and is evaluated for 140 marks. The college shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

17. Guidelines for offering a Minor:

To promote interdisciplinary knowledge among the students, the students admitted into B.Tech. in a major stream/branch are eligible to obtain degree in Minor in another stream.

The Minor program requires the completion of 18 credits in Minor stream chosen.

05 theory courses of 3 credits each, 2 practical courses of 1.5 credits each or a Project for 3 credits, for Minor Program.

Specialization tracks are available for Minor Program.

18. Guidelines for offering Honors

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

i. Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.
ii. A student shall earn additional 18 credits for award of B.Tech. (Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).
    05 theory courses of 3 credits each, 2 practical courses of 1.5 credits each or a Project for 3 credits, for Honors Program.
    Specialization tracks are available for Honors Program.
iii. A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honors from V Semester onwards.
iv. The concerned Principal of the college shall arrange separate class work and timetable of the courses offered under Honors program.
v. Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.
vi. Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8 weeks' duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.
vii. The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.
viii. A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.
ix. A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree programme.
x. If a student drops or is terminated from the Honors program, the additional credits so

far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xi. The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering.

19. Enrolment into Honors:

i. Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline.

ii. The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for Honors.

iii. If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.

iv. Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.

v. Honors are to be completed simultaneously with a Major degree program.

20. Registration for Honors:

i. The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.

ii. The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.

iii. The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

iv. There is no fee for registration of subjects for Honors program offered in offline at the respective institutions.

21. Attendance Requirements:

i. A student shall be eligible to appear for the College external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

ii. Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.

iii. A stipulated fee shall be payable towards Condonation of shortage of attendance to the College.

iv. Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

v. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.

vi. If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

vii. If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

viii. For induction programme attendance shall be maintained as per AICTE norms.

22. Promotion Rules:
The following academic requirements must be satisfied in addition to the attendance requirements mentioned in **section 18**.

i. A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per College norms.
ii. A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any ***decimal*** fraction should be ***rounded off*** to ***lower*** digit) up to in the subjects that have been studied up to III semester
iii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any ***decimal*** fraction should be ***rounded off*** to ***lower*** digit) in the subjects that have been studied up to V semester. And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.
iv. When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfillment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

23. Grading:
As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed:

After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	Grade	Grade points Assigned
90 & above	S(Superior)	10
80 - 89	A(Excellent)	9
70 - 79	B(Very Good)	8
60 - 69	C (Good)	7
50 - 59	D (Average)	6
40 - 49	E (Pass)	5
< 40	F (Fail)	0
Absent	Ab (Absent)	0

A student obtaining Grade 'F' or Grade 'Ab' in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point

Average (CGPA):
The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade point scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$SGPA = \sum_{i=1}^{n}(C_i \times G_i) \Big/ \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} subject, G_i is the grade point scored by the student in the i^{th} course and n is the no. of subjects. The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of aprogramme, i.e.

$$CGPA = \sum_{i=1}^{n}(C_i \times S_i) \Big/ \sum_{i=1}^{n} C_i$$

Where S_i is the SGPA of the i^{th} semester, C_i is the total number of credits in that semester and n is the no. of semesters. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts. While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included. Grade Point: It is a numerical weight allotted to each letter grade on a 10- point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D, E and F.

24. Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following four classes:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 5.0 < 5.5

CGPA to Percentage Conversion Formula – (CGPA – 0.5) x 10

25. Recounting / Revaluation:

Students shall be permitted to apply for Recounting /Revaluation of the end examination answer scripts within a stipulated period after payment of the prescribed fee. After completion of the process of Recounting /Revaluation, the records are updated with changes if any, and the student shall be issued a revised grade sheet. If there are no changes, the student shall be intimated the same through a notice.

The Revaluation shall be carried out by an expert not less than Associate Professor cadre, as per the scheme of evaluation supplied by the examination branch in the presence of Principal/Controller of Examinations. Neither the students nor his parents shall be permitted to the present during the valuation.

26. Supplementary Examinations:

In addition to the regular end examinations conducted, the college may also schedule and conduct supplementary examinations for all the subjects of other semesters when feasible for the benefit of students. Such candidates writing supplementary examinations may have to write more than one examination per day. For eighth semester advanced supplementary examinations will be conducted.

27. Withholding of Results:

In case of indiscipline or malpractice is pending against the candidate, the result of the candidate shall be withheld and he/she shall not be allowed/promoted to the next higher semester.

28. Re-Registration for Improvement of Internal Marks:

Following are the conditions to avail the benefit of improvement of internal marks.

i. The candidate should have completed the 4 years of B.Tech. course work and obtained examinations results from I semester to VIII semester.
ii. He/she should have passed all the subjects for which the internal evaluation marks secured are more than 50%
iii. Out of the subjects the candidate has failed in the examinations due to internal evaluation marks secured being less than 50%, the candidate shall be given a chance for Theory subjects and for a maximum of **three** theory subjects for improvement of internal evaluation marks.
iv. This provision is only for Theory courses. The candidate has to re-register for the chosen courses and fulfil the academic requirements (i.e., a student has to attend the classes regularly and appear for the mid-examinations and satisfy the attendance requirements to become eligible for appearing at the semester-end examinations).
v. For each subject, the candidate has to pay a prescribed fee. In the event of availing the provision of Improvement of Internal evaluation marks, the internal evaluation marks as well as the Semester-end Examinations marks secured in the previous attempt(s) for the re-registered courses shall stand cancelled.

29. Multiple Entry / Exit Option:

(a) Exit Policy:

The students can choose to exit the four-year programme at the end of first/second/third year.

UG Certificate in (Field of study/discipline) - Programme duration: First year (first two semesters) of the undergraduate programme, 40 credits followed by an additional exit 10-credit bridge / Skill oriented course(s) lasting two months, including at least 6- credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

UG Diploma (in Field of study/discipline) - Programme duration: First two years (first four semesters) of the undergraduate programme, 80 credits followed by an additional exit 10-credit bridge / Project oriented course(s) lasting two months, including at least 6- credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

Bachelor of Science (in Field of study/discipline) i.e., **B.Sc. Engineering in (Field of study/discipline)**- Programme duration: First three years (first six semesters) of the undergraduate programme, 120 credits.

(b) Entry Policy:

Modalities on multiple entry by the student into the B.Tech. programme will be provided in due course of time.

Note: The Universities shall resolve any issues that may arise in the implementation of Multiple Entry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE and State government.

30. Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship programme/to establish start-ups. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The principal of the respective college shall forward such proposals submitted by the students to the College. An evaluation committee constituted by the College shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not.

31. Transitory Regulations:

Discontinued, detained, or failed candidates are eligible for readmission as and when the

semester is offered after fulfillment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to **section 4. (c)** and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B.Tech. from the date of commencement of class work, subject to **section 4. (c)** and they will follow the academic regulations into which they are readmitted.

32. Minimum Instruction Days for a Semester:
The minimum instruction days including exams for each semester shall be 90 days.

33. Medium of Instruction:
The medium of instruction of the entire B. Tech undergraduate programme in Engineering & Technology (including examinations and project reports) will be in English only.

34. Student Transfers:
Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the Universities from time to time.

35. General Instructions:
The academic regulations should be read as a whole for purpose of any interpretation.

i. Malpractices **rules-nature** and punishments are appended.
ii. Where the words "he", "him", "his", occur in the regulations, they also include "she", "her", "hers", respectively.
iii. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Head of the institution is final.
iv. The College may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the College.
v. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Head of the institution is final.

36. Amendments to Regulations:
The Academic Council of **Sri Venkateswara College of Engineering (Autonomous)** reserves the right to revise, amend, or change the Regulations, Scheme of Examinations, and / or Syllabi or any other policy relevant to the needs of the society or industrial requirements etc., with the recommendations of the concerned Board(s) of Studies.

NOTE: FAILURE TO READ AND UNDERSTAND THE RULES & REGULATIONS IS NOT AN EXCUSE

37. Rules for Disciplinary Action for Malpractices / Improper Conduct in Examinations

S No	Nature of Malpractices/ Improper conduct	Punishment
	If the candidate	
1. (a)	Possesses or keeps accessible in Examination Hall, any paper, note book, programmable calculators, Cell phones, Pager, Palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which	Expulsion from the examination hall and cancellation of the performance in that subject only.

S No	Nature of Malpractices/ Improper conduct	Punishment
	he/she is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination).	
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the Exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he/she will be handed over to the police and a case is registered against him/her.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the notice of Principal.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four consecutive semesters from class work and all End examinations. The continuation of the course by the candidate is subject to the Academic regulations in connection with forfeiture of seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for four consecutive semesters from class work and all end examinations, if his/her involvement is established. Otherwise, the candidate is debarred for two consecutive semesters from class work and all End examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him/her.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including

S No	Nature of Malpractices/ Improper conduct	Punishment
	or after the examination.	practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all End examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in Cancellation of the performance in that subject only. The answer paper or in letters to the examiners or writes to the examiner requesting him/her to award pass marks.	Cancellation of the performance in that subject only.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant - Superintendent / any Officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-In charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-In-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. If the candidate physically assaults the invigilator/ officer-In-charge of the Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that

S No	Nature of Malpractices/ Improper conduct	Punishment
		subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in **clause 6** to **8**.	Student of the college's expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person (s) who do not belong to the College will be handed over to police and, a police case will be registered against them .
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as during valuation or during special scrutiny.	Cancellation of the performance in that subject only or in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations, depending on the recommendation of the committee.
12.	If any malpractice is detected which is not covered in the above **clauses 1** to **11** shall be reported to the Principal for further action and suitable punishment.	

Note: Whenever the performance of a student is cancelled in any subject/subjects due to malpractice, he has to register for End Examinations in that subject/subjects consequently and has to fulfill all the norms required for the award of Degree.

ACADEMIC REGULATIONS (R23)
FOR B.TECH. (LATERAL ENTRY SCHEME)

(Effective for the students admitted into II year through Lateral Entry Scheme from the Academic Year **2024-25** onwards)

1. Award of the Degree

(a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:

i. Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).
ii. Registers for 120 credits and secures all 120 credits.

(b) Award of B.Tech. Degree with Honors if he/she fulfils the following:

i. Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 120 credits.
ii. Registering for Honors is optional.
iii. Honors is to be completed simultaneously with B.Tech. programme.

2. Students, who fail to fulfil the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat.

3. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.**2**

i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.
ii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester. And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. Course Pattern:

i. The entire course of study is three academic years on semester pattern.
ii. A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.
iii. When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfillment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

5. All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

COURSE STRUCTURE

B.Tech. – I Year I Semester

S. No	Course Code	Course Name	Category	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
				L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	MA23ABS101	Linear Algebra & Calculus	BS	3	0	0	3	3	30	70	100
2	CS23AES101	Introduction to Programming	ES	3	0	0	3	3	30	70	100
3	CH23ABS101	Chemistry	BS	3	0	0	3	3	30	70	100
4	ME23AES101	Basic Civil & Mechanical Engineering	ES	3	0	0	3	3	30	70	100
5	EG23AHS101	Communicative English	HS	2	0	0	2	2	30	70	100
6	CS23AES102	Computer Programming Lab	ES	0	0	3	3	1.5	30	70	100
7	CH23ABS102	Chemistry Lab	BS	0	0	2	2	1	30	70	100
8	EG23AHS102	Communicative English Lab	HS	0	0	3	3	1	30	70	100
9	ME23AES103	Engineering Workshop	ES	0	0	3	3	1.5	30	70	100
10	CH23ABS106	NSS/NCC/Scouts & Guides/Community Service	BS	0	0	1	1	0.5	100	--	100
Total				**14**	**0**	**12**	**26**	**19.5**	**370**	**630**	**1000**

B.Tech. – I Year II Semester

S. No	Course Code	Course Name	Category	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
				L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	MA23ABS201	Differential Equations & Vector Calculus	BS	3	0	0	3	3	30	70	100
2	CS23APC201	Data Structures	PC	3	0	0	3	3	30	70	100
3	PH23ABS101	Engineering Physics	BS	3	0	0	3	3	30	70	100
4	ME23AES102	Engineering Graphics	ES	1	0	4	5	3	30	70	100
5	EE23AES101	Basic Electrical& Electronics Engineering	ES	3	0	0	3	3	30	70	100
6	EE23AES102	Electrical and Electronics Engineering Workshop	ES	0	0	3	3	1.5	30	70	100
7	CS23APC202	Data Structures Lab	PC	0	0	3	3	1.5	30	70	100
8	PH23ABS102	Engineering Physics lab	BS	0	0	2	2	1	30	70	100
9	CS23AES103	IT Workshop	ES	0	0	2	2	1	30	70	100
10	CH23ABS105	Health and wellness, Yoga and Sports	BS	0	0	1	1	0.5	100	--	100
Total				**13**	**0**	**15**	**28**	**20.5**	**370**	**630**	**1000**

B.Tech. – II Year I Semester

S. No	Course Code	Course Name	Category	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
				L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	MA23ABS302	Discrete Mathematics and Graph Theory	BS	3	0	0	3	3	30	70	100
2	EC23AES301	Digital Logic and Computer Organization	ES	3	0	0	3	3	30	70	100
3	DS23APC301	Introduction to Data Science	PC	3	0	0	3	3	30	70	100
4	CS23APC301	Advanced Data Structures and Algorithm Analysis	PC	3	0	0	3	3	30	70	100
5	CS23APC302	Object Oriented Programming Through JAVA	PC	3	0	0	3	3	30	70	100
6	DS23APC302	Data Science Lab	PC	0	0	2	2	1	30	70	100
7	CS23APC303	Advanced Data Structures and Algorithm Analysis Lab	PC	0	0	3	3	1.5	30	70	100
8	CS23APC304	Object Oriented Programming Through JAVA Lab	PC	0	0	3	3	1.5	30	70	100
9	CS23ASC302	Python Programming	SC	0	1	2	3	2	30	70	100
10	CH23AMC301	Environmental Science	MC	2	0	0	2	0	30	--	30
Total				**17**	**1**	**10**	**28**	**21**	**270**	**630**	**930**

B.Tech. – II Year II Semester

S. No	Course Code	Course Name	Category	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
				L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	BA23AHS302	Universal Human Values	HS	2	1	0	3	3	30	70	100
2	MA23ABS403	Optimization Techniques	BS	2	0	0	2	2	30	70	100
3	MA23AHS404	Statistical Methods for Data Science	BS	3	0	0	3	3	30	70	100
4	DS23APC401	Data Engineering	PC	3	0	0	3	3	30	70	100
5	CS23APC401	Database Management Systems	PC	3	0	0	3	3	30	70	100
6	DS23APC402	Data Engineering Lab	PC	0	0	2	2	1	30	70	100
7	CS23APC403	Database Management Systems Lab	PC	0	0	2	2	1	30	70	100
8	DS23ASC401	Exploratory Data Analysis with Python	SC	0	1	2	3	2	30	70	100
9	CS23AES301	Design Thinking and Innovation	ES	1	0	2	3	2	30	70	100
Total				**14**	**2**	**8**	**24**	**20**	**270**	**630**	**900**
Mandatory Community Service Project Internship of 08 Weeks Duration during Summer Vacation											

I Year B.Tech. CSE (Data Science) – I Semester

L	T	P	C
3	0	0	3

(MA23ABS101) LINEAR ALGEBRA & CALCULUS

COURSE OBJECTIVES:

The objective of this course are to:

- Illuminate the students in the concepts of calculus and linear algebra.
- Equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

- **CO 1:** Understanding the concepts of matrix algebra techniques to solve the system of linear equations.
- **CO 2:** Develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- **CO 3:** Apply mean value theorems to solve real life problems in engineering.
- **CO 4:** Make use of partial differentiation to solve optimization problems.
- **CO 5:** Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.

UNIT I: (8 Periods)

Matrices: Rank of a matrix by echelon form, normal form, Cauchy–Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT II: (10 Periods)

Eigenvalues, Eigenvectors and Orthogonal Transformation: Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley- Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley- Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT III: (7 Periods)

Calculus: Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

UNIT IV: (10 Periods)

Partial differentiation and Applications (Multi variable calculus): Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT V: (10 Periods)

Multiple Integrals (Multi variable Calculus): Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Total Periods: 45

TEXT BOOKS:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers,2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

REFERENCES:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. GlynJames, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
4. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education
5. H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
6. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

I Year B.Tech. CSE (Data Science) – I Semester

L	T	P	C
3	0	0	3

(CS23AES101) INTRODUCTION TO PROGRAMMING

COURSE OBJECTIVES:
The objective of this course are to:
- Learn how to solve a given problem.
- Illustrate the basic concepts of C programming language.
- Discuss the concepts of Functions, Arrays, Pointers and Structures.
- Familiarize with dynamic memory allocation concepts.
- Apply concepts of structures and files to solve real word problems.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
- **CO 1:** Solve computational problems.
- **CO 2:** Select the features of C language appropriate for solving a problem.
- **CO 3:** Design computer programs for real world problems.
- **CO 4:** Organize the data which is more appropriated for solving a problem.
- **CO 5:** Understanding the basic concept of structures and file handling.

UNIT I: (10 Periods)
Introduction to Problem Solving: Problem Solving Aspect, Problem Identification, Problem Understanding, Algorithm Development, Solution Planning, characteristics of algorithm, Top-down approach, Bottom-up approach, Time and space complexities of algorithms, Flowchart. Overview of C: History of C, C Language Elements, Basic Structure of C Program, C Tokens-Variables and Data Types, Operators, Expressions and Type Conversions.

UNIT II: (8 Periods)
Control Statements: Selection Statements- if and switch statements.
Iterative Statements: for, while and do-while statements.
Jump Statements: break, continue, go to statements.

UNIT III: (8 Periods)
Arrays: Declaration, accessing array elements, Storing values, Operations on arrays, multi-dimensional arrays.
Functions: Introduction, Using Functions, Function declaration, Function definition and Function call, Parameter passing, Passing arrays to functions, Recursion, Storage classes.

UNIT IV: (10 Periods)
Pointers: Declaration and Initialization of pointer variables, Pointer arithmetic, Pointers and arrays, Pointer to pointer, Array of pointers, Pointers and functions, Dynamic Memory Allocation.
Strings: Introduction to Strings, String handling functions, Preprocessor Directives.

UNIT V: (9 Periods)
Structures: Introduction, Nested Structures, Array of Structures, Structures and Functions, Unions.
Files in C: Using Files in C, read data from Files, Writing data to Files, Random access to files, Command-line Arguments

Total Periods: 45

TEXT BOOKS:
1. B. A. Forouzan and R. F. Gilberg, Computer Science: A Structured Programming Approach Using C, 3/e, Cengage Learning, 2007.
2. Problem solving with C, M.T.Somashekara, PHI

REFERENCES:

1. Jeri R. Hanly, Ellot B. Koffman, Problem Solving and Program Design in C, 5/e, Pearson
2. Brian W Kernighan and Dennis M Ritchie, The C Programming Language, Second Edition, Prentice Hall Publication.
3. Reema Thareja, Programming in C, Oxford University Press, AICTE Edition, 2018.
4. R.G. Dromey, "How to Solve it by Computer". 2014, Pearson.

I Year B.Tech. CSE (Data Science) – I Semester

L	T	P	C
3	0	0	3

(CH23ABS101) CHEMISTRY

COURSE OBJECTIVES:

The objective of this course are to:

- Familiarize engineering chemistry and its applications.
- Train the students on the principles and applications of electrochemistry and polymers.
- Introduce instrumental methods.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand Schrodinger Wave equation, MOT, energy level diagrams.

CO 2: Apply the principle of Band diagrams in the application of conductors and semiconductors.

CO 3: Compare the materials for construction of a battery and electrochemical sensors.

CO 4: Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.

CO 5: Explain the principles of spectrometry and separation of solid and liquid mixtures by chromatography.

UNIT I: (9 Periods)

Structure and Bonding Models: Fundamentals of Quantum Mechanics-Plank's quantum theory, de-Broglie's hypothesis, Heisenberg uncertainty principle, Schrodinger Wave equation, significance of Ψ and Ψ^2, molecular orbital theory – bonding in homo- and hetero nuclear diatomic molecules – energy level diagrams of O_2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II: (8 Periods)

Modern Engineering Materials: Crystal field theory, d- orbital's splitting in tetra hedral and octa hedral complexes, Semiconductors – Introduction, doping concept, application, Super Conductors- Introduction basic concept, applications.

Super capacitors: Introduction, Basic Concept-Classification – applications. Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon Nano tubes and Graphenes.

UNIT III: (8 Periods)

Electrochemistry and Applications: Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors: potentiometric sensors with examples, amperometric sensors with examples Primary cells – Zinc-air battery, Secondary cells –lithium- ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT IV: (10 Periods)

Polymer Chemistry: Introduction to polymers, functionality of monomers, Tactility, chain growth and step growth polymerization, co- polymerization, with specific examples and mechanisms of polymer formation.

Plastics: Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6, 6.

Elastomers: Processing and vulcanization of natural rubber, Buna-S, Buna-N– preparation, properties and applications.

Conducting polymers: poly acetylene, poly aniline, – mechanism of conduction and

applications. Bio-Degradable polymer - Poly Glycolic Acid (PGA).

UNIT V: (10 Periods)

Instrumental Methods and Applications: Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV- Visible Spectroscopy- electronic transition, Instrumentation and applications, IR spectroscopy- principle, Instrumentation and applications. Chromato graphy-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

Total Periods: 45

TEXT BOOKS:

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical.Chemistry,10/e, Oxford University Press, 2010.
3. Vogel's quantitative chemical analysis, 6th edition-2009.

REFERENCES:

1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson,2007.
2. J.D. Lee, Concise Inorganic Chemistry, 5th Edition, Wiley Publications, Feb.2008
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition
4. Chemistry Mc GrawHill, K.N.Jayaveera, G.V. Subba Reddy and C. Rama Chandraiah.

I Year B.Tech. CSE (Data Science) – I Semester

L	T	P	C
3	0	0	3

(ME23AES101) BASIC CIVIL & MECHANICAL ENGINEERING

PART A: BASIC CIVIL ENGINEERING

COURSE OBJECTIVES:
The objective of this course are to:
- Get familiarized with basic Construction Materials; the scope and importance of Civil Engineering specializations.
- Introduce the preliminary concepts of Structural and Geotechnical Engineering.
- Acquire preliminary knowledge on Surveying and Transportation Engineering.
- Get familiarized with the importance of Water Resources and Environmental Engineering.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
- **CO 1:** Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society and the basic characteristics of Construction Materials.
- **CO 2:** Gain knowledge regarding Structural and Geotechnical Engineering.
- **CO 3:** Explain the concepts of surveying and Transportation Engineering, Water Resources and Environmental Engineering.

UNIT I: (8 Periods)
Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-Technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering- Scope of each discipline.
Construction Materials - Cement – Sand - Aggregate - Bricks- Cement concrete – Steel - Timber.

UNIT II: (7 Periods)
Structural Engineering: Importance- Types of Structures and structural Members- Building Components –Building Planning principles.
Geotechnical Engineering: Types of Foundations-Functions and Requirement of a good foundation

UNIT III: (8 Periods)
Surveying & Transportation Engineering: Objectives and Principles of Surveying- Instruments used in Surveying-Importance of Transportation in Nation's economic development- Modes of Transportation- Types of Highway Pavements- Flexible Pavements and Rigid Pavements -Traffic signals and signs.
Water Resources and Environmental Engineering: Introduction to Hydrology– hydrological cycle- Sources of water- Quality of water- Specifications- Rainwater Harvesting- Water Storage and Conveyance Structures- Dams and Reservoirs-types and components.

TEXT BOOKS:
1. Basic Civil Engineering, M.S. Palanisamy, Tata Mc Graw Hill publications (India) Pvt., Ltd., Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers, 2022, First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

REFERENCES:

1. Surveying, Vol – I and Vol - II, S.K.Duggal, Tata McGraw Hill Publishers2019, Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi, 2016.
3. Irrigation Engineering and Hydraulic Structures –Santosh Kumar Garg, Khanna Publishers, Delhi 2023, 38thEdition.
4. Highway Engineering, S.K.Khanna, C.E.G.Justoand Veeraraghavan, Nemchandand Brothers Publications2019. 10thEdition.
5. Indian Standard DRINKING WATER — SPECIFICATIONIS 10500-2012.

PART B: BASIC MECHANICAL ENGINEERING

COURSE OBJECTIVES:

The objective of this course are to:

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Understand and familiarize the different engineering materials and different manufacturing processes.
- Get an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand the different manufacturing processes.
CO 2: Explain the basics of thermal engineering and its applications.
CO 3: Describe the working of different mechanical power transmission systems and power plants and describe the basics of robotics and its applications.

UNIT I: (7 Periods)

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in Different Sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine Sectors.

Engineering Materials: Metals-Ferrous and Non-Ferrous, Ceramics, Composites, Smart Materials.

UNIT II: (8 Periods)

Manufacturing Processes: Principles of Casting, Forming, Joining Processes, Machining, Introduction to CNC Machines, 3D Printing, and Smart Manufacturing.

Thermal Engineering – Working Principle of Boilers, Otto Cycle, Diesel Cycle, Refrigeration and Air-Conditioning Cycles, IC Engines, 2-Stroke and 4-Stroke Engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT III: (7 Periods)

Power Plants – Working Principle of Steam, Diesel, Hydro, Nuclear Power Plants.

Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

Introduction to Robotics - Joints & Links, Configurations and Applications of Robotics.

Total Periods: 45

TEXT BOOKS:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

REFERENCES:

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.

I Year B.Tech. CSE (Data Science) – I Semester

L	T	P	C
2	0	0	2

(EG23AHS101) COMMUNICATIVE ENGLISH

COURSE OBJECTIVES:

The objective of this course are to:

- Facilitate effective listening, Reading, Speaking and Writing skills among the students.
- Enhance the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary.
- Make them effective in speaking and writing skills and to make them industry ready.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand the context, topic, and pieces of specific information from socialor Transactional dialogues.
CO 2: Apply grammatical structures to formulate and correct word forms.
CO 3: Analyze discourse markers to speak clearly on a specific topic in informal discussions.
CO 4: Evaluate reading/listening texts and write summaries based on global comprehension of these texts.
CO 5: Create a coherent paragraph, essay, and resume.

UNIT I: **(6 Periods)**

Lesson: HUMAN VALUES: The Gift of the Magi (Short Story)
Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information. Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.
Grammar: Parts of Speech, Basic Sentence Structures-forming questions.
Writing: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II: **(7 Periods)**

Lesson: NATURE: The Brook by Alfred Tennyson (Poem)
Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts.
Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks.
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
Writing: Structure of a paragraph - Paragraph writing (specific topics)
Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions.
Vocabulary: Homonyms, Homophones, Homographs.

UNIT III: **(6 Periods)**

Lesson: BIOGRAPHY: Elon Musk
Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed.
Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
Writing: Summarizing, Note-making, paraphrasing.
Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations.

Vocabulary: Compound words, Collocation.

UNIT IV: **(5 Periods)**

Lesson: INSPIRATION: The Toys of Peace by Saki
Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
Reading: Studying the use of graphic elements in texts to convey information, reveal trends / patterns / relationships, communicate processes or display complicated data.
Writing: Letter Writing: Official Letters, Resumes
Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice.
Vocabulary: Words often confused, Jargons.

UNIT V: **(6 Periods)**

Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)
Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
Speaking: Formal oral presentations on topics from academic contexts
Reading: Reading comprehension.
Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement).
Vocabulary: Technical Jargons

Total Periods: 30

TEXT BOOKS:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3).
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5).

REFERENCES:

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

ONLINE RESOURCES:

Grammar:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

Vocabulary:

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

I Year B.Tech. CSE (Data Science) – I Semester

L	T	P	C
0	0	3	1.5

(CS23AES102) COMPUTER PROGRAMMING LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Use basic data types, operators, expressions and expression evaluation mechanisms using C Programming Language.
- Implement control flows, construct in C Programming Language and understand the syntax, semantics and usability contexts of these different constructs.
- Develop composite data types in C and constructs available to develop their datatypes, utilize them to model things and dealing with data from and to external files.
- Design programs with different variations of the constructs available for practicing modular programming and understand the pros and cons of using different variants and apply optimization.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Read, understand and trace the execution of programs written in C language.
CO 2: Select the right control structure for solving the problem.
CO 3: Develop C programs which utilize the memory efficiently using programming constructs like pointers.
CO 4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

WEEK 1:

Objective: Getting familiar with the programming environment on the computer and writing the first program.

Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

- Basic Linux environment and its editors like Vi, Vim & Emacs etc.
- Exposure to Turbo C, gcc.
- Writing simple programs using printf (), scanf ()

WEEK 2:

Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab 1: Converting algorithms/flow charts into C Source code. Developing the algorithms/flowcharts for the following sample programs

- Sum and average of 3 numbers
- Conversion of Fahrenheit to Celsius and vice versa
- Simple interest calculation

WEEK 3:

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Activities:

Tutorial 3: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions.

- Finding the square root of a given number
- Finding compound interest
- Area of a triangle using heron's formulae
- Distance travelled by an object

WEEK 4:
Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.
Activities:
Tutorial 4: Operators and the precedence and as associativity:
Lab 3: Simple computational problems using the operator precedence and associativity

i) Evaluate the following expressions.
   a. A+B*C+(D*E) + F*G
   b. A/B*C-B+A*D/3
   c. A+++B---A
   d. J= (i++) + (++i)

ii) Find the maximum of three numbers using conditional operator.
iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5:
Objective: Explore the full scope of different variants of "if construct" namely if- else, null-else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".
Suggested Experiments/Activities:
Tutorial 5: Branching and logical expressions:
Lab 4: Problems involving if-then-else structures.

i. Write a C program to find the max and min of four numbers using if-else.
ii. Write a C program to generate electricity bill.
iii. Find the roots of the quadratic equation.
iv. Write a C program to simulate a calculator using switch case.
v. Write a C program to find the given year is a leap year or not.

WEEK 6:
Objective: Explore the full scope of iterative constructs namely while loop, do- while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.
Activities:
Tutorial 6: Loops, while and for loops
Lab 5: Iterative problems e.g., the sum of series

i. Find the factorial of given number using any loop.
ii. Find the given numberis a prime or not.
iii. Compute sine and cos series.
iv. Checking a number palindrome.
v. Construct a pyramid of numbers.

WEEK 7:
Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.
Activities:
Tutorial 7: 1 D Arrays: searching.
Lab 6:1D Array manipulation, linear search

i. Find the min and max of a 1-D integer array.
ii. Perform linear search on1Darray.
iii. The reverse of a 1D integer array
iv. Find 2's complement of the given binary number.
v. Eliminate duplicate elements in an array.

WEEK 8:
Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort

using integer arrays.
Activities:
Tutorial 8: 2 D arrays, sorting and Strings.
Lab 7: Matrix problems, String operations, Bubble sort

i. Addition of twomatrices
ii. Multiplication two matrices
iii. Sort array elements using bubble sort
iv. Concatenate two strings without built-in functions
v. Reverse a string using built-in and without built-in string functions

WEEK 9:
Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration
Activities:
Tutorial 9: Functions, call by value, scope and extent,
Lab 8: Simple functions using call by value, solving differential equations using Eulers theorem

i. Write a C function to calculate NCR value
ii. Write a C function to find the length of a string
iii. Write a C function to transpose of a matrix
iv. Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 10:
Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.
Activities:
Tutorial 10: Recursion, the structure of recursive calls
Lab 9: Recursive functions

i. Write a recursive function to generate Fibonacci series
ii. Write a recursive function to find the lcm of two numbers
iii. Write arecursive function to find the factorial of a number
iv. Write a C Program to implement Ackermann function using recursion
v. Write a recursive function to find the sum of series.

WEEK 11:
Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers
Activities:
Tutorial 11: Call by reference, dangling pointers
Lab 10: Simple functions using Call by reference, Dangling pointers

i. Write a C program to swap two numbers using call by reference
ii. Demonstrate Dangling pointer problem using a C program
iii. Write a C program to copy one string into another using pointer
iv. Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK 12:
Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C.
Suggested Experiments/Activities:
Tutorial 12: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures, memory dereference.

i. Write a C program to find the sum of a 1D array using malloc()
ii. Write a C program to find the total, average of n students using structures
iii. Enter n students data using calloc() and display failed students list

iv. Read student name and marks from the command line and display the student details along with the total.
v. Write a C program to implement realloc()

WEEK 13:
Objective: Experiment with C Structures, Unions, bit fields and nested structures
Activities:
Tutorial 13: Bit fields, Self-Referential Structures, Linked lists
Lab 12: Bit fields, linked lists Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

i. Demonstrate the differences between structures and unions using a C program
ii. Write a C program to shift/rotate using bitfields.
iii. Write a C program to copy one structure variable to another structure of the same type.

WEEK14:
Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.
Activities:
Tutorial 14: File handling
Lab 13: File operations

i. Write a C program to write and read text into a file.
ii. Write a C program to write and read text into a binary file using fread() and fwrite().
iii. Copy the contents of one file to another file.
iv. Write a C program to merge two files into the third file using command-line arguments.
v. Find no. of lines, words and characters in a file
vi. Write a C program to print last n characters of a given file.

TEXT BOOKS:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill.

REFERENCES:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice- Hall of India.
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, Cengage.

I Year B.Tech. CSE (Data Science) – I Semester

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0	0	2	1

(CH23ABS102) CHEMISTRY LAB

COURSE OBJECTIVES:

The objectives of this course are to:

Verify the fundamental concepts with experiments.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: To verify Beer Lambert's law.
CO 2: To analyse the IR and NMR spectra of some organic compounds.
CO 3: To apply electro analytical techniques foe sample analysis.
CO 4: To measure the strength of an acid present in the samples.
CO 5: To prepare advanced polymer materials.

LIST OF EXPERIMENTS:

1. Measurement of 10Dq by spectrophotometric method
2. Conduct metric titration of strong acid vs. strong base
3. Conduct metric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of Bakelite
8. Verify Lambert-Beer's law
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of simple organic compounds by IR
11. Preparation of nanomaterials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

REFERENCES:

1. "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson

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0	0	3	1

(EG23AHS102) COMMUNICATIVE ENGLISH LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Expose the students to a variety of self-instructional, learner friendly modes of language learning.
- Train students in basic communication skills and also make them ready to face job interviews.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand the different aspects of the English language proficiency with an emphasis on LSRW skills.
CO 2: Apply communication skills through various language learning activities.
CO 3: Analyze the English speech sounds, stress, rhythm, intonation, and syllable division for better listening and speaking comprehension.
CO 4: Evaluate and exhibit professionalism in participating in debates and group discussions.
CO 5: Create effective Course Objectives.

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

Suggested Software:

- Walden InfoTech
- Young India Films

REFERENCES:

1. Raman Meenakshi, Sangeeta-Sharma. Technical Communication Oxford Press.2018.
2. Taylor Grant: English Conversation Practice, Tata McGraw-Hill Education India, 2016.
3. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. A Course in Phonetics and Spoken English, (2nd Ed), Kindle, 2013

ONLINE RESOURCES:

Spoken English:

2. www.esl-lab.com
3. www.englishmedialab.com
4. www.englishinteractive.net
5. https://www.britishcouncil.in/english/online
6. http://www.letstalkpodcast.com/
7. https://www.youtube.com/c/mmmEnglish_Emma/featured
8. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
9. https://www.youtube.com/c/engvidAdam/featured

10. https://www.youtube.com/c/EnglishClass101/featured
11. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
12. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

VOICE AND ACCENT:

2. https://www.youtube.com/user/letstalkaccent/videos
3. https://www.youtube.com/c/EngLanguageClub/featured
4. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
5. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

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(ME23AES103) ENGINEERING WORKSHOP

COURSE OBJECTIVES:

The objective of this course are to:

- Identify and explain safety practices and precautions relevant to workshop activities.
- Recognize and differentiate various types of woods and tools used in woodwork.
- Demonstrate the ability to create different wood joints, including half-lap, mortise and tenon, and dovetail joints.
- Familiarize students with sheet metal working tools and techniques.
- Enable students to develop sheet metal projects such as tapered trays, conical funnels, elbow pipes and brazing.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Fabricate sheet metal components manually.
CO 2: Construct wood joints such as half-lap, mortise, and tenon.
CO 3: Assemble the components to create joints like a V-fit.
CO 4: Demonstrate the plumbing, welding, foundry, and fitting jobs to form the components.
CO 5: Connect &Check the basic house wiring circuit connections for various applications.

1. **Demonstration**: Safety Practices and Precautions to be Observed in the Workshop.
2. **Wood Working:** Familiarity with Different Types of Woods and Tools used in Wood Working and Making Following Joints.
    a) Half – Lap Joint
    b) Mortise and Tenon Joint
    c) Corner Dovetail Joint or Bridle Joint
3. **Sheet Metal Working**: Familiarity with Different Types of Tools used in Sheet Metal Working, Developments of Following Sheet Metal Job from GI Sheets.
    a) Tapered Tray
    b) Conical Funnel
    c) Elbow Pipe
    d) Brazing
4. **Fitting:** Familiarity with Different Types of Tools used in Fitting and do the Following Fitting Exercises.
    a) V-Fit
    b) Dovetail Fit
    c) Semi-Circular Fit
    d) Bicycle Tire Puncture and Change of Two-Wheeler Tyre
5. **Electrical Wiring**: Familiarity with Different Types of Basic Electrical Circuits and make the Following Connections.
    a) Parallel and Series
    b) Two-Way Switch
    c) Godown Lighting
    d) Tube Light
    e) Three Phase Motor
    f) Soldering of Wires
6. **Foundry Trade:** Demonstration and Practice on Moulding Tools and Processes, Preparation of Green Sand Moulds for Given Patterns.
7. **Welding Shop:** Demonstration and Practice on Arc Welding and Gas Welding. Preparation of Lap Joint and Butt Joint.
8. **Plumbing:** Demonstration and Practice of Plumbing Tools, Preparation of Pipe Joints with Coupling for Same Diameter and with Reducer for Different Diameters.

TEXT BOOKS:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge Publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

REFERENCES:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai, 2007, 14th edition.
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

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0	0	1	0.5

(CH23ABS106) NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE

COURSE OBJECTIVES:

The objective of this course are to:

- Impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand the importance of discipline, character and service motto.
CO 2: Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO 3: Explore human relationships by analyzing social problems.
CO 4: Determine to extend their help for the fellow beings and downtrodden people.
CO 5: Develop leadership skills and civic responsibilities

UNIT I:

Orientation: General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

i) Conducting –ice breaking sessions-expectations from the course- knowing personal talents and skills
ii) Conducting orientations programs for the students –future plans- activities-releasing road map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings-any other contribution.

UNIT II:

Nature & Care

Activities:

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues.

UNIT III:

Community Service

Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders-Survey in the village, identification of problems- helping them to solve via media-authorities experts-etc.
ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc.
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
v) Any other programmes in collaboration with local charities, NGOs etc.

REFERENCES:

1. Nirmalya Kumar Sinha & Surajit Majumder, A Text Book of National Service Scheme Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81- 952368-8-6)
2. Red Book - National Cadet Corps – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering", McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007 5. Ram Ahuja. Social Problems in India, Rawat Publications, New Delhi.

I Year B.Tech. CSE (Data Science) – II Semester

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3	0	0	3

(MA23ABS201) DIFFERENTIAL EQUATIONS & VECTOR CALCULUS

COURSE OBJECTIVES:
The objective of this course are to:
- Enlighten the learners in the concept of differential equations and multivariable calculus.
- Furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
- **CO 1:** Familiarize to solve the first and higher order differential equations.
- **CO 2:** Apply the knowledge of linear differential equations related to various engineering fields.
- **CO 3:** Identify solution methods for partial differential equations that model physical processes.
- **CO 4:** Interpret the physical meaning of different operators such as gradient, curl and divergence.
- **CO 5:** Evaluate the work done by force field, circulation and transformation between single, double and triple integrals using vector calculus.

UNIT I: (8 Periods)
Differential Equations: Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay, Electrical circuits.

UNIT II: (10 Periods)
Linear Differential Equations of Higher Order: Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT III: (10 Periods)
Partial Differential Equations: Introduction, Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogenous linear Partial Differential equations with constant coefficients.

UNIT IV: (8 Periods)
Vector Differentiation: Scalar and vector point functions, vector operator Del, Del applies to scalar point functions, Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT V: (9 Periods)
Vector Integration: Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

Total Periods: 45

TEXT BOOKS:
1. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

REFERENCES:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones andBartlett,2011.
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018.
3. George B.Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
5. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education.
6. H. K Dass, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
7. N. Bali, M.Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

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3	0	0	3

(CS23APC201) DATA STRUCTURES

COURSE OBJECTIVES:
The objectives of this course are to:

- Familiarize with basic techniques of algorithm analysis.
- Familiarize Stacks, Queues using Arrays and Linked List.
- Understand Searching and Sorting techniques.
- Learn the concepts of different types of trees and its operations.
- Familiarize with graph algorithms.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Analyze the problems using asymptotic notations.
CO 2: Apply Stack, Queues and linked list to solve different applications.
CO 3: Demonstrate suitable sorting techniques for the real world problem.
CO 4: Implement tree structures in different patterns of representation of data.
CO 5: Analyze the given problem using graph traversal techniques.

UNIT I: (8 Periods)
Introduction to Linear Data Structures: Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures. Searching Techniques: Linear & Binary Search, Sorting Techniques: Bubble sort, Selection sort, Insertion Sort, Merge Sort, Quick Sort.

UNIT II: (10 Periods)
Linked Lists: Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

UNIT III: (10 Periods)
Stacks: Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.
Queues: Introduction to queues: Introduction to queues: properties and operations, Implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc

UNIT IV: (9 Periods)
Deque: Introduction to deque (double-ended queues), Operations on deque and their applications.
Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversal, AVL Trees, Heap Sort

UNIT V: (8 Periods)
Graph Theory: Graphs Terminology, Graph ADT, Data Structures for Graphs- Adjacency Matrix Structure, Graph Traversals, Shortest Paths, Minimum Spanning Trees- Prims' Algorithm, Kruskal's Algorithm.
Hashing: Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

Total Periods: 45

TEXT BOOKS:

1. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, SecondEdition, 2002, Pearson.
2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson,Ronald L.Rivest, Clifford Stein, Third Edition, 2010, PHI.
3. Data Structures and Algorithms Made Easy by Narasimha Karumanchi,2020, Career Monk Publications.

REFERENCES:

1. Fundamental of Data Structures in C, Horowitz, Sahani, Anderson-Freed,Second Edition, 2008, Universities Press.
2. Classic Data Structures, Debasis Samantha, Second Edition, 2009, PHI

I Year B.Tech. CSE (Data Science) – II Semester

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3	0	0	3

(PH23ABS101) ENGINEERING PHYSICS

COURSE OBJECTIVES:

The objective of this course are to:

- Bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, nidiffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand the intensity variation of light due to interference, diffraction and polarization.

CO 2: Apply the basic concepts of crystal structures and X-ray diffraction to study the behavior of materials for engineering applications.

CO 3: Summarize the fundamental properties of dielectric and magnetic materials for engineering applications.

CO 4: Analyze the properties of quantum particles to interpret the energy band formation and classification of solids

CO 5: Assess the current flow mechanism to understand the transport phenomenon of charge carriers in semiconductors.

UNIT I: (10 Periods)

Wave Optics Interference: Introduction - Principle of superposition –Interference of light Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index. Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT II: (8 Periods)

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X- ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods.

UNIT III: (10 Periods)

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative)

- Lorentz internal field - Clausius- Mossotti equation – Frequency dependence of polarization – dielectric loss.

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization- Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro &Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials- Applications of magnetic materials.

UNIT IV: **(9 Periods)**

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution
- Density of states - Fermi energy

UNIT V: **(8 Periods)**

Semiconductors: Formation of energy bands – classification of solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers (Qualitative) – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications - Direct and indirect bandgap semiconductors and its applications.

Total Periods: 15 Periods and 60 Practical's

TEXT BOOKS:

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar& TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015).

REFERENCES:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, CengageLearning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.2010
4. Engineering Physics - M.R. Srinivasan, New Age internationalpublishers (2009).

ONLINE RESOURCES:

1. https://www.loc.gov/rr/scitech/selected-ternet/physics.html

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1	0	4	3

(ME23AES102) ENGINEERING GRAPHICS

COURSE OBJECTIVES:

The objective of this course are to:

- Enable with various concepts like dimensioning, conventions and standards related to engineering drawing.
- Impart knowledge on the projection of points, lines and plane surfaces.
- Improve the visualization skills for better understanding of projection of solids.
- Develop the imaginative skills required to understand section of solids and developments of surfaces.
- Draw the viewing perception of a solid object in isometric and orthographic projections.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Draw various engineering curves, scales.
CO 2: Draw and Interpret orthographic projections of points, lines, planes.
CO 3: Draw the projection of solids in various positions.
CO 4: Draw and Explore the sections of solids and development of surfaces.
CO 5: Draw an isometric and orthographic views of simple solids.

UNIT I: (2 Periods and 8 Practical's)

Introduction to Engineering Drawing: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing Regular Polygons by General Methods.
Curves: Construction of Ellipse, Parabola and Hyperbola by General Method, Cycloids, Involutes, Normal and Tangent to Curves.
Scales: Plain Scales, Diagonal Scales and Vernier Scales.

UNIT II: (3 Periods and 12 Practical's)

Orthographic Projections: Reference Plane, Importance of Reference Lines or Plane, Projections of a Point Situated in any One of the Four Quadrants.
Projections of Straight Lines: Projections of Straight Lines Parallel to both Reference Planes, Perpendicular to One Reference Plane and Parallel to other Reference Plane, Inclined to one Reference Plane and Parallel to the other Reference Plane. Projections of Straight Line Inclined to both the Reference Planes.
Projections of Planes: Regular Planes Perpendicular to both Reference Planes, Parallel to One Reference Plane and Inclined to the other Reference Plane; Plane Inclined to both the Reference Planes.

UNIT III: (3 Periods and 12 Practical's)

Projections of Solids: Types of Solids: Polyhedra and Solids of Revolution. Projections of Solids in Simple Positions: Axis Perpendicular to Horizontal Plane, Axis Perpendicular to Vertical Plane and Axis Parallel to both the Reference Planes, Projection of Solids with Axis Inclined to One Reference Plane and Parallel to another Plane, Projection of Solids Inclined to both the Reference Planes.

UNIT IV: (3 Periods and 12 Practical's)

Sections of Solids: Perpendicular and Inclined Section Planes, Sectional Views and True Shape of Section, Sections of Solids in Simple Position only.
Development of Surfaces: Methods of Development: Parallel Line Development and Radial Line Development. Development of a Cube, Prism, Cylinder, Pyramid and Cone.

UNIT V: (4 Periods and 16 Practical's)

Conversion of Views: Conversion of Isometric Views to Orthographic Views of Simple Solids; Conversion of Orthographic Views to Isometric views of Simple Solids.

Computer Graphics: Creating 2D&3D Drawings of Objects Including Domain Specific Engineering Applications using Auto CAD (Not for end examination).

Total Periods: 15 Periods and 60 Practical's

TEXT BOOKS:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 54th Edition, 2023.

REFERENCES:

1. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
2. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw-Hill, 2017.
3. Engineering Drawing and Graphics by K. Venugopal, 4/e, New Age Publishers, 2004.
4. Engineering Drawing by Basant Agarwal & C.M. Agarwal, 2/e, Tata McGraw-Hill, 2013

I Year B.Tech. CSE (Data Science) – II Semester

L	T	P	C
3	0	0	3

(EE23AES101) BASIC ELECTRICAL & ELECTRONICS ENGINEERING

PART A: BASIC ELECTRICAL ENGINEERING

COURSE OBJECTIVES:

The objective of this course are to:

- Gain the knowledge about various laws, simplification techniques and principles associated with electrical circuits.
- Acquire basic knowledge about the Electric machines, their principle of operation and the concept of measuring instruments.
- Understand the concept of Power Generation, Electricity Bill and Safety Measures.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Apply the knowledge of theorems/laws to analyze the simple AC and DC circuits.
CO 2: Illustrate the operating principles of various electrical machines and electrical measuring equipment's.
CO 3: Understand the basic concepts of electrical power generation, Electricity Bill and Safety Measures.

UNIT I: (8 Periods)

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT II: (7 Periods)

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone Bridge.

UNIT III: (7 Periods)

Energy Resources, Electricity Bill & Safety Measures Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity Bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

TEXT BOOKS:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition.
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013.
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition.

REFERENCES:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition.
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers,2020.
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017.
4. Basic Electrical and Electronics Engineering, S.K.Bhatacharya, Person Publications, 2018, Second Edition.

PART B: BASIC ELECTRONICS ENGINEERING

COURSE OBJECTIVES:

The objective of this course are to:

- Understand the working principle of various electronic devices.
- Acquire knowledge on the operating conditions of a DC power supply system, amplifiers and general electronic instrumentation system.
- Learn basic techniques in the design of a logic circuit.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Apply the concept of science and mathematics to understand the working principles of electronic devices.
CO 2: Analyze the working principle of a DC power supply system and Amplifiers.
CO 3: Solve digital logic circuits and implement using different logic gates.

UNIT I: (7 Periods)

Semiconductor Devices: Introduction - Evolution of electronics - Characteristics of PN Junction Diode - Zener Effect- Zener Diode and its Characteristics. Bipolar Junction Transistor - CB, CE, CC Configurations and Characteristics - Elementary Treatment of Small Signal CE Amplifier.

UNIT II: (8 Periods)

Basic Electronic Circuits and Instrumentation: Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT III: (8 Periods)

Digital Electronics: Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adder, Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only).

Total Periods: 45

TEXT BOOKS:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill,2009

REFERENCES:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand &Co, 2010.
2. SantiramKal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

I Year B.Tech. CSE (Data Science) – II Semester

L	T	P	C
0	0	3	1.5

(EE23AES102) ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP

PART A: ELECTRICAL ENGINEERING LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Gain the practical knowledge about various laws/theorems for the given circuit.
- Acquire knowledge about various electrical measuring instruments and safety measures.
- Obtain the performance characteristics of DC generator.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand the concept of KCL, KVL and Theorems practically for the given circuit.
CO 2: Evaluate the resistance, power and power factor of circuit elements by using measuring instruments.
CO 3: Obtain the Magnetization Characteristics of DC shunt Generator

List of Experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

REFERENCES:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition.
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013.
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition.

Note: Minimum Six Experiments to be performed.

PART B: ELECTRONICS ENGINEERING LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Gain hands on experience in testing various electronic components.
- Acquire knowledge related to the use of electronic measuring instruments for different applications.
- Design and simulate a RC coupled amplifier.
- Verify the operating conditions of combinational and sequential circuits.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Identify & Test various electronic components.
CO 2: Employ various electronic measuring instruments for different applications.
CO 3: Evaluate the biasing conditions of various diodes and BJTs.
CO 4: Examine the operating conditions of a digital circuit

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
   i. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
7. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs. Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

REFERENCES:

1. R. L. Boylestad& Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

I Year B.Tech. CSE (Data Science) – II Semester

L	T	P	C
0	0	3	1.5

(CS23APC202) DATA STRUCTURES LAB

COURSE OBJECTIVE:
The objectives of this course are to:

- Identify and apply the suitable data structurefor the given real-world problem.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO1: Demonstrate the concept of Recursion for solving a problem.
CO2: Choose and implement linear data structure to solve problems.
CO3: Develop programs for searching and sorting algorithms.
CO4: Select and implement suitable nonlinear data structure for solving a problem.

TASKS:

1. Implement basic operations on arrays: insertion, deletion, searching.
2. Create a program to find the maximum and minimum elements in an array.
3. Write a program to reverse an array.
4. Demonstrate recursive algorithms with examples.
5. Develop a program to perform operations of a Stack and Queue using arrays.
6. Implement and perform different operations on Single, Double and CircularLinked Lists.
7. Develop a program to perform operations of Stack and Queue using LinkedLists.
8. Develop a program to implement Stack applications.
9. Implement Circular Queues.
10. Implement various Searching techniques.
11. Develop programs for different Sorting techniques.
12. Develop a program to demonstrate operations on Binary Search Tree.
13. Demonstrate Graph Traversal Techniques.
14. Develop a program to find Minimum Cost Spanning tree.

TEXT BOOKS:

1. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, SecondEdition, 2002, Pearson.
2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson,Ronald L. Rivest, Clifford Stein, Third Edition, 2010, PHI.
3. Data Structures and Algorithms Made Easy by Narasimha Karumanchi,2020, Career Monk Publications.

I Year B.Tech. CSE (Data Science) – II Semester

L	T	P	C
0	0	2	1

(PH23ABS102) ENGINEERING PHYSICS LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity, Hall effect in semiconductors, study the parameters and applications of dielectric and magnetic materials by conducting experiments.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Compare the wavelengths of different colours using diffraction grating.
CO 2: Utilize optical instruments like travelling microscope and spectrometer.
CO 3: Analyze the intensity of the magnetic field of circular coil carrying current with distance.
CO 4: Evaluate dielectric constant for a dielectric material.
CO 5: Estimate the band gap of a given semiconductor and the type of semiconductor using Hall effect.

List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Determination of dielectric constant using charging and discharging method.
4. Study the variation of B versus H by magnetizing the magnetic material (B- H curve).
5. Determination of wavelength of Laser light using diffraction grating.
6. Estimation of Planck's constant using photoelectric effect.
7. Determination of the resistivity of semiconductors by four probe methods.
8. Determination of energy gap of a semiconductor using p-n junction diode.
9. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
10. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
11. Determination of temperature coefficients of a thermistor.
12. Sonometer: Verification of laws of stretched string.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

REFERENCES:

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

ONLINE RESOURCES:

1. www.vlab.co.inhttps://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

I Year B.Tech. CSE (Data Science) – I Semester

L	T	P	C
0	0	2	1

(CS23AES103) IT WORKSHOP

COURSE OBJECTIVES:
The objective of this course are to:
- Introduce the internal parts of a computer, peripherals, I/O ports, connecting cables.
- Teach basic command line interface commands on Linux.
- Teach the usage of Internet for productivity and self-paced life-long learning
- Introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Perform Hardware troubleshooting.
CO 2: Understand Hardware components and inter dependencies.
CO 3: Safeguard computer systems from viruses/worms.
CO 4: Document/ Presentation preparation.
CO 5: Perform calculations using spreadsheets

Hardware:
Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheraland submit to your instructor.
Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.
Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.
Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web:
Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.
Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.
Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.
Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block activey downloads to avoid viruses and/or worms.

LaTeX and WORD:
Task 1: Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word
– Accessing, overview of toolbars, saving files, Using help and resources, rulers, format

painter in word.
Task 2: Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.
Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.
Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

Excel:
Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.
Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text
Task 2: Calculating GPA - Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,
LOOKUP/VLOOKUP
Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean andlogical operators, Conditional formatting

Power Point:
Task 1: Students will be working on basic power point utilities and toolswhich help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrowsin PowerPoint.
Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art,Audio, Video, Objects, Tables and Charts.
Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI Tools – ChatGPT:
Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences
to see how the model completes them.
Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"
Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas
Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this newreality."
Task 3: Code Generation: Test the model's ability to generate code by giving it partial code snippets and asking it to complete them. You can also ask the model to explain programming concepts or help you debug code.
Ex: Prompt: "Complete the following Python code to swap the values of two variables:\npython\na = 5\nb = 10\ntemp = a\na = b\nb = temp\n"
Task 4: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it intoanother language. Compare the output to see how accurate and fluent the translations are.
Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"
Task 5: Summarization: Provide a long piece of text, such as an article or a blog post, and

ask the model to summarize it. Compare the model's summary with the original text to assess its ability to condense information effectively.
Ex: Prompt: "Summarize the article titled `Ramayanam' in 3-4 sentences."
Task 6: Futuristic Predictions: Have fun by asking the model to predict future technological advancements, societal changes, or even hypothetical scenarios. Compare its responses with your own ideas.
Ex: Prompt: "Predict how artificial intelligence will transform everyday life in the next 20 years."
Task 7: Technical Explanations: Challenge the model with technical questions from different domains. Ask it to explain scientific concepts, mathematical theorems, or complex algorithms in simple terms.
Ex: Prompt: "Explain the concept of neural networks in machine learning, including their layers and the process of backpropagation."

REFERENCES:

1. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dream tech
2. The Complete Computer upgrade and repair book, 3rd edition Cheryl A chmidt, WILEY Dream tech
3. Introduction to Information Technology, ITL EducationSolutions limited, Pearson Education.
4. PC Hardware - A Handbook – Kate J. Chase PHI (Microsoft)
5. LaTeX Companion – Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfins on and Ken Quamme. – CISCO Press, Pearson Education.
7. IT Essentials PC Hardware and Software Labs and Study Guide Third Edition by Patrick Regan– CISCO Press, Pearson Education.

I Year B.Tech. CSE (Data Science) – II Semester

L	T	P	C
0	0	1	0.5

(CH23ABS105) HEALTH AND WELLNESS, YOGA AND SPORTS

COURSE OBJECTIVES:

The objective of this course are to:

- Make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand the importance of yoga and sports for Physical fitness and sound health.
CO 2: Demonstrate an understanding of health-related fitness components.
CO 3: Compare and contrast various activities that help enhance their health.
CO 4: Assess current personal fitness levels.
CO 5: Develop Positive Personality.

UNIT I:

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

ii) Organizing health awareness programmes in community.
iii) Preparation of health profile.
iv) Preparation of chart for balance diet for all age groups.

UNIT II:

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas-Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III:

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho,Table tennis, Cricket etc. Practicing general and specific warm up, aerobics
ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

REFERENCES:

2. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones &Bartlett Learning, 2022
3. T. K. V. Desikachar. The Heart of Yoga: Developing a Personal Practice
4. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
5. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
6. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014 General

II Year B.Tech. CSE (Data Science) – I Semester

L	T	P	C
3	0	0	3

(MA23ABS302) DISCRETE MATHEMATICS AND GRAPH THEORY

COURSE OBJECTIVES:

The objective of this course are to:

- To describe logical sentences in terms of predicates, quantifiers, and logical connectives in theory of inference for the statement calculus.
- To demonstrate the application of basic methods of discrete mathematics in Computer Science problem solving.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

- **CO 1:** Apply mathematical concepts and logical reasoning to solve problems in different fields of computer science and information technology.
- **CO 2:** Categorize the properties of Algebraic Structures to find the given sets are semi group, Monoid and Groups.
- **CO 3:** Analyze the concepts of Combinations, permutations and Binomial theorems.
- **CO 4:** Analyze the concepts of Generating and Recurrence relations for solving Homogeneous and In-Homogeneous equations
- **CO 5:** Apply Graph Theory in solving in computer science problems.

UNIT I: (09 Hours)

Mathematical Logic: Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, Functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus.

UNIT II: (10 Hours)

Set theory: The Principle of Inclusion- Exclusion, Pigeon hole principle and its application, Functions, Composition of functions, Inverse Functions, Recursive Functions.

Algebraic structures: Algebraic systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, Homomorphism, Isomorphism.

UNIT III: (09 Hours)

Elementary Combinatorics : Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial theorems.

UNIT IV: (09 Hours)

Recurrence Relations : Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of In homogeneous Recurrence Relations.

UNIT V: (08 Hours)

Graphs: Basic Concepts, Isomorphism and Sub-graphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs.

Total Periods: 45

TEXT BOOKS:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata Mc Graw Hill, 2002.
2. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited.

REFERENCES:

1. Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science.

ONLINE RESOURCES:

1. http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

II Year B.Tech. CSE (Data Science) – I Semester

L	T	P	C
3	0	0	3

(EC23AES301) DIGITAL LOGIC AND COMPUTER ORGANIZATION

Course Objectives:

The main objective of the course is to

- Provide students with a comprehensive understanding of digital logic designprinciples and computer organization fundamentals
- Describe memory hierarchy concepts
- Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices

Course Outcomes:

After successful completion of the course, students will be able to:

- **CO 1:** Understand the properties of Boolean algebra, logic operations and design of Combinational Circuits.
- **CO 2:** Analyze & Design sequential Circuits and demonstrate an understanding of the designof the functional units of a digital computer system.
- **CO 3:** Understand the architecture of modern computer, and also understanding of how thecomputer performs arithmetic operations on positive and negative numbers.
- **CO 4:** Describe memory hierarchy concepts, including cache memory, virtual memory, and secondary storage, and evaluate their impact on system performance and scalability.
- **CO 5:** Understand of I/O devices communicating with Processing Unit and also knowing thecharacteristics of multi processors.

UNIT I: (10 Periods)

Data Representation: Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, complements, Signed binary numbers, Binary codes

Digital Logic Circuits-I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification, Combinational Circuits, Decoders, Multiplexers

UNIT II: (9 Periods)

Digital Logic Circuits-II: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Von- Neumann Architecture

UNIT III: (10 Periods)

Computer Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations

Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Multi programmed Control

UNIT IV: (9 Periods)

The Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage

UNIT V: (8 Periods)

Input /Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces

Total Periods: 45

TEXT BOOKS:

1. Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 6th edition, McGraw Hill, 2023.
2. Digital Design, 6th edition, M. Morris Mano, Pearson Education, 2018.
3. Computer Organization and Architecture, William Stallings, 11th edition, Pearson, 2022.

REFERENCES:

1. Computer Systems Architecture, M.Moris Mano, 3rd edition, Pearson, 2017.
2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier, 2004.
3. Fundamentals of Logic Design, Roth, 5th edition, Thomson, 2003.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106/103/106103068/

II Year B.Tech. CSE (Data Science) – I Semester

L	T	P	C
3	0	0	3

(DS23APC301) INTRODUCTION TO DATA SCIENCE

COURSE OBJECTIVES:

The objective of this course are to:

- Knowledge and expertise to become a data scientist.
- Essential concepts of statistics and machine learning that are vital for data science;
- Significance of exploratory data analysis (EDA)in data science.
- Critically evaluate data visualizations presented on the dash boards
- Suitabilityandlimitationsoftoolsandtechniquesrelatedtodatascienceprocess

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO1: Understand significance of Data Science.
CO2: Analyze large data
CO3: Understand the fundamentals of Data Science Process Methods.
CO4: Apply machine learning in Data Science.
CO5: Perform Data reduction and apply visualization techniques.

UNIT I: **(8 Periods)**

Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science.

Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

UNIT II: **(10 Periods)**

Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning

Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

UNIT III: **(9 Periods)**

NoSQL movement for handling Big data: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling

UNIT IV: **(8 Periods)**

Tools and Applications of Data Science: Introducing Neo4jfor dealing with graph databases, graph query language Cypher, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts

UNIT V: **(10 Periods)**

Data Visualization and Prototype Application Development: Data Visualization options, Cross filter, the JavaScript MapReduce library, Creating an interactive dashboard with dc.js, Dashboard development tools. Applying the Data Science process for real-world problem-solving scenarios as a detailed case study.

Total Periods: 45

TEXT BOOKS

1. Davy Cielen, Arno D.B. Meysman, and Mohamed Ali, "Introducing to Data Science using Python tools", Manning Publications Co, Dream tech press, 2016.
2. Prateek Gupta, "Data Science with Jupyter" BPB publishers,2019forbasics

REFERENCES:

3. Joel Grus, "Data Science from Scratch", OReilly,2019
4. Doing Data Science: Straight Talk from TheFrontline,1st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013

II Year B.Tech. CSE (Data Science) – I Semester

L	T	P	C
3	0	0	3

(CS23APC301) ADVANCED DATA STRUCTURES AND ALGORITHM ANALYSIS

COURSE OBJECTIVES:

The objective of this course are to:

- Provide knowledge on advance data structures frequently used in Computer Science domain
- Develop skills in algorithm design techniques popularly used
- Understand the use of various data structures in the algorithm design

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

- **CO 1:** Illustrate the working of the advanced tree data structures and their applications
- **CO 2:** Understand the Graph data structure, traversals and apply them in various contexts.
- **CO 3:** Use various data structures in the design of algorithms
- **CO 4:** Recommend appropriate data structures based on the problem being solved
- **CO 5:** Analyze algorithms with respect to space and time complexities
- **CO 6:** Design new algorithms.

UNIT I: (9 periods)

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations. AVL Trees – Creation, Insertion, Deletion operations, and Applications. Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications

UNIT II: (9 periods)

Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's Matrix multiplication, Convex Hull Problem.

UNIT III: (9 periods)

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths
Dynamic Programming: General Method, All pairs shortest paths

UNIT IV: (9 periods)

Dynamic Programming: 0/1 Knapsack, String Editing, Travelling Salesperson problem. Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem

UNIT V: **(9 periods)**

Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem Introduction to NP Hard and NP Complete Problems: Basic Concepts.

Total Periods: 45

TEXTBOOKS:

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh 2nd Edition Universities Press
2. Computer Algorithms/C++Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran 2nd Edition University Press

REFERENCES:

1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
2. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures & Programs: N. Wirth, PHI
6. Fundamentals of Data Structures in C++: Horowitz Sahni & Mehta, Galgottia Pub.
7. Data structures in Java:, Thomas Standish, Pearson Education Asia

ONLINE RESOURCES:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html
3. Abdul Bari,1. Introduction to Algorithms (youtube.com)

II Year B.Tech. CSE (Data Science) – I Semester

L	T	P	C
3	0	0	3

(CS23APC302) OBJECT ORIENTED PROGRAMMING THROUGH JAVA

COURSE OBJECTIVES:

The objective of this course are to:

- Identify Java language components and how they work together in applications.
- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications.
- Understand how to design applications with threads in Java.
- Understand how to use Java apis for program development.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.

CO 2: .Design and implement classes to model real-world entities, with a focus on attributes, behaviors, and relationships between objects

CO 3: Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch.

CO 4: Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.

CO 5: Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX.

CO 6: Choose appropriate data structure of Java to solve a problem

UNIT I: (9 Periods)

Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final.

Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II: (9 Periods)

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III: (9 Periods)

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class- Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV: (9 Periods)

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto- unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

UNIT V: (9 Periods)

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events.

Total Periods: 45

TEXT BOOKS:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.

3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

REFERENCES:

1. The complete Reference Java, 11th edition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347shared/overview

II Year B.Tech. CSE (Data Science) – I Semester

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0	0	2	1

(DS23APC302) DATA SCIENCE LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Inculcate the basic understanding of Data Science and its practical implementation using Python.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO1: Apply principles and techniques for optimizing the performance of Python applications

CO2: Implement parallel computing applications using Python.

CO3: Develop GPU accelerated Python applications.

CO4: Develop skills in performing exploratory data analysis using statistical and visualization tools.

CO5: Learn techniques for cleaning and preprocessing raw data, including handling missing values, outliers, and data normalization.

LIST OF EXPERIMENTS:

1. Creating a NumPy Array
   a. Basic nd array
   b. Array of zeros
   c. Array of ones
   d. Random numbers in nd array
   e. An array of your choice
   f. Imatrix in NumPy
   g. Evenly space dndarray
2. The Shape and Reshaping of NumPy Array
   a. Dimensions of NumPy array
   b. Shape of NumPy array
   c. Size of NumPy array
   d. Reshaping a NumPy array
   e. Flattening a NumPy array
   f. Transpose of a NumPy array
3. Expanding and Squeezing a NumPy Array
   a. Expanding a NumPy array
   b. Squeezing a NumPy array
   c. Sorting in NumPy Arrays
4. Indexing and Slicing of NumPy Array
   a. Slicing1-DNumPyarrays
   b. Slicing2-DNumPyarrays
   c. Slicing3-DNumPyarrays
   d. Negative slicing of NumPy arrays
5. Stacking and Concatenating Numpy Arrays
   a. Stacking and arrays
   b. Concatenating and arrays
   c. Broadcasting in Numpy Arrays

6. Perform following operations using pandas
   a. Creating data frame
   b. Concat ()
   c. Setting conditions
   d. Adding an new column
7. Perform following operations using pandas
   a. Filling NaN with string
   b. Sorting based on column values
   c. Group by()
8. Read the following file formats using pandas
   a. Text files
   b. CSV files
   c. Excel files
   d. JSON files
9. Read the following file formats
   a. Pickle files
   b. Image files using PIL
   c. Multiple file susing Glob
   d. Importing data from database
10. Demonstrate web scraping using python
11. Perform following preprocessing techniques on loan prediction dataset
    a. Feature Scaling
    b. Feature Standardization
    c. Label Encoding
    d. One Hot Encoding
12. Perform following visualizations using matplotlib
    a. Bar Graph
    b. Pie Chart
    c. Box Plot
    d. Histogram
    e. Line Chart and Subplots
    f. Scatter Plot
13. Getting started with NLTK, install NLTK using PIP
14. Python program to implement with Python SciKit-Learn &NLTK
15. Python program to implement with Python NLTK/Spicy/PyN LPI.

ONLINE RESOURCES:

1. https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-beginners/
2. https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts/
3. https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/
4. https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn/
5. https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-data-visualization-exploration-python/ https://www.nltk.org/book/ch01.html

II Year B.Tech. CSE (Data Science) – I Semester

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0	0	3	1.5

(CS23APC303) ADVANCED DATA STRUCTURES AND ALGORITHM ANALYSIS LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Acquire practical skills in constructing and managing Data structures
- Apply the popular algorithm design methods in problem-solving scenarios

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

- **CO 1:** Design and develop programs to solve real world problems with the popular algorithm design methods.
- **CO 2:** Demonstrate an understanding of Non-Linear data structures by developing implementing the operations on AVL Trees, B-Trees, Heaps and Graphs.
- **CO 3:** Critically assess the design choices and implementation strategies of algorithms and data structures in complex applications.
- **CO 4:** Utilize appropriate data structures and algorithms to optimize solutions for specific computational problems.
- **CO 5:** Compare the performance of different of algorithm design strategies
- **CO 6:** Design algorithms to new real world problems

Experiments Covering the Topics:

1. Operations on AVL trees, B-Trees, Heap Trees
2. Graph Traversals
3. Sorting techniques
4. Minimum cost spanning trees
5. Shortest path algorithms
6. 0/1 Knapsack Problem
7. Travelling Salesperson problem
8. Optimal Binary Search Trees
9. N-Queens Problem
10. Job Sequencing

Sample Programs:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.
2. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
3. Implement BFT and DFT for given graph, when graph is represented by
   a) Adjacency Matrix b) Adjacency Lists
4. Write a program for finding the bi-connected components in a given graph.
5. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).
6. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.
7. Implement Job sequencing with deadlines using Greedy strategy.
8. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.

9. Implement N-Queens Problem Using Backtracking.
10. Use Backtracking strategy to solve 0/1 Knapsack problem.
11. Implement Travelling Sales Person problem using Branch and Bound approach.

REFERENCES:

1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2nd Edition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, Sanguthevar
3. Rajasekaran, 2nd Edition, University Press
4. Data Structures and program design in C, Robert Kruse, Pearson Education
5. Asia
6. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill

ONLINE RESOURCES:

1. http://CSE 01-iiith.vlabs.ac.in/
2. http://peterindia.net/Algorithms.html

II Year B.Tech. CSE (Data Science) – I Semester

L	T	P	C
0	0	3	1.5

(CS23APC304) OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Practice object-oriented programming in the Java programming language
- Implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
- Illustrate inheritance, Exception handling mechanism, JDBC connectivity
- Construct Threads, Event Handling, implement packages, Java FX GUI

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Demonstrate a solid understanding of Java syntax, including data types, control structures, methods, classes, objects, inheritance, polymorphism, and exception handling.

CO 2: Apply fundamental OOP principles such as encapsulation, inheritance, polymorphism, and abstraction to solve programming problems effectively.

CO 3: Familiar with commonly used Java libraries and APIs, including the Collections Framework, Java I/O, JDBC, and other utility classes.

CO 4: Develop problem-solving skills and algorithmic thinking, applying OOP concepts to design efficient solutions to various programming challenges.

CO 5: Proficiently construct graphical user interface (GUI) applications using JavaFX

CO 6: Develop new programs for solving typical computer science problems

Experiments Covering the Topics:

- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI

Sample Experiments:

Exercise – 1:

a) Write a JAVA program to display default value of all primitive data type of JAVA
b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise – 2

a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
b) Write a JAVA program to sort for an element in a given list of elements using bubble sort
c) Write a JAVA program using StringBuffer to delete, remove character.

Exercise – 3

a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
b) Write a JAVA program implement method overloading.

c) Write a JAVA program to implement constructor. Write a JAVA program to implement constructor overloading.

Exercise – 4

a) Write a JAVA program to implement Single Inheritance
b) Write a JAVA program to implement multi level Inheritance
c) Write a JAVA program for abstract class to find areas of different shapes

Exercise – 5

a) Write a JAVA program give example for "super" keyword.
b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
c) Write a JAVA program that implements Runtime polymorphism

Exercise – 6

a) Write a JAVA program that describes exception handling mechanism
b) Write a JAVA program Illustrating Multiple catch clauses
c) Write a JAVA program for creation of Java Built-in Exceptions
d) Write a JAVA program for creation of User Defined Exception

Exercise – 7

a) Write a JAVA program that creates threads by extending Thread class. First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds, (Repeat the same by implementing Runnable)
b) Write a program illustrating is Alive and join ()
c) Write a Program illustrating Daemon Threads.
d) Write a JAVA program Producer Consumer Problem

Exercise – 8

a) Write a JAVA program that import and use the user defined packages
b) Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX)
c) Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI

TEXT BOOKS:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta,Monalisa Sarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th edition, Pearson.

REFERENCES:

1. The complete Reference Java, 11th edition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547

II Year B.Tech. CSE (Data Science) – I Semester

L	T	P	C
0	1	2	2

(CS23ASC302) PYTHON PROGRAMMING

COURSE OBJECTIVES:

The objectives of this course are to:

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries.
- Implement Functions, Modules and Regular Expressions in PythonProgramming and to create practical and contemporary applications using these

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Classify data structures of Python.
CO 2: Apply Python programming concepts to solve a variety of computational problems.
CO 3: Understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs.
CO 4: Become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas.
CO 5: Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries.
CO 6: Propose new solutions to computational problems

UNIT I

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupiter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if.eif else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
    - Arithmetic Operators
    - Relational Operators
    - Assignment Operators
    - Logical Operators
    - Bit wise Operators Ternary Operator
    - Membership Operators Identity Operators
5. Write a program to print multiplication table of a given number.

UNIT II

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in

String by Index Number, String Slicing and Joining, String Methods, Formatting Strings. **Lists**: Creating Lists, Basic List Operations, Indexing and Slicing in Lists.

Sample Experiments:

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
   i. Addition ii. Insertion iii. slicing
6. Write a program to perform any 5 built-in functions by taking any list

UNIT III

Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries.

Sample Experiments:

1. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2. Write a program to count the number of vowels in a string (No control flow allowed).
3. Write a program to sum all the items in a given dictionary.

UNIT IV

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Python os and os.path Modules.
Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, method overloading, constructor overloading, classes with Multiple Objects, Inheritance, Polymorphism.

Sample Experiments:

1. Write a program to create Classes and Objects in Python
2. Write a program to implement inheritance concept
3. Write a Python program to implement method overloading, constructor overloading

UNIT V

Introduction to Data Science: NumPy, Pandas, Matplotlib libraries.

Sample Experiments:

1. Python Program to demonstrate NumPy arrays creation using array () function.
2. Python program to demonstrate use of ndim, shape, size, dtype.
3. Python programs to demonstrate different ways to create Pandas Dataframe
4. Python programs to demonstrate various plots in matplotlib.

REAL TIME PROJECT:

Dice Rolling Simulator in Python

REFERENCES:

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press1st Edition, 2018
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson 1stEdition 2017.

ONLINE RESOURCES:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

II Year B.Tech. CSE (Data Science) – I Semester

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(CH23AMC301) ENVIRONMENTAL SCIENCE

COURSE OBJECTIVES:

The objective of this course is:

- Make the students to get awareness on environment.
- Understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life.
- Save earth from the inventions by the engineers.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Exploring different types of renewable and non-renewable energy sources.
CO 2: Students will learn about the structure and function of different ecosystems.
CO 3: Students will learn about different types of pollution and their sources, effects and control measures.
CO 4: Exploring the science behind climate change, its evidence, and its impacts on ecosystems and human societies.
CO 5: Understanding demographic factors and their environmental implications.

UNIT I: **(6 Periods)**

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance – Need for Public Awareness.

Natural Resources: Energy Resources**-** Renewable and Non-Renewable Resources – Natural Resources and Associated Problems – Forest Resources – Use and Over – Exploitation, Deforestation, Case Studies – Timber Extraction – Mining, Dams and other effects on Forest and Tribal People Water Resources – Use and Over Utilization of Surface and Ground Water – Floods, Drought, conflicts over Water, Dams – Benefits and Problems – Mineral Resources: Use and Exploitation, Environmental Effects of extracting and using Mineral Resources, Case Studies – Food Resources, World Food Problems, changes caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer-Pesticide Problems, Water Logging, Salinity, Case Studies.

UNIT II: **(7 Periods)**

Ecosystems: Concept of an Ecosystem. – Structure and Function of an Ecosystem – Producers, Consumers and Decomposers – Energy flow in the Ecosystem – Ecological Succession – Food Chains, Food Webs and Ecological Pyramids – Introduction, Types, Characteristic Features, Structure and Function of the following Ecosystems:

a) Forest Ecosystem.
b) Grassland Ecosystem
c) Desert Ecosystem.
d) Aquatic Ecosystems (Freshwater - Ponds, Streams, Lakes, Rivers, Marine Ecosystem- Oceans, Estuaries)

Biodiversity and its Conservation : Introduction, Definition: Genetic, Species and Ecosystem Diversity – Bio-Geographical Classification of India – Value of Biodiversity: Consumptive use, Productive use, Social, Ethical, Aesthetic and Option Values – Biodiversity at Global, National and Local levels – India as a Mega-Diversity Nation – Hot-Spots of Biodiversity – Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts – Endangered and Endemic Species of India – Conservation of Biodiversity: In-situ and Ex-situ Conservation of Biodiversity. Specific Case Studies.

UNIT III: **(6 Periods)**

Environmental Pollution: Definition, Cause, Effects, and Control measures of: Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards - Pollution Case Studies - Role of an Individual in the Prevention of Pollution - Solid Waste Management- Causes, Effects and Control Measures of Urban and Industrial Wastes - Disaster Management-Floods, Earthquakes, Cyclones and Landslides.

UNIT IV: **(5 Periods)**

Social Issues and the Environment: Sustainable Development Goals, From Unsustainable to Sustainable Development–Urban Problems related to Energy – Water Conservation, Rainwater Harvesting, Watershed Management –Resettlement and Rehabilitation of People; Its Problems and Concerns. Case Studies – Environmental Ethics: Issues and Possible Solutions – Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust. Case Studies – Wasteland Reclamation. – Consumerism and Waste Products - Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in Enforcement of Environmental Legislation – Public Awareness.

UNI TV: **(6 Periods)**

Human Population and the Environment: Population Growth, Variation among Nations. Population Explosion – Family Welfare Programmes. – Environment and Human Health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of Information Technology in Environment and Human Health – Case Studies.

Field Work: Visit a Local Area to Document Environmental Assets River / Forest Grassland / Hill / Mountain – Polluted Site – Urban / Rural / Industrial / Agricultural - Study of Common Plants, Insects and Birds – River, Hill Slopes.

Total Periods: 30

TEXT BOOKS:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press, Third Edition, 2021.
2. K. Raghavan Nambiar, "Textbook of Environmental Studies for Undergraduate Courses asper UGC model syllabus", Scitech Publications (India), Pvt. Ltd. Second Edition, 2008.
3. Palaniswamy, "Environmental Studies", Pearson Education, Second Edition, 2014.
4. S. Azeem Unnisa, "Environmental Studies" Academic Publishing Company
5. A. Koushik & C. P. Koushik, Perspectives in Environmental Studies, New Age International,Fourth Edition, 2006.

REFERENCES:

1. Deeksha Dave and E. Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications, Second Edition, 2012.
2. M. Anji Reddy, "Textbook of Environmental Sciences and Technology", BS Publication, Second Edition, 2023.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, Third Edition, 2009.
4. J. Glynn Henry and Gary W. Heinke, "Environmental Sciences and Engineering", Prentice Hall of India Private Limited, Second Edition, 2004.
5. G.R. Chatwal, "A Text Book of Environmental Studies" Himalaya Publishing House, Fourth Edition, 2014.
6. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science, Prentice Hall of India Private Limited, Third Edition, 2007.

II Year B.Tech. CSE (Data Science) – II Semester

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(BA23AHS302) UNIVERSAL HUMAN VALUES

COURSE OBJECTIVES:

The objective of this course is:

- Help the students appreciate the essential complementary between 'VALUES' and' SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- Facilitate the development of a Holistic perspective among students towards life and profession as well as toward shappiness and prosperity based on a correct understanding of the Human reality and there of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- Highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Define the terms like Natural Acceptance, Happiness and Prosperity
CO 2: Identify one's self, and one's surroundings (family, society nature).
CO 3: Apply what they have learnt to their own self in different day-to-day settings in real life.
CO 4: Relate human values with human relationship and human society.
CO 5: Justify the need for universal human values and harmonious existence.
CO 6: Develop as socially and ecologically responsible engineers

UNIT I: **(7 Periods)**

Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) – Understanding Value Education ;Practice Session - Sharing about Oneself ; Self-Exploration as the Process for Value Education - Continuous Happiness and Prosperity - the Basic Human Aspirations ; Practice Session - Exploring Human Consciousness ; Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations ; Practice Session - Exploring Natural Acceptance.

UNIT II: **(6 Periods)**

Harmony in the Human Being: Understanding Human Being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body ; Practice Session - Exploring the difference of Needs of self and body ; The Body as an Instrument of the Self - Understanding Harmony in the Self ; Practice Session - Exploring Sources of Imagination in the Self ; Harmony of the Self with the Body - Programme to ensure Self-regulation and Health ; Practice Session - Exploring Harmony of Self with the Body.

UNIT III: **(6 Periods)**

Harmony in the Family and Society: Harmony in the Family – The Basic Unit of Human Interaction - 'Trust' – The Foundational Value in Relationship; Practice Session - Exploring the Feeling of Trust ; 'Respect' – as the Right Evaluation ; Practice Session - Exploring the Feeling of Respect ; Other Feelings, Justice in Human-to-Human Relationship - Understanding Harmony in the Society - Vision for the Universal Human Order ; Practice Session ; Exploring Systems to fulfill Human Goal.

UNIT IV: **(5 Periods)**

Harmony in the Nature / Existence: Understanding Harmony in the Nature - Interconnectedness, Self-regulation and Mutual fulfillment among the Four Orders of Nature ;Practice Session - Exploring the Four Orders of Nature ; Realizing Existence as Co-existence at All Levels - The Holistic Perception of Harmony in Existence ; Practice Session - Exploring Co-existence in Existence**.**

UNIT V: **(6 Periods)**

Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct ; Practice Session -Exploring Ethical Human Conduct ; A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order - Competence in Professional Ethics ; Practice Session - Exploring Humanistic Models in Education ; Holistic Technologies, Production Systems and Management Models-Typical Case Studies - Strategies for Transition towards Value-based Life and Profession ; Practice Session - Exploring Steps of Transition towards Universal Human Order.

Total Periods: 30

TEXT BOOKS:

1. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria,Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

REFERENCES:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. A.N. Tripathy, 2003, Human Values, New Age International Publishers. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
3. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
4. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
5. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow, Reprinted 2008.

ONLINE RESOURCES:

1. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
2. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

II Year B.Tech. CSE (Data Science) – II Semester

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(MA23ABS403) OPTIMIZATION TECHNIQUES

COURSE OBJECTIVES:

The objective of this course are to:

- Provide the basic knowledge about optimization, importance, application areas of in Industry, Linear programming.
- Impart different optimization models under typical situations in the business organization like transportation, assignment.
- Understand the process of sequencing in typical industry, different game strategies and develop networks of activities of projects.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understanding Optimization and Formulation of Linear Programming Models.
CO 2: Formulate and Solve Transportation & Assignment Models.
CO 3: Apply simple problems of Sequencing and implement practical cases of decision making under different business environments.
CO 4: Discuss the game theory and strategies.
CO 5: Developing networks of activities and finding optimal mode of projects evaluation.

UNIT I: (08 Periods)

Introduction: Meaning, Nature, Scope & Significance of Optimization - Typical applications. The Linear Programming Problem – Introduction, Formulation of Linear Programming problem, Limitations of L.P.P, Graphical Method, Simplex Method: Maximization and Minimization model (exclude Duality problems), Big-M method and Two Phase method.

UNIT II: (09 Periods)

Transportation Problem: Introduction, Transportation Model, Finding initial basic feasible solutions, moving towards optimality, Unbalanced Transportation problems, Transportation problems with maximization, Degeneracy.

Assignment Problem: Introduction, Mathematical formulation of the problem, Solution of an Assignment problem, Hungarian Algorithm, Multiple Solution, Unbalanced Assignment problems, Maximization in Assignment Model.

UNIT III: (10 Periods)

Sequencing- Job sequencing, Johnsons Algorithm for n Jobs and Two machines, n Jobs and Three Machines, n jobs through m machines, two jobs and m Machines Problems.

UNIT IV: (10 Periods)

Game Theory: Concepts, Definitions and Terminology, Two Person Zero Sum Games, Pure Strategy Games (with Saddle Point), Principal of Dominance, Mixed Strategy Games (Game without Saddle Point), Significance of Game Theory in Managerial Application.

UNIT V: (08 Periods)

Project Management: Network Analysis- Definition- objectives - Rules for constructing network diagram – Determining Critical Path –Earliest & Latest Times – Floats - Application of CPM and PERT techniques in Project Planning and Control – PERT Vs CPM (exclude Project Crashing).

Total Periods: 45

TEXT BOOKS:

1. Operations Research / R. Pannerselvam, PHI Publications.
2. Operations Research / S.D.Sharma-Kedarnath
3. Operations Research /A.M.Natarajan,P. Balasubramani, A. Tamilarasi / Pearson Education.
4. Engineering Optimization: Theory and practice/S.S.Rao, New Age International (P) Limited.

REFERENCES:

1. Quantitative Techniques in Management /ND Vohra, Tata McGraw Hill,4th Edition,2011.
2. Introduction to O.R/Hiller & Libermann (TMH).
3. Operations Research: Methods & Problems / Maurice Saseini, Arhur Yaspan & Lawrence Friedman. Pearson
4. Quantitative Analysis for Management/ Barry Render, Ralph M. Stair, Jr and Michael E. Hanna/
5. Operations Research/ Wagner /PHI Publications.

ONLINE RESOURCES:

1. https://onlinecourses.swayam2.qc.in/cec20_ma10/preview
2. https://onlinecourses.nptel.ac.in/noc20_ma23/preview
3. https://onlinecourses.nptel.ac.in/noc19_ma29/preview

II Year B.Tech. CSE (Data Science) – II Semester

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(MA23ABS404) STATISTICAL METHODS FOR DATA SCIENCE

COURSE OBJECTIVES:

The objective of this course are to:

- Illuminate the students in the concepts of Statistical methods.
- Equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand the basic concepts of Statistics.
CO 2: Analyze the data and draw conclusion about collection of data under study using Point estimation.
CO 3: Analyze data and draw conclusion about collection of data under study using Interval estimation.
CO 4: Analyze to test various hypotheses included in theory and types of errors for large samples.
CO 5: Apply the different testing tools like t-test, F-test, chi-square test to analyze the relevant real life problems.

UNIT I: (10 Periods)

Basic Concepts: Random variables (discrete and continuous), Probability density functions, properties, mathematical expectation. Probability distributions: Binomial, Poisson and Normal-their properties. Population, Sample, Parameter and Statistic; Characteristics of a good estimator; Consistency – Invariance property of Consistent estimator, sufficient condition for consistency; Unbiasedness, Sufficiency.

UNIT II: (09 Periods)

Point Estimation: Point Estimation- Estimator, Estimate, Methods of point estimation – Maximum likelihood method (the asymptotic properties of ML estimators are not included), Large sample properties of ML estimator (without proof)- applications, Method of moments, method of least squares, method of minimum chi-square and modified minimum chi-square-Asymptotic Maximum Likelihood Estimation and applications.

UNIT III: (10 Periods)

Interval Estimation: Confidence limits and confidence coefficient; Duality between acceptance region of a test and a confidence interval; Construction of confidence intervals for population proportion (small and large samples) and between two population proportions(large samples); Confidence intervals for mean and variance of a normal population; Difference between the mean and ratio of two normal populations.

UNIT IV: (08 Periods)

Testing of hypothesis: Types of errors, power of a test, most powerful tests: Neyman-Pearson Fundamental Lemma and its applications; Notion of Uniformly most powerful tests; Likelihood Ratio tests: Description and property of LR tests - Application to standard distributions.

UNIT V: (08 Periods)

Small sample tests: Student's t-test, test for a population mean, equality of two population

means, paired t-test, F- test for equality of two population variances, Chi-square test for goodness of fit and test for independence of attributes, $\chi 2$ test for testing variance of a normal distribution.

Total Periods: 45

TEXT BOOKS:

1. Miller and Freund's, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
2. Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference–Testing of Hypothesis, Prentice Hall of India, 2014.

REFERENCE BOOKS:

1. S.C. Gupta and K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, S Chand & Sons Publications, 2012.
2. S. Ross, a First Course in Probability, Pearson Education India, 2002.
3. W.Feller, an IntroductiontoProbabilityTheoryanditsApplications,1/e,Wiley,1968.
4. Robert V Hogg, Elliot A Tannis and Dale L Zimmerman, Probability and Statistical Inference, 9th edition, Pearson publishers, 2013.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ma74/preview
2. https://onlinecourses.nptel.ac.in/noc22_mg31/preview

II Year B.Tech. CSE (Data Science) – II Semester

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(DS23APC401) DATA ENGINEERING

COURSE OBJECTIVES:

The objective of this course are to:

- Explain basic concepts of Data Engineering
- Discuss about Data Engineering Life Cycle
- How to design Good Data Architecture

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO1: Understand Data Engineering Life cycle.
CO2: Apply appropriate data modeling techniques for different types of data.
CO3: Evaluate and select appropriate technologies and frameworks for specific data engineering tasks.
CO4: Implement data quality checks and governance processes to ensure data reliability and compliance.
CO5: Understanding of the importance of staying current with emerging data engineering tools and technologies.

UNIT I: (9 Periods)

Introduction to Data Engineering: Definition, Data Engineering Life Cycle, Evolution of Data Engineer, Data Engineering Versus Data Science, Data Engineering Skills and Activities, Data Maturity, Data Maturity Model, Skills of a Data Engineer, Business Responsibilities, Technical Responsibilities, Data Engineers and Other Technical Roles.

UNIT II: (9 Periods)

Data Engineering Life Cycle: Data Life Cycle Versus Data Engineering Life Cycle, Generation: Source System, Storage, Ingestion, Transformation, Serving Data. **Major under currents across the Data Engineering Life Cycle:** Security, Data Management, DataOps, Data Architecture, Orchestration, Software Engineering.

UNIT III: (10 Periods)

Designing Good Data Architecture: Enterprise Architecture, Data Architecture, Principles of Good Data Architecture, Major Architecture Concepts. **Data Generation in Source Systems:** Sources of Data, Files and Unstructured Data, APIs, Application Databases (OLTP), OLAP, Change Data Capture, Logs, Database Logs, CRUD, Source System Practical Details.

UNIT IV: (8 Periods)

Storage: Raw Ingredients of Data Storage, Data Storage Systems, Data Engineering Storage Abstractions, Data warehouse, Data Lake, Data Lakehouse. **Ingestion:** Data Ingestion, Key Engineering considerations for the Ingestion Phase, Batch Ingestion Considerations, Message and Stream Ingestion Considerations, Ways to Ingest Data

UNIT V: (9 Periods)

Queries, Modeling and Transformation: Queries, Life of a Query, Query Optimizer, Queries on Streaming Data, Data Modelling, Modeling Streaming Data, Transformations, Streaming Transformations and Processing. **Serving Data for Analytics, Machine**

Learning and Reverse ETL: General Considerations for serving Data, Business Analytics, Operational Analytics, Embedded Analytics, Ways to serve data for analytics and ML, Reverse ETL.

Total Periods: 45

TEXT BOOKS:

1. Joe Reis, Matt Housley, Fundamentals of Data Engineering, O'Reilly Media, Inc. June 2022, ISBN: 9781098108304.

REFERENCES:

1. Paul Crickard, Data Engineering with Python, Packt Publishing, October2020.
2. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Wiley, 3rd Edition, 2013.
3. James Densmore, Data Pipe lines Pocket Reference: Moving and Processing Data for Analytics, O'Reilly Media, 1st Edition, 2021.

II Year B.Tech. CSE (Data Science) – II Semester

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(CS23APC401) DATABASE MANAGEMENT SYSTEMS

COURSE OBJECTIVES:

The objective of this course are to:

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Databaseindexing techniques and storage techniques

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand the basic concepts of database management systems
CO 2: Analyze a given database application scenario to use ER model for conceptual design of the database
CO 3: Utilize SQL proficiently to address diverse query challenges
CO 4: Employ normalization methods to enhance database structure
CO 5: Assess and implement transaction processing, concurrency control and database recovery protocols in databases.

UNIT I: (9 Periods)

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT II: (9 Periods)

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT III: (9 Periods)

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non- updatable), relational set operations.

UNIT IV: (9 Periods)

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V: **(9 Periods)**

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Storage and File Structure: Overview of Physical Storage Media, RAID, File Organization.

Introduction to Indexing Techniques: B+ Trees, operations on B+ Trees, Hash Based Indexing.

Total Periods: 45

TEXT BOOKS:

1. Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke,TMH.
2. Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan,TMH.

REFERENCES:

1. Introduction to Database Systems, 8thedition, C J Date, Pearson.
2. Database Management System, 6th edition, RamezElmasri, Shamkant B. Navathe,Pearson
3. Database Principles Fundamentals of Design Implementation and
4. Management,Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview

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(DS23APC402) DATA ENGINEERING LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Teach how to build data engineering infrastructure and data pipelines.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

- **CO1:** Analyze and trouble shoot data engineering problems using systematic approaches.
- **CO2:** Work effectively in teams to solve data engineering challenges and deliver projects on time.
- **CO3:** Develop skills in creating and managing relational and non-relational databases.
- **CO4:** Develop skills in monitoring and optimizing the performance of data pipelines and databases.
- **CO5:** Develop skills in integrating data from various sources using APIs and data connectors.

List of Experiments:

1. On-Destructive testing on concrete (for demonstration). Installing and configuring Apache NiFi, Apache Airflow
2. Installing and configuring Elastic search, Kibana, PostgreSQL, pgAdmin4
3. Reading and Writing files
    a. Reading and writing files in Python
    b. Processing files in Airflow
    c. NiFi processors for handling files
    d. Reading and writing data to databases in Python
    e. Databases in Airflow
    f. Data base processors in NiFi
4. Working with Databases
    a. Inserting and extracting relational data in Python
    b. Inserting and extracting No SQL database data in Python
    c. Building data base pipe lines in Air flow
    d. Building data base pipe lines in NiFi
5. Cleaning, Transforming and Enriching Data
    a. Performing exploratory data analysis in Python
    b. Handling common data issues using pandas
    c. Cleaning data using Airflow
6. Building the Data Pipeline
7. Building a Kibana Dash Board
8. Perform the following operations
    a. Staging and validating data
    b. Building idempotent data pipe lines
    c. Building atomic data pipe lines

9. Version Control with the NiFi Registry
    a. Installing and configuring the NiFi Registry
    b. Using the Registry in NiFi
    c. Versioning your data pipe lines
    d. Using git-persistence with the NiFi Registry
10. Monitoring Data Pipe lines
    a. Monitoring NiFi in the GUI
    b. Monitoring NiFi using processors
    c. Monitoring NiFi with Python and the RESTAPI
11. Deploying Data Pipelines
    a. Finalizing your data pipe lines for production
    b. Using the NiFi variable registry
    c. Deploying your data pipelines
12. Building a Production Data Pipeline
    a. Creating a test and production environment
    b. Building a production data pipeline
    c. Deploying a data pipe line in production

REFERENCES:

1. Paul Crickard, Data Engineering with Python, Packt Publishing, October2020.

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(CS23APC403) DATABASE MANAGEMENT SYSTEMS LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Utilizing Data Definition Language (DDL), Data Manipulation Language (DML), and Data Control Language (DCL) commands effectively within a database environment

CO 2: Constructing and execute queries to manipulate and retrieve data from databases.

CO 3: Develop application programs using PL/SQL.

CO 4: Analyze requirements and design custom Procedures, Functions, Cursors, and Triggers, leveraging their capabilities to automate tasks and optimize database functionality

CO 5: Establish database connectivity through JDBC (Java Database Connectivity)

Experiments Covering the Topics:

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures
- Procedures, Functions, Cursors, Triggers,
- Database connectivity- ODBC/JDBC

Sample Experiments:

1. Creation, altering and droping of tables and inserting rows into a table (use constraintswhile creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between,least, greatest, trunc, round, to_char, to_date)
5. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
6. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
7. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE

functions.

8. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.
9. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
10. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
11. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
12. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
13. Create a table and perform the search operation on table using indexing and non-indexing techniques.
14. Write a Java program that connects to a database using JDBC
15. Case Study: Database Design Given the following requirements for the e-commerce system: products catalog, customer accounts, order management, and reviews. Design a normalized relational database schema. Include tables, primary keys, foreign keys, and relationships. Explain your design decisions and how normalization principles are applied.

TEXT BOOKS:

1. Oracle: The Complete Reference by Oracle Press
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 20077

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(DS23ASC401) EXPLORATORY DATA ANALYSIS WITH PYTHON

COURSE OBJECTIVES:

The objective of this course are to:

- Introduce the fundamentals of Exploratory Data Analysis
- Cover essential exploratory techniques for understanding multivariate data by summarizing it through statistical methods and graphical methods.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO1: Understand the fundamentals of exploratory data analysis.
CO2: Implement the data visualization using Matplotlib.
CO3: Perform univariate data exploration and analysis.
CO4: Apply bivariate data exploration and analysis.
CO5: Use Data exploration and visualization techniques for multivariate and time series data.

UNIT I:

Exploratory Data Analysis Fundamentals: Understanding data science, the significance of EDA, steps in EDA, making sense of data, Numerical data, Categorical data, Measurement scales, Comparing EDA with classical and Bayesian analysis, Software tools available for EDA, getting started with EDA.

Sample Experiments:

a) Download Data set from Kaggle using the following link:
https://www.kaggle.com/datasets/sukhmanibedi/cars4u
b) Install python libraries required for Exploratory Data Analysis (numpy, pandas, matplotlib, seaborn)

1. Perform Numpy Array basic operations and Explore Numpy Built-in functions.
2. Loading Data set in to pandas data frame
3. Selecting rows and columns in the data frame

UNIT II:

Visual Aids for EDA: Technical requirements, Line chart, Bar charts, Scatter plot using seaborn, Polar chart, Histogram, Choosing the best chart

Case Study: EDA with Personal Email, Technical requirements, Loading the dataset, Data transformation, Data cleansing, Applying descriptive statistics, Data refactoring, Data analysis.

Sample Experiments:

4. Apply different visualization techniques using sample data set
   a. Line Chart
   b. Bar Chart
   c. Scatter Plots
   d. Bubble Plot
5. Generate Scatter Plot using seaborn library for iris data set
6. Apply following visualization Techniques for a sample data set
   a. Area Plot
   b. Stacked Plot
   c. Pie chart
   d. Table Chart

7. Generate the following charts for a data set.
    a. Polar Chart
    b. Histogram
    c. Lollipop chart

Case Study: Perform Exploratory Data Analysis with Personal Email Data

UNIT III:

Data Transformation: Merging database-style data frames, concatenating along with an axis, merging on index, Reshaping and pivoting, Transformation techniques, Handling missing data, Mathematical operations with NaN, Filling missing values, Discretization and binning, Outlier detection and filtering, Permutation and random sampling, Benefits of data transformation, Challenges.

Sample Experiments:

8. Perform the following operations
    a. Merging Data frames
    b. Reshaping with Hierarchical Indexing
    c. Data Deduplication
    d. Replacing Values
9. Apply different Missing Data handling techniques
    a. NaN values in mathematical Operations
    b. Filling in missing data
    c. Forward and Backward filling of missing values
    d. Filling with index values
    e. Interpolation of missing values
10. Apply different data transformation techniques
    a. Renaming axis ndexes
    b. Discretization and Binning
    c. Permutation and Random Sampling
    d. Dummy variables

UNIT IV:

Descriptive Statistics: Distribution function, Measures of central tendency, Measures of dispersion, Types of kurtosis, calculating percentiles, Quartiles, Grouping Datasets, Correlation, Understanding univariate, bivariate, multivariate analysis, Time Series Analysis

Sample Experiments:

11. Study the following Distribution Techniques on a sample data
    a. Uniform Distribution
    b. Normal Distribution
    c. Gamma Distribution
    d. Exponential Distribution
    e. Poisson Distribution
    f. Binomial Distribution
12. Perform Data Cleaning on a sample data set.
13. Compute measure of Central Tendency on a sample dataset
    a. Mean
    b. Median
    c. Mode
14. Explore Measures of Dispersion on a sample dataset
    a. Variance
    b. Standard Deviation
    c. Skewness
    d. Kurtosis
15. Calculating percentiles on sample dataset
    a. Calculate Inter Quartile Range (IQR) and Visualize using Box Plots
16. Perform the following analysis on automobile dataset.

a. Bivariate analysis
b. Multi variate analysis

17. Perform Time Series Analysis on Open Power systems dataset

UNIT V:

Model Development and Evaluation: Unified machine learning workflow, Data preprocessing, Data preparation, Training sets and corpus creation, Model creation and training, Model evaluation, Best model selection and evaluation, Model deployment

Case Study: EDA on Wine Quality Data Analysis

Sample Experiments:

18. Perform hypothesis testing using stats models library
    a. Z-Test
    b. T-Test
19. Develop model and Perform Model Evaluation using different metrics such as prediction score, R2 Score, MAE Score, MSE Score.
20. Case Study: Perform Exploratory Data Analysis with Wine Quality Dataset

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, Hands-On Exploratory Data Analysis with Python, Packt Publishing, 2020.

REFERENCES:

1. Ronald K.Pearson, Exploratory Data Analysis Using R,CRCPress,2020.
2. Radhika Datar, Harish Garg, Hands-On Exploratory Data Analysis with R: Become an expert in exploratory data analysis using R packages, 1st Edition, Packt Publishing, 2019.

II Year B.Tech. CSE (Data Science) – II Semester

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(CS23AES301) DESIGN THINKING AND INNOVATION

COURSE OBJECTIVES:

The objective of this course are to:

- Familiarize students with design thinking process as a tool for breakthrough innovation.
- Equip students with design thinking skills and ignite their minds to create innovative ideas, develop solutions for real-time problems.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Define the concepts related to design thinking.
CO 2: Explain the fundamentals of Design Thinking and innovation.
CO 3: Apply the design thinking techniques for solving problems in various sectors.
CO 4: Analyze to work in a multidisciplinary environment.
CO 5: Evaluate the value of creativity.
CO 6: Formulate specific problem statements of real-time issues.

UNIT I: **(2 Periods)**

Introduction to Design Thinking Introduction to elements and principles of Design, basics of design - dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, new materials in Industry.

UNIT II: **(2 Periods)**

Design Thinking Process Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, customer, journey map, brainstorming, product development.

Activity: Every student presents their idea in three minutes. Every student can present the design process in the form of a flow diagram or flow chart, etc. Every student should explain about product development.

UNIT III: **(4 Periods)**

Innovation Art of innovation, difference between innovation and creativity, role of creativity and innovation in organizations - Creativity to Innovation - Teams for innovation - Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, flow and planning from idea to innovation, debate on value-based innovation.

UNIT IV: **(3 Periods)**

Product Design Problem formation, introduction to product design, product strategies, product value, product planning, product specifications - Innovation towards product design - Case studies.

Activity: Importance of modeling, how to set specifications, explaining their own product design.

UNIT V: **(4 Periods)**

Design Thinking in Business Processes Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business - Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs - Design thinking for Startups - Defining and testing Business Models and Business Cases - Developing & testing prototypes.

Activity: How to market our own product, about maintenance, reliability and plan for startup.

Total Periods: 15

TEXT BOOKS:

1. Tim Brown, Change by Design, Harper Collins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

REFERENCES:

1. David Lee, Design Thinking in the Classroom, Ulysses Press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell, Universal Principles of Design - Kritinaholden, Jill Butter.
4. Chesbrough H, The Era of Open Innovation – 2013

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/110/106/110106124/
2. https://nptel.ac.in/courses/109/104/109104109/
3. https://swayam.gov.in/nd1_noc19_mg60/preview

COMMUNITY SERVICE PROJECT

Experiential learning through community engagement

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development.
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will benefit with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternativeto the 2 months of Summer Internships / Apprenticeships / On the Job Training, wheneverthere is an exigency when students cannot pursue their summer internships.
The specific objectives are;

- To sensitize students to the living conditions of the people who are around them'To help students to realize the stark realities of society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out ofbox solutions to social problems.
- To make students socially responsible citizens who are sensitive to the needs ofthe disadvantaged sections.
- To help students to initiate developmental activities in the community incoordination with public and government authorities.
- To develop a holistic life perspective among the students by making themstudy culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

- Every student should put in 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, housewives, etc
- A logbook must be maintained by each of the students, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty in charge.
- An evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.The Community Service Project should be different from the regular programs of
- NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project reports should be submitted by each student. An internal Viva shallalso be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ onthe job training.

Procedure

A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, to enable them to commute from their residence and return back by evening or so.

The Community Service Project is a twofold one –

- First, the student/s could conduct a survey of the habitation, if necessary, interms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format couldbe designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
- Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like
  - Agriculture Health
  - Marketing and Cooperation
  - Animal Husbandry
  - Horticulture
  - Fisheries Sericulture
  - Revenue and Survey
  - Natural Disaster Management
  - Irrigation
  - Law & Order
  - Excise and Prohibition
  - Mines and Geology
  - Energy
  - Internet
  - Free Electricity
  - Drinking Water

EXPECTED OUTCOMES

Benefits of Community Service Project To Students

Learning Outcomes

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, andmoral development
- Greater interpersonal development, particularly the ability to work well withothers, and build leadership and communication skills.

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities

- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity.

Relationship with the Institution
- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

Benefits of Community Service Project to Faculty Members
- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between facultyand community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research.

Benefits of Community Service Project to Colleges and Universities
- Improved institutional commitment.Improved student retention
- Enhanced community relations

Benefits of Community Service Project to Community
- Satisfaction with student participation
- Valuable human resources needed to achieve community goals.
- New energy, enthusiasm and perspectives applied to community Work. Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following are the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions, and modifications. Colleges are expected to focus on specific local issues for this kind of project. The students are expectedto carry out these projects with involvement, commitment, responsibility, andaccountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of project. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting should be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution

18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilization of free electricity to farmers and related issues
40. Gender ration in schooling level- observation.

Complementing the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs are

Programs for School Children

1. Reading Skill Program (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially relevant themes.

Programs for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti-Plastic Awareness
9. Programs on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days

Programs for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Developmen

Common Programs

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programs in consonance with the Govt. Departments like –
   i. Agriculture
   ii. Health
   iii. Marketing and Cooperation
   iv. Animal Husbandry
   v. Horticulture
   vi. Fisheries
   vii. Sericulture
   viii. Revenue and Survey
   ix. Natural Disaster Management
   x. Irrigation
   xi. Law & Order
   xii. Excise and Prohibition
   xiii. Mines and Geology
   xiv. Energy

Role of Students:

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also, with the Governmental Departments. If the program is rolled out, the District Administration could be roped in for the successful deployment of the program.
- An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. Preliminary Survey (One Week)

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

2. Community Awareness Campaigns (One Week)

- Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeksof time. The list

of activities suggested could be taken into consideration.

3. Community Immersion Programme (Three Weeks)

- **Along with the Community Awareness Programmes**, the student batch can also work with any one of the below-listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.

4. Community Exit Report (One Week)

During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks' works to be drafted and a copy shall be submitted to thelocal administration. This report will be a basis for the next batch of students visiting that habitation. The same report submitted to the teacher-mentor will be evaluated bythe mentor and suitable marks are awarded for onward submission to the University. Throughout the Community Service Project, a daily logbook need to be maintained by the students batch, which should be countersigned by the governmental agencyrepresentative and the teacher-mentor, who is required to periodically visit the studentsand guide them.