Assam down town University

Curriculum and Syllabus

Bachelor of Technology

in

Civil Engineering

OUTCOME BASED EDUCATION FRAMEWORK

CHOICE BASED CREDIT SYSTEM

Version: 2.1

FACULTY OF ENGINEERING

July, 2023

PREAMBLE

Assam down town University is a premier higher educational institution which offers Bachelor, Master, and Ph.D. degree programmes across various faculties. These programmes, collectively embodies the vision and mission of the university. In keeping with the vision of evolutionary changes taking place in the educational landscape of the country, the university has restructured the course curriculum as per the guidelines of National Education Policy 2020. This document contains outline of teaching and learning framework and complete detailing of the courses. This document is a guidebook for the students to choose desired courses for completing the programme and to be eligible for the degree. This volume also includes the prescribed literature, study materials, texts, and reference books under different courses as guidance for the students to follow.

Recommended by the Board of Studies (BOS) meeting of the Faculty of Engineering held on dated 10/06/2023 and approved by the Emergent Academic Council (AC) meeting held on dated 28/07/2023.

Chairperson, Board of Studies

Member Secretary, Academic Council

Vision

To become a Globally Recognized University from North Eastern Region of India, dedicated to the Holistic Development of Students and Making Society Better

Missions

1. Creation of curricula that address the local, regional, national, and international needs of graduates, providing them with diverse and well-rounded education.
2. Build a diverse student body from various socio-economic backgrounds, provide exceptional value-based education, and foster holistic personal development, strong academic careers, and confidence.
3. Achieve high placement success by offering students skill-based, innovative education and strong industry connections.
4. Become the premier destination of young people, desirous of becoming future professional leaders through multidisciplinary learning and serving society better.
5. Create a highly inspiring intellectual environment for exceptional learners, empowering them to aspire to join internationally acclaimed institutions and contribute to global efforts in addressing critical issues, such as sustainable development, Climate mitigation and fostering a conflict-free global society.
6. To be renowned for creating new knowledge through high quality interdisciplinary research for betterment of society.
7. Become a key hub for the growth and excellence of AdtU's stakeholders including educators, researchers and innovators
8. Adapt to the evolving needs and changing realities of our students and community by incorporating national and global perspectives, while ensuring our actions are in harmony with our foundational values and objectives of serving the community.

Programme Details

Programme Overview:

The professional practise of designing and developing infrastructure projects is known as civil engineering. This can be done on a large scale, such as the construction of national transportation systems or water supply networks, or on a smaller scale, such as the construction of individual roads or buildings**.**

I. Specific Features of the Curriculum

The Programme Specific Outcomes (PSOs) for Civil Engineering in Construction Management graduates focus on three main areas. First, graduates should excel in research and reasoning, capable of identifying, formulating, reviewing literature, and analysing complex Civil Engineering in Construction Management problems using logical and critical thinking and scientific principles. Second, they should demonstrate techno-professional efficiency by applying multidisciplinary concepts and interdisciplinary approaches to serve mankind. Lastly, graduates should exhibit global competency by addressing interdisciplinary Civil Engineering in Construction Management issues and enhancing their expertise through international certification courses.

II. Eligibility Criteria:

Minimum 45% in 10+2 with Physics, Chemistry & Mathematics. 5% relaxation for SC/ST, EWS, and Especially able candidates.

III. Programme Educational Objectives (PEOs):

PEO-1: To understand and incorporate the ability to apply, update, extend, and build deep knowledge through a flexible, research-intensive programme tailored to suit current academic and industry demands.

PEO-2: Establish professional integrity and an ethical attitude while being aware of global and national competencies, and consider the social implications of their job, particularly its impact on safety, health, and the environment for long-term growth.

PEO-3: Participate in individual and team-oriented, open-ended activities promoting productive thinking to provide opportunities for students to manage and work on multidisciplinary projects through interaction with their peers in the industry.

IV. Programme Specific Outcomes (PSOs):

PSO1: Research and Reasoning: Identify, formulate, review literature, and analyze complex Civil Engineering in Construction Management problems reaching substantial conclusions using logical and critical thinking, and scientific principles.

PSO2: Techno-Professional Efficiency: Apply the understanding of multidisciplinary concepts of Civil Engineering in Construction Management with interdisciplinary approaches in the service of mankind.

PSO3: Global Competency: Demonstrate global competency in addressing interdisciplinary Civil Engineering in Construction Management issues through international certification courses.

V. Programme Outcome (PO):

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

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

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

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

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

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

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

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

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

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

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

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

VI. Total Credits to be Earned: 172

VII. Career Prospects:

When it comes to graduate programmes in India, Civil Engineering in Construction Management remains at the top of the list because of its flexibility and capacity to adapt to changing requirements, as well as providing students with the required information and skills for a successful career. Some of the opportunities for Civil Engineering in Construction Management graduates are:

- Construction manager
- Geotechnical engineer
- Environmental engineer
- Public Health engineer
- Transportation engineer
- Urban planning engineer.

EVALUATION METHODS

The student performance shall be evaluated through In-semester (Sessional) and semester-end examinations. A weightage of 40% or as prescribed by the programme shall be added to the score of the end-semester examination.

A. INTERNAL ASSESSMENT:

The teacher who offers the course shall be responsible for internal assessment by conducting in-semester (Sessional) examination and evaluating the performance of the students pursuing that course. The components for internal assessment are illustrated in the table given below.

SN	Components/ Examinations	Marks Allotted
1.	In-Sem Exam – I (ISE-I) (Written Examination) *	30
2.	In-Sem Exam – II (ISE-II) (Written Examination) *	30
3.	Assignment	10
4.	Presentation (SP)	10
5.	Quiz	5
6.	Class Performance based score*	5

are compulsory

Note: *Total Internal assessment should be out of 40*

INSTRUCTION

1. If a student fails to appear in the any of the component without any valid reason, he/she shall be marked zero in that component. However, the course teacher at his discretion may arrange for the missed test on an alternate date for the absentee students after determining ground with genuine/valid reasons for the absent.
2. The report of evaluation of an activity towards the in-semester (Sessional) component of a course shall be duly notified by the concerned course teacher within a week of completion.
3. The programme coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the programme to the Controller of Examinations before the start of the End-semester examination.

B. SEMESTER END EXAMINATION:

Time table for end semester examination is published at least 25 days prior to the start of Examination.

I. Pre-Examination:

Eligibility Criteria for a student to appear in University Examinations:

The student shall only be allowed to appear in a University Examination, if:

i) He/ She is a registered student of the University;
ii) He/ She is of good conduct and character;
iii) He/ She has completed the prescribed Programme of study with minimum percentage of attendance as laid down in the Regulations of the Programme concerned.

Under special cases, a student may be allowed to appear for an examination without being registered in the University but the result of the said student will be kept on hold till the registration of the concerned student is completed.

II. Admit Card:

Admit card for the examination may be downloaded through ERP where the system will generate a Unique ID Cards through online.

The University shall have the right to cancel admission for examination of any candidate on valid grounds.

III. Pattern of Question Papers:

The question paper shall follow the principles of Bloom's Taxonomy.
Table

S. N.	Level	Questions /verbs for test
1	Remember	List, Define, tell, describe, recite, recall, identify, show who, when, where, etc.
2	Understand	Describe, explain, contrast, summarize, differentiate, discuss, etc.
3	Apply	Predict, apply, solve, illustrate, determine, examine, modify
4	Analyze	Classify, outline, categorize, analyze, diagrams, illustrate, infer, etc.
5	Evaluate	Assess, summarize, choose, evaluate, recommend, justify, compare etc.
6	Create	Design, Formulate, Modify, Develop, integrate, etc.

Note: No course is to be evaluated on basis of **all 6 knowledge levels.**

The format of the question paper across all the programme follows a unique pattern and the total marks is 60

Table 1: Question paper pattern for End semester examination

Sl no	Question pattern	Total marks
1	MCQs (10 Questions)	10
2	2 Marks questions (10 Questions)	20
3	4 Marks questions (5 Questions)	20
4	10 Marks questions (1 Question)	10

IV. Examination Duration:

Each paper of 60 marks shall ordinarily be of two hours duration.

V. Practical Examinations, Viva-Voce etc.:

i) Practical examination shall be conducted in the presence of one external expert and one or more internal examiners.

ii) Viva-Voce, Oral examinations of the Project report, Dissertation etc. shall be undertaken by a Board of Examiners constituted by the respective Dean of Programme with the advice of Supervisor(s).

VI. Procedure of Expulsion:

If any candidate is found to be using any unfair-means during the examination, the invigilator may cease his/her answer sheet and report it directly to the Officer-in-Charge. The Office-in-Charge of the center may take appropriate decisions as per the rules and procedure of the examination. The Officer-in-Charge may allow the students to write the exam with new answer sheet or may expel the student from appearing the paper depending on the nature of unfair-means. In case of Computer based test, the students may be directed to write an apology letter

and sign in the prescribe expulsion form. The student may not be allowed to write that examination.

VII. Instruction to the Students:

(i) The students shall not bring to the Examination Hall, any electronic gadget used as a means of communication or record except electronic calculator, if required.

(ii) The students shall not receive any book or printed or hand written or photo copy (Xerox) or blank-paper from any other person while he/she is in the examination-room or in laboratory or in any other place to which he/she is allowed to have access during course of examination.

(iii) The students shall not communicate with any other candidate in the examination room or with any other person in and outside the examination-room.

(iv) The students shall not see, read or copy anything written by any other candidate, nor shall he/she knowingly or negligently permit any other candidate to see, read or copy anything written by him/her or conveyed by him/her.

(v) The students shall not write anything on the Question Paper or in other paper or materials during the examination, or pass any kind of paper to any other candidate in the examination-room, or to any person outside the room.

(vi) The students shall not disclose his/her identity to the examiner by writing his/her name or putting any sign / symbol in any part of his answer-script.

(vii) The students shall not use any abusive language or write any objectionable remark or make any appeal to examiner by writing in any part of his answer-script.

(viii) The students shall not detach any page from the answer-script or insert any authorized or unauthorized loose sheet into it. He /she shall also not insert any other answer-script / loose sheet by removing the pins of the origin answer-scripts and re-fixing it.

(ix) The students shall not resort to any disorderly conduct inside the examination-room or misbehave with the invigilator or any other examination official.

VIII. Provision for an Amanuensis (writer):

(i) A candidate may be provided with an Amanuensis (writer) to write down on dictation on his / her behalf on ground of his / her physical disability to write down by himself / herself due to accident or any other reason. The amanuensis may be provided till he / she recovers from the physical disability. The physical disability to write down by himself / herself must be supported by Medical Certificate from a competent Medical Officer.

(ii) The qualifications of the amanuensis so provided must not be equal or higher than that of the candidate. This is also to be supported by Certificate from the Faculty of Study where the Amanuensis is provided.

(iii) Such candidates are to be accommodated in a separate room under the supervision of an invigilator so that the fellow candidates are not disturbed in the process.

C. Credit Point:

It is the product of grade point and number of credits for a course, thus, CP = GP x CR

i. Credit:

A unit by which the course work is measured. It determines the number of hours of instructions required per week. 'Credit' refers to the weightage given to a course, usually in terms of the number of instructional hours per week assigned to it. Credits assigned for a

single course always pay attention to how many hours it would take for an average learner to complete a single course successfully.

ii. Grade Point:

Grade Point is a numerical weight allotted to each Grade Letter on a 10-point scale.

iii. Letter Grade:

Letter Grade is an index of the performance of students in a said paper of a particular course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and Abs. Student obtaining Grade F / Grade Abs shall be considered failed/ absent and, will be required to appear in the subsequent ESE. The UGC recommends a 10-point grading system with the following (Table: 1) Letter Grades:

(i) A Letter Grade shall signify the level of qualitative/quantitative academic achievement of a student in a Course, while the Grade Point shall indicate the numerical weight of the Letter Grade on a 10-point scale.

(ii) There shall be 08 (eight) Letter Grades bearing specific Grade Points as listed in Table 1, where the Letter Grades 'O' to 'P' shall indicate successful completion of a course.

(iii) Apart from the 08 (eight) regular Letter Grades listed in Table 1, there shall be 03 (three) additional Letter Grades, which shall be awarded if a Course is withdrawn or spanned over the next Semester or remains incomplete as stated in Table 2.

Table 2: Letter Grades and Grade Points

Letter Grade	Grade Points	Description
O	10	Outstanding
A+	9	Excellent
A	8	Very Good
B+	7	Good
B	6	Above Average
C	5	Average
P	4	Pass
F	0	Fail
Abs	0	Absent
UFM	0	Unfair Means

iv. Grade Point Average:

a. SGPA (Semester Grade Point Average)

The SGPA of a student in a Semester shall be the weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered in that Semester, irrespective of whether he/she could or could not complete the Courses. More specifically, the calculation of SGPA shall take into account the Courses graded with Letter Grades 'O' to 'F' as given in Table 1.

$$\text{SGPA} = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i} \qquad (1.1)$$

The SGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.1) up to two decimal places, where n is the total number of Credit Courses registered by the student in that Semester, Gi is the Grade Point secured in the i^{th} registered Course and Ci is the Credit (weight) of that Course.

b. CGPA (Cumulative Grade Point Average)

(i) The CGPA of a student in a Semester of a Programme shall be the accumulated weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered and successfully completed so far starting from the enrollment in the Programme. In other words, taking into account all the Courses graded with 'O' to 'P' as given in Table 1.1, generally the CGPA of a student shall be calculated starting from the first Semester of his/her enrolled Programme, while the CGPA of a lateral-entry student shall be calculated starting from the Semester of his/her enrollment.

(ii) The CGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.2) up to two decimal places, where N is the total number of Credit Courses registered and successfully completed so far by the student, Gi is the Grade Point secured in the ith completed Course and Ci is the Credit (weight) of that Course.

$$\text{CGPA} = \frac{\sum_{i=1}^{N} C_i G_i}{\sum_{i=1}^{N} C_i} \qquad (1.2)$$

(iii) The CGPA shall be convertible into equivalent percentage of marks using Equation Conversion of CGPA to percentage marks: = CGPA*10

D. Post-Examination

i. Transcript or Grade Card or Certificate:

A marking certificate shall be issued to all the registered students after every Semester. The Semester mark sheet will display the course details (code, title, number of credits, grade secured) along with total credit earned in that Semester.

ii. Grievance Readdress Mechanism:

Students with any dissatisfaction or grievance regarding the marks awarded in any of the Papers / Courses may appeal to the Controller of Examinations for remedial action such as Re-evaluation within 10 days of the declaration of result.

(i) A student has options to appeal for re-evaluation of his /her answer script to the Controller of Examination.

(ii) Application for re-evaluation / re-scrutiny of answer scripts shall be made in the definite proforma available with the Examination Office through the head of the respective departments within 10 days of declaration of the results of the respective examinations.

(iii) The Controller of Examination may appoint an examiner for re-evaluation and will consider and recognize the evaluation done by a university appointed examiner.

(iv) There shall be no provision for re-evaluation of the Practical Papers, Project Work, and Dissertation etc. However, the students fail in practical examination or viva voce and wish to appear again may apply to be evaluated can do so with the next schedule.

(v) After screening the application for re-evaluation, the CoE may send the answer scripts of the student to the examiners appointed by the CoE with the approval of Vice Chancellor.

(vi) The marks/grades achieved by the students after the re-evaluation shall be final and binding.

(vii) Fresh Marks – sheets / Grade Card shall be issued only if the candidate secures pass marks / passing grade in the re-evaluated paper.

(viii) Revaluation of answer scripts shall be deemed to be an additional facility provided to the students with a view to improving upon their results at the preceding examination result for any reason whatsoever shall not confer any right upon them for admission to next higher class which matters always be regulated in accordance with the relevant rules or regulations framed by the University.

(ix) If as a result of revaluation of the candidate attracts the provision of condonation of deficiency, the same may be applied to his/her only for fresh attempt.

INSTRUCTION TO TEACHERS AND STUDENTS

(Teaching and Learning Methods)

In all the courses the teacher has to select topics for teacher-method which should not be less than 20 percent. The approach will be direct classroom teaching through a series of lectures delivering concepts using ITC facilities, white or blackboard. Notes may also be circulated to the students; however, the students are to be involved in the preparation of the notes. The teacher will be responsible for selecting the best note for circulation. The teacher-centric methodology has recently fallen out of favour because this strategy for teaching is seen to favour passive students.

1. Student- centric / Constructivist Approach:

The topics of the courses may be selected at the start of the class and assigned one topic to each of the students for studying by themselves, prepare presentations, notes, etc., and present at respective class time after consultation and discussion with the course teachers. The teacher facilitates the learning of the students by guiding and providing input and explaining concepts. 60 percent of the course contents may be selected for this purpose. To avoid behaviour problems, teachers must lay a lot of groundwork in student-centric classrooms. Typically, it involves instilling a sense of responsibility in students. In addition, students must learn internal motivation.

a. Project-Based Learning: The teacher may select 5 percent of topics for the purpose and may conduct visits to the laboratory for experiments or field surveys. The selection of the topic may be done considering the available facility for the purpose. However, in the final semester of each of the programme the student has to undergo project-based learning at least 4 months duration. This approach will help the student to think critically, evaluate, analyse, make decisions, collaborate and more.

b. Inquiry-Based Learning: The teacher/students are supposed to list at least five questions in each contact hour and student solve these question or search for answer which becomes the home work for the students "question-driven" learning approach. The teacher may look for the correctness of the solution or the best possible answer and discuss in the successive class. This will help in the preparation for various competitive examinations and develop a habit for search for solutions.

c. Flipped Classroom: About 10 percent of the course content has to be completed by this method. In this approach the students are asked to watch video or lecture prepared by the teacher or any video available (relevant to the course). A set of questions may be given to the students for searching answers by the students. The idea is that students should have more time in-classroom focusing on achieving these higher levels of thinking and learning. The Flipped classroom is also an acronym. The letters FLIP represent the four pillars included in this type of learning: Flexible environment, Learning culture shift, Intentional content, and Professional educator. As you can see, the second pillar refers to a culture shift from the traditional approach where students are more passive to an approach where students are active participants. As a result, this approach is also a student-centric teaching method.

d. Cooperative Learning: The remaining five percent has to be completed by cooperative learning approach. In this approach, the students are allotted problems. During library hours the students along with the teacher visit the library and search for probable solutions for the assigned problem. The same has to be done in groups so that the students discuss among themselves for the appropriate answers. Essentially, cooperative learning believes that social interactions can improve learning. In addition, the approach recreates real-world work situations in which collaboration and cooperation are required.

2. The percentage categorization for the completion of a theory course

Teacher-centric or Direct Classroom Teaching: Delivery by series of lectures	20%
Student-centric Approach, Students present and deliver lectures in the presence of teacher and supervised by teacher	60%
Students visit fields or perform experiments or teachers perform demonstration	05%
Flipped Classroom approach	10%
Cooperative learning approach	05%

3. Inquiry-based approach has to be followed in all of the classes

Teacher has to distribute the topics to be considered for teaching by the above-mentioned approaches and prepare a lesson plan for execution and maintain a file.

Breakdown of Credits

Sl. No	Category		Total number of Credits
1	University Core (UC)	Skill Enhancement Course (SEC)	14
		Ability Enhancement Course (AEC)	12
		Field Training	3
		Discipline Specific Elective (DSE)	4
		Value Added Course (VAC)	4
2	University Elective (UE)	Multidisciplinary Course (MDC)	12
		Value Added Course (VAC)	6
3	Programme Core (PC)	Discipline Specific Core (DSC)	22
		Field Training	15
		Research /Industry Internship	16
		Summer Internship	10
4	Programme Elective (PE)	Discipline Specific Elective (DSE)	36
		Value Added Course (VAC)	11
5	Faculty Core (FC)	Skill Enhancement Course (SEC)	4
		Ability Enhancement Course (AEC)	3
Total			**172**

Breakdown by categories of courses

Sl. No	Category	Credits	%
1	Engineering	142	82.56%
2	Science	20	11.63%
3	Computer Technology	4	2.33%
4	Humanities	5	2.91%
5	Commerce and Management	1	0.57%
Total		**172**	**100%**

SEMESTER WISE COURSE DISTRIBUTION

	S. No.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester I	1	23BTCE111R	Calculus and Linear Algebra	DSC	3	0	0	0	0	0	3	40	60	0	100
	2	23BTCE112R	Introduction to Basic Mathematics, Logic and Coding	DSC	3	0	0	0	0	0	3	40	60	0	100
	3	23BTCE113R	Physics for Engineers	DSC	2	0	2	0	0	0	3	40	60	100	200
	4	23BTCE114R	Workshop/Manufacturing Practice	DSE	0	0	2	0	0	0	1	0	0	100	200
	5	23MOCE112R	MOOCS Mechanics: Motion, Forces, Energy and Gravity, from Particles to Planets	DSE	0	0	0	0	0	0	1	100	0	0	100
	6	23BTCE115R	Field-based Training	MDC	0	0	0	0	0	16	1	100	0	100	100
	7	23UBPD114R	PDP	AEC/SEC	0	0	4	0	0	0	2	0	0	100	100
	8	23UBEC111	Extra-curricular	VAC	0	0	0	4	0	0	1	100	0	000	100
	Total				8	0	8	4	0	16	15	420	180	400	1000

	S. No.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester II	1	23BTCE121R	Elements of Probability & Statistics for Civil Engineering Application	DSC	4	0	0	0	0	0	4	40	60	0	100
	2	23BTCE122R	Chemistry for Engineers	DSC	2	0	2	0	0	0	3	40	60	100	200
	3	23BTCE123R	Engineering Drawing	DSC	0	0	4	0	0	0	2	40	60	100	200
	4	23BTCE124R	Problem solving and Python Programming	DSC	3	0	0	0	0	0	3	40	60	0	100
	5	23UBEC121	Extra-Curricular	VAC	0	0	0	4	0	0	1	100	0	0	100
	6	23MOCE122R	Ethics, Technology and Engineering	DSE	0	0	0	0	0	0	1	100	0	0	100
	7	23UBES101R	Environmental Science	MDC	2	0	0	0	0	0	2	40	60	0	100
	8	23BTCE125R	Field-based Training	AEC	0	0	0	0	0	16	1	100	0	0	100
	9	23UBPD123R	PDP	AEC	0	0	4	0	0	0	2	0	0	100	100
	Total				11	0	10	4	0	16	19	400	300	300	1100

	S. No.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester III	1	23BTCE211R	Elements of Surveying & Geomatics	DSC	3	0	2	0	0	0	4	40	60	0	100
	2	23BTCE212R	Introduction to Solid Mechanics	DSC	3	0	2	0	0	0	4	40	60	100	200
	3	23BTCE215R	Building Information Modelling in Construction	AEC	3	0	0	0	0	0	3	40	60	0	100
	4	23BTCE216R	Biology for Engineers	DSC	2	1	0	0	0	0	3	0	0	100	100
	5	23BTCE217R	Basic Electronics for Civil Engineering Application	DSC	1	0	2	0	0	0	2	40	60	0	100
	6	23BTCE214R	Building Materials & Construction Practice	DSC	2	0	0	0	0	0	2	40	60	0	100
	7	23MOCE212R	Computational Thinking for Problem Solving	DSC	0	0	0	0	0	0	1	0	0	100	100
	8	23BTCE218R	Field-based Training	DSC	0	0	0	0	16	0	1	40	60	100	200
	9	23UBPD213R	PDP & DL/FL COURSES	MDC	0	0	3	0	0	0	2	0	0	100	100
	10	23UBCC211	PDP & DL/FL COURSES	AEC	0	0	3	0	0	0	1	0	0	100	100
	11	23UBEC211	Basic Life Saving Skills	AEC	0	0	4	0	0	0	1	0	0	100	100
	12	23UULS212R	Introduction to Psychology	VAC	0	0	0	0	0	0	1	0	0	100	100
	13	23UUFL213R	EXTRA-CURRICULAR	SEC	0	0	0	4	0	0	1	0	0	100	100
	Total				**14**	**1**	**16**	**4**	**16**	**0**	**26**	**240**	**360**	**900**	**1500**

	S. No.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester IV	1	23BTCE221R	Transportation Engineering	DSC	3	0	2	0	0	0	4	40	60	100	200
	2	23BTCE213R	Fluid Mechanics & Hydraulics Engineering	DSC	3	0	2	0	0	0	4	40	60	100	200
	3	23BTCE222R	Soil Mechanics & Geotechnical Engineering	DSC	3	0	2	0	0	0	4	40	60	100	200
	4	23BTCE223R	Structural Analysis I	DSC	3	0	0	0	0	0	3	40	60	0	100
	5	23BTME225R	Instrumentation and Control	DSC	2	0	2	0	0	0	3	40	60	100	100
	6	23BTCE226R	Construction Equipments and Techniques	DSC	3	0	0	0	0	0	3	40	60	0	100
	7	23BTCE227R	Field-based Training	Field Training	0	0	0	0	16	0	1	100	0	0	100
	8	23UBPD224R	PDP	AEC	0	0	4	0	0	0	2	0	0	100	100
	10	23UULS221R	BAS	VAC	0	0	4	0	0	0	1	0	0	100	100
	12	23MOCE221R	Entrepreneurship Strategy: From Ideation to Exit	MDC	0	0	0	0	0	0	2	100	0	0	100
	14	23MOCE222R	Contemporary India	VAC	0	0	0	0	0	0	1	100	0	0	100
	Total				**17**	**0**	**11**	**0**	**16**	**0**	**28**	**540**	**360**	**600**	**1400**

	S. No.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester V	1	23BTCE311R	Structural Analysis II	DSC (Major)	3	0	0	0	0	0	3	40	60	0	100
	2	23BTCE312R	Environmental Engineering	DSC (Major)	2	0	2	0	0	0	3	40	60	100	200
	3	23BTCE224R	Engineering Geology	DSC (Major)	1	0	2	0	0	0	2	40	60	100	200
	4	23BTCE225R	Sustainable Construction Method/Concrete Technology/GIS & Remote Sensing	DSC (Minor)	3	0	0	0	0	0	3	40	60	0	100
	5	23BTCE316R	Deep excavations, Foundations and Tunnels	DSC (Minor)	3	0	0	0	0	0	3	40	60	0	100
	6	23BTCE316R	Formwork Engineering Practices	DSC (Minor)	3	0	0	0	0	0	3	40	60	0	100
	7	23MOCE311R	Recovering the humankind's past and saving the universal heritage	DSC (Minor)	0	0	0	0	0	0	1	100	0	0	100
	8	23BTCE317R	Field-based Training	Field Training	0	0	0	0	0	16	1	100	0	0	100
	9	23BTCE318R	Summer Internship	Internship	0	0	0	0	0	48	3	100	0	0	100
	10	23UBPD314R	PDP	SEC	0	0	4	0	0	0	2	0	0	100	100
	11	23MOCE312R	Foundations of Project Management	MDC	0	0	0	0	0	0	1	100	0	0	100
	12	23UBEC311	EXTRA CURRICULAR ACTIVITY	VAC	0	0	0	0	4	0	1	100	0	0	100
	Total				**15**	**0**	**9**	**0**	**4**	**62**	**26**	**740**	**360**	**300**	**1400**

	S. No.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester VI	1	23BTCE321R	Hydrology & Water Resource Engineering	DSC	3	0	2	0	0	0	4	40	60	100	200
	2	23BTCE322R	Design of RC Structures	DSC	3	3	0	0	0	0	3	40	60	0	100
	3	23BTCE323R	Irrigation Engineering/Solid & Hazardous Waste Management/ Environmental Impact Assessment	DSE	3	0	0	0	0	0	3	40	60	0	100
	4	23BTCE324R	Geospatial Techniques in Practice	DSE	3	3	0	0	0	0	3	40	60	0	100
	5	23BTCE327R	Career Readiness in Digital era	DSE	3	3	0	0	0	0	3	40	60	0	100
	6	23BTCE326R	Building Planning & Drawing	DSE	2	0	2	0	0	0	3	40	60	100	200
	7	23MOCE321R	Technical support Fundamental	DSE	0	0	0	0	0	0	1	100	0	0	100
	8	23UBPD324R	PDP	AEC/SEC	0	0	0	4	0	0	2	0	0	100	100
	9	23MOCE322R	Build Personal Resilience	MDC	0	0	0	0	0	0	1	100	0	0	100
	10	23UBEC311	Extra-Curricular Activity	VAC	0	0	0	4	0	0	1	100	0	0	100
					17	**9**	**4**	**8**	**0**	**0**	**24**	**540**	**360**	**300**	**1200**

	S. No.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester VII		23BTCE411R	Design of Steel Structures	DSC	4	0	0	0	0	0	4	40	60	0	100
	2	23BTCE412R	DPR	DSC	0	0	2	0	0	0	1	0	0	100	100
	3	23BTCE413R	Estimation & Costing	DSC	0	0	2	0	0	0	1	0	0	100	100
	4	23BTCE414R	Heavy Lifting Techniques & Machinery	DSC	3	0	0	0	0	0	3	40	60	0	100
	6	23BTCE415R	Elementary Statistical Analysis	Compulsory	0	0	0	0	0	24	3	100	0	0	100
	7	23BTCE416R	Literature Review	Compulsory	0	0	0	0	0	24	3	100	0	0	100
	8	23MOCE411R	Mindfulness and Wellbeing: Living with Balance and Ease	DSE	0	0	0	0	0	0	2	100	0	0	100
	Total				**7**	**0**	**4**	**0**	**0**	**48**	**17**	**380**	**120**	**200**	**700**

	S. No.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester VIII	1	23BTCE421R	Construction Practice & Management	Compulsory	4	0	0	0	0	0	4	40	60	0	100
	2	23BTCE422R	Foundation Engineering	Compulsory	4	0	0	0	0	0	4	40	60	0	100
	3	23BTCE423R	Application of AI in Engineering	DSC	3	0	0	0	0	0	3	40	60	0	100
	4	23BTCE424R	Research Based Course III	Compulsory	0	0	0	0	0	64	6	100	0	0	100
	Total				11	0	0	0	0	64	17	220	180	0	400

SEMESTER – I									
Course Title	**Calculus and Linear Algebra**								
Course code	**23BTCE111R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ I semester of first year of the programme**								
Course Objectives	1. To understand and be able to use the language, symbols and notation of mathematics 2. To develop the ability to create a programmable model for a given problem. 3. To become confident in using mathematics, logic, reasoning and coding to analyze and solve problems in real-life situations								
CO1	Enabling solving skills of definite and improper integrals.								
CO2	Familiarize with the techniques of calculus								
CO3	Understand the application of differential and integral calculus.								
CO4	Understand the concept of convergence and divergence of sequence and series.								
CO5	Understand the concepts of matrices to solve systems of linear equations and application problems requiring them.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Integral Calculus and its applications** : Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	**6**	To make understand to evaluate definite and improper integrals. Apart from these some special functions like Beta and Gamma function has to be introduced.	1, 2
II	**Application of Differential Calculus :** Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and Minima	**5**	Determine the information from a graph that when the second derivative is positive the graph is concave upward, when the second derivative is negative the graph is concave downward, and when there is a switch in sign there is an inflection point.	1, 2, 3, 4
III	**Sequence and series** Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.	**7**	Learn the concept of sequence and series	1, 2, 3, 4, 5
IV	**Matrices:** Definition; Types of matrices; Operation of matrices; Symmetric, skew-symmetric, Inverse and rank of a matrix, Determinants	**6**	To provide an essential tool of matrices and linear algebra in a comprehensive manner.	2, 3, 4
V	**Application and algebra of Matrices :** System of linear equations; Eigen values and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem and it's application.	**6**	Learn the concept of application of matrices	2, 3, 4, 5

TEXT BOOKS:

T1: Calculus and Analytic geometryG.B. Thomas and R.L. Finney9th Edition, Pearson,Reprint, 2002

T2: Advanced Engineering Mathematics Erwin kreyszig9thEdition,John Wiley & Sons, 2006

T3: Higher Engineering Mathematics Ramana B.V.TataMcGrawHill New Delhi, 11th. Reprint, 2010.

REFERENCE BOOKS:

R1: Higher Engineering Mathematics B.S. Grewal Khanna Publishers,36th Edition, 2010

R2: A text book of Engineering Mathematics N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2008

R3: Linear Algebra: A Modern Introduction D. Poole 2nd Edition. Brooks/Cole, 2005

OTHER LEARNING RESOURCES:

https://www.javatpoint.com/discrete-mathematics-tutorial

https://www.khanacademy.org/test-prep/lsat/lsat-lessons/logical-reasoning/a/logical-reasoning--article--getting-started

https://www.javatpoint.com/c-programming-language-tutorial

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	The students will be able to develop a strong foundation in differential and integral calculus, including limits, continuity, derivatives, and integrals, as well as key concepts in linear algebra such as matrices, determinants, and vector spaces	**1,8**
2	Students will be able to apply calculus techniques to solve real-world problems involving rates of change, optimization, and area under curves, and use linear algebra methods to solve systems of linear equations and perform vector transformations	**3,7**
3	Enhance logical and analytical thinking by interpreting mathematical results, proving theorems, and understanding the geometric and algebraic interpretations of calculus and linear algebra concepts.	**6,9,10**
4	Utilize calculus and linear algebra in various fields such as physics, engineering, computer science, economics, and data science, particularly in modeling and simulation. .	**5,9**
5	Develop the ability to use software tools like MATLAB, Python, or other computational platforms to perform complex calculations, visualize mathematical functions, and analyze data.	**7,1,12**

SEMESTER – I									
Course Title	**Introduction to Basic Mathematics, Logic and Coding**								
Course code	**23BTCE112R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ I semester of first year of the programme**								
Course Objectives	1.To understand and be able to use the language, symbols and notation of mathematics 2.To develop the ability to create a programmemable model for a given problem. 3.To become confident in using mathematics, logic, reasoning and coding to analyze and solve problems in real-life situations								
CO1	The students will be able to demonstrate the ability to understand the concepts of mathematics, logic, reasoning and coding								
CO2	Students will be able to apply of applications of concepts in other disciplines such as engineering, computer science, physics, etc.								
CO3	Solve and devise solutions to a range of elementary real-world problems in mathematics and programming								
CO4	Explore and apply key concepts in logical thinking to business problems.								
CO5	Enable students to critically analyze information in order to evaluate evidence and construct reasoned arguments								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Basics of Set Theory and Functions:** **Sets**: Basic definitions, cardinality of a set, principle of exclusion and inclusion, combination of sets: union, intersection, difference, complement etc., De Morgan laws, Venn Diagram **Cartesian Products and Relations:** Basic Definitions, binary relations – composition and inverse, binary relation on a set : properties – reflexive, irreflexive, symmetric, anti-symmetric, transitive, equivalence relations, partial order relations **Functions:** Basic definition, domain and co-domain, image and range, identity function, one-to-one and onto functions, bijections, characteristic function, composition of functions, inverse of a function, operations on sets: unary operators – idempotence, binary operators – associativity, commutativity **Number systems:** Natural numbers, whole numbers, integers, rational numbers, real numbers, operations on numbers: addition, subtraction, multiplication and division	**5**	Students will gain a fundamental understanding of set theory, including basic definitions, cardinality, and operations on sets such as union, intersection, difference, and complement. They will learn the principle of exclusion and inclusion, De Morgan's laws, and how to represent sets using Venn diagrams. The unit covers Cartesian products, basic definitions of relations, and properties of binary relations including reflexivity, irreflexivity, symmetry, antisymmetry, transitivity, equivalence relations, and partial order relations. Additionally, students will explore the basics of functions, including domain, codomain, image, range, identity function, injective, surjective, and bijective functions, characteristic functions, composition and inverse of functions, and operations on sets	1, 2

			involving unary and binary operators.	
II	**Introduction to Mathematical Logic and Induction:** **Mathematical Logic:** Truth values of mathematical statements, formulas in mathematical logic, logical operators - AND, OR, NOT etc, De Morgan Laws, Truth values of formulas, Truth tables **Propositional Logic:** Constants, variables, assignment of variables in a formula, tautology, contradiction and satisfiability, truth table of a formula, equivalence of formulas, proving formulas and equivalences by truth table method **Mathematical Induction:** Principle of mathematical induction – induction basis and induction step, examples	**10**	This unit introduces students to various number systems such as natural numbers, whole numbers, integers, rational numbers, and real numbers, along with their basic operations: addition, subtraction, multiplication, and division. In the realm of mathematical logic, students will learn about truth values, logical operators (AND, OR, NOT), De Morgan's laws, and how to construct and interpret truth tables. The unit covers propositional logic, including constants, variables, tautology, contradiction, satisfiability, and equivalence of formulas. Students will also learn to prove formulas and equivalences using truth tables.	1, 2, 3, 4
III	**Introduction to Logic and Reasoning:** Alphanumeric series, Direction, Logical Reasoning, Data Sufficiency, Ranking and order , Puzzle, Blood Relations , Analogy, Cube and Dice, Coding-Decoding	**10**	Students will understand the principle of mathematical induction, learning to identify the induction basis and perform the induction step, with various examples to illustrate these concepts. The unit also introduces basic logic and reasoning skills, including alphanumeric series, directional reasoning, logical reasoning, data sufficiency, ranking and ordering, puzzles, blood relations, analogy, and coding-decoding. These topics will develop students' problem-solving abilities and logical thinking skills.	1, 2, 3, 4, 5
IV	**Introduction to Coding:** **C Programming constructs:** Types of Programming Languages, Evolution of 'C' Language, Structure of a 'C' Programme, Executing and Debugging a 'C' Programme, 'C' Tokens: Keywords and Identifiers, Operators, Constants, Variables, Data Types, Precedence of Operators, Scope and	**10**	This unit introduces students to the fundamentals of C programming, covering the types of programming languages and the evolution of the C language. Students will learn the structure of a C programme, and how to execute and debug it. The unit covers C tokens such as	2, 3, 4

	Lifetime of Variables, Arithmetic Expressions, Evaluation of Expressions. **Control Statements:** Decision Making using if statement, Types of if ...else block, Switch case Block, GOTO statement. **Looping:** Concept of Loop, For loop, While loop, Do- while loop, jumping in Loop, break and continue statement		keywords, identifiers, operators, constants, variables, data types, and operator precedence. Students will understand the scope and lifetime of variables, arithmetic expressions, and their evaluation. Control statements will be covered, including decision-making using if statements, types of if...else blocks, switch case blocks, and the GOTO statement.	
V	**Introduction to Arrays, Strings and Functions** **Arrays:** One Dimensional Arrays, Two-Dimensional Arrays, Multidimensional Arrays, Dynamic Arrays. **Strings:** Implementing String Variables, String handling Functions. **Functions:** Concept of Functions, user-defined Functions, System-defined Functions, passing in Functions.	**10**	Students will delve deeper into C programming, focusing on control structures such as loops (for, while, do-while) and how to manage loop execution using break and continue statements. The unit introduces arrays, covering one-dimensional, two-dimensional, multidimensional, and dynamic arrays. Students will also learn about strings, including how to implement string variables and use string handling functions. The concept of functions is explored, differentiating between user-defined and system-defined functions, and understanding how to pass parameters to functions. This unit provides a comprehensive understanding of essential programming constructs and prepares students for more advanced coding tasks.	2, 3, 4, 5

TEXT BOOKS:

T1: Schaum's Outline of Programming with C by Byron Gottfried, Third Edition
T2: Programming in ANSI C by E. Balaguruswamy, Eight Edition
T3: Discrete Mathematics by Lipschutz, Lipsonand and Patil, Revised Third Edition
T4: A Textbook on Discrete Mathematics by Sastry and Nayak

REFERENCE BOOKS:

R1: A Modern Approach To Verbal & Non Verbal Reasoning by R S Agarwal, Revised Edition
R2: Analytical and Logical Reasoning by Sijwali B S, Revised Edition
R3: The C Programming Language, by Brian W. Kernighan and Dennis M. Ritchie, Second Edition
R4: 2000 Solved Problems in Discrete Mathematics by Lipschutz and Lipson

OTHER LEARNING RESOURCES:

https://www.javatpoint.com/discrete-mathematics-tutorial
https://www.khanacademy.org/test-prep/lsat/lsat-lessons/logical-reasoning/a/logical-reasoning--article--getting-started
https://www.javatpoint.com/c-programming-language-tutorial

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	The students will be able to demonstrate the ability to understand the concepts of mathematics, logic, reasoning and coding	**1,8**
2	Students will be able to apply of applications of concepts in other disciplines such as engineering, computer science, physics, etc.	**3,7**
3	Solve and devise solutions to a range of elementary real-world problems in mathematics and programming	**6,9,10**
4	Explore and apply key concepts in logical thinking to business problems.	**5,9**
5	Enable students to critically analyze information in order to evaluate evidence and construct reasoned arguments	**7,1,12**

SEMESTER – I									
Course Title	**Physics for Civil Engineers**								
Course code	**23BTCE113R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T+30P	**2**	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ I semester of first year of the programme**								
Course Objectives	1. To understand the theories of physics 2. To apply the concepts in practical problems 3. To understand the physics of any process								
CO1	Develop a foundational understanding of the vectors and scalar representation of forces and nature of forces.								
CO2	Illustrate conservative and non-conservative forces, angular momentum and energy equations								
CO3	Explain basics of non-inertial frames and acceleration and its application in engineering field								
CO4	Comprehend on oscillations and its application in the field of engineering kinematics								
CO5	Understand the three-dimensional rigid body motion and determine the moment of inertia.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Unit I: Electrostatics in Vacuum** Coulomb's law, electric field intensity, Gauss's law and its applications, electric potential and potential energy, conductors in electrostatic equilibrium, capacitors and capacitance calculations.	**10**	By the end of this unit, students will demonstrate a comprehensive understanding of the development of railways in India, including the evolution of permanent way and railway track components. They will be able to explain the significance of different gauges used in India and the process of conning wheels. Students will identify and describe the functions and characteristics of key components such as rails, sleepers, and ballast, detailing their types, spacing, and densities. They will analyze the advantages and disadvantages of various types of ballast and understand the requirements for subgrade and embankment construction. Additionally, students will be able to identify common rail defects, understand rail creep, and explain the principles behind rail joints and welding techniques.	1, 2
II	**Unit II: Magnetostatics** Biot-Savart law, Ampère's law and applications, magnetic vector potential, magnetic properties of materials (diamagnetism, paramagnetism, ferromagnetism).	**10**	Upon completing this unit on the geometric design of railway tracks, students will be able to analyze and design railway track layouts incorporating gradients, grade compensation, speed considerations	1, 2, 3, 4

			for curves, and principles of super elevation to enhance safety and efficiency. They will understand the concepts of cant deficiency and negative super elevation, applying them appropriately to track design. Furthermore, students will gain proficiency in designing and implementing various track layouts including switches, crossings (such as diamond and scissors crossings), and turnouts (including double turnouts). They will comprehend the operational requirements and design considerations for railway stations and yards, including traction and track resistance, stress analysis on track components (rails, sleepers, ballast), and the equipment necessary in yards. Additionally, students will grasp the fundamentals of signaling and control systems, their objectives, classifications, and the principles of interlocking signals and points to ensure safe railway operations.	
III	**Unit III: Faraday's Law** Electromagnetic induction, Faraday's law (integral and differential forms), magnetic flux, induced electromotive force (emf), practical applications.	**10**	The learning outcome of the unit on air transport and airport planning encompasses a comprehensive understanding of the historical evolution, regulatory frameworks, and operational aspects of air transport systems worldwide. Students will gain knowledge of aircraft types and their characteristics, aerodrome classifications, and the roles of air transport authorities. They will develop proficiency in airport planning principles according to international standards (ICAO and FAA), covering regional planning concepts, airport master planning, site selection criteria, zoning laws, and the design and classification of airport elements such as airfields and terminals. Additionally, students will learn to assess airport and runway capacities, estimate future air traffic demands, and apply principles for developing new airports, culminating in the ability to conceptualize ideal airport layouts.	1, 2, 3, 4, 5

IV	**Unit IV: Displacement Current and Maxwell's Equations** Displacement current, magnetic field due to time-dependent electric field, Maxwell's equations in integral and differential forms, boundary conditions for electromagnetic fields.	**10**	Upon completion of this unit on Airfield Design and Planning, students will be able to demonstrate comprehensive knowledge and skills in various critical aspects of airfield infrastructure. They will understand the principles of runway design, including the influence of wind orientation and coverage on runway orientation and length requirements, as well as factors affecting runway length determination and geometric configurations. Students will be proficient in designing taxiways, considering geometric elements, layout, and exit strategies, as well as planning apron locations, sizes, and configurations for efficient aircraft parking and turnaround operations. Additionally, they will grasp the essentials of pavement design using the LCN system, comprehend common airfield pavement failures, and formulate strategies for maintenance and rehabilitation. This unit will equip students with the necessary expertise to contribute effectively to the planning, design, and operational efficiency of airfield facilities.	2, 3, 4
V	**Unit V: Electromagnetic Waves** Wave equation for electromagnetic fields, propagation of electromagnetic waves in free space and in materials, energy and momentum of electromagnetic waves, reflection and refraction, polarization, electromagnetic wave applications	**5**	By the end of this unit, learners will demonstrate a comprehensive understanding of terminal area planning and design within an airport context. They will be able to analyze and apply the fundamental elements and requirements of terminal buildings, including functional spaces and spatial requirements. Students will also grasp essential concepts in vehicular parking area design and circulation networks, incorporating considerations for efficient operations and user experience. Furthermore, they will comprehend the significance of airport grading and drainage systems, understanding their roles in ensuring operational safety and efficiency.	2, 3, 4, 5

TEXT BOOKS:

T1: Introduction to Electrodynamics. David Griffiths. Prentice Hall, Upper Saddle River, New Jersey, 07458

T2: Basic Laws of Electromagnetism. IE IRODOV

REFERENCE BOOKS:

R1: Principles of physics. Halliday Resnick

OTHER LEARNING RESOURCES:

https://www.sciencedirect.com/science/article/pii/S0951832022005142

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Develop a foundational understanding of the vectors and scalar representation of forces and nature of forces.	**1,2**
2	Illustrate conservative and non-conservative forces, angular momentum and energy equations	**3,5**
3	Explain basics of non-inertial frames and acceleration and its application in engineering field	**6,9,10**
4	Comprehend on oscillations and its application in the field of engineering kinematics	**5,9**
5	Understand the three dimensional rigid body motion and determine the moment of inertia.	**4,1,11**

SEMESTER – I										
Course Title	**Workshop for Engineers**									
Course code	**23BTCE114R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30P	**0**	**0**	**2**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ I semester of first year of the programme**								
Course Objectives	1. Learning this course will lead you to understand basic concepts of workshop and manufacturing 2. Apply fundamental knowledge of workshop and manufacturing in day-to-day life. 3. Recognize components using different materials.								
CO1	Infer about various manufacturing methods like casting, forming, machining etc								
CO2	Apply fitting oparation and power tools in manufacturing works								
CO3	Demonstrate to Carpentry & fitting operations and its application in industries								
CO4	Enhance skills in machining operations like material cutting and preparation of mould etc.								
CO5	Critique the different types of welding, metal cassting and its field of application.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Manufacturing Methods** Casting, forming, machining, joining, advanced manufacturing methods.	**10**	Students will gain a comprehensive understanding of traditional manufacturing methods, including casting, forming, machining, and joining processes. They will explore the fundamentals of each method, learning about the materials and techniques used to shape and assemble components. The unit also introduces advanced manufacturing methods, focusing on CNC (Computer Numerical Control) machining and additive manufacturing. Students will gain an overview of the CNC machining process, including the programming, setup, and operation of CNC machines. They will also learn about additive manufacturing, covering its principles, technologies, and applications in modern manufacturing	1, 2
II	**CNC machining, Additive Manufacturing** Overview of CNC machining process, overview of additive manufacturing	**10**	This unit covers essential skills and knowledge in carpentry and fitting operations. Students will become familiar with various carpentry tools and their uses, as well as common carpentry operations such as cutting, shaping, and assembling wooden components. The unit also includes fitting tools and operations, teaching students how to measure, mark, cut, and assemble metal components with precision. These skills are fundamental for producing and maintaining high-quality mechanical systems and structures.	2, 3, 4
III	**Carpentry & Fitting operations** Carpentry tools, carpentry operations, fitting tools, fitting operations	**10**	Students will delve into machining operations, focusing on turning and milling processes. They will learn the principles and techniques involved in turning, such as setting up the lathe, selecting cutting tools, and executing turning operations to produce cylindrical parts. The unit also covers milling processes, including the setup and operation of milling machines, and the selection of appropriate milling tools. Students will gain practical skills in	1, 2, 3, 4

			producing components with complex shapes and precise dimensions.	
IV	**Machining operations** Turning, milling, turning processes, milling processes	**10**	In this unit, students will explore various welding techniques, with a focus on arc welding and gas welding. They will learn about the equipment, materials, and safety procedures involved in these welding methods. The unit also covers brazing, teaching students the principles and techniques for joining metals using a filler material that melts at a lower temperature than the base materials. Through hands-on practice, students will develop the skills needed to create strong, durable welds for a variety of applications.	1, 2
V	**Welding** Arc welding & gas welding, brazing	**5**	Students will gain an in-depth understanding of advanced manufacturing technologies, particularly CNC machining and additive manufacturing. The unit provides an overview of the CNC machining process, highlighting its precision, flexibility, and automation capabilities. Students will learn about the various types of CNC machines, programming techniques, and practical applications in industry. The unit also covers additive manufacturing, discussing its revolutionary impact on product design and production. Students will explore different additive manufacturing technologies, materials, and the wide range of applications, from prototyping to production of complex, custom parts.	2, 3, 4, 5

TEXT BOOKS:

T1: Elements of Workshop Technology, Vol. I 2008 and Vol. II 2010, Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K Media promoters and publishers private limited, Mumbai.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Infer about various manufacturing methods like casting, forming, machining etc	**1,3,5**
2	Apply fitting oparation and power tools in manufacturing works	**2,4**
3	Demonstrate to Carpentry & fitting operations and its application in industries	**6,8**
4	Enhance skills in machining operations like material cutting and preparation of mould etc.	**7,10,12**
5	Critique the different types of welding, metal cassting and its field of application.	**8,9**

SEMESTER – I									
Course Title	**MOOCS-Mechanics: Motion, Forces, Energy and Gravity, from Particles to Planets**								
Course code	**23MOCE112R**	**Total credits: 1** **Total hours: 15T**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**0**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ I semester of first year of the programme**								
Course Objectives	1. Introduce fundamental concepts of mechanics including motion, forces, and energy. 2. Develop problem-solving skills in classical mechanics. 3. Explore the principles of gravity and their applications from particles to planetary motion.								
CO1	Demonstrate an understanding of the principles of motion and the ability to solve kinematics problems.								
CO2	Analyze forces and predict the resulting motion of objects using Newton's laws.								
CO3	Apply the concepts of work and energy to solve problems involving mechanical systems.								
CO4	Explain the gravitational interactions between particles and celestial bodies.								
CO5	Utilize conservation laws to analyze and predict the outcomes of collisions and other interactions in mechanics.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Unit 1: Kinematics and Dynamics of Particles Introduction to Mechanics: Scope and history, Kinematics in one, two, and three dimensions. Displacement, velocity, and acceleration. Projectile motion. Dynamics of particles: Newton's Laws of Motion. Applications of Newton's Laws. Friction: Static and kinetic. Circular Motion and Rotational Dynamics. Centripetal force. Angular velocity and acceleration	**3**	By the end of this unit, students will be able to describe the motion of particles in one, two, and three dimensions using concepts of displacement, velocity, and acceleration. They will apply Newton's Laws of Motion to analyze and predict the behavior of particles under various forces, including friction. Additionally, students will understand circular motion and rotational dynamics, enabling them to solve problems involving centripetal force and angular motion.	1, 2
II	Unit 2: Work, Energy, and Power Work done by a constant and variable force. Kinetic and Potential Energy. Work-Energy Theorem. Conservative and non-conservative forces. Power and its calculation in mechanical systems. Conservation of Mechanical Energy: Energy diagrams. Applications in mechanical systems.	**3**	Students will gain a thorough understanding of work done by both constant and variable forces. They will be able to distinguish between kinetic and potential energy, applying the Work-Energy Theorem to solve mechanical problems. Furthermore, students will calculate power in mechanical systems and understand the principles of energy conservation. This unit will enhance their ability to analyze energy diagrams and apply these concepts to real-world scenarios involving mechanical energy.	2, 3, 4
III	Unit 3: Systems of Particles and Collisions	**3**	By completing this unit, students will be able to determine the center of mass	1, 2, 3, 4

	Center of Mass and Motion of the Center of Mass. Linear Momentum and Impulse. Conservation of Linear Momentum. Collisions: Elastic and inelastic collisions. Analysis of collisions in one and two dimensions.Rocket propulsion and variable mass systems.		of a system of particles and describe its motion. They will understand and apply the concepts of linear momentum and impulse, utilizing the conservation of linear momentum to analyze elastic and inelastic collisions. Students will also explore the dynamics of variable mass systems, such as rocket propulsion, and solve complex problems involving collisions in multiple dimensions.	
IV	Unit 4: Rotational Motion and Dynamics Rotational Kinematics and Energy. Moment of inertia and rotational kinetic energy. Dynamics of Rotational Motion. Torque and angular momentum. Equilibrium of Rigid Bodies. Conditions for equilibrium. Center of gravity. Rolling Motion and Angular Momentum. Rolling without slipping. Conservation of angular momentum.	**3**	Students will develop a solid understanding of rotational kinematics and the concept of moment of inertia. They will analyze the dynamics of rotational motion, including torque and angular momentum, and apply these principles to solve equilibrium problems involving rigid bodies. Additionally, students will explore rolling motion, the conditions for rolling without slipping, and the conservation of angular momentum, preparing them to tackle advanced problems in rotational dynamics.	1, 2
V	Unit 5: Gravitation and Planetary Motion Newton's Law of Universal Gravitation. Gravitational Potential Energy. Orbits of Planets and Satellites. Kepler's Laws of Planetary Motion. Orbital mechanics and escape velocity. Gravitational Fields and Potential. Gravitational field strength. Gravitational potential and energy. Applications of Gravitation: Tidal forces. Black holes and General Relativity basics.	**3**	In this unit, students will learn Newton's Law of Universal Gravitation and its applications to planetary and satellite motion. They will understand gravitational potential energy and analyze orbits using Kepler's Laws of Planetary Motion. Students will explore gravitational fields and potentials, enhancing their ability to solve problems related to gravitational interactions. Additionally, they will apply concepts of gravitation to phenomena such as tidal forces and black holes, gaining an introductory understanding of general relativity.	2, 3, 4, 5

TEXT BOOKS:

T1: Classical Mechanics by Herbert Goldstein, 2002, Addison-Wesley, DOI: 10.1063/1.3069576.

T2: An Introduction to Mechanics by Daniel Kleppner and Robert Kolenkow, 2014, Cambridge University Press, DOI: 10.1119/1.4947436.

T3: Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker, 2013, Wiley, DOI: 10.1002/9781118981245.

T4: Mechanics by L.D. Landau and E.M. Lifshitz, 1976, Butterworth-Heinemann, DOI: 10.1016/B978-0-08-029139-6.50010-4.

T5: Physics for Scientists and Engineers by Raymond A. Serway and John W. Jewett, 2018, Cengage Learning, DOI: 10.1136/978-1-305-47398-2.

REFERENCE BOOKS

R1: Analytical Mechanics by Grant R. Fowles and George L. Cassiday, 2004, Cengage Learning, DOI: 10.1088/0031-9120/40/2/001.
R2: Introduction to Classical Mechanics by David Morin, 2008, Cambridge University Press, DOI: 10.1017/CBO9781139174533.
R3: Mechanics: Volume 1 by Charles Kittel, Walter D. Knight, Malvin A. Ruderman, and A. Carl Helmholz, 1973, McGraw-Hill, DOI: 10.1063/1.3127498.
R4: Classical Dynamics of Particles and Systems by Stephen T. Thornton and Jerry B. Marion, 2003, Brooks Cole, DOI: 10.1136/978-0-534-40896-1.
R5: Principles of Dynamics by Donald T. Greenwood, 1988, Prentice Hall, DOI: 10.2307/2323459.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Demonstrate an understanding of the principles of motion and the ability to solve kinematics problems.	**1,3,5**
2	Analyze forces and predict the resulting motion of objects using Newton's laws.	**2,4**
3	Apply the concepts of work and energy to solve problems involving mechanical systems.	**6,8**
4	Explain the gravitational interactions between particles and celestial bodies.	**7,10,12**
5	Utilize conservation laws to analyze and predict the outcomes of collisions and other interactions in mechanics.	**8,9**

SEMESTER – I									
Field Based Training									
Course code	**23BTCE115R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30P	**0**	**0**	**0**	**0**	**0**	**16**	**1**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech Civil Engineering**								
Semester	**Fall/ III semester of second year of the programme**								
Course Objectives	1.Equip students with advanced AutoCAD skills necessary for civil engineering projects, enhancing their technical proficiency and professional competency. 2.Develop students' ability to create precise engineering drawings and detailed designs, fostering attention to detail and accuracy in their work. 3.Enhance problem-solving and critical thinking abilities through practical AutoCAD applications, preparing students for real-world engineering challenges.								
CO1	Demonstrate proficiency in using AutoCAD tools for creating complex civil engineering drawings.								
CO2	Apply advanced AutoCAD techniques to design detailed structural plans and layouts.								
CO3	Develop the ability to interpret and convert conceptual sketches into precise digital drawings.								
CO4	Integrate AutoCAD skills with other engineering tools and software for comprehensive project development.								
CO5	Exhibit improved problem-solving skills and technical knowledge through practical AutoCAD applications.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL****
I	**Introduction to Advanced AutoCAD Features:** Overview of advanced drawing tools, customization options, and productivity features.	4	Master advanced drawing tools and customization features in AutoCAD.	1, 2
II	**Creating Detailed Civil Engineering Drawings:** Techniques for creating detailed structural and architectural drawings, including layering, dimensioning, and annotation.	4	Create precise and detailed civil engineering drawings with advanced techniques.	2, 3
III	**3D Modeling and Visualization:** Introduction to 3D modeling, rendering, and visualization techniques in AutoCAD for civil engineering applications.	4	Develop 3D models and visualize civil engineering designs using AutoCAD.	3, 4
IV	**Integration with Other Tools:** Methods for integrating AutoCAD with other engineering software and tools, including importing/exporting files and collaborative project workflows.	4	Integrate AutoCAD skills with other tools for comprehensive engineering project development.	4, 5
V	**Practical Applications and Projects:** Hands-on projects and case studies to apply AutoCAD skills in real-world civil engineering scenarios, including project presentation and documentation.	4	Apply AutoCAD skills in practical projects, demonstrating problem-solving and technical proficiency.	5

TEXTBOOKS:

T1: "Field Research: A Sourcebook and Field Manual" – Robert G. Burgess
T2: "Methods in Field Biology" – Robert H. Giles
T3: "Fieldwork Ready: An Introductory Guide to Field Research for Agriculture, Environment, and Earth Sciences" – Sara E. Vero
T4: "Research Methods in Education" – Louis Cohen, Lawrence Manion, and Keith Morrison (For Education Field Training)

REFERENCE BOOKS:

R1: "The Field Guide to Fieldwork" – Bruce L. Berg
R2:"Handbook of Field Experiments" – Abhijit V. Banerjee and Esther Duflo
R3:"Doing Fieldwork in Areas of International Intervention" – Berit Bliesemann de Guevara
R4:"Practical Field Ecology: A Project Guide" – C. Philip Wheater, James R. Bell, Penny A. Cook
R5:"Field and Laboratory Methods for General Ecology" – James E. Brower, Jerrold H. Zar

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Demonstrate proficiency in using AutoCAD tools for creating complex civil engineering drawings.	**5, 7**
2	Apply advanced AutoCAD techniques to design detailed structural plans and layouts.	**8**
3	Develop the ability to interpret and convert conceptual sketches into precise digital drawings.	**7,9,10**
4	Integrate AutoCAD skills with other engineering tools and software for comprehensive project development.	**11,12**
5	Exhibit improved problem-solving skills and technical knowledge through practical AutoCAD applications.	**10**

SEMESTER – I									
Course Title	**Introductory English for Engineers**								
Course code	**23UBPD114R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 15T+60P	**0**	**0**	**4**	**0**	**0**	**0**	**2**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall: Winter/ I semester of first year of the programme**								
Course Objectives	1. To capacitate the students with mastery over Basic English grammar. 2. To enable the students to communicate confidently with a focus on listening and speaking skills. 3. With the help of the basics of Phonetics, the students will be able to pronounce words correctly.								
CO1	Understand and correctly use various grammar elements, including parts of speech, articles, auxiliary verbs, determiners, and degrees of comparison, to construct different types of sentences.								
CO2	Analyze and comprehend written texts through comprehension exercises, demonstrating an understanding of sentence construction and types.								
CO3	Understand the process and purpose of listening, differentiate between listening and hearing, identify factors affecting listening, and implement strategies to improve their listening skills.								
CO4	Develop speaking skills by introducing themselves, practicing self-discovery, improving pronunciation through phonetics, delivering extempore speeches, and using video recordings for self-reflection.								
CO5	Understand the fundamentals of communication, including its types, purposes, barriers, and importance, and apply this knowledge to improve their communication skills in both formal and informal contexts.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Grammar i. Parts of Speech ii. Articles iii. Auxiliary Verbs Affirmative and Negative Sentences	**6**	In this module, students will master the foundational elements of grammar. They will explore the parts of speech, including nouns, pronouns, verbs, adjectives, adverbs, prepositions, conjunctions, and interjections. Understanding articles (definite and indefinite) and their correct usage will be emphasized. Students will learn about auxiliary verbs and their role in forming tenses, voices, and moods. The module will also cover the construction of affirmative and negative sentences, helping students to build grammatically correct and meaningful sentences.	1, 2
II	Grammar i. Determiners ii. Sentence Construction iii. Types of Sentences (Assertive, Imperative, etc.) iv. Degree of Comparison v. Comprehension Exercises	**7**	Building on the basics, this module will delve into determiners and their functions in sentences. Students will learn sentence construction techniques and the different types of sentences (assertive, imperative, interrogative, and exclamatory). The concept of the degree of comparison (positive, comparative,	2, 3, 4

			and superlative) will be explored. The module will also	
III	Listening Skills i. What is listening? ii. The Process of Listening iii. Factors that adversely affect Listening iv. Difference between Listening and Hearing, v. Purpose and Importance of Effective Listening vi. How to Improve Listening Process.	**6**	Students will be introduced to the fundamentals of listening, distinguishing it from hearing. They will study the process of listening and identify factors that adversely affect it. The module will highlight the purpose and importance of effective listening and provide strategies to improve the listening process. By understanding these concepts, students will enhance their ability to comprehend and retain spoken information.	1, 2, 3, 4
IV	Speaking Skills i. Introducing yourself ii. Self-discovery iii. Basics of Phonetics, pronunciation iv. Extempore speech v. Video Recording for Self-reflection	**5**	This module focuses on developing students' speaking abilities. They will learn how to introduce themselves and engage in self-discovery to build confidence. Basics of phonetics and pronunciation will be covered to ensure clear and correct speech. Students will practice extempore speech to improve their ability to speak spontaneously. Video recording for self-reflection will be used as a tool for students to evaluate and improve their speaking skills.	1, 2
V	Communication Skills i. Introduction to Communication, ii. Importance of Communication Skills. iii. Purpose of Communication. iv. Types of Communication. v. Formal and informal communication vi. Importance of Communication. vii. Barriers to Communication. viii. How to improve/ tips to improve Communication skills. ix. Responding to different questions in various situations (formal/informal)	**5**	Students will gain a comprehensive understanding of communication and its significance. The module will cover the types and purposes of communication, distinguishing between formal and informal contexts. Students will learn about the importance of communication skills and the barriers that can impede effective communication. Tips and strategies to improve communication skills will be provided. The module will also include exercises on responding to different questions in various situations, enhancing students' adaptability and effectiveness in both formal and informal interactions.	2, 3, 4, 5

TEXT BOOKS:

T1. Chaturvedi, P.D., Chaturvedi Mukesh, 2011.Business Communication: Concepts, Cases and Applications, second edition, Pearson, Noida

T2. Alex K., Chand, S, 2009. Soft Skills: Know Yourself and Know the World, first edition, S. Chand & Company Ltd.: New Delhi.

REFERENCE BOOKS:

R1. Quirk, Randolp. (2010) A Comprehensive Grammar of the English Language by Randolph Quirk, Sidney Greenbaum, Pearson Education India

R2. Marks, Jonathan. (2017) IELTS Advantage Speaking and Listening Skills: A step-by-step guide to a high IELTS speaking and listening score. Book + CD-ROM, Delta Publishing by Klett

OTHER LEARNING RESOURCES:

1. https://youtu.be/bEB8-SWMYhI
2. https://youtu.be/-zZau_dttRY

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

SN	Course Outcome (CO)	Mapped Program Outcome
1	Understand and correctly use various grammar elements, including parts of speech, articles, auxiliary verbs, determiners, and degrees of comparison, to construct different types of sentences.	1,2
2	Analyze and comprehend written texts through comprehension exercises, demonstrating an understanding of sentence construction and types.	3,5
3	Understand the process and purpose of listening, differentiate between listening and hearing, identify factors affecting listening, and implement strategies to improve their listening skills.	6,9,10
4	Develop speaking skills by introducing themselves, practicing self-discovery, improving pronunciation through phonetics, delivering extempore speeches, and using video recordings for self-reflection.	5,9
5	Understand the fundamentals of communication, including its types, purposes, barriers, and importance, and apply this knowledge to improve their communication skills in both formal and informal contexts.	1, 4,11

SEMESTER – I									
Course Title	**EXTRA-CURRICULAR ACTIVITIES**								
Course code	**23UBEC111**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 10T	**0**	**0**	**0**	**4**	**0**	**0**	**1**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech in Civil Engineering**								
Semester	**Fall/ I semester of first year of the programme**								
Course Objectives	1. To develop soft and social skills 2. To promote a holistic development of the learners 3. To enhance the learning experience in different stages etc.								
CO1	Participants will develop personal skills, such as leadership, communication, time management, and teamwork, contributing to their overall character development and self-confidence.								
CO2	Engagement in Community service and outreach activities will cultivate a sense of social responsibility, empathy, and civic awareness, encouraging students to actively contribute to society								
CO3	Express their ideas, views, In-depth evaluation and analysis clearly in the topic of their interest.								
CO4	The students will be given a platform to earn from invited experts in their respective fields.								
CO5	Demonstrate and practices different activities, by Integrating learning experiences by demonstrating transferable skills.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Different types of activities outside regular curriculum	**10**	1. AdtU encourages a range of activities outside the regular curriculum intended to meet learner's interest. These activities are aimed to develop the social and soft skills and promote a holistic development of the learners. 2. Keeping in mind the 360-degree learning methodology the students are engaged in different activities headed under different clubs viz. Dance, music, photography, drama, literary etc. 3. The students are encouraged to participate in regular club activities, workshops, competitions as per their interest and hobbies. 4. The student members of the club are trained represent AdtU in various inter University student and national level competitions 5. Renewed personalities are invited to conduct workshops that benefit the members and students by giving them the platform to learn from experts in the respective fields.	1,2,3,4, 5

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
Course Outcome (CO)		**Mapped Program Outcome**
1	Participants will develop personal skills, such as leadership, communication, time management, and teamwork, contributing to their overall character development and self-confidence.	1,3
2	Engagement in Community service and outreach activities will cultivate a sense of social responsibility, empathy, and civic awareness, encouraging students to actively contribute to society	3,4,7
3	Express their ideas, views, In-depth evaluation and analysis clearly in the topic of their interest.	6,8
4	The students will be given a platform to earn from invited experts in their respective fields.	4,6
5	Demonstrate and practices different activities, by Integrating learning experiences by demonstrating transferable skills.	7,11

SEMESTER – II									
Course Title	**Elements of Probability & Statistics for Civil Engineering Application**								
Course code	**23BTCE121R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 60T	**4**	**0**	**0**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ II semester of first year of the programme**								
Course Objectives	1. Describe the concept of first order differential equation and apply them in understanding complex problems. 2. Apply the concept of ordinary differential equations of higher orders. 3. Analyze: To develop students' skills in basic probability and statistics, including the analysis of probability distributions, measures of central tendency, and statistical parameters, and to apply these concepts to real-world data and hypothesis testing.								
CO1	Solve first-order ordinary differential equations using exact, linear, Bernoulli's, Euler's equations, and those solvable for ppp, yyy, xxx, and Clairaut's type.								
CO2	Analyze and solve second-order linear differential equations with variable coefficients using variation of parameters and the Cauchy-Euler equation.								
CO3	Evaluate complex functions through differentiation, using Cauchy-Riemann equations for analyticity, and identify harmonic functions and their conjugates.								
CO4	Understand and analyze basic probability concepts, including probability spaces, conditional probability, independence, and various distributions.								
CO5	Evaluate statistical methods for measures of central tendency, moments, skewness, kurtosis, probability distributions, and conduct significance tests for large samples.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	***First order ordinary differential equations:*** Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	**7**	First-order ordinary differential equations include understanding and solving exact, linear, and Bernoulli equations, as well as Euler's equations for rigid body dynamics. Students will also learn to handle equations not of the first degree, including those solvable for pp, yy, or xx, and Clairaut's type equations. These outcomes focus on enhancing analytical and problem-solving skills in differential equations.	1,2
II	***Ordinary differential equations of higher orders:*** Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation.	**9**	Method of variation of parameters. Students will also understand and solve the Cauchy-Euler equation, which is a specific type of second-order linear differential equation useful in various applications.	1,2
III	***Complex variable-Differentiation:*** Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions(exponential, trigonometric, logarithm) and	**8**	Gaining proficiency in solving second-order linear differential equations with variable coefficients using techniques like the variation of parameters. Additionally, students will learn to solve the Cauchy-Euler equation, a particular type of second-order differential equation, and comprehend its applications and solution	1,2

	their properties.		methods. This expertise prepares students to tackle complex differential equations found in various scientific and engineering contexts	
IV	***Basic probability:*** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution.	**8**	Understanding the foundational concepts of probability spaces and the ability to calculate conditional probability and determine the independence of events. Students will also learn about discrete random variables and how to analyze distributions involving independent random variables. Additionally, they will gain proficiency in working with the multinomial distribution and applying the Poisson approximation to the binomial distribution, equipping them with essential tools for solving a variety of probabilistic problems.	1,2
V	***Basic and applied Statistics:*** ***Basic:*** Measures of central tendency: Moments, skewness and Kurtosis- Probability distributions: Binomial, Poisson and Normal-evaluation of statistical parameters for these three distributions, Correlation and regression. ***Applied:*** Test of significance: Large sample test for single proportion. Difference of proportions, single mean, difference of means and difference of standard deviations.	**8**	Understanding and calculating measures of central tendency such as mean, median, and mode. Students will also learn to compute moments, and analyze skewness and kurtosis to describe data distribution shapes. Additionally, they will gain proficiency in working with key probability distributions (Binomial, Poisson, and Normal), including evaluating their statistical parameters. Furthermore, students will develop skills in correlation and regression analysis to examine relationships between variables.	1,2

TEXT BOOKS:

T1: Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
T2: N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

REFERENCE BOOKS:

R1: S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
R2: S. L. Ross, Differential Equations, 3rd Ed. Wiley India, 1984.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Solve first-order ordinary differential equations using exact, linear, Bernoulli's, Euler's equations, and those solvable for ppp, yyy, xxx, and Clairaut's type.	**1,2**
2	Analyze and solve second-order linear differential equations with variable coefficients using variation of parameters and the Cauchy-Euler equation.	**1,2,3**
3	Evaluate complex functions through differentiation, using Cauchy-Riemann equations for analyticity, and identify harmonic functions and their conjugates.	**2,4,5**
4	Understand and analyze basic probability concepts, including probability spaces, conditional probability, independence, and various distributions.	**1,3,5**
5	Evaluate statistical methods for measures of central tendency, moments, skewness, kurtosis, probability distributions, and conduct significance tests for large samples.	**1,2,3,4,5**

SEMESTER – II									
Course Title	**Chemistry for Civil Engineers**								
Course code	**23BTCE122R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T+30P	**2**	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ II semester of first year of the programme**								
Course Objectives	1. To develop a deep understanding of atomic and molecular structures, including the application of quantum mechanics to solve complex problems. 2. To apply theoretical concepts to real-world scenarios, such as predicting molecular properties and understanding spectroscopic techniques. 3. To foster critical thinking and analytical skills necessary for interpreting complex chemical phenomena.								
CO1	Apply the Schrödinger equation to predict the particle in a box solutions and analyze their implications for conjugated molecules and nanoparticles.								
CO2	Evaluate the spatial variations of hydrogen atom wave functions through graphical representations and interpret their significance in atomic structure.								
CO3	Analyze molecular orbitals of diatomic molecules and multicenter orbitals using quantum mechanical equations and visualize these orbitals through plots.								
CO4	Explain the concept of aromaticity and predict the pi-molecular orbitals of butadiene and benzene using molecular orbital theory.								
CO5	Illustrate the energy level diagrams for transition metal ions using crystal field theory and analyze their magnetic properties								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Dry and wet corrosion - detrimental effects to buildings, machines, devices & decorative art forms, emphasizing Differential aeration, Pitting, Galvanic and Stress corrosion cracking; Factors that enhance corrosion and choice of parameters to mitigate corrosion. Corrosion protection - cathodic protection – sacrificial anodic and impressed current protection methods; Advanced protective coatings: electroplating and electroless plating, PVD and CVD. Alloying for corrosion protection – Basic concepts of Eutectic composition and Eutectic mixtures - Selected examples – Ferrous and non-ferrous alloys.	**6**	Demonstrate proficiency in solving quantum mechanical problems related to atomic and molecular structures.	1
II	Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Difference between thermoplastics and thermosetting plastics; Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and poly dispersity index; Engineering application of plastics - PE, PVC, PC, PTFE, PP, Nylon 6, Nylon 66, Bakelite, Epoxy; Compounding of plastics: moulding of plastics for Car parts, bottle caps (Injection moulding), Pipes, Hoses (Extrusion moulding), Battery Trays,(Compression moulding), Fibre reinforced polymers, Composites (Transfer moulding), PET bottles(blow moulding); Polymer Coatings and Sealant Conducting polymers- Polyacetylene- Mechanism of conduction – applications (polymers in sensors, self-	**6**	Analyze spectroscopic data to deduce molecular structures and dynamics.	2

	cleaning windows)			
III	Brief introduction to conventional primary and secondary batteries; High energy electrochemical energy systems: Lithium batteries – Primary and secondary, its Chemistry, advantages and applications. Fuel cells – Polymer membrane fuel cells, Solid-oxide fuel cells- working principles, advantages, applications. Solar cells – Types – Importance of silicon single crystal, polycrystalline and amorphoussiliconsolar cells, dye sensitized solar cells - working principles, characteristics and applications. Explosives – classification, examples: TNT, RDX, Dynamite	**6**	Evaluate the impact of intermolecular forces on the physical and chemical properties of substances.	3
IV	Calorific value - Definition of LCV, HCV. Measurement of calorific value using bomb calorimeter and Boy's calorimeter including numerical problems. Controlled combustion of fuels - Air fuel ratio – minimum quantity of air by volume and by weight Numerical problems-three way catalytic converter- selective catalytic reduction of NOX; Knocking in ICengines-Octane and Cetane number - Antiknocking agents	**6**	Apply thermodynamic principles to chemical equilibria and electrochemical systems.	4
V	Water quality parameters: colour, odour, pH, hardness, alkalinity, TDS, COD and BOD. Boiler feed water – requirement – troubles (scale & sludge, causticembrittlement, boiler corrosion and priming & foaming. Internal conditioning – phosphate, Calgon and carbonate treatment. External conditioning - zeolite (permutit) and ion exchangedemineralization. Municipal water treatment process – primary (screening, sedimentation and coagulation), secondary (activated sludge process and trickling filter process) and tertiary (ozonolysis, UV treatment, chlorination, reverse osmosis).	**6**	Interpret periodic trends and their implications on chemical behavior and reactivity.	5

TEXT BOOKS:

T1: University chemistry, by B. H. Mahan
T2: Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
T3: Fundamentals of Molecular Spectroscopy, by C. N. Banwell
T4: Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

REFERENCE BOOKS:

R1: Physical Chemistry, by P. W. Atkins
R2: Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Apply the Schrödinger equation to predict the particle in a box solutions and analyze their implications for conjugated molecules and nanoparticles.	**1,2,3**
2	Evaluate the spatial variations of hydrogen atom wave functions through graphical representations and interpret their significance in atomic structure.	**1,2,5**
3	Analyze molecular orbitals of diatomic molecules and multicenter orbitals using quantum mechanical equations and visualize these orbitals through plots.	**2,3,5**
4	Explain the concept of aromaticity and predict the pi-molecular orbitals of butadiene and benzene using molecular orbital theory.	**1,2,3,4**
5	Illustrate the energy level diagrams for transition metal ions using crystal field theory and analyze their magnetic properties	**4,5**

SEMESTER – II										
Course Title	**Problem Solving & Python Programming**									
Course code	**23BTCE124R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T+30P	**2**	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ II semester of first year of the programme**								
Course Objectives	1. To learn the fundamentals of computers. 2. To understand the various steps in programme development. 3. To learn the syntax and semantics of C programming language.								
CO1	Apply programming concepts such as flowcharts and pseudo code to design algorithms for solving computational problems.								
CO2	Analyze and synthesize variables and data types to construct arithmetic expressions with appropriate precedence rules.								
CO3	Evaluate conditional statements and loops to control programme flow and optimize algorithm efficiency.								
CO4	Create and implement algorithms using arrays (1-D and 2-D), character arrays, and strings to manipulate and store data effectively.								
CO5	Design and develop solutions using functions and recursion, including advanced examples such as Quick Sort and the Ackermann function.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	History of Programming Languages Overview of Programming Languages, Basic Syntax of a few programming languages, Advantages and disadvantages of Python, Real-life examples of application of Python	**11**	Demonstrate proficiency in constructing and interpreting flowcharts and pseudo code for algorithm design.	1,2
II	Introduction to Python Programming Introduction to Python Language, Writing and Compiling Python Programmes, Basic Structure of a Python Programme, Data Types and Constants.	**10**	Apply knowledge of variables, data types, and arithmetic expressions with appropriate precedence in programming tasks.	1,2
III	Data types and Variables Data types, Variable declaration and use, Typecasting in Python, Operators in Python: Assignment, Logical, Arithmetic, Conditional statements: If statement, If else statement, Python Collections: List, Tuple, Sets and Dictionary.	**10**	Implement conditional branching and iterative structures to control programme flow and optimize algorithm efficiency.	1,2
IV	Loops and Functions : Loops in Python: For Loop, While Loop and Nested Loops, User Defined functions	**7**	Develop proficiency in manipulating arrays, character arrays, and strings to manage and process data effectively.	1,2
V	Lambda Functions: Types of functions, Lambda functions	**7**	Analyze and evaluate algorithm efficiency through the application of basic searching and sorting techniques, understanding time complexity implications.	1,2

TEXT BOOKS:

T1: Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
T2: E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

REFERENCE BOOKS:

R1: Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Apply programming concepts such as flowcharts and pseudo code to design algorithms for solving computational problems.	**1,2,3,8**
2	Analyze and synthesize variables and data types to construct arithmetic expressions with appropriate precedence rules.	**1,3,5**
3	Evaluate conditional statements and loops to control programme flow and optimize algorithm efficiency.	**2,3,8**
4	Create and implement algorithms using arrays (1-D and 2-D), character arrays, and strings to manipulate and store data effectively.	**1,3,5**
5	Design and develop solutions using functions and recursion, including advanced examples such as Quick Sort and the Ackermann function.	**1,2,3,4,5,11**

SEMESTER – II										
Course Title	**Engineering Drawing**									
Course code	**23BTCE123R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 10T+60P	**0**	**0**	**4**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ II semester of first year of the programme**								
Course Objectives	1.To introduce students to the principles and techniques of traditional and computer-based engineering graphics. 2.To equip students with the skills necessary to interpret, create, and analyze technical drawings and models. 3.To familiarize students with modern engineering graphics software and its applications in design and visualization.									
CO1	Determine the various fluid characteristics that affect fluid behavior.									
CO2	Explain the fluid pressure and about its measurements.									
CO3	Summarize the various fluid flow.									
CO4	Apply the conservation laws for fluids in fluid dynamics.									
CO5	Discuss various non-dimensional parameters of fluid flow.									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Unit 1: Traditional Engineering Graphics**:** Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles.	**3**	Upon completion of the course, students will be able to demonstrate the application of orthographic projection using Descriptive Geometry principles.	1,2
II	Unit 2: Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.	**2**	Students will be able to interpret and create technical drawings incorporating isometric projection, sectional views, and accurate dimensioning.	1,2
III	Unit 3: Computer Graphics: Engineering Graphics Software; - Spatial Transformations; Orthographic Projections; Model Viewing.	**2**	Students will develop proficiency in utilizing engineering graphics software for spatial transformations, model viewing, and orthographic projections.	1,2
IV	Unit 4: Co-ordinate Systems; Multi-view Projection; Exploded Assembly	**2**	Upon completion, students will understand the principles of co-ordinate systems and multi-view projection, and apply them effectively in technical drawings.	1,2
V	Unit 5: Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)	**1**	Students will be able to utilize surface and solid modelling techniques in BIM to design and visualize complex engineering structures.	1,2

TEXT BOOKS:

T1: Bhatt, N.D., Engineering Drawing, Charotar Publishing House Pvt. Ltd.
T2: John, K.C. Engineering Graphics, Prentice Hall India Publishers.

REFERENCE BOOKS:

R1: Anil kumar, K.N., Engineering Graphics, Adhyuth Narayan Publishers
R2: Agrawal, B. And Agrawal, C.M., Engineering Darwing, Tata McGraw Hill
R3: Varghese, P.I., Engineering Graphics, V I P Publishers

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Introduction to engineering design and its place in society.	**1,2,3**
2	Exposure to the visual aspects of engineering design.	**1,3,5**
3	Exposure to engineering graphics standards.	**2,5,10**
4	Exposure to solid modelling.	**2,3,5,7**
5	Exposure to computer-aided geometric design	**1,3,5,8**

SEMESTER – II										
Course Title	**Ethics, Technology And Engineering**									
Course code	**23MOCE122R**	**Total credits:1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**	
		Total hours: 20P	**0**	**0**	**0**	**0**	**0**	**0**	**1**	
Pre- requisite	**Nil**	**Co-requisite**	**Nil**							
Programme	**B.Tech Civil Emgineering**									
Semester	**Winter/II semester of s1st year of the programme**									
Course Objectives	1. To understand the moral values that ought to guide the Engineering profession 2. To resolve the moral issues in the profession 3. To justify the moral judgment concerning the profession									
CO1	Recognize professionalism in an organization.									
CO2	Distinguish between the does and don'ts for the betterment of the society and environment.									
CO3	Classify Various types of contract and their features.									
CO4	Discuss the measures of Alternative Dispute Resolution.									
CO5	Categorize different types of Intellectual property rights.									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL ******
I	**Professional Practice** – Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards)	4	Students will develop a comprehensive understanding of the roles and responsibilities of stakeholders in the construction industry, including regulatory bodies, standardization organizations, professional bodies, clients, developers, consultants, contractors, and manufacturers.	1, 2
II	**Professional Ethics** – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs. Bribery, Environmental breaches	4	Students will develop a comprehensive understanding of professional ethics encompassing personal, business, and engineering contexts, including codes of conduct and responsibilities towards ethical dilemmas.	2, 3
III	**General Principles of Contracts Management:** Indian Contract Act,	4	Participants will develop comprehensive knowledge	3, 4

	1972,Characteristics of a Simple Contract, Various types of contract and their features, Valid & Voidable Contracts, Prime and sub-contracts, Joint Ventures, Tenders & Request For Proposals, Bids & Proposals, Bid Evaluation, Contract Conditions & Specifications, Contract award & Notice To Proceed, Variations & Changes in Contracts, Differing site conditions, cost escalation, Contract documentation, Contract Notices, Wrong practices in contracting (Bid shopping).		of contract management principles, including contract types, conditions, bid evaluation, and legal considerations under the Indian Contract Act, 1972.	
IV	**Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system:** Arbitration – meaning, scope, distinction between laws of 1940 and 1996; UNCITRAL model law; International Commercial Arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Distinction between conciliation, mediation and arbitration; Dispute Resolution Boards; LokAdalats.	4	Students will develop comprehensive knowledge of arbitration, conciliation, and ADR systems, including the distinctions between arbitration laws, types of arbitration agreements, and alternative dispute resolution methods like mediation and LokAdalats.	4, 5
V	**Engagement of Labour and Labour & other construction and Law relating to Intellectual property***:* Role of Labour in Civil Engineering; Methods of engaging labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017; meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India; Meaning of copyright; Ownership of copyrights and assignment; Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India.	4	Students will develop a comprehensive understanding of labor engagement methods, industrial dispute resolution frameworks, and intellectual property laws pertinent to civil engineering projects.	5

TEXT BOOKS:

T1: B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.

T2: The National Building Code, BIS, 2017

T3: T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House

REFERENCE BOOKS:

R1: Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India .
R2: UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
R3: Bare text (2005), Right to Information Act

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Recognize professionalism in an organization.	**5, 7**
2	Distinguish between the does and don'ts for the betterment of the society and environment.	**8**
3	Classify Various types of contract and their features.	**7,9**
4	Discuss the measures of Alternative Dispute Resolution.	**11,12**
5	Categorize different types of Intellectual property rights.	**10**

SEMESTER – II									
Course Title	**EXTRA-CURRICULAR ACTIVITIES**								
Course code	**23UBEC121**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 10	**0**	**0**	**0**	**4**	**0**	**0**	**1**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. tech Civil Engineering**								
Semester	**Fall/ II semester of first year of the programme**								
Course Objectives	1.To develop soft and social skills 2.To promote a holistic development of the learners 3To enhance the learning experience in different stages etc.								
CO1	Participants will develop personal skills, such as leadership, communication, time management, and teamwork, contributing to their overall character development and self-confidence.								
CO2	Engagement in Community service and outreach activities will cultivate a sense of social responsibility, empathy, and civic awareness, encouraging students to actively contribute to society								
CO3	Express their ideas, views, In-depth evaluation and analysis clearly in the topic of their interest.								
CO4	The students will be given a platform to earn from invited experts in their respective fields.								
CO5	Demonstrate and practices different activities, by Integrating learning experiences by demonstrating transferable skills.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL ******
I	Different types of activities outside regular curriculum	**10**	6. AdtU encourages a range of activities outside the regular curriculum intended to meet learner's interest. These activities are aimed to develop the social and soft skills and promote a holistic development of the learners. 7. Keeping in mind the 360-degree learning methodology the students are engaged in different activities headed under different clubs viz. Dance, music, photography, drama, literary etc. 8. The students are encouraged to participate in regular club activities, workshops, competitions as per their interest and hobbies. 9. The student members of the club are trained represent AdtU in various inter University student and national level competitions 10. Renewed personalities are invited to conduct workshops that benefit the members and students by giving them the platform to learn from experts in the respective fields.	1,2,3,4,5

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
Course Outcome (CO)		**Mapped Programme Outcome**
1	Participants will develop personal skills, such as leadership, communication, time management, and teamwork, contributing to their overall character development and self-confidence.	1,3
2	Engagement in Community service and outreach activities will cultivate a sense of social responsibility, empathy, and civic awareness, encouraging students to actively contribute to society	3,4,7
3	Express their ideas, views, In-depth evaluation and analysis clearly in the topic of their interest.	6,8
4	The students will be given a platform to earn from invited experts in their respective fields.	4,6
5	Demonstrate and practices different activities, by Integrating learning experiences by demonstrating transferable skills.	7,11

SEMESTER – II									
Course Title	**Environmental Science**								
Course code	**23UBES101R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T	**2**	**0**	**0**	**0**	**0**	**0**	**2**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ II semester of first year of the programme**								
Course Objectives	1. This course provides students with a comprehensive overview of fundamental ecological principles, environmental chemistry, biodiversity conservation, and the impacts of human activities on the environment. 2. Through a blend of theoretical knowledge and practical applications, students delve into the complexities of pollution, resource management, and sustainable development. The course emphasizes the interconnectedness of ecological systems, aiming to cultivate an understanding of the delicate balance required for environmental harmony. 3. By studying environmental chemistry, biodiversity, and pollution, students develop the skills needed to critically analyze and propose solutions to contemporary environmental challenges.								
CO1	Understand the relationships between natural and man-made systems.								
CO2	Develop critical thinking for shaping strategies (scientific, social, economic, administrative, and legal) for environmental protection, conservation of biodiversity, environmental equity, and sustainable development.								
CO3	Understand the consequences of human actions on the web of life, global economy, and quality of human life.								
CO4	Understand about Environment Pollution, Global Environment issues, Impact of Human Population and modern civilization on the Environment								
CO5	Analyse various aspects of human population, and the impact of the population growth on the environment.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL ****
I	To Develop a comprehensive understanding of the components of the environment, including the atmosphere, hydrosphere, lithosphere, and biosphere. Gain knowledge of the structure and composition of these systems, as well as the principles governing life systems, metabolic processes, and the diversity of plant and animal life.	**6**	Develop a holistic understanding of the environment's components and principles governing life systems, metabolic processes, and biodiversity.	1,2
II	To Acquire proficiency in ecological concepts, including terminology, ecosystem structure and function, mineral cycling, energy flow, trophic chains, and the development and evolution of ecosystems. Understand the relationships between different components of ecosystems and their ecological roles.	**6**	Acquire proficiency in ecological terminology, ecosystem structure, energy flow, trophic chains, and understand the relationships between ecosystem components and their ecological roles.	1,2
III	To Develop the ability to analyze environmental pollution by examining its sources, causes, assessment, effects, and methods of prevention and control. Explore strategies for managing different types of pollution, emphasizing the concept of sustainability and the relationships between energy, environment, and human	**6**	Develop the ability to analyze environmental pollution sources, causes, effects, and prevention methods, emphasizing sustainability and the interplay between energy, environment, and human	1,2

	activities.		activities.	
IV	To Gain knowledge of the utilization and sustainable management of water and forest resources. Understand the role of human activities in shaping the environment, including the management of rivers, lakes, forests, and wildlife. Explore concepts related to urbanization, green cities, global warming, and carbon sequestration.	**6**	Gain knowledge of sustainable water and forest resource management, understand human impacts on the environment, and explore concepts related to urbanization, global warming, and carbon sequestration.	1,2
V	To Develop awareness of international agreements and protocols addressing global environmental issues. Understand the role of society, non-governmental organizations (NGOs), and government agencies in addressing environmental challenges. Familiarize yourself with national forest policies, environmental laws, acts, and Environmental Impact Assessment (EIA) processes.	**6**	Develop awareness of international agreements and protocols addressing global environmental challenges, understand the roles of society, NGOs, and government agencies, and familiarize oneself with national environmental policies and laws, including Environmental Impact Assessment processes.	1,2

TEXT BOOKS:

T1: H.S. Peavy, D.R. Rowe and G. Tchobanoglous, Environmental Engineering, McGraw Hill International.

T2: J. G. Henry and G.H. Heinke, Environmental Science and Engineering, Prentice Hall International.

REFERENCE BOOKS:

R1: G.M. Masters, Introduction to Environmental Engineering and Science, Pearson Education.

R2: R.T. Wright and D.F. Boorse, Environmental Science Towards a Sustainable Future, PHI Learning.

R3: P.A. Vesilind and S.M. Morgan, Introduction to Environmental Engineering, Thomson Books.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand the relationships between natural and man-made systems.	**1,3 & 4**
2	Develop critical thinking for shaping strategies (scientific, social, economic, administrative, and legal) for environmental protection, conservation of biodiversity, environmental equity, and sustainable development.	**1,2**
3	Understand the consequences of human actions on the web of life, global economy, and quality of human life.	**7.9,10**
4	Understand about Environment Pollution, Global Environment issues, Impact of Human Population and modern civilization on the Environment	**5,7**
5	Analyse various aspects of human population, and the impact of the population growth on the environment.	**5,8**

SEMESTER – II									
Course Title	**EFFECTIVE ENGLISH FOR ENGINEERS** (Communicative English & Soft Skills)								
Course code	**23UBPD123R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 15T+60P	**0**	**0**	**4**	**0**	**0**	**0**	**2**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Civil Engineering**								
Semester	**Winter/ II semester of first year of the programme**								
Course Objectives	1. This course will enable the students to acquire the important knowledge on grammar like the formation of sentences. 2. To enable the students to use vocabulary meaningfully for a successful conversation. 3. To establish Reputation and Rapport, a dress code session is much needed								
CO1	Enable students to understand grammar to write effectively and speak flawlessly, knowing correct usage of tenses and rectifying grammatical errors.								
CO2	Students will acquire the technique of expanding vocabulary and creating new words and use them in different contexts.								
CO3	Encouraging and helping them to sharpen their listening skills and to become good listeners.								
CO4	To make them prepare for various public and private sector exams & placement drives.								
CO5	To enhance the analytical skill and problem-solving skill of the students								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL ******
I	Interchange of Interrogative and Assertive Sentences, Interchange of Exclamatory and Assertive Sentences, Analysis of Sentences, Types of Tenses, Exercises on Tense	**12**	Students will be able to analyse and transform the different types of sentences.	1,2
II	Synonyms, Antonyms, Homonyms	**8**	Helpful in integrating the skills of reading and speaking in professional communication.	3,4
III	Techniques of Effective, Reading, Gathering ideas and information from a text, The SQ3R Technique, Interpret the text	**8**	Helps in analyzing the techniques of effective reading, gathering ideas and information from a text	3,4
IV	Introduction to Dress Code Ethics, ii. Purpose and Importance, iii. How to Make FIRST IMPRESSION iv. What to Wear During Interviews or Any Other Formal Meetings – Male & Female Activity:	**6**	Dress code etiquette will boost their confidence.	3,4
V	Introduction To Time Management Purpose And Importance of Time Management, Basic Tips to Maintain Time.	**6**	Students will learn to utilize time effectively.	3,4

TEXT BOOKS:

T1: Wren,P.C and Martin,H. 1995. High School English Grammar and Composition, S Chand Publishing.

T2: Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing

REFERENCES

R1. Mccarthy. (2008) English Vocabulary in Use Upper - Intermediate with CD-ROM, Cambridge University Press

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Enable students to understand grammar to write effectively and speak flawlessly, knowing correct usage of tenses and rectifying grammatical errors.	**9,10**
2	Students will acquire the technique of expanding vocabulary and creating new words and use them in different contexts.	**10**
3	Encouraging and helping them to sharpen their listening skills and to become good listeners.	**9,10,11**
4	To make them prepare for various public and private sector exams & placement drives.	**1,2,12**
5	To enhance the analytical skill and problem- solving skill of the students	**4,5**

SEMESTER – II									
Course Title	**Field Based Training**								
Course code	**23BTCE125R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30P	**0**	**0**	**0**	**0**	**0**	**16**	**1**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech Civil Emgineering**								
Semester	**Winter/ II semester of 1st year of the programme**								
Course Objectives	1.Equip students with advanced AutoCAD skills necessary for civil engineering projects, enhancing their technical proficiency and professional competency. 2.Develop students' ability to create precise engineering drawings and detailed designs, fostering attention to detail and accuracy in their work. 3.Enhance problem-solving and critical thinking abilities through practical AutoCAD applications, preparing students for real-world engineering challenges.								
CO1	Demonstrate proficiency in using AutoCAD tools for creating complex civil engineering drawings.								
CO2	Apply advanced AutoCAD techniques to design detailed structural plans and layouts.								
CO3	Develop the ability to interpret and convert conceptual sketches into precise digital drawings.								
CO4	Integrate AutoCAD skills with other engineering tools and software for comprehensive project development.								
CO5	Exhibit improved problem-solving skills and technical knowledge through practical AutoCAD applications.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL ****
I	**Introduction to Advanced AutoCAD Features:** Overview of advanced drawing tools, customization options, and productivity features.	4	Master advanced drawing tools and customization features in AutoCAD.	1, 2
II	**Creating Detailed Civil Engineering Drawings:** Techniques for creating detailed structural and architectural drawings, including layering, dimensioning, and annotation.	4	Create precise and detailed civil engineering drawings with advanced techniques.	2, 3
III	**3D Modeling and Visualization:** Introduction to 3D modeling, rendering, and visualization techniques in AutoCAD for civil engineering applications.	4	Develop 3D models and visualize civil engineering designs using AutoCAD.	3, 4
IV	**Integration with Other Tools:** Methods for integrating AutoCAD with other engineering software and tools, including importing/exporting files and collaborative project workflows.	4	Integrate AutoCAD skills with other tools for comprehensive engineering project development.	4, 5
V	**Practical Applications and Projects:** Hands-on projects and case studies to apply AutoCAD skills in real-world civil engineering scenarios, including project presentation and documentation.	4	Apply AutoCAD skills in practical projects, demonstrating problem-solving and technical proficiency.	5

TEXT BOOKS:

T1: "Field Research: A Sourcebook and Field Manual" – Robert G. Burgess
T2: "Methods in Field Biology" – Robert H. Giles
T3: "Fieldwork Ready: An Introductory Guide to Field Research for Agriculture, Environment, and Earth Sciences" – Sara E. Vero
T4: "Research Methods in Education" – Louis Cohen, Lawrence Manion, and Keith Morrison (For Education Field Training)

REFERENCE BOOKS:

R1: "The Field Guide to Fieldwork" – Bruce L. Berg
R2:"Handbook of Field Experiments" – Abhijit V. Banerjee and Esther Duflo
R3:"Doing Fieldwork in Areas of International Intervention" – Berit Bliesemann de Guevara
R4:"Practical Field Ecology: A Project Guide" – C. Philip Wheater, James R. Bell, Penny A. Cook
R5:"Field and Laboratory Methods for General Ecology" – James E. Brower, Jerrold H. Zar

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Demonstrate proficiency in using AutoCAD tools for creating complex civil engineering drawings.	**5, 7**
2	Apply advanced AutoCAD techniques to design detailed structural plans and layouts.	**8**
3	Develop the ability to interpret and convert conceptual sketches into precise digital drawings.	**7.9,10**
4	Integrate AutoCAD skills with other engineering tools and software for comprehensive project development.	**11,12**
5	Exhibit improved problem-solving skills and technical knowledge through practical AutoCAD applications.	**10**

SEMESTER – II									
Course Title	**Elements of Surveying & Geomatics**								
Course code	**23BTCE125R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T+30P	**3**	**0**	**2**	**0**	**0**	**0**	**4**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ III semester of second year of the programme**								
Course Objectives	1. Know the principle and methods of surveying. 2. Measure horizontal and vertical- distances and angles 3. Recording of observation accurately								
CO1	Identify various surveying instruments used for mapping topographical drawings								
CO2	Explain Methods of Leveling and setting Levels with different instruments								
CO3	Apply the principle and working of theodolite for measuring angles in vertical and horizontal planes.								
CO4	Understand the methods of radiation and intersection for obtaining an area enclosed with in the traverse								
CO5	Discuss the concept and principle of modern surveying.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL **
I	**Introduction and Basic Concepts:** Introduction, Objectives, classification and principles of surveying, Scales, Shrinkage of Map, Conventional symbols and Code of Signals, Surveying accessories, phases of surveying. **Measurement of Distances and Directions** **Linear distances-** Approximate methods, Direct Methods- Chains- Tapes, ranging, Tape corrections. **Prismatic Compass-** Bearings, included angles, Local Attraction, Magnetic Declination and dip.	**11**	Understand the fundamental principles, classifications, and objectives of surveying, including the use of scales, conventional symbols, and various surveying accessories.	1,2
II	**Leveling-** Types of levels and levelling staves, temporary adjustments, methods of levelling, booking and Determination of levels, Effect of Curvature of Earth and Refraction. **Contouring-** Characteristics and uses of Contours, methods of contour surveying. **Areas -**Determination of areas consisting of irregular boundary and regular boundary. **Volumes -**Determination of volume of earth work in cutting and embankments for level section, volume of borrow pits, capacity of reservoirs.	**10**	Acquire skills in measuring linear distances and directions using chains, tapes, and prismatic compasses, and comprehend corrections for tape measurements and the impact of magnetic declination.	1,2
III	**Theodolite Surveying:** Types of Theodolites, Fundamental Lines, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical levelling when base is accessible and inaccessible. **Traversing:** Methods of traversing, traverse computations and adjustments, Omitted measurements.	**10**	Master different leveling techniques, including the use of various types of levels and levelling staves, and understand the methods and applications of contour surveying.	1,2
IV	**Curves:** Types of curves and their necessity,	**7**	Learn to calculate	1,2

	elements of simple, compound, reverse, transition and vertical curves. **Tachometric Surveying:** Principles of Tacheometry, stadia and tangential methods of Tacheometry, **Modern Surveying Methods:** Principle and types of E.D.M. Instruments, Total station- advantages and Applications. Field Procedure for total station survey, Errors in Total Station Survey, Global Positioning System- Principle and Applications.		areas with irregular and regular boundaries and determine the volumes of earthwork in different contexts, such as cutting, embankments, borrow pits, and reservoir capacities.	
V	**Photogrammetry Surveying:** Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes.	**7**	Apply advanced surveying methods using theodolites, traverse computations, curves, tacheometry, and modern instruments like EDM, total stations, and GPS, along with understanding the principles and applications of photogrammetry.	1,2
Practical	1. To range a line more than one chain length and recording the details in a field book. 2. Profile leveling and cross section leveling with Dumpy level. 3. Trigonometric Constant 4. Close Compass Traversing to plot the existing layout or built up area 5. Measurement of horizontal and angles with Theodolite 6. Measurement of vertical angles with Theodolite Contouring of a given area by method of grid and prepare the contour map of that area.	**30**	Describe, illustrate and explain and apply the concepts of surveying in engineering prospect.	1,2,3,4

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Identify various surveying instruments used for mapping topographical drawings	**1,2,4**
2	Explain Methods of Leveling and setting Levels with different instruments	5, 7
3	Apply the principle and working of theodolite for measuring angles in vertical and horizontal planes.	**2,6,10**
4	Understand the methods of radiation and intersection for obtaining an area enclosed with in the traverse	8,10,12
5	Discuss the concept and principle of modern surveying.	**1,2,3,4,6**

SEMESTER – III									
Course Title	**Building Materials & Construction Practice**								
Course code	**23BTCE214R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T	**2**	**0**	**0**	**0**	**0**	**0**	**2**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ III semester of second year of the programme**								
Course Objectives	1. Develop knowledge of material science and behavior of various building materials used in construction. 2. Identify the construction materials required for the assigned work. 3. Provide procedural knowledge of the simple testing methods of cement, lime and concrete etc.								
CO1	Recognize the various phases associated with simple residential and commercial construction.								
CO2	Identify and use correctly a wide variety of hand and power tools associated with the construction industry.								
CO3	Understand current construction industry trends and become familiar with standards for quality construction and trends in building technology.								
CO4	Understand construction procedure of different components								
CO5	Understand the property, use, advantage and disadvantage of different material used in construction.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL ******
I	**Introduction-** Objectives, Requirements of Foundation, Aim Of Superstructure, Types Of Construction, Aim Of Site Inspection, Laying Out The Building Plan At Site For Foundation	**9**	Students will be able to explain the objectives and requirements of building foundations and the aim of superstructures. They will also gain proficiency in site inspection, planning, and the processes involved in laying out a building plan at the site, ensuring accurate foundation placement.	1, 2
II	**CONSTRUCTION PRACTICES** Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick — weather and water proof – roof finishes – acoustic and fire protection.	**9**	Students will learn to describe and sequence construction activities, ensuring proper coordination on-site. They will understand specifications and details for site clearance, earthwork, masonry, concrete block masonry, flooring, damp proofing, and various joint constructions.	2, 3, 4

			Additionally, they will be able to manage temporary structures, steel fabrication, and the installation of weatherproof and fire protection systems.	
III	**SUB STRUCTURE CONSTRUCTION** Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunneling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation.	**9**	Students will acquire knowledge of advanced substructure construction techniques, including box and pipe jacking, underwater diaphragm walls, basement construction, tunneling, and piling. They will be skilled in handling deep excavations, dewatering, and installing well points, as well as using stand-by equipment for underground excavations.	1, 2, 3, 4
IV	**SUPERSTRUCTURE CONSTRUCTION** Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors -Erection of articulated structures, braced domes and space decks.	**9**	Students will develop the ability to oversee the construction and erection of superstructures, including launching girders, bridge decks, offshore platforms, and special forms for shells. They will be proficient in techniques for handling and erecting heavy decks and lightweight components, supporting high-rise structures, and assembling articulated and braced dome structures.	1, 2
V	**CONSTRUCTION EQUIPMENT** Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers – Equipment for foundation and pile driving. Equipment for compaction, batching and mixing and concreting - Equipment for material handling and	**9**	Students will be able to identify and select appropriate construction equipment for diverse activities such as earthwork, foundation work, pile driving, and	2, 3, 4, 5

	erection of structures - Equipment for dredging, trenching, tunnelling.		concreting. They will also learn about equipment for compaction, batching, mixing, material handling, structure erection, dredging, trenching, and tunneling.	

TEXT BOOKS:

T1: Building construction: metric volume 1 by WR McKay.

T2: Fundamentals of building construction: materials and methods by Edward Allen and Joseph Iano.

REFERENCE BOOKS:

R1: Building materials and construction book with reference to B.C.Rangawala, Sushil Kumar, B.P.Bindra, A.Kamala.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Recognize the various phases associated with simple residential and commercial construction.	**1,2,3,4,5,6**
2	Identify and use correctly a wide variety of hand and power tools associated with the construction industry.	**2,4,5,6**
3	Understand current construction industry trends and become familiar with standards for quality construction and trends in building technology.	**2,6,7,8**
4	Understand construction procedure of different components	**1,4**
5	Understand the property, use, advantage and disadvantage of different material used in construction.	**2,3,6,7**

SEMESTER – III									
Course Title	**Basic Electronics for Civil Engineering Application**								
Course code	**23BTCE217R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 15T+30P	**1**	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ III semester of second year of the programme**								
Course Objectives	1. Understand the principles of electronic components, circuits, and semiconductor devices relevant to civil engineering applications. 2. Analyze electronic applications in civil engineering for designing, constructing, and maintaining infrastructure. 3. Acquire proficiency in digital electronics, including the understanding and application of logic gates for civil engineering applications.								
CO1	Attain foundational knowledge in electronic components, circuits, and semiconductor devices.								
CO2	Analyze electronic applications in civil engineering for infrastructure design and maintenance								
CO3	Attain digital electronics expertise, including logic gates, for civil engineering applications.								
CO4	Enhance problem-solving with hands-on application of electronic principles in civil projects								
CO5	Apply knowledge in projects, design tailored electronic systems, fostering practical skills.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	***Introduction to Electronics and Circuit Fundamentals*** ● Overview of electronics and its relevance to civil engineering ● Basic electronic components: resistors, capacitors, inductors ● Ohm's Law, Kirchhoff's Laws, and circuit analysis ● Series and parallel circuits	**7**	Understand basic electronic components and fundamental circuit analysis techniques using Ohm's Law and Kirchhoff's Laws in the context of civil engineering applications.	1, 2
II	***Semiconductor Devices and Diodes*** ● Introduction to semiconductor materials ● Diodes and their applications in civil engineering ● Zener diodes and voltage regulation ● Rectifiers and power supply basics	**7**	Comprehend the properties and applications of semiconductor materials and diodes, including rectification and voltage regulation in civil engineering.	1, 2
III	***Transistors and Amplifiers*** ● Bipolar Junction Transistors (BJTs) and Field Effect Transistors (FETs) ● Transistor amplifiers and amplifier configurations ● Operational amplifiers (Op-amps) and their applications	**7**	Learn the operation and applications of BJTs, FETs, and operational amplifiers, and their use in designing transistor amplifiers and amplifier configurations.	1, 2
IV	***Sensors and Instrumentation in Civil Engineering*** ● Overview of sensors and transducers	**7**	Gain knowledge of various sensors and transducers, their applications in civil	1, 2

	● Types of sensors relevant to civil engineering ● Data acquisition systems and instrumentation		engineering, and the principles of data acquisition systems and instrumentation.	
V	***Digital Electronics and Control Systems*** ● Basics of digital electronics ● Logic gates and digital circuits ● Introduction to control systems in civil engineering applications	**7**	Understand the basics of digital electronics, logic gates, digital circuits, and the introduction of control systems for civil engineering applications.	1, 2
Practical	1. To study about the components used in electronics laboratory 2. To Study the V-I characteristics of Forward Biased PN junction diode. 3. To Study the Reverse characteristics of Zener diode. 4. To Study the working of a diode as half wave rectifier with and without filter 5. To Study the working of a diode as full wave rectifier with and without filter. 6. To study the input and output characteristic of in CE configuration. 7. To study and verify the truth table of logic gates. 8. Practical Implementation of Electronic circuit based 35 projects in real world	**30**	Describe, illustrate and explain and apply the concepts of electronics engineering in engineering prospect.	1, 2, 3, 4

TEXT BOOKS:

T1: Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis NashelskyT2: Introduction to Control System Technology" by Robert N. Bateson

REFERENCE BOOKS:

R1: Basic Electronics, Santiram Kal, Prentice Hall

R2: Basic Electronics, BL Thareja, S.Chand Publishing

R3: All-in-One Electronics Simplified, A.K. Maini, Khanna Book Publishing

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Attain foundational knowledge in electronic components, circuits, and semiconductor devices	**1,3,4**
2	Analyze electronic applications in civil engineering for infrastructure design and maintenance	**1,2**
3	Attain digital electronics expertise, including logic gates, for civil engineering applications.	**7,9,10**
4	Enhance problem-solving with hands-on application of electronic principles in civil projects	**5,7**
5	Apply knowledge in projects, design tailored electronic systems, fostering practical skills.	**5,8**

SEMESTER – III										
Course Title	**Biology for Engineers**									
Course code	**23BTCE216R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T	**2**	**1**	**0**	**0**	**0**	**0**	**3**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Civil Engineering**								
Semester	**Fall/ III semester of second year of the programme**								
Course Objectives	1. To make connections between the various branches of science. 2. To identify and define the basic life processes, the basic needs and the chemistry of living things. 3. Biology for Engineers is designed to introduce engineering students to fundamental concepts in biology and their applications in engineering disciplines.								
CO1	Discuss biological sciences, its scope and perspectives.								
CO2	Discuss regarding the ecological energetics, its working mechanism, identification of organisms.								
CO3	Analyse the mechanism of transfer of character from parent to next generation.								
CO4	Explain the genetic code and production of proteins.								
CO5	Interprets the relation between various physiological processes of our body								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction Importance and scope of Biology as an important scientific discipline Branches of biological sciences Fundamental differences between science and engineering Comparison between the working mechanism of eye and camera, Bird flying and aircraft Biological observations of 18th century that lead to major discoveries in the world Steps in scientific research works Brownian motion in biological sciences	**10**	This unit introduces the importance and scope of biology, covering its branches and comparing fundamental differences between science and engineering. It explores biological systems such as the eye versus a camera and bird flight versus aircraft dynamics. Students also learn about key 18th-century biological observations and phenomena like Brownian motion.	1, 2
II	Classification & Ecology Classification of organisms, Basis of classification: Morphological, biochemical or ecological, level of organization, symmetry, germ layer organization, segmentation, notochord Concept of unicellular and multicellular organisms; prokaryotes and eukaryotes; Habitat & Adaptations Concept of Ecosystem: Structure & Function Energy flow in an ecosystem: Lindemann ten percent law Types of excretion: Ammonotelism, Ureotelism and Uricotelism Animal Kingdom: Characters of phylum with examples Model organisms for the study of biology come from different groups. E. coli, S. cerevisiae, D. Melanogaster, C. elegans, A. thaliana, M. musculus	**10**	Students study organism classification based on morphology, biochemistry, and ecology. They learn about unicellular and multicellular organisms, prokaryotes versus eukaryotes, and habitats and adaptations. The unit covers ecosystem structures, functions, energy flow, and types of excretion (ammonotelism, ureotelism, uricotelism).	2, 3, 4

III	Genetics & Biomolecules Concept of Allele; Dominance & Recessive; Monohybrid, Dihybrid & Trihybrid cross; Mitosis & Meiosis Mendel's laws, Concept of Segregation and Independent assortment Concept of co-dominance and incomplete dominance with illustrations Sex determination in human Genetic disorders in human beings DNA & RNA as genetic material Enzymes: Classification; Mechanism of enzyme action	**10**	This unit covers basic genetics including alleles, dominance, and recessiveness. Students learn about monohybrid, dihybrid, and trihybrid crosses, mitosis, meiosis, Mendel's laws, and genetic disorders. Biomolecules like DNA, RNA, enzymes (classification and mechanism), and genetic material are also discussed.	1, 2, 3, 4
IV	Information Transfer & Metabolism Genetic code: Properties Structure of DNA Concept of recombination and crossing over Proteins: Primary secondary, tertiary and quaternary structure Concept of Central dogma ATP as an energy currency of cell Concept of docking: Protein Ligand interaction	**10**	Students delve into the genetic code, DNA structure, recombination, crossing over, and protein structures (primary, secondary, tertiary, quaternary). The unit covers the central dogma of biology, ATP as an energy carrier, and protein-ligand interactions.	1, 2
V	Physiology Human Circulatory System: Heart and its working mechanism; Blood groups; Erythroblastosis fetalis Neuroendocrine system of human: Endocrine glands and their functions Human Excretory system: Structure of Kidney and Nephron Nervous system of human: Structure of neuron; Resting Membrane Potential; Origin and conduction of nerve impulse Human Respiratory System: Structure of lungs and exchange of gases Human digestive enzymes: Components and enzymes Mechanism of muscle contraction.	**5**	This unit focuses on human physiology, covering the circulatory system (heart function, blood groups), neuroendocrine system (endocrine glands and functions), excretory system (kidney structure, nephron), nervous system (neuron structure, nerve impulse), respiratory system (lung structure, gas exchange), digestive enzymes, and muscle contraction mechanisms.	2, 3, 4, 5

TEXT BOOKS:

T1: Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman,S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd

T2: Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons.

REFERENCE BOOKS:

R1: Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

R2: Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Discuss biological sciences, its scope and perspectives.	2,6,4
2	Discuss regarding the ecological energetics, its working mechanism, identification of organisms.	3,9,7
3	Analyse the mechanism of transfer of character from parent to next generation.	1,3,5
4	Explain the genetic code and production of proteins.	2,9
5	Interprets the relation between various physiological processes of our body	10,12

SEMESTER – III									
Course Title	**BUILDING INFORMATION MODELING IN CONSTRUCTION**								
Course code	**23BTCE215R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ III semester of second year of the programme**								
Course Objectives	1The concept of Building Information Modeling 2The workflow followed in industry during creation of BIM 3D model which includes building the discipline-based model and create the federated models. 3The Discipline based modeling of a building using Revit tool.								
CO1	Interpret the basic principles of BIM evolution and concept of BIM in lifecycle of project								
CO2	Understand the workflows of Design authoring followed in industry during creation of 3Dmodel.								
CO3	Create the discipline-based model of the building using Revit Software tool								
CO4	Evaluate the developed model for Clashes and rectify them using software tool.								
CO5	Illustrate the various emerging trends of BIM & concept of digital twin								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Introduction to BIM** Building Information Modeling - Evolution of Engineering from 2D drawings to BIM Model, Isometric view – Examples and Limitation, Building Information Modeling – Introduction & Process, Application. Design Authoring – Concepts and workflow, Introduction to stages of BIM Modeling process as per ISO 19650. Introduction to Revit, User Interface in Revit - Architecture, Structure, Systems, Insert, Annotate, View, Manage, Modify.	**6**	Develop a holistic understanding of the environment's components and principles governing life systems, metabolic processes, and biodiversity.	1,2
II	**Design Authoring in Revit Tool** Revit Architecture – File setup, creating levels and grids, Modeling Architectural elements, Schedules and Annotation, Sheet creation, Parameter creation. Revit Structure - File setup, creating levels and grids, modeling structural elements, Schedules and Annotation, Sheet creation, Parameter creation, Remove warnings. Revit Systems - File setup, creating levels and grids, HVAC, plumbing and piping, Fire line and sprinklers, Electrical lightings, Cable trays and parametric creation. Federated model – Concept, Strategy and benefits, Linking of Revit files and reload of links in Revit, exporting file formats, Rendering and Animation..	**6**	Acquire proficiency in ecological terminology, ecosystem structure, energy flow, trophic chains, and understand the relationships between ecosystem components and their ecological roles.	1,2
III	**Visualization, Clash check and LOD** Views in BIM Model, Visualization Modes,	**6**	Develop the ability to analyze environmental	1,2

	Walkthrough of the Model, Fly through the model, Layers & Properties, Concept of viewpoints, Sectioning and Visualization through Tablet and Mobile, Concept of BIM Kiosk & BIM Rooms, Visualization through Augment Reality (AR), Virtual Reality (VR) & Mixed Reality (MR) Clash Check – Types, Clash avoidance process, Clash Detection Process, Clash Detection Priority Matrix and Report generation, Clash Detection Rules, Report, Grouping, Clash Detection using software tool. Documentation and CDE (Common Data Environment) - Concept of Cloud Computing, Concept and Application of CDE, Setting up the workflow and process for CDE. Concept of LOD (Level of Development), preparation of LOD matrix and Progression matrix, LOD- Chart, Matrix, and Model Progression Matrix		pollution sources, causes, effects, and prevention methods, emphasizing sustainability and the interplay between energy, environment, and human activities.	
IV	**4D / Field BIM & Its Applications** Introduction to 4D / Field BIM - Concept of 4D, Project scheduling using Gantt Chart and its limitation, Demo - Synchronization of 4D BIM Model with project schedule, reviewing project progress w.r.t planned dates and actual dates, Generation of Reports Application of Field BIM/ 4D BIM - Understanding concept and usage of BIM in field for coordination- 3D Coordination and Visual Communication, Site utilization planning and Construction analysis, Application of wearables in coordination. 3D Control and planning Other Applications of Field BIM/ 4D BIM - Concept and usages of BIM in field for safety, disaster and risk analysis, digital fabrication and scan to BIM, Existing Condition Modelling, Phase Planning, As-built/ Record Models	**6**	Gain knowledge of sustainable water and forest resource management, understand human impacts on the environment, and explore concepts related to urbanization, global warming, and carbon sequestration.	1,2
V	**5D BIM and Beyond BIM** - Emerging Trends 5D BIM - Introduction concepts of 5D BIM, BIM Maturity LOD and General Practice of QTO, Cost Breakup structures, 5D BIM and cost control AIM: Introduction to Asset Information Model (AIM), COBie structures and Asset requirement- Discipline wise Infrastructure	**6**	Develop awareness of international agreements and protocols addressing global environmental challenges, understand the roles of society, NGOs, and government agencies, and familiarize oneself with national environmental policies and laws, including	1,2

	System, Classification code and Information Exchange, Information Exchange with Facility Management Beyond BIM - Concepts of Industrialization, IoT, Big Data, Data Analytics and their applications in BIM: Industrialization of Construction through BIM-DfMA, IoT in BIM BIM and Big data, Data Analytics using AI & MLFuture scope of BIM Applications: Smart Infrastructure and the need for connected infrastructure, Digital twins-Concepts and benefits, National Digital Twin or a City level Digital Twin in a Smart City, Fundamental requirements for the success of a Digital Twin and its uses, Digital Twin applications in diverse industries.		Environmental Impact Assessment processes.	

TEXT BOOKS:

T1: **IM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers**
Authors: Charles M. Eastman, Paul Teicholz, Rafael Sacks, and Kathleen Liston
Overview: This comprehensive guide covers BIM concepts, technologies, and practical applications across various disciplines in the construction industry.
Publisher: John Wiley & Sons
ISBN: 978-0470541371.

T2: **BIM and Construction Management: Proven Tools, Methods, and Workflows**
Author: Brad Hardin
Overview: This practical resource offers tools, methods, and workflows for integrating BIM into construction management processes, enhancing project delivery and collaboration.
Publisher: Sybex
ISBN: 978-0470402351

REFERENCE BOOKS:

R1: **Building Information Modeling: Planning and Managing Construction Projects with 4D CAD and Simulations**
Author: Willem Kymmell
Overview: Focuses on the planning and management aspects of BIM, emphasizing 4D CAD and simulations to improve project scheduling and visualization.
Publisher: McGraw-Hill Professional
ISBN: 978-0071494533

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Gain fundamental knowledge of Building Information Modeling, its importance, and its role in modern construction.	**1,3 & 4**
2	Develop proficiency in using industry-standard BIM software like Autodesk Revit, Navisworks, and other relevant tools	**1,2**
3	Create 3D models to visualize construction projects, improving design understanding and communication.	**7.9,10**
4	Utilize BIM to facilitate interdisciplinary collaboration among architects, engineers, and contractors	**5,7**
5	Use BIM tools to identify and resolve design conflicts before construction begins..	**5,8**

SEMESTER – III									
Course Title	**Computational Thinking for Problem Solving**								
Course code	**23MOCE212R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 15T	**0**	**0**	**0**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ III semester of second year of the programme**								
Course Objectives	1.To understand computational thinking concepts by using the principles of decomposition, abstraction, pattern recognition, and algorithm design as fundamental tools for solving problems. 2.To develop Problem-Solving Strategies by Breaking down complex problems into manageable components and devise structured, step-by-step solutions. 3.To promote innovation and creativity by encouraging innovative thinking and creative approaches to designing computational solutions for complex, real-world problems.								
CO1	To apply computational thinking across discipline.								
CO2	To understand and apply computational thinking concepts.								
CO3	To analyze and solve problems systematically.								
CO4	To use computational tools and programming basics.								
CO5	To develop critical thinking and Innovation Skills.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Definition and importance of computational thinking** Core concepts: Decomposition, abstraction, pattern recognition, and algorithm design Problem-solving frameworks and systematic approaches. Real-world application computational thinking and discipline. Problem analysis and breaking down complex problems. Designing step-by-step solutions (algorithms). Representing algorithms using flowcharts and pseudocode Basic algorithmic constructs: Sequencing, selection, and iteration. Case studies in algorithmic problem- solving	**6**	Understand the principles of computational thinking. Identify real-world problems suitable for computational approaches. Develop and represent algorithms for given problems. Apply logical reasoning to design structured solutions..	1,2
II	**Introduction to programming concepts:** Variables, data types, operators. Writing basic programs for problem- solving. Control structures: Conditionals, loops. Functions and modular programming. Debugging and testing solutions. Understanding and organizing data: Arrays, lists	**6**	Write and execute basic programs to solve computational problems. Understand and apply control structures in programming. Use computational tools to manipulate and analyze data. Automate processes to optimize problem- solving tasks.	1,2
III	**Computational thinking in emerging fields**: Artificial Intelligence, Data Science, Robotics. Optimization techniques and evaluating solution efficiency. Ethical considerations in computational problem-solving.	**6**	Apply computational thinking to solve interdisciplinary problems. Evaluate and optimize solutions for	1,2

	Preparing for advanced studies in computational sciences. Capstone project: Solving a real-world problem using computational thinking principles		performance and scalability.	
IV	**Data Structures and Their Role in Problem Solving** Lists, Arrays, and Strings,Stacks and Queues, Linked Lists,Trees and Graphs (Introduction), Searching and Sorting Algorithms	**6**	Understand the fundamental differences and applications of lists, arrays, and strings. Implement arrays and lists in programming to store and manipulate data efficiently.Perform basic operations on strings (concatenation, searching, pattern matching, etc. Analyze the time and space complexity of operations on arrays, lists, and strings.	1,2
V	**Case Studies and Applications** Computational Thinking in Science, Engineering, and BusinessReal-world Problems and Their SolutionsTeam-Based Problem-Solving Projects	**6**	Understand how computational thinking is applied in various disciplines such as science, engineering, and business.Analyze real-world problems in these fields and identify computational approaches to solve them. Apply decomposition, pattern recognition, abstraction, and algorithm design to industry-specific challenges. Develop efficient models and simulations to optimize processes in scientific research, engineering design, and business decision-making.national environmental policies and laws, including Environmental Impact Assessment processes.	1,2

Text Books:

T1 David D. Riley and Kenny A. Hunt "Computational thinking for the Modern problem solver".

T2 Jane Krauss and Kiki Prottsman "Computational thinking and coding for every student: The Teacher guide"

T3 Mark J. Guzdial and Barbara Ericson, ""Introduction to Computing and Programming in Python: A Approach"

Reference Books:

R1 Peter J.Denning and Matti Tedre "Computational Thinking".

R2 Daniel Zingaro 'The art of Computational Tninking".

R3 Paolo Ferragina and Fabrizio Luccio "Computational Thinking: A Problem-Based Introduction".ent aspects of BIM, emphasizing 4D CAD and simulations to improve project scheduling and visualization.
Publisher: McGraw-Hill Professional
ISBN: 978-0071494533

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	To apply computational thinking across disciplines.	**1,3 & 5**
2	To understand and apply computational thinking concepts	**1,2,4**
3	To analyze and solve problems systematically.	**1,4,5**
4	To use computational tools and programming basics.	**2,4**
5	To develop critical thinking and innovation skills.	**5,8**

SEMESTER – III									
Course Title	**Field Based Trainig**								
Course code	**23BTCE217R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30P	**0**	**0**	**0**	**0**	**16**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech Civil Engineering**								
Semester	**Fall/ III semester of second year of the programme**								
Course Objectives	1.Equip students with advanced AutoCAD skills necessary for civil engineering projects, enhancing their technical proficiency and professional competency. 2.Develop students' ability to create precise engineering drawings and detailed designs, fostering attention to detail and accuracy in their work. 3.Enhance problem-solving and critical thinking abilities through practical AutoCAD applications, preparing students for real-world engineering challenges.								
CO1	Demonstrate proficiency in using AutoCAD tools for creating complex civil engineering drawings.								
CO2	Apply advanced AutoCAD techniques to design detailed structural plans and layouts.								
CO3	Develop the ability to interpret and convert conceptual sketches into precise digital drawings.								
CO4	Integrate AutoCAD skills with other engineering tools and software for comprehensive project development.								
CO5	Exhibit improved problem-solving skills and technical knowledge through practical AutoCAD applications.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Introduction to Advanced AutoCAD Features:** Overview of advanced drawing tools, customization options, and productivity features.	4	Master advanced drawing tools and customization features in AutoCAD.	1, 2
II	**Creating Detailed Civil Engineering Drawings:** Techniques for creating detailed structural and architectural drawings, including layering, dimensioning, and annotation.	4	Create precise and detailed civil engineering drawings with advanced techniques.	2, 3
III	**3D Modeling and Visualization:** Introduction to 3D modeling, rendering, and visualization techniques in AutoCAD for civil engineering applications.	4	Develop 3D models and visualize civil engineering designs using AutoCAD.	3, 4
IV	**Integration with Other Tools:** Methods for integrating AutoCAD with other engineering software and tools, including importing/exporting files and collaborative project workflows.	4	Integrate AutoCAD skills with other tools for comprehensive engineering project development.	4, 5
V	**Practical Applications and Projects:** Hands-on projects and case studies to apply AutoCAD skills in real-world civil engineering scenarios, including project presentation and documentation.	4	Apply AutoCAD skills in practical projects, demonstrating problem-solving and technical proficiency.	5

Textbooks:

T1: "Field Research: A Sourcebook and Field Manual" – Robert G. Burgess

T2: "Methods in Field Biology" – Robert H. Giles

T3: "Fieldwork Ready: An Introductory Guide to Field Research for Agriculture, Environment, and Earth Sciences" – Sara E. Vero

T4: "Research Methods in Education" – Louis Cohen, Lawrence Manion, and Keith Morrison (For Education Field Training)

Reference Books:

R1: "The Field Guide to Fieldwork" – Bruce L. Berg

R2:"Handbook of Field Experiments" – Abhijit V. Banerjee and Esther Duflo

R3:"Doing Fieldwork in Areas of International Intervention" – Berit Bliesemann de Guevara

R4:"Practical Field Ecology: A Project Guide" – C. Philip Wheater, James R. Bell, Penny A. Cook

R5:"Field and Laboratory Methods for General Ecology" – James E. Brower, Jerrold H. Zar

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Demonstrate proficiency in using AutoCAD tools for creating complex civil engineering drawings.	**5, 7**
2	Apply advanced AutoCAD techniques to design detailed structural plans and layouts.	**8**
3	Develop the ability to interpret and convert conceptual sketches into precise digital drawings.	**7.9,10**
4	Integrate AutoCAD skills with other engineering tools and software for comprehensive project development.	**11,12**
5	Exhibit improved problem-solving skills and technical knowledge through practical AutoCAD applications.	**10**

SEMESTER – III										
Course Title	**Basic Life Saving Skills**									
Course code	**23UULS212R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**	
		Total hours: 60P	**0**	**0**	**4**	**0**	**0**	**0**	**1**	
Pre-requisite	**Nil**	**Co-requisite**	**Nil**							
Programme	**Bachelor of Technology in Civil Engineering**									
Semester	**Fall / III semester of second year of the programme**									
Course Objectives	1. Equip students with essential knowledge and skills in basic life-saving techniques, including CPR and first aid. 2. Develop the ability to assess emergency situations and respond effectively to various types of injuries and medical conditions. 3. Foster an understanding of preventive measures and safety protocols to minimize the occurrence of emergencies and enhance overall community safety.									
CO1	Demonstrate proficiency in performing CPR, administering first aid, and using automated external defibrillators (AEDs).									
CO2	Exhibit the ability to quickly assess emergency situations and make informed decisions to provide immediate care									
CO3	Understand and apply basic safety protocols to prevent accidents and handle emergencies efficiently.									
CO4	Display confidence and competence in handling a range of medical emergencies, from minor injuries to life-threatening conditions.									
CO5	Advocate for and promote safety and preventive measures within the community, contributing to a safer environment.									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Unit 1: Introduction to Life-Saving Skills** • Importance of life-saving skills • Basic principles of first aid • Legal and ethical aspects of providing first aid • Personal safety and use of protective equipment • Assessing the scene of an emergency	5	This unit covers the importance of life-saving skills and the basic principles of first aid. It discusses the legal and ethical aspects of providing first aid, emphasizing the importance of personal safety and the use of protective equipment. Students will learn how to assess the scene of an emergency to ensure safety and efficiency in providing aid.	1, 2
II	**Unit 2: Cardiopulmonary Resuscitation (CPR) and Automated External Defibrillators (AED)** • Anatomy and physiology relevant to CPR • Steps for performing CPR on adults, children, and infants • Use of an AED: principles and procedures • Hands-on practice sessions for CPR and AED use • Recognizing and responding to cardiac emergencies	5	Students will delve into the anatomy and physiology relevant to CPR, learning the steps for performing CPR on adults, children, and infants. This unit includes the principles and procedures for using an AED, with hands-on practice sessions to ensure proficiency. The unit also focuses on recognizing and responding to cardiac emergencies.	2, 3, 4

III	**Unit 3: First Aid Techniques** • Managing bleeding, wounds, burns, and fractures • Providing first aid for choking, poisoning, and shock • Practical sessions for bandaging, splinting, and other first aid procedures	5	This unit teaches essential first aid techniques for managing bleeding, wounds, burns, and fractures. Students will learn how to provide first aid for choking, poisoning, and shock. The unit includes practical sessions to practice bandaging, splinting, and other first aid procedures	1, 2, 3, 4
IV	**Unit 4: Emergency Medical Conditions** • Recognizing symptoms of heart attacks, strokes, asthma attacks, and diabetic emergencies • Immediate response actions for medical emergencies • Ongoing care until professional help arrives • Importance of staying calm and effective communication during emergencies	5	Students will explore common medical emergencies such as heart attacks, strokes, asthma attacks, and diabetic emergencies. This unit covers the recognition of symptoms, immediate response actions, and ongoing care until professional help arrives. Emphasis is placed on staying calm and effective communication during emergencies.	1, 2
V	**Unit 5: Safety and Prevention** • Home and workplace safety measures • Fire prevention and electrical safety • Accident prevention strategies • Community safety programs • Advocating for safety and preventive measures within the community	5	The final unit focuses on preventive measures to minimize the occurrence of emergencies. Students will learn about home and workplace safety, including fire prevention, electrical safety, and accident prevention. The unit also covers community safety programs and how to advocate for safety and preventive measures within the community.	2, 3, 4, 5

Textbooks:

T1:"First Aid Manual" by British Red Cross, St John Ambulance, St Andrew's First Aid, 2016.
T2:"Emergency Care and Transportation of the Sick and Injured" by American Academy of Orthopaedic Surgeons (AAOS), 2016.
T3:"Advanced First Aid, CPR, and AED" by American Academy of Orthopaedic Surgeons (AAOS), 2011.

Reference Books:

R1:"Wilderness First Responder: How to Recognize, Treat, and Prevent Emergencies in the Backcountry" by Buck Tilton, 2010.
R2:"Prehospital Trauma Life Support" by National Association of Emergency Medical Technicians (NAEMT), 2014.
R3:"Fundamentals of Basic Emergency Care" by Richard W. O. Beebe, Deborah L. Funk, 2013.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Demonstrate proficiency in performing CPR, administering first aid, and using automated external defibrillators (AEDs).	2,3,4
2	Exhibit the ability to quickly assess emergency situations and make informed decisions to provide immediate care	1,2,4
3	Understand and apply basic safety protocols to prevent accidents and handle emergencies efficiently.	3,5,6
4	Display confidence and competence in handling a range of medical emergencies, from minor injuries to life-threatening conditions.	3,2,5
5	Advocate for and promote safety and preventive measures within the community, contributing to a safer environment.	2,3,7

SEMESTER – III										
Course Title	**Introductory English for Engineers**									
Course code	**23UBPD214R**	**Total credits: 1.5**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45P	**0**	**0**	**3**	**0**	**0**	**0**	**1.5**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Civil Engineering**								
Semester	**Fall / III semester of second year of the programme**								
Course Objectives	1.To capacitate the students with mastery over Basic English grammar. 2.To enable the students to communicate confidently with a focus on listening and speaking skills. 3.With the help of the basics of Phonetics, the students will be able to pronounce words correctly.								
CO1	Understand and correctly use various grammar elements, including parts of speech, articles, auxiliary verbs, determiners, and degrees of comparison, to construct different types of sentences.								
CO2	Analyze and comprehend written texts through comprehension exercises, demonstrating an understanding of sentence construction and types.								
CO3	Understand the process and purpose of listening, differentiate between listening and hearing, identify factors affecting listening, and implement strategies to improve their listening skills.								
CO4	Develop speaking skills by introducing themselves, practicing self-discovery, improving pronunciation through phonetics, delivering extempore speeches, and using video recordings for self-reflection.								
CO5	Understand the fundamentals of communication, including its types, purposes, barriers, and importance, and apply this knowledge to improve their communication skills in both formal and informal contexts.								

Unit- No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Module 1 - Grammar I. Parts of Speech I. Articles I. Auxiliary Verbs Affirmative and Negative Sentences	**6**	In this module, students will master the foundational elements of grammar. They will explore the parts of speech, including nouns, pronouns, verbs, adjectives, adverbs, prepositions, conjunctions, and interjections. Understanding articles (definite and indefinite) and their correct usage will be emphasized. Students will learn about auxiliary verbs and their role in forming tenses, voices, and moods. The module will also cover the construction of affirmative and negative sentences, helping students to build grammatically correct and meaningful sentences.	1, 2
II	Module 2- Grammar I. Determiners I. Sentence Construction I. Types of Sentences (Assertive, Imperative, etc.) . Degree of Comparison	**7**	Building on the basics, this module will delve into determiners and their functions in sentences. Students will learn sentence construction techniques and the different types of sentences (assertive, imperative, interrogative,	2, 3, 4

	. Comprehension Exercises		and exclamatory). The concept of the degree of comparison (positive, comparative, and superlative) will be explored. The module will also	
III	Module 3 - Listening Skills i. What is listening? i. The Process of Listening i. Factors that adversely affect Listening . Difference between Listening and Hearing, .Purpose and Importance of Effective Listening I. How to Improve Listening Process.	**6**	Students will be introduced to the fundamentals of listening, distinguishing it from hearing. They will study the process of listening and identify factors that adversely affect it. The module will highlight the purpose and importance of effective listening and provide strategies to improve the listening process. By understanding these concepts, students will enhance their ability to comprehend and retain spoken information.	1, 2, 3, 4
IV	Module 4 - Speaking Skills I. Introducing yourself I. Self-discovery I. Basics of Phonetics, pronunciation . Extempore speech . Video Recording for Self-reflection	**5**	This module focuses on developing students' speaking abilities. They will learn how to introduce themselves and engage in self-discovery to build confidence. Basics of phonetics and pronunciation will be covered to ensure clear and correct speech. Students will practice extempore speech to improve their ability to speak spontaneously. Video recording for self-reflection will be used as a tool for students to evaluate and improve their speaking skills.	1, 2
V	Module 5- Communication Skills I. Introduction to Communication, I. Importance of Communication Skills, I. Purpose of Communication, . Types of Communication, . Formal and informal communication I. Importance of Communication, I. Barriers to Communication, I. How to improve/ tips to improve Communication skills. .Responding to different questions in various situations (formal/informal)	**5**	Students will gain a comprehensive understanding of communication and its significance. The module will cover the types and purposes of communication, distinguishing between formal and informal contexts. Students will learn about the importance of communication skills and the barriers that can impede effective communication. Tips and strategies to improve communication skills will be provided. The module will also include exercises on responding to different questions in various situations, enhancing students' adaptability and effectiveness in both formal and informal interactions.	2, 3, 4, 5

Text Books:

T1. Chaturvedi, P.D., Chaturvedi Mukesh, 2011.Business Communication: Concepts, Cases and Applications, second edition, Pearson, Noida

T2. Alex K., Chand, S, 2009. Soft Skills: Know Yourself and Know the World, first edition, S. Chand & Company Ltd.: New Delhi.

Reference Books:

R1. Quirk, Randolp. (2010) A Comprehensive Grammar of the English Language by Randolph Quirk, Sidney Greenbaum, Pearson Education India

R2. Marks, Jonathan. (2017) IELTS Advantage Speaking and Listening Skills: A step-by-step guide to a high IELTS speaking and listening score. Book + CD-ROM, Delta Publishing by Klett

Other Learning Resources:

3. https://youtu.be/bEB8-SWMYhI
4. https://youtu.be/-zZau_dttRY

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

SN	Course Outcome (CO)	Mapped Program Outcome
1	Understand and correctly use various grammar elements, including parts of speech, articles, auxiliary verbs, determiners, and degrees of comparison, to construct different types of sentences.	1,2
2	Analyze and comprehend written texts through comprehension exercises, demonstrating an understanding of sentence construction and types.	3,5
3	Understand the process and purpose of listening, differentiate between listening and hearing, identify factors affecting listening, and implement strategies to improve their listening skills.	6,9,10
4	Develop speaking skills by introducing themselves, practicing self-discovery, improving pronunciation through phonetics, delivering extempore speeches, and using video recordings for self-reflection.	5,9
5	Understand the fundamentals of communication, including its types, purposes, barriers, and importance, and apply this knowledge to improve their communication skills in both formal and informal contexts.	1, 4,11

SEMESTER – III									
Course Title	**Introduction to Psychology**								
Course code	**23MOCE213R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 15T	**0**	**0**	**0**	**0**	**0**	**0**	**1**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Civil Engineering**								
Semester	**Fall / III semester of second year of the programme**								
Course Objectives	1. To identify the stages of human development. 2.To understand the nature of psychological disorders. 3.To apply psychological principles to real-life situations.								
CO1	An ability to explain the interactions between biological, cognitive, and environmental factors that shape human behavior.								
CO2	An understanding of identifying and evaluating the application of psychological concepts and theories to real-life situations, such as motivation, learning, and relationships								
CO3	An ability to define psychology, its history, and its major subfields								
CO4	An ability to understand the scientific method and its application to psychology.								
CO5	An ability to express psychological concepts and ideas clearly and concisely..								

Unit- No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Introduction to Psychology** Overview of psychology as a science, Branches of psychology, Research methods in psychology, Ethics in psychology	**6**	Gain knowledge of the fundamental principles, theories, and history of psychology, including key perspectives such as behavioral, cognitive, biological, and humanistic psychology.	1, 2
II	**Biological Psychology** Structure and function of the brain, Sensory systems, Neurotransmitters and hormones, Sleep and dreams	**7**	Apply psychological principles to real-world scenarios, including mental health, social interactions, learning, and decision-making processes.	2, 3, 4
III	**Sensation, Perception, and Learning** Sensory systems and perception, Classical conditioning, Operant conditioning, Learning theories	**6**	Develop analytical skills to evaluate psychological research, understand experimental methods, and critically assess claims about human behavior..	1, 2, 3, 4
IV	**Motivation, Emotion, and Personality** Motivation theories, Emotion theories, Personality theories, Assessment and research methods	**5**	Recognize how psychological concepts vary across cultures, genders, and life stages, fostering empathy and appreciation for individual differences.	1, 2
V	**Abnormal Psychology and Therapy** Defining abnormal behavior, Anxiety disorders, Mood disorders, Therapy approaches.	**5**	Understand ethical considerations in psychological research and practice, ensuring responsible application of psychological knowledge in various professional and personal settings.	2, 3, 4, 5

	.Responding to different questions in various situations (formal/informal)			

Textbooks:

T1: "Psychology" – Richard S. Atkinson & Ernest R. Hilgard
T2: "Introduction to Psychology" – James W. Kalat
T3: "Psychology: The Science of Mind and Behavior" – Richard Gross
T4: "Understanding Psychology" – Robert S. Feldman
T5: "Psychology" – Saundra K. Ciccarelli & J. Noland White

Reference Books:

R1: "The Principles of Psychology" – William James (Classic Work)
R2:"Psychology and Life" – Richard J. Gerrig & Philip G. Zimbardo

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

SN	Course Outcome (CO)	Mapped Program Outcome
1	Gain knowledge of the fundamental principles, theories, and history of psychology, including key perspectives such as behavioral, cognitive, biological, and humanistic psychology.	1,2
2	Apply psychological principles to real-world scenarios, including mental health, social interactions, learning, and decision-making processes.	3,5
3	Develop analytical skills to evaluate psychological research, understand experimental methods, and critically assess claims about human behavior.	6,9,10
4	Recognize how psychological concepts vary across cultures, genders, and life stages, fostering empathy and appreciation for individual differences.	5,9
5	Understand ethical considerations in psychological research and practice, ensuring responsible application of psychological knowledge in various professional and personal settings.	1, 4,11

SEMESTER – IV									
Course Title	**Soil Mechanics & Geotechnical Engineering**								
Course code	**23BTCE222R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T+30P	**3**	**0**	**2**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ IV semester of second year of the programme**								
Course Objectives	1. To focus on the study of soil behavior and properties to design secure foundations, assess slope stability, and conduct geotechnical investigations for construction and environmental projects. 2. To impart knowledge on the various factors governing the Engineering behaviour of soils and the suitability of soils for various Geotechnical Engineering applications. 3. To characterize the failure criteria and to evaluate the shear strength and compressibility parameters of soils.								
CO1	Distinguish various soil type based on their properties and behabior.								
CO2	Calculate soil parameters of soils at different site condition.								
CO3	Predict the occuarance of failure of sub-soil beneath any foundation.								
CO4	Determine the bearing capacity of soil and possible settlement of the foundation.								
CO5	Test various direct and indirect soil exploration.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	***Introduction***–Origin and types of soils, Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weights voids ratio- moisture content, unit weight- percent air voids, saturation- moisture content, moisture content- specific gravity etc. Determination of various parameters (such as: Moisture content, Specific gravity, Unit weight of soil), Plasticity Characteristics of Soil - Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and Consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit, Classification of Soils.	**11**	Understand the origin, types, and basic properties of soils, and establish relationships between key parameters such as moisture content, unit weights, and void ratios.	1,2
II	***Permeability of Soil***- Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method, Seepage Analysis-Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets. Effective Stress Principle - Introduction, effective stress principle, nature of effective stress, effect of water table, Stresses in soils.	**10**	Learn and apply Darcy's law to determine soil permeability using laboratory methods and perform seepage analysis through the construction of flow nets.	1,2
III	***Compression of soil:***Compaction of Soil-	**10**	Grasp the concept of	1,2

	Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. *Consolidation of Soil* - Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation,.		effective stress, analyze the impact of the water table on soil stress, and differentiate between soil compaction and consolidation processes.	
IV	***Shear Strength***- Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, unconfined compression test, vane shear test, Types of slopes and their failure mechanisms, factor of safety, Introduction to of finite and infinite slopes.	**7**	Analyze soil shear strength using Mohr-Coulomb theory and various shear tests, and understand the mechanisms of slope failures and the factor of safety in slope stability.	1,2
V	***Soil Exploration***- Introduction, methods of site exploration and soil investigation, methods of boring, soil samplers, sampling procedures, trail pits, borings, penetrometer tests, analysis of borehole logs, geophysical methods.	**7**	Acquire knowledge of site exploration methods, soil sampling techniques, and the interpretation of borehole data for geotechnical investigations.	1,2
Practical	1. Moisture content by oven dry method 2. Field density by core cutter method 3. Sieve analysis 4. Liquid limit test by Casagrande Apparatus 5. Plastic limit test 6. Standard compaction test (OMC & MDD) 7. Consolidation test 8. Direct shear test 9. Unconfined compression test	**30**	Describe, illustrate and explain and apply the concepts of geotechnical engineering in engineering prospect.	1,2,3,4

TEXT BOOKS:

T1: Ranjan G., Rao A.S.R (2011), Basic and Applied Soil Mechanics
T2: Saran S. (2015) Analysis and Design of Substructures
T3:Punmia B.C. (2005), Soil Mechanics And Foundation Engineering

REFERENCE BOOKS:

R1: Soil Mechanics by Craig R.F., Chapman & Hall
R2: Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
R3: An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
R4: Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and Gholamreza Mesri.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Distinguish various soil type based on their properties and behabior.	**1,3 & 4**
2	Calculate soil parameters of soils at different site condition.	**1,2**
3	Predict the occuarance of failure of sub-soil beneath any foundation.	**7.9,10**
4	Determine the bearing capacity of soil and possible settlement of the foundation.	**5,7**
5	Test various direct and indirect soil exploration.	**5,8**

SEMESTER – IV									
Course Title	**Fluid mechanics & Hydraulics Engineering**								
Course code	**23BTCE213R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T+30P	**3**	**0**	**2**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ IV semester of second year of the programme**								
Course Objectives	1. The course introduces fundamental fluid mechanics principles, including fluid statics, fluid dynamics, and flow measurement, emphasizing their application across various engineering fields such as mechanical, civil, and aerospace engineering. 2. Students engage in theoretical lectures, laboratory experiments, and computational exercises to gain a deep understanding of fluid behavior, enhancing their problem-solving skills and critical analysis of fluid flow phenomena. 3. The course equips students with the knowledge and skills necessary to apply fluid mechanics principles to real-world engineering problems, preparing them for advanced study and professional practice in the field.								
CO1	Determine the various fluid characteristics that affect fluid behaviour.								
CO2	Explain the fluid pressure and about its measurements.								
CO3	Summarize the various fluid flow.								
CO4	Apply the conservation laws for fluids in fluid dynamics.								
CO5	Discuss various non-dimensional parameters of fluid flow.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility. **Laminar Flow**- Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity. **Turbulent Flow**- Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram. **Boundary Layer Analysis**-Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and	**11**	Comprehend fundamental fluid properties such as viscosity, density, surface tension, and compressibility, and understand the distinction between fluids and solids.	1,2

	average friction coefficients. Separation and Control.			
II	Fluid Statics - Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, UTube Differential Manometer, Micromanometers. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.	**10**	Analyze fluid pressure variations and measure pressure using various manometers and gauges, while understanding hydrostatic forces and buoyancy on submerged and floating bodies.	1,2
III	Fluid Kinematics-Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates	**10**	Classify different types of fluid flow, understand flow patterns and visualization methods, and apply the continuity equation in one, two, and three dimensions.	1,2
IV	Fluid Dynamics- Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation : venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced **Hydraulic Jump-** Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges. Dynamics of Fluid Flow- Momentum principle, applications: Force on plates, pipe bends, moments of momentum equation,	**7**	Apply Euler's and Bernoulli's equations to solve fluid flow problems and analyze forces in practical applications like venturimeters, orifice meters, and pipe bends.	1,2
V	Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π-Theorem. **Flow through Pipes:** Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power	**7**	Utilize dimensional analysis and understand dimensionless numbers like Reynolds, Froude, Mach, Weber, and Euler for modeling and analyzing fluid flow similarity.	1,2

	transmissionthrough pipes, nozzles. Analysis of pipe networks: Hardy Cross method, water hammer in pipes and control measures, branching of pipes, three reservoir problem.			
Practical	1. Bernoulli's Theorem 2. Discharge Over Notches ● Triangular ● Rectangular 3. Impact Of Jet On Vanes ● Flat ● Hemispherical 4. Flow Through Orifice And Mouthpiece 5. Reynolds's Number Determination 6. Losses Due To Pipe Friction 7. Determination of metacentric height of a given ship model	**30**	Describe, illustrate and explain and apply the properties of fluid in engineering prospect.	1,2,3,4

TEXT BOOKS:

T1: Dr. D.S. Kumar , "Fluid Mechanics and Fluid Power Engineering".

T2: Dr. R.K.Bansal, " A textbook on Fluid Mechanics and Hydraulic Machines", Laxmi Publication ltd

T3: Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010.

REFERENCE BOOKS:

R1: Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House.

R2: Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.

R3: Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, Mc Graw Hill.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Determine the various fluid characteristics that affect fluid behaviour.	**1,3 & 4**
2	Explain the fluid pressure and about its measurements.	**1,2**
3	Summarize the various fluid flow.	**7.9,10**
4	Apply the conservation laws for fluids in fluid dynamics.	**5,7**
5	Discuss various non-dimensional parameters of fluid flow.	**5,8**

SEMESTER – IV									
Course Title	**Basic Acclimatizing Skills (BAS)**								
Course code	**23UULS221R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 60P	**0**	**0**	**4**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ IV semester of second year of the programme**								
Course Objectives	1. Develop students' abilities in technical writing, speaking, and presentations to effectively convey engineering concepts and solutions.Analyze electronic applications in civil engineering for designing, constructing, and maintaining infrastructure. 2. Focus on crafting professional resumes and cover letters tailored for engineering positions, improving students' chances of securing employment. 3. Strengthen teamwork abilities and prepare students for job interviews through practical exercises and targeted training, enhancing their readiness for engineering careers.								
CO1	Demonstrate clear and concise technical communication in both written and oral formats, incorporating industry-specific terminology.								
CO2	Develop expertise in crafting resumes, cover letters, and technical reports to effectively showcase engineering qualifications.								
CO3	Acquire proficiency in creating and delivering impactful presentations, utilizing visual aids to convey engineering concepts to diverse audiences.								
CO4	Cultivate effective interpersonal skills for collaborative teamwork, emphasizing active listening, conflict resolution, and clear communication within engineering contexts.								
CO5	Prepare for engineering job interviews by articulating qualifications, experiences, and career goals, addressing both technical and behavioral questions confidently.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Unit 1- Introduction to Accommodation Management • Telephone handling technique • Organizing of Rooms. • Cleaning equipments and uses. • Bed making Process.	**4**	Develop skills in telephone handling, room organization, cleaning equipment usage, and bed-making processes.	1,2
II	Unit-2- Fundamental of Cooking • Uses of basic cooking equipments • Uses of fire & Fuel • Different cuts of vegetables • Uses of herbs & spices • Regional Food Habits	**4**	Gain proficiency in using basic cooking equipment, fire, and fuel, as well as preparing different cuts of vegetables, utilizing herbs, spices, and understanding regional food habits.	1,2
III	Unit 3- Food and Beverage skills • Introduction to catering industry • Types menus and beverages • Identifications of Cutlery, crockery & glassware • Table etiquettes or manners • Customer handling skills or Situation Handling	**4**	Understand catering industry basics, menu types, beverage identification, table etiquette, and customer handling skills.	1,2
IV	Unit 4- Travel management • Travel Documentation (Types) • Application of passport & Visa • Tourism products (UNESCO sites)	**4**	Learn about travel documentation, passport and visa applications, tourism products like	1,2

	• Types of logistics in travel and tourism management		UNESCO sites, and various logistics in travel and tourism management.	
V	Unit 5- Basic Hospitality Skills • Various Egg Preparations • Canapés preparations • Mocktail & Shakes Preparations • Butter Rice / Lemon Rice • Various Lentils Preparations • 1 non-veg preparation/ 1 veg preparation	**4**	Master various egg preparations, canapés, mocktails, shakes, rice dishes, lentil preparations, and both vegetarian and non-vegetarian dishes.	1,2

TEXT BOOKS:

T1: Arora K (2011). Theory of cookery, Frank brothers & company (pub) pvt ltd-New Delhi.

T2: Bruce H. Axler, Carol A. Litrides (2010) Food and Beverage Service Volume 1 of Wiley Professional Restauranteur, Guides.

T3: Mohammed Zulfikar (2010) - Introductions to Tourism and Hotel Industry Introduction to Tourism and Hotel Industry. Vikas Publishing.

T4: Sudhir Andrews (2013) Food and Beverage Service: A Training Manual, Tata McGraw Hill, 2013.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Demonstrate clear and concise technical communication in both written and oral formats, incorporating industry-specific terminology.	**5, 7**
2	Develop expertise in crafting resumes, cover letters, and technical reports to effectively showcase engineering qualifications.	**8**
3	Acquire proficiency in creating and delivering impactful presentations, utilizing visual aids to convey engineering concepts to diverse audiences.	**7.9,10**
4	Cultivate effective interpersonal skills for collaborative teamwork, emphasizing active listening, conflict resolution, and clear communication within engineering contexts.	**11,12**
5	Prepare for engineering job interviews by articulating qualifications, experiences, and career goals, addressing both technical and behavioral questions confidently.	**10**

SEMESTER – IV										
Course Title	**English Language Proficiency For Engineers**									
Course code	**23UBPD224R**	**Total credits: 1.5** **Total hours: 45P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**	
			0	**0**	**3**	**0**	**0**	**0**	**1.5**	
Pre-requisite	**Nil**	**Co-requisite**	**Nil**							
Programme	**B. Tech in Civil Engineering**									
Semester	**Winter/ IV semester of second year of the programme**									
Course Objectives	1. Develop students' abilities in technical writing, speaking, and presentations to effectively convey engineering concepts and solutions.Analyze electronic applications in civil engineering for designing, constructing, and maintaining infrastructure. 2. Focus on crafting professional resumes and cover letters tailored for engineering positions, improving students' chances of securing employment. 3. Strengthen teamwork abilities and prepare students for job interviews through practical exercises and targeted training, enhancing their readiness for engineering careers.									
CO1	Demonstrate clear and concise technical communication in both written and oral formats, incorporating industry-specific terminology.									
CO2	Develop expertise in crafting resumes, cover letters, and technical reports to effectively showcase engineering qualifications.									
CO3	Acquire proficiency in creating and delivering impactful presentations, utilizing visual aids to convey engineering concepts to diverse audiences.									
CO4	Cultivate effective interpersonal skills for collaborative teamwork, emphasizing active listening, conflict resolution, and clear communication within engineering contexts.									
CO5	Prepare for engineering job interviews by articulating qualifications, experiences, and career goals, addressing both technical and behavioral questions confidently.									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Writing Skills** i. Paragraph Writing & Narratives ii. Letter Writing iii. Technical Writing **Pipe and cistern** i. Introduction of pipes and cistern ii. Solving different types of questions iii. Worksheet1 and Worksheet 2	**7**	Develop proficiency in various forms of writing, including paragraph and narrative construction, letter writing, and technical documentation.	1,2
II	**Self-Management Skills** **i.** SWOT Analysis ii. Goal Setting and Personal Hygiene **Mixture allegation and Clock** i. Introduction of basics ii. Solving questions on mixture and alligationion. iii. Worksheet1 and Worksheet 2	**7**	Gain competency in solving practical problems related to pipes and cisterns, mixtures and alligations, clocks, and profit, loss, and discounts through targeted practice and worksheets.	1,2
III	**Vocabulary Development** i. Understanding different aspects of a word (such as the use of say, tell, speak). ii. Learning strategies to develop vocabulary iii Contextual vocabulary learning iv. Use of phrasal verbs and idioms in a conversation v. Effectively using dictionary, thesaurus **Statement and Course of action**	**7**	Enhance personal effectiveness through SWOT analysis, goal setting, and maintaining personal hygiene.	1,2

	iv. Revision of syllogism v. Statement and conclusion vi. Course of action based on statement vii. Worksheet1 and Worksheet 2			
IV	**Interview Skills & Dress Code Ethics** i. Types of interview- telephonic, virtual & face to face online interview, personal interview, Panel interview, Group interview ii. Common interview questions and answering strategies iii. Dress Code Ethics during Interviews iv. Mock Interview Session **Sitting arrangement (puzzle)** i. Linear arrangement puzzle ii. Circular arrangement puzzle iii. Matrix iv. Worksheet1	**7**	Improve vocabulary through understanding word usage, contextual learning, and effective dictionary use, and strengthen logical reasoning with practice in syllogisms, statements, conclusions, and courses of action.	1,2
V	**Grammar (Flipped Classroom)** i. Word-stress, Syllables Practice Session: Common Errors (testing the students' grammar already learnt) **Profit loss and discount** i. Introduction to basics ii. Introduction to discount iii. Probems related on the topics iv. Worksheet1 and Worksheet 2	**7**	Master interview techniques for various formats, understand dress code ethics, and improve performance through mock interviews and puzzle-solving exercises in linear, circular, and matrix arrangements.	1,2

TEXT BOOKS:

T1: Barrett, Grant. 2016. *Perfect English Grammar: The Indispensible Guide to Excellent Writing and Speaking*, Zephyros Press.

T2: McDowell, Gayle Laakmann.2008.*Cracking the Coding Interview* (Indian Edition)

T3: A Modern Approach to Logical Reasoning All Exams

T4:General Mental Ability & Logical Reasoning Compendium

REFERENCE BOOKS:

R1: Zinsser, William. (2006) *On Writing Well: The Classic Guide to Writing Nonfiction*

R2: Fast track Objective mathematics for Competitive exam by Arihant

R3: General Mental Ability & Logical Reasoning Compendium By R.S. Agarwala

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Demonstrate clear and concise technical communication in both written and oral formats, incorporating industry-specific terminology.	**5, 7**
2	Develop expertise in crafting resumes, cover letters, and technical reports to effectively showcase engineering qualifications.	**8**
3	Acquire proficiency in creating and delivering impactful presentations, utilizing visual aids to convey engineering concepts to diverse audiences.	**7.9,10**
4	Cultivate effective interpersonal skills for collaborative teamwork, emphasizing active listening, conflict resolution, and clear communication within engineering contexts.	**11,12**
5	Prepare for engineering job interviews by articulating qualifications, experiences, and career goals, addressing both technical and behavioral questions confidently.	**10**

SEMESTER – IV									
Course Title	**Structural Analysis I**								
Course code	**23BTCE223R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ IV semester of Second year of the programme**								
Course Objectives	1. Classify different types of structures and analyze their stress resultants and determine degrees of freedom per node, as well as static and kinematic indeterminacy. 2. Utilize strain energy concepts for axial load, bending, and shear analysis. 3. Apply energy theorems like Castigliano's, Betti's, and Maxwell's to determine deflections in beams.Use the unit load method for structural deflection calculations.								
CO1	Understand the classification of structures, stress resultants, degrees of freedom per node, and concepts of static and kinematic indeterminacy.								
CO2	Apply strain energy concepts, including strain energy due to axial load, bending, and shear, and utilize principles such as minimum potential energy, virtual work, Castigliano's theorems, and reciprocal theorems to analyze structural behavior.								
CO3	Analyze beams, arches, and cables using methods such as strain energy, unit load, and Eddy's theorem, and determine deflections in beams and arches.								
CO4	Evaluate the elastic stability of columns using Euler's theory, derive buckling loads for different end conditions, and apply Rankine's formula for short and long columns.								
CO5	Analyze thin cylinders and spheres by deriving formulas for hoop stress and longitudinal stress and calculating stresses due to internal pressure.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Introduction** Classification of Structures, Stress resultants, Degrees of freedom per node, Static and Kinematic Indeterminacy	**9**	Understand the classification of Structures, Stress resultants, Degrees of freedom per node, Static and Kinematic Indeterminacy	1, 2
II	**Strain Energy** Strain energy due to axial load, bending and shear, theorem of minimum potential energy, principle of virtual work, law of conservation of energy, 1st and 2nd Castiglione's Theorem, Betti's & Maxwell's reciprocal theorem, Deflection of Beams using Strain Energy Method and Unit load method	**9**	Analysethe strain energy due to axial load, bending and shear, theorem of minimum potential energy, principle of virtual work, law of conservation of energy, 1st and 2nd Castiglione's Theorem, Betti's & Maxwell's reciprocal theorem, Deflection of Beams using Strain Energy Method and Unit load method.	1, 2,
III	**Analysis of Arches and Cables**Analysis of pin-jointed structures: Method of joints and sections, deflection of joints, Maxwell's reciprocal theorem. Analysis of Arches, Linear Arch, Eddy's theorem, three hinged parabolic arch, Spandrel braced arch, Analysis of Cables under point loads and UDL	**9**	Apply the theory and method of joints and sections, deflection of joints, Maxwell's reciprocal theorem. Analysis of Arches, Linear Arch, Eddy's theorem, three hinged parabolic arch, Spandrel braced arch, Analysis of Cables under point loads and	1, 2, 3, 4, 5

			UDL	
IV	**Elastic Stability of Columns**: Short and Long Column, Euler's Theory of Columns, Derivation of Buckling Load for different end conditions, Rankine's Formula	**9**	Utilize the concept of short column and long column, Euler's Theory of Columns, Derivation of Buckling Load for different end conditions, Rankine's Formula	2, 3, 4
V	**Thin Cylinders and Spheres**- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.	**9**	Derive the formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.	2, 3, 4, 5

TEXT BOOKS:

T1: Design Of Structures - S. Ramamrutham., DhanpatRai Publishing Co Pvt Ltd
T2: Design Of Steel Structures - N. Subramanian

REFERENCE BOOKS:

R1: Analysis of Indeterminate Structures by C.K. Wang.
R2: Balagopal and Prabhu (1987), "Building Drawing and Detailing", Spades publishing
R3: KDR building, Calicut,
R4: (Corresponding set of) CAD Software Theory and User Manuals.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Demonstrate their knowledge of structural mechanics in addressing design problems of structural engineering.	**1,3 & 4**
2	Distinguish the varying materials and different loading systems in a structure.	**1,2**
3	Classify structures and explain their behaviour by drawing its components and forces acting on it.	**7.9,10**
4	Apply the design concepts to develop a R.C.C. members.	**5,7**
5	Explain the basic concepts of special structures.	**5,8**

SEMESTER – IV									
Course Title	**Transportation Engineering**								
Course code	**23BTCE221R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T+30P	**3**	**0**	**2**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ IV semester of Second year of the programme**								
Course Objectives	1. To introduce the students about different classifications/types of roads 2. To explain the students about different geometric features of highways 3. To describe about traffic characteristics and traffic control devices								
CO1	Describe different types of roads, its administration and highway survey techniques								
CO2	Design different geometric features of flexible and rigid pavement to determine ideal road alignment in different topographies								
CO3	Perform traffic survey to collect data required for traffic regulations and control								
CO4	Discuss about different materials and their suitability to be used in construction of road.								
CO5	Design various components of flexible and rigid pavements as per the latest code of practice								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Highway development and planning** Classification of roads, road development inIndia, Current Road projects in India; highway alignment, Highway Survey, and project preparation	**9**	Explain the fundamental concepts, principles, and components of transportation systems, including highways, railways, airways, and waterways.	1, 2
II	**Geometric design of highways** Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems	**9**	Apply engineering principles to design and analyze transportation facilities, including roadways, intersections, and traffic control systems, to ensure safety, efficiency, and sustainability.	2, 3, 4
III	**Traffic engineering & control** Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems	**9**	Evaluate traffic flow characteristics, capacity analysis, and control measures to optimize transportation network performance and reduce congestion.	1, 2, 3, 4
IV	**Highway Materials and Construction** Material requirement for pavements – Soil classification for Highway – Soil tests – CBR and Plate Load Test, Aggregate – materials testing and specification, Bitumen – material testing and specification – Concrete Mix Design, construction of bituminous and rigid pavements, Highway Maintenance – Material recycling	**9**	Assess the impact of transportation systems on the environment and society, and explore sustainable, smart, and multimodal transportation solutions.	1, 2

V	**Design of pavements-** Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements-components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems.	**9**	Develop transportation planning strategies and policies that integrate land use, economic development, and technological advancements to improve mobility and accessibility.	2, 3, 4, 5

Text Books:

1. S.K.Khanna, C.E.G.Justo, (2001) " Highway Engineering", Nem Chand & Bros, Roorkee.
2. Rao.G.V., (2005) "Principles of Transportation and Highway Engineering", Tata McGraw Hill Co.

Reference Books:

1. L.R.Kadiyali, (2003) "Principles and Practice of Highway Engineering", Khanna Publishers.
2. ParthaChakroborthy, Animesh Das, (2005) "Principles of Transportation Engineering", Prentice-Hall of India.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Describe different types of roads, its administration and highway survey techniques	**1,3 & 4**
2	Design different geometric features of flexible and rigid pavement to determine ideal road alignment in different topographies	**1,2**
3	Perform traffic survey to collect data required for traffic regulations and control	**7.9,10**
4	Discuss about different materials and their suitability to be used in construction of road.	**5,7**
5	Design various components of flexible and rigid pavements as per the latest code of practice	**5,8**

SEMESTER – IV									
Course Title	**Instrumentation and Control**								
Course code	**23BTCE225R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T+30P	**2**	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ IV semester of Second year of the programme**								
Course Objectives	This course is designed for the 4th semester students of Civil Engineering. This course is intended to develop an understanding of Measurement systems and performance models and its analysis at Instrumentation system elements, Signal processing and conditioning; correction elements. The course also indulges Control systems, and different types of Control method.								
CO1	The uses of Measurement systems and performance								
CO2	To generalization of the Instrumentation system elements								
CO3	Analysis of the Signal processing and conditioning; correction elements								
CO4	Outlining the Control systems								
CO5	To learn the other Controlling methods								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Measurement systems and performance – accuracy, range, resolution, error source	**9**	To provide a basic knowledge about measurement systems and their components	1, 2
II	Instrumentation system elements – sensors for common engineering measurements	**9**	To learn about various sensors used for measurement of mechanical quantities	2, 3, 4
III	Signal processing and conditioning; correction elements- actuators: pneumatic, hydraulic, electric	**9**	Uses of different techniques of signal processing.	1, 2, 3, 4
IV	Control systems – basic elements, open/closed loop, design of block diagram	**9**	To learn about system stability and control	1, 2
V	Control method – P, PI, PID, when to choose what, tuning of controllers; System models, transfer function and system response, frequency response	**9**	To integrate the measurement systems with the process for process monitoring and control	2, 3, 4, 5

Text Books:

T1 Instrumentation and control systems by W. Bolton, 2nd edition, Newnes, 2000
T2 Automatic Control Systems by S. Hasan Saeed, Katson Books
T3 Electrical and Electronic Measurement and Instrumentation by A.K Sawhney

Reference Books:

R1 Instrumentation and control systems by W. Bolton, 2nd edition, Newnes, 2000
R2 Thomas G. Beckwith, Roy D. Marangoni, John H. LienhardV, Mechanical Measurements (6th Edition) 6th Edition, Pearson Education India, 2007
R3 Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, McGraw-Hill: New York,1999.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	The uses of Measurement systems and performance	**1,3 & 4**
2	To generalization of the Instrumentation system elements	**1,2**
3	Analysis of the Signal processing and conditioning; correction elements	**7.9,10**
4	Outlining the Control systems	**5,7**
5	To learn the other Controlling methods	**5,8**

SEMESTER – IV										
Course Title	**Construction Equipments and Techniques**									
Course code	**23BTCE226R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**	
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**	
Pre-requisite	**Nil**	**Co-requisite**	**Nil**							
Programme	**B. Tech in Civil Engineering**									
Semester	**Winter/ IV semester of Second year of the programme**									
Course Objectives	1. To provide insight on the different functions and operations of different equipment and techniques during construction 2. To impart knowledge on the various maintenance and safety to be considered during construction 3. To acquire knowledge on the life cycle of a construction equipment									
CO1	Evaluate equipment and techniques required during construction									
CO2	Understand the operation of a batching plant.									
CO3	Analyze the equipment life cycle management.									
CO4	Comprehend mechanization and digitalisation in construction									
CO5	Students will be able to analyze and select appropriate construction equipment and techniques for various construction projects, considering factors such as efficiency, cost, safety, and environmental impact.									

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Basics and Hydraulics of Construction Equipment** Introduction to Construction Equipment- Functions, Operations of Construction Equipment- Introduction to Four & Two Stroke Engine and their components- Introduction and Components to Automobiles. Introduction to Principles of Hydraulic- Calculation of Pressure, Force & Flow- Components of a Hydraulic System- Basic layout of Hydraulic System- Applications of Hydraulics- Strand Jack Operation	**9**	Demonstrate knowledge of various types of construction equipment, their functions, and their appropriate applications in different construction projects.	1, 2
II	**Concreting, Earth Moving, Road Making and Quarry/Mining Equipment** Operations of a Batching Plant - Introduction and Components of Concrete Pump & Placer- Concrete Pipeline- Laying and Cleaning- Bulldozer- Classification and Components- Classification, Components and Attachments of Excavator- Backhoe Loader- Classification & components- Introduction and classification to Hot mix Plant- Process of Asphalt Paver- PQC Paver- Classification & Components- Motor Grader- Classification & Components- Horizontal Movement Vehicles- Quarry/Mining	**9**	Evaluate factors such as cost, efficiency, environmental impact, and site conditions to determine the most suitable construction equipment for specific tasks.	2, 3, 4
III	**Equipment Life Cycle Management** Life Cycle of an Equipment- Equipment Performance Parameters - Introduction to Maintenance- Types of Maintenance-	**9**	Explain and apply various construction techniques, including excavation, foundation work, concrete	1, 2, 3, 4

	Maintenance Practices		placement, and structural assembly, in compliance with industry standards and safety regulations.	
IV	**Tunneling Equipment / Piling Equipment** Introduction to Tunnel Boring Machines- Details and Operation of a Hard-Rock TBM- Details of Earth Pressure Balance (EPB) TBM- Details and operation of Slurry TBM & Components- Hydraulic Grabs- Piling Rig	**9**	Calculate and analyze the productivity of construction equipment, considering factors like cycle time, fuel consumption, and maintenance requirements.	1, 2
V	**Mechanization and Digitalization in Construction and Safety in Construction Equipment** Importance of Digital Analytics- Digital Solution in Construction Projects- Importance of Mechanization - Railway Track Construction- Rebar Processing Machine- Operation of Mechanized Equipment- Introduction to 3D Concrete Printer- Importance of Safety- Various PPE & Purpose- Safety of Men & Machines at Work- Safety During Construction Activities- Safety with Tools & Tackles.	**9**	Understand and apply safety measures, risk assessments, and maintenance procedures to ensure the efficient and safe operation of construction equipment on-site.	2, 3, 4, 5

Reference Books:

R1:Velumani. P, "Construction Techniques and Practices", SIA Publishers & Distributers Pvt Ltd, 2020.

Textbook:

T1:Dr. Manoranjan Samal, "Advanced Construction Techniques and Equipment" S.K. Kataria & Sons
T2:S.C.Sharma, "Construction Equipment and management" E-Book .2019

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Evaluate equipment and techniques required during construction	**1,2,7&10**
2	Understand the operation of a batching plant.	**1,3,6&7**
3	Analyze the equipment life cycle management.	**1,2,3,5,6 &7**
4	Comprehend mechanization and digitalisation in construction	**1,2,3,5&6**
5	Students will be able to analyze and select appropriate construction equipment and techniques for various construction projects, considering factors such as efficiency, cost, safety, and environmental impact.	**1,2,3,7**

SEMESTER – IV									
Course Title	**Entrepreneurship Strategy: From Ideation To Exit**								
Course code	**23MOCE221R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 15T	**0**	**0**	**0**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ IV semester of Second year of the programme**								
Course Objectives	1.Develop Strategic Thinking for Entrepreneurial Ventures 2 Foster an understanding of how to develop innovative business models, create compelling value propositions, and build sustainable competitive advantages. 3. Provide students with the tools to lead entrepreneurial teams, manage organizational growth, and make informed decisions that mitigate risks.								
CO1	Develop the ability to identify and evaluate profitable business opportunities.								
CO2	Formulate innovative business models and value propositions.								
CO3	Create actionable strategic plans for launching and scaling entrepreneurial ventures.								
CO4	Enhance leadership skills for managing teams and resources in a startup environment.								
CO5	Master risk management and decision-making strategies to ensure business sustainability and growth.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Chapter 1: *Entrepreneurship: Strategy and Resources* (Gartner & Roberts)	**9**	Understand the entrepreneurial mindset and identify business opportunities.	1, 2
II	Chapter 2: *Entrepreneurship: Strategy and Resources* (Gartner & Roberts)	**9**	Learn how to evaluate and assess business opportunities.	2, 3, 4
III	Chapter 3: *Business Model Generation* (Osterwalder & Pigneur)	**9**	Understand how to design and develop business models.	1, 2, 3, 4
IV	Chapter 4: *Business Model Generation* (Osterwalder & Pigneur)	**9**	Develop skills to differentiate and innovate business models.	1, 2
V	Chapter 5: *Strategic Management: Concepts and Cases* (David)	**9**	Analyze industry structure and competitive positioning.	2, 3, 4, 5

Text Book

T1: Gartner, W. B., & Roberts, P. W. (Eds.). (2009). *Entrepreneurship: Strategy and resources*. Routledge.

Reference Book

R1: Ries, E. (2011). *The Lean Startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. Crown Business

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Develop the ability to identify and evaluate profitable business opportunities.	**1,3 & 4**
2	Formulate innovative business models and value propositions.	**1,2**
3	Create actionable strategic plans for launching and scaling entrepreneurial ventures.	**7.9,10**
4	Enhance leadership skills for managing teams and resources in a startup environment.	**5,7**
5	Master risk management and decision-making strategies to ensure business sustainability and growth.	**5,8**

SEMESTER – IV									
Course Title	**Field-based Training**								
Course code	**23BTCE227R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 16P	**0**	**0**	**0**	**0**	**0**	**16**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ IV semester of 2nd year of the programme**								
Course Objectives	1. Provide hands-on experience in real-world construction, surveying, and infrastructure projects. 2. Develop practical problem-solving skills and adaptability in field conditions. 3. Enhance students' ability to interpret and apply theoretical knowledge in professional environments.								
CO1	Understand the significance of field-based training in civil engineering applications..								
CO2	Apply site surveying, construction techniques, and material testing in a field environment.								
CO3	Analyze site constraints, risk factors, and environmental impact during project execution.								
CO4	Evaluate quality control measures, safety protocols, and field management techniques.								
CO5	Document field observations, report findings, and suggest practical improvements.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction to Field-Based Training – Importance, Objectives, and Role in Civil Engineering Projects.	**3**	Understand the relevance and objectives of field-based training in engineering.	1, 2
II	Surveying Techniques – Total Station, GPS, Leveling, and Contouring; Site Layout & Measurement Methods.	**3**	Apply field surveying techniques and analyze measurements.	1, 2, 3, 4
III	Construction Practices – Foundations, Reinforcement, Formwork, and Concreting Methods.	**3**	Gain hands-on exposure to key construction practices and material handling and application in pavement construction.	1, 2, 3, 4, 5
IV	Safety, Quality Control & Risk Assessment – Site Safety Measures, Quality Testing, Risk Identification, and Mitigation.	**3**	Implement quality assurance and safety protocols in field projects.	2, 3, 4
V	Field Report & Analysis – Documentation, Report Writing, and Case Study Evaluation	**3**	Analyze and document field experiences for future reference and improvement.	2, 3, 4, 5

Textbooks

T1: Construction Planning, Equipment, and Methods – Robert L. Peurifoy

T2: Surveying for Engineers – J. Uren & W. F. Price

Reference Books

R1: Building Construction Handbook – Roy Chudley & Roger Greeno

R2: Field Guide for Construction Management – Richard H. Clough

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SL N	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand the relevance of field-based training.	1,2
2	Apply surveying and construction techniques.	3,4
3	Analyze field constraints and risk factors.	2,5
4	Evaluate quality control and safety measures.	4,6
5	Document and report field observations effectively.	5,7

SEMESTER – V									
Course Title	**Structural Analysis II**								
Course code	**23BTCE311R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**SA I**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ V semester of Third year of the programme**								
Course Objectives	1. Students will develop the ability to analyze statically determinate beams and frames using influence lines and design these structures to withstand specified loads by calculating critical stress resultants. 2. Students will gain proficiency in using Muller Breslau's principle to analyze indeterminate beams and frames, with a focus on understanding the distribution of shear force, bending moment, and support reactions. 3. Students will be equipped to analyze different types of arches and suspension systems, considering settlement, temperature effects, and the behavior of cables under various loading conditions, and apply plastic theory to determine plastic moments, plastic moduli, and load factors for statically indeterminate structures.								
CO1	Students will be able to analyze statically determinate beams and frames using influence lines, and design them to withstand specified loads by calculating critical stress resultants.								
CO2	Students will gain proficiency in analyzing indeterminate beams and frames using Muller Breslau's principle, understanding the distribution of shear force, bending moment, and support reactions.								
CO3	Students will be capable of analyzing different types of arches and suspension systems, considering factors such as settlement, temperature effects, and the behavior of cables under various loading conditions.								
CO4	Students will develop a thorough understanding of plastic theory and its application to statically indeterminate structures, including the determination of plastic moments, plastic moduli, and load factors.								
CO5	Students will be able to apply the knowledge gained to analyze and design structural systems under realistic conditions, incorporating factors such as dynamic loads, environmental effects, and safety considerations.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Influence lines for reactions in statically determinate beams – Influence lines for shear force and bending moment – Calculation of critical stress resultants due to concentrated and distributed moving loads – absolute maximum bending moment - influence lines for member forces in pin jointed plane frames.	**5**	Upon completing the course, students will demonstrate proficiency in deriving and interpreting influence lines for reactions, shear force, bending moment, and member forces in determinate and indeterminate beams and pin-jointed plane frames.	1, 2
II	Muller Breslau's principle– Influence line for Shearing force, Bending Moment and support reaction components of propped cantilever, continuous beams (Redundancy restricted to one), and fixed beams	**10**	Students will be able to analyze various types of arch structures, including three- hinged, two-hinged, and fixed arches, considering settlement and temperature effects, and applying equilibrium principles specific to arch geometry.	1, 2, 3, 4
III	Equilibrium of cable – length of cable		By the end of the course, students	1,

	- anchorage of suspension cables – stiffening gird	**5**	will understand the principles governing cables and suspension bridges, including the equilibrium of cables, determination of cable length, and the role of stiffening girders in suspension bridge design.	2, 3, 4, 5
IV	Analysis of Indeterminate Structure-Fixed beam, support settlement, Introduction to Matrix Method etc.	**5**	Students will gain proficiency in analysis techniques for statically indeterminate structures, including Matrix Method.	2, 3, 4
V	Plastic theory - Statically indeterminate structures – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – collapse load - Static and kinematic methods – Upper and lower bound theorems - Plastic analysis of indeterminate beams and frames.	**5**	Upon completion, students will be able to apply theoretical concepts such as Muller Breslau's principle, plastic theory, and influence line analysis to solve practical engineering problems related to structural analysis, including beams, arches, cables, and suspension bridges.	2, 3, 4, 5

TEXT BOOKS:

T1: Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004. ISBN: 9780131913455

T2: Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979. ISBN: 9780070662308

REFERENCE BOOKS:

R1 Gere, J. M. Mechanics of Materials. 2Ed (Pb 2004)

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Students will be able to analyze statically determinate beams and frames using influence lines, and design them to withstand specified loads by calculating critical stress resultants.	**1,2**
2	Students will gain proficiency in analyzing indeterminate beams and frames using Muller Breslau's principle, understanding the distribution of shear force, bending moment, and support reactions.	**1,2, 3, 4**
3	Students will be capable of analyzing different types of arches and suspension systems, considering factors such as settlement, temperature effects, and the behavior of cables under various loading conditions.	**7.9,10**
4	Students will develop a thorough understanding of plastic theory and its application to statically indeterminate structures, including the determination of plastic moments, plastic moduli, and load factors.	**5,7**
5	Students will be able to apply the knowledge gained to analyze and design structural systems under realistic conditions, incorporating factors such as dynamic loads, environmental effects, and safety considerations.	**5,8**

SEMESTER – V									
Course Title	**Environmental Engineering**								
Course code	**23BTCE312R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T+30P	**2**	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ V semester of Third year of the programme**								
Course Objectives	1. To understand the basic principles and concepts and processes involved in water and waste water treatment. 2. To develop a student's skill in the basic design of unit operations and processes involved in water and wastewater treatment. 3. To learn the basics of water treatment plant composition and its characteristics 4. To design the structures involved in an water treatment plant								
CO1	Analyze characteristics of water and wastewater								
CO2	Estimate the quantity of drinking water and domestic wastewater generated								
CO3	Design components of water supply systems								
CO4	Design sewerage system								
CO5	Plan strategies to control, reduce and monitor pollution.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Water: -Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, Need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design. Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes	**9**	Understanding the intricate processes of water treatment and supply ensures safe, reliable water for diverse societal needs and environmental sustainability.	1, 2
II	Sewage- Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans, Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes	**9**	Understanding the comprehensive design, management, and environmental impact of sewage and stormwater systems, including treatment and recycling techniques.	2, 3, 4
III	Air - Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution automobile pollution, Chemistry	**9**	Understanding the chemistry of combustion is crucial for comprehending air	1, 2, 3, 4

	of combustion, Automobile engines, quality of fuel, operating conditions and interrelationship. Air quality standards, Control measures for Air pollution, construction and limitations, Noise- Basic concept, measurement and various control methods.		pollution sources and implementing effective control measures.	
IV	Solid waste management-Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Special MSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes, Effects of solid waste on environment: effects on air, soil, water surface and ground health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle. Disposal methods-Integrated solid waste management. Hazardous waste: Types and nature of hazardous waste as per the HW Schedules of regulating authorities, Government authorities and their roles in water supply, sewerage disposal. Solid waste management and monitoring/control of environmental pollution.	**9**	Students will be able to demonstrate an understanding of solid waste management principles, including the composition and parameters of municipal solid waste, as well as the methods and environmental impacts associated with its collection, treatment, and disposal.	1, 2
V	Building Plumbing-Introduction to various types of home plumbing systems for water supply and waste water disposal, high rise building plumbing, Pressure reducing valves, Break pressure tanks, Storage tanks, Building drainage for high rise buildings, various kinds of fixtures and fittings used.	**9**	Students will gain proficiency in understanding and implementing diverse home plumbing systems, including high-rise building plumbing, pressure reducing valves, storage tanks, and drainage solutions.	2, 3, 4, 5

TEXT BOOKS:

T1: Droste R.L., (1997), Theory and Practice of water wastewater treatment, John Wiley & sons.

T2: Garg S.K., (2001), Environmental Engineering, Vols. I and II, 12th Edition, Khanna Publishers, New Delhi.

REFERENCE BOOKS:

R1: Peavy H. S. Rowe D.R and George Tchobanoglous (2001), Environmental Engineering, McGraw-Hill Company, New Delhi.

R2: Metcalf and Eddy (2003), Wastewater Engineering, Treatment and reuse, Tata McGraw-Hill Edition, Fourth edition.

R3: Rangwala (1999), Water supply & Sanitary Engineering, Charotar Publishing House, Anand-16th Edition.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Analyze characteristics of water and wastewater	**1,2,7&10**
2	Estimate the quantity of drinking water and domestic wastewater generated	**1,3,6&7**
3	Identify the components of water supply systems	**1,2,3,5,6 &7**
4	Design sewerage system	**1,2,3,5&6**
5	Plan strategies to control, reduce and monitor pollution.	**1,2,3,7**

SEMESTER – V										
Course Title	**Engineering Geology**									
Course code	**23BTCE313R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 15T+30P	**1**	**0**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Civil Engineering**								
Semester	**Fall / V semester of 3rd year of the programme**								
Course Objectives	1. Use suitable software to examine geology, soil, geologic hazard, and NEHRP data to characterize a geologic site. 2. Calculate the bulk properties of rocks and unconsolidated sediments such as density, void ratio, water contents, and unit weights. 3. Evaluate rock-mass quality and perform a kinematic analysis.								
CO1	1. Discuss the importance of Geology in making engineering decisions specially site selection of engineering projects.								
CO2	2. Analyze the concepts of how minerals form and their uses for identifying the rock forming.								
CO3	3. Analyze graphs and models used in structural geology for demonstrating stress, strain and tectonics.								
CO4	4. Generalize rocks using basic geological systems for selective construction material								
CO5	5. Apply quantitative skills and frame work for solving basic engineering geology problems related to geological features and geological hazards and remedial measures thereof.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction- Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Mineralogy-Mineral, Origin and composition. Physical properties of minerals, susceptibility of minerals to alteration, basic of optical mineralogy, Rock forming minerals, megascopic identification of common primary & secondary minerals.	**5**	Geological studies are crucial for site selection, foundation design, and material sourcing. They prevent hazards like landslides and sinkholes and aid in environmental assessments and resource management for sustainable construction.	1, 2
II	Petrology-Rock forming processes. Specific gravity of rocks. Ternary diagram. Igneous petrology- Volcanic Phenomenon and different materials ejected by volcanoes. Types of volcanic eruption. Concept of Hot spring and Geysers. Characteristics of different types of magma. Division of rock on the basis of depth of formation, and their characteristics. Chemical and Mineralogical Composition. Texture and its types. Various forms of rocks. IUGS Classification of phaneritic and volcanic rock.. Field Classification chart. Structures. Classification of Igneous rocks on the basis of Chemical composition. Detailed study of Acidic	**5**	Geology provides essential knowledge to civil engineering through structural geology, hydrogeology, and engineering geology. Structural geology helps understand rock behavior under stress, while hydrogeology deals with groundwater flow. Engineering geology assesses geological factors affecting construction sites.	1, 2, 3, 4

	Igneous rocks like Granite, Rhyolite or Tuff, Felsite, Pegmatite, Hornfels. Metamorphic Aureole, Kaolinization. Landform as Tors. Engineering aspect to granite. Basic Igneous rocks Like Gabbro, Dolerite, and Basalt. Engineering aspect to Basalt. Sedimentary petrology- mode of formation, Mineralogical Composition. Texture and its types, Structures, Gradation of Clastic rocks. Classification of sedimentary rocks and their characteristics. Detailed study of Conglomerate, Breccia, Sandstone, Mudstone and Shale, Limestone Metamorphic petrology- Agents and types of metamorphism, metamorphic grades, Mineralogical composition, structures & textures in metamorphic rocks. Important Distinguishing features of rocks as Rock cleavage, Schistosity, Foliation. Classification. Detailed study of Gneiss, Schist, Slate with engineering consideration.			
III	Physical Geology- Weathering. Erosion and Denudation. Factors affecting weathering and product of weathering. Engineering consideration. Superficial deposits and its geotechnical importance: Water fall and Gorges, River meandering, Alluvium, Glacial deposits, Laterite (engineering aspects), Desert Landform, Loess, Residual deposits of Clay with flints, Solifluction deposits, mudflows, Coastal deposits.	**5**	Geological studies are crucial for site selection, foundation design, and material sourcing. They prevent hazards like landslides and sinkholes and aid in environmental assessments and resource management for sustainable construction.	1, 2, 3, 4, 5
IV	Strength Behavior of Rocks- Stress and Strain in rocks. Concept of Rock Deformation & Tectonics. Dip and Strike. Outcrop and width of outcrop. Inliers and Outliers. Main types of discontinuities according to size. Fold- Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field, effects on outcrops. Joints & Unconformity; Types, Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding, Earthquake and Subsidence. Strength of Igneous rock	**5**	Physical geology examines weathering (mechanical, chemical), erosion, and denudation processes influencing rock properties. Superficial deposits like alluvium and glacial deposits impact construction and groundwater management. Geological structures such as folds, faults, and joints affect rock strength and stability. Understanding these structures is vital for engineering operations, preventing hazards like landslides and earthquakes	2, 3, 4

	structures.			
V	Geological Hazards-Rock Instability and Slope movement: Concept of sliding blocks. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. Types of landslide. Prevention by surface drainage, slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Case study on black clay. Ground water: Factors controlling water bearing capacity of rock. Pervious & impervious rocks and ground water. Lowering of water table and Subsidence. Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence in Himalayan region in India. Seismic Zone in India.	**10**	Geological hazards include slope instability, groundwater dynamics, and seismic activities. Prevention measures like drainage systems, slope reinforcement, and seismic design mitigate risks in civil engineering projects. This structured approach covers essential topics in geology relevant to civil engineering, ensuring a comprehensive understanding of geological principles and their practical applications.	2, 3, 4, 5

Text Book

T1:P.C. Varghese, Engineering Geology for Civil Engineers, PHI Learning private limited.
T2:Parbin Singh, Engineering & General Geology, S.K. Kataria and Sons- Delhi.

Reference Book

R1:Dr. D.V. Reddy, Engineering Geology, Vikas Publishing House.
R2:Chadha S. K., Elements of Geological Maps for Geology, Geography & Civil Engineering, CBS Publishers & Distributors- New Delhi.
R3:Gautam Mahajan, Evaluation and Development of Ground Water, APH Publishers.
R4:Jerome V. Degraff Robert B. Johnson, Principles of Engineering Geology, Wiley India Pvt Ltd.
R5:Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Discuss the importance of Geology in making engineering decisions specially site selection of engineering projects.	1,2
2	Analyze the concepts of how minerals form and their uses for identifying the rock forming.	3,5,6
3	Analyze graphs and models used in structural geology for demonstrating stress, strain and tectonics.	7,2
4	Generalize rocks using basic geological systems for selective construction material	1,9
5	Apply quantitative skills and frame work for solving basic engineering geology problems related to geological features and geological hazards and remedial measures thereof.	4,7

SEMESTER – V									
Course Title	**Concrete Technology**								
Course code	**23BTCE314R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ V semester of 3rd year of the programme**								
Course Objectives	1. To define and understand concepts related Concrete technology which involves types and property of concrete and different adhesive materials and its vital use for safe, economic development for the buildings. 2. To present the foundations of many basic Engineering tools and concepts related to Concrete technology and Civil Engineering. 3. To give an experience in the implementation of engineering concepts which are applied in field of Civil Engineering.								
CO1	Understand constituents and their roles in concrete, including cement, aggregates, water, and admixtures.								
CO2	Improve proficiency in proportioning concrete ingredients for desired properties like strength, workability, and durability.								
CO3	Develop practical skills in conducting tests to assess fresh and hardened concrete properties.								
CO4	Integrate eco-friendly practices like alternative materials and efficient curing methods in concrete technology.								
CO5	Learn to conduct tests to maintain industry standards and ensure safe construction practices.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Basics: Historical background, composition of concrete, general note on strength mechanism, recent practice and future trends.	**5**	Gain a broad understanding of concrete, including its history, composition, and future trends.	1, 2
II	Constituent of Concrete: 1. Cement - Chemical composition, hydration, heat of hydration, hydrated structure, various types of cement, testing of cement as per Indian standard. 2. Aggregates - Utility in concrete, classification, effect of geometry & texture, strength, mechanical properties, moisture content, water absorption, bulking of sand, deleterious substances, sieve analysis, various grading and grading requirements, sampling & testing as per Indian Standards. 3. Water - General Requirements & limiting values of impurities. 4. Admixtures - Additives and admixtures, types, necessity and benefit Mineral admixture - Fly ash, silica fume, blast furnace slag, and other pozzolanic materials. Chemical admixtures - Accelerator, retarder, water reducing elements, plasticizer and super-plasticizer, their functions and usage	**10**	Understand the key components of concrete (cement, aggregates, water, admixtures) and their properties.	1, 2, 3, 4
III	Fresh concrete: Methods of mixing, transporting and placing of concrete. Workability – Definition	**5**	Learn about fresh concrete's properties	1, 2, 3, 4,

	and requirement, factors affecting workability, various tests as per IS and ASTM. Segregation and bleeding, stiffening, re-tempering. Curing: necessity and various methods, micro-cracking.		(workability, handling), how to manage it, and proper curing techniques.	5
IV	Hardened concrete: Compressive and tensile strength and their relationship, various tests as per IS and ASTM. Factors affecting strength – water cement ratio, gel space ratio, aggregate cement ratio, properties of ingredients, effect of age, maturity, aggregate cement-paste inter-face, various finishes of concrete. Introduction to aspects of elasticity, shrinkage and creep. Tests for strength of concrete: Destructive, semi destructive and non-destructive tests with their limitations, test methods as per IS and ASTM. 5 Durability and permeability of concrete: Definitions, causes, carbonation, cracking.	**5**	Understand the mechanics of hardened concrete (strength, elasticity, shrinkage, creep) and how to test its properties.	2, 3, 4
V	Concrete in aggressive environment: Alkali – aggregate reaction, sulphate attack, chloride attack, acid attack, effect of sea water, special coating for water proofing, sulphate chloride and acid attack, concrete for hot liquids.	**5**	Identify and address challenges concrete faces in harsh environments (alkali reaction, sulfate attack, etc.).	2, 3, 4, 5

TEXT BOOKS:

T1: M S Shetty; Concrete Technology, S.Chand Publication New Delhi 2. P Kumar Mehta, Monteiro;
T2: Concrete Technology, Indian Concrete Institute

REFERENCE BOOKS:

R1: A.M. Neville; Properties of Concrete, Pearson Education
R2: M L Gambhir; Concrete Technology, Tata McGraw Hill
R3: IS 456-2000 7.
R4: IS 269-1989
R5: IS 516-1959 9
R6: IS 1786-1985 10
R7: IS 1893-2002
R8: IS 12269-1987
R9: IS 9103-1999
R10: IS 8112-1989

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand constituents and their roles in concrete, including cement, aggregates, water, and admixtures.	**1,2,3,4,5,6,7,12**
2	Improve proficiency in proportioning concrete ingredients for desired properties like strength, workability, and durability.	**1,2,3,4,5,6,7,12**
3	Develop practical skills in conducting tests to assess fresh and hardened concrete properties.	**1,2,3,4,5,6,7,12**
4	Integrate eco-friendly practices like alternative materials and efficient curing methods in concrete technology.	**1,2,3,4,5,6,7,12**
5	Learn to conduct tests to maintain industry standards and ensure safe construction practices.	**1,2,3,4,5,6,7,12**

SEMESTER – V									
Course Title	**Deep excavations, Foundations and Tunnels**								
Course code	**23BTCE315R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ V semester of Third year of the programme**								
Course Objectives	1. Explore the concepts of Deep excavations and Pre-excavation support systems 2. Explain the construction and design of pile foundations 3. Discuss the tunnel construction methods and support systems								
CO1	Comprehend the basic concepts of deep excavation, support systems								
CO2	Compute capacity of piles and select suitable type of pile foundation based on soil conditions								
CO3	Apply different construction procedures of pile foundation.								
CO4	Select suitable pre-excavation and tunnel support systems for different ground conditions								
CO5	Comprehend the tunnel instrumentation and monitoring systems								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Deep Excavations and Deep Foundations** Introduction to deep excavations, types of deep foundations, Design basis for pile foundations and selection of Pile foundations, Site investigations	**4**	Students will develop a comprehensive understanding of the roles and responsibilities of stakeholders in the construction industry, including regulatory bodies, standardization organizations, professional bodies, clients, developers, consultants, contractors, and manufacturers.	1, 2
II	**Construction and design of Pile foundations** Bored Cast In-situ piles, Precast driven Piles, Under reamed Piles, Pile group and Load testing on piles, Challenges in piling operations, Quality control of Piles, Case studies	**4**	Students will develop a comprehensive understanding of professional ethics encompassing personal, business, and engineering contexts, including codes of conduct and responsibilities towards ethical dilemmas.	2, 3
III	**Underground Metro stations and Retaining structures** Diaphragm walls, Secant piles, Contiguous piles, Soldier piles, Design of Embedded Earth retaining systems, shafts.	**4**	Participants will develop comprehensive knowledge of contract management principles, including contract types, conditions, bid evaluation, and legal considerations under the Indian Contract Act, 1972.	3, 4
IV	**Tunnels and Pre-Excavation support systems** Methods of construction of tunnels, top down methods, bottom up methods, Drill and blast, NATM, NMT, Cut and cover tunnels, Support systems – Rock Bolts, Lattice girders, Anchors, shotcrete, face support, umbrella arch	**4**	Students will develop comprehensive knowledge of arbitration, conciliation, and ADR systems, including the distinctions between arbitration laws, types of arbitration agreements, and alternative dispute resolution methods like mediation and LokAdalats.	4, 5

	systems.			
V	**Tunnel Monitoring systems** Instrumentation and monitoring, Monitoring Plan, Trigger limits, Case studies	**4**	Students will develop a comprehensive understanding of labor engagement methods, industrial dispute resolution frameworks, and intellectual property laws pertinent to civil engineering projects.	5

TEXT BOOKS:

T1: B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
T2: The National Building Code, BIS, 2017
T3: T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House

Reference Books:

R1: Indian Standard code- IS 456, Guidance on embedded retaining wall design CIRIA- C760
R2:David Chapman, ,Nicole MetjeCRC Press , 2017Alfred Stark " Introduction to Tunnel Construction "
R3:M. Ramachandran,"Metro Rail Projects in India- A Study in Project Planning "2011, Oxford University Press

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Recognize professionalism in an organization.	**5, 7**
2	Distinguish between the does and don'ts for the betterment of the society and environment.	**8**
3	Classify Various types of contract and their features.	**7,9**
4	Discuss the measures of Alternative Dispute Resolution.	**11,12**
5	Categorize different types of Intellectual property rights.	**10**

SEMESTER – V									
Course Title	**Formwork Engineering Practices**								
Course code	**23BTCE316R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ V semester of Third year of the programme**								
Course Objectives	1. To select the appropriate formwork system 2. To design the formwork system 3. To compute the bill of quantity for the formwork system								
CO1	Analyze the project, and decide appropriate formwork materials and suitable formwork system								
CO2	Design formwork systems as per Industrial requirement								
CO3	Estimate the bill of quantity and optimize the formwork cost								
CO4	Prepare the layout and detailed drawing for the formwork system								
CO5	Analyze the project, and decide appropriate formwork materials and suitable formwork system								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Introduction to Formwork** Classification, benefits, objectives, areas of competitiveness, selection of Formwork, formwork materials, accessories and consumables, application of Tools. Formwork for Foundation, Wall, Columns, Slab and Beam. Conventional drawings. Vertical Application of Conventional Foundation Formwork, Formwork components, Components, assembly and de-shuttering of formwork System, Flex System, Heavy Duty Tower System, safety of work, Formwork for stairs, Load Bearing Tower.	**4**	Students will understand the classification, benefits, and components of formwork for various structural elements.	1, 2
II	**Planning and Design of formwork** Formwork planning and monitoring, basics of formwork design, design assumptions and design methods. Design of wall formwork, slab formwork and checks. Formwork drawing Concept and preparation Guidelines, BOQ Calculation and Checklist	**4**	Students will develop Develop skills in formwork planning, design, BOQ preparation, and cost estimation.	2, 3, 4
III	**Formwork cost estimation and optimization** Schedule of formwork, Mobilization distribution, BOQ, Quantity Calculation, Cost optimization	**4**	Students will develop a comprehensive Analyze modular and special formwork systems, including scaffolding safety and global innovations.	1, 2, 3, 4
IV	**Modular and Special formwork, scaffolding** Modular and Special formwork: Advantages and Limitations, Shuttering and de-shuttering, applications, Aluminum formwork - Drawings & Components, Activities, High rise construction,	**4**	Students will develop a comprehensive understanding of Indian fine arts, encompassing painting, handicrafts,	1, 2

	Table lifting system Scaffolding: Modular scaffold Installation sequence, Tie and material specification, Ladder safety, Loading Classification, application, Components of L&T Modular Scaffolding system, Access scaffold Do's and Don'ts. Innovation and Global practices.		music, dance, drama, architecture, and the evolution of science and technology throughout Indian history.	
V	**Formwork building and erection, Formwork Failures** Formwork assembly for Wall & Column Panels, Equipment and Layout, Plant and Machinery, Formwork erection and safety, Inspection and Corrections, Plant and Machinery, Code and Contractual Requirements. Formwork Failures: Causes, design deficiency, safety in formwork, prevention of formwork failures.	**4**	Students will develop a comprehensive understanding of best practices in formwork assembly, erection, safety, and failure prevention..	2, 3, 4, 5

TEXT BOOKS:

T1: DIN 18218 Pressure of fresh concrete on vertical formwork

REFERENCE BOOKS:

R1: " IS14687:1999 Guidelines for falsework for concrete structures
R2:ACI 347-04 Guide to Formwork for Concrete
R3: Concrete pressure on formwork (R108D) - CIRIA
R4:DIN 18218 Pressure of fresh concrete on vertical formwork
R5:IS 456: Plain and Reinforced Concrete - Code of Practice
R6:IS: 800–2007 General Construction in Steel - Code of Practice
R7:IS: 399–1963 Classification of Commercial Timbers and their Zonal Distribution
R8:IS: 883–1994 Design of Structural Timber in Building - Code of Practice
R9:IS: 4990–1993 Plywood for concrete shuttering work
R10:IS: 2750–1964 Steel Scaffoldings
R11:IS 1161: 2014 Covers Steel Tubes for Structural Purposes

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Analyze the project, and decide appropriate formwork materials and suitable formwork system	**2,6,8**
2	Design formwork systems as per Industrial requirement	**3,9,5**
3	Estimate the bill of quantity and optimize the formwork cost	**1,7,9**
4	Prepare the layout and detailed drawing for the formwork system	**9,1,8**
5	Analyze the project, and decide appropriate formwork materials and suitable formwork system	**10,12,6**

SEMESTER – V									
Course Title	**Foundations of Project Management**								
Course code	**23MOCE312R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 15P	**0**	**0**	**0**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ V semester of Third year of the programme**								
Course Objectives	1.Develop a fundamental understanding of project management principles, including lifecycle phases, constraints, and stakeholder roles. 2.Equip students with essential tools and techniques for project planning, scheduling, budgeting, and risk management to ensure effective execution. 3.Enhance analytical and decision-making skills for monitoring, controlling, and evaluating project performance, ensuring successful project completion.								
CO1	Understand the fundamental principles, lifecycle, and key constraints of project management.								
CO2	Apply project planning techniques, including WBS, scheduling (CPM & PERT), and resource allocation.								
CO3	Analyze project cost estimation, budgeting, and financial control methods to ensure cost-effectiveness.								
CO4	Evaluate project execution, monitoring, and risk management strategies for successful project delivery.								
CO5	Assess project closure processes, documentation, and lessons learned for continuous improvement.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Introduction to Project Management** – Definition, Importance, and Lifecycle of a Project; Project Phases; Role of a Project Manager; Project Constraints (Scope, Time, Cost, Quality, Risk, and Resources).	**3**	Understand the fundamental concepts of project management and the role of project managers in ensuring successful project execution.	1,2
II	**Project Planning and Scheduling** – Work Breakdown Structure (WBS); Gantt Charts; Critical Path Method (CPM); Program Evaluation Review Technique (PERT); Resource Allocation; Risk Management in Planning.	**3**	Develop and apply project planning techniques, including scheduling methods like CPM and PERT.	2,3
III	**Project Cost and Budgeting** – Estimating Costs; Cost Control Techniques; Earned Value Management (EVM); Project Budgeting and Financial Planning; Cost-Benefit Analysis.	**3**	Analyze and manage project costs, ensuring effective budgeting and financial control.	2,3
IV	**Project Execution, Monitoring, and Control** – Project Implementation Strategies; Performance Measurement; Change Management; Risk Identification and Mitigation; Quality Assurance in Projects;	**3**	Implement project execution and monitoring techniques, ensuring adherence to scope, cost, and quality requirements.	3,4

	Communication and Stakeholder Management.			
V	**Project Closure and Lessons Learned** – Project Evaluation; Post-Project Reviews; Documentation and Reporting; Best Practices for Future Projects; Case Studies.	**3**	Assess completed projects, identifying key takeaways and improvement areas for future project management success.	4,5

Textbooks:

T1: Project Management: A Systems Approach to Planning, Scheduling, and Controlling – Harold Kerzner

T2:Project Management for Engineering and Construction – Garold D. Oberlender

Reference Books:

R1: PMBOK Guide (Project Management Body of Knowledge) – Project Management Institute (PMI)

R2:Construction Project Management – Frederick Gould & Nancy Joyce

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand the fundamentals of project management and its lifecycle.	1,2
2	Apply project planning and scheduling techniques for effective execution.	3,4
3	Evaluate project cost estimation and financial control methods.	2,5
4	Monitor and control project performance, ensuring quality and risk management.	4,6
5	Assess project closure processes and lessons learned for future improvements.	5,7

SEMESTER – V									
Course Title	**Field-based Training**								
Course code	**23BTCE317R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 16P	**0**	**0**	**0**	**0**	**0**	**16**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ Vsemester of Third year of the programme**								
Course Objectives	1.Provide hands-on experience in real-world construction, surveying, and infrastructure projects. 2.Develop practical problem-solving skills and adaptability in field conditions. 3.Enhance students' ability to interpret and apply theoretical knowledge in professional environments.								
CO1	Understand the significance of field-based training in civil engineering applications..								
CO2	Apply site surveying, construction techniques, and material testing in a field environment.								
CO3	Analyze site constraints, risk factors, and environmental impact during project execution.								
CO4	Evaluate quality control measures, safety protocols, and field management techniques.								
CO5	Document field observations, report findings, and suggest practical improvements.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction to Field-Based Training – Importance, Objectives, and Role in Civil Engineering Projects.	**3**	Understand the relevance and objectives of field-based training in engineering.	1, 2
II	Surveying Techniques – Total Station, GPS, Leveling, and Contouring; Site Layout & Measurement Methods.	**3**	Apply field surveying techniques and analyze measurements.	1, 2, 3, 4
III	Construction Practices – Foundations, Reinforcement, Formwork, and Concreting Methods.	**3**	Gain hands-on exposure to key construction practices and material handling.and application in pavement construction.	1, 2, 3, 4, 5
IV	Safety, Quality Control & Risk Assessment – Site Safety Measures, Quality Testing, Risk Identification, and Mitigation.	**3**	mplement quality assurance and safety protocols in field projects.	2, 3, 4
V	Field Report & Analysis – Documentation, Report Writing, and Case Study Evaluation	**3**	Analyze and document field experiences for future reference and improvement.	2, 3, 4, 5

Textbooks

T1: Construction Planning, Equipment, and Methods – Robert L. Peurifoy

T2: Surveying for Engineers – J. Uren & W. F. Price

Reference Books

R1: Building Construction Handbook – Roy Chudley & Roger Greeno

R2: Field Guide for Construction Management – Richard H. Clough

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SL N	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand the relevance of field-based training.	1,2
2	Apply surveying and construction techniques.	3,4
3	Analyze field constraints and risk factors.	2,5
4	Evaluate quality control and safety measures.	4,6
5	Document and report field observations effectively.	5,7

SEMESTER – V									
Course Title	**Competent English for Engineers**								
Course code	**23UBPD314R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 60P	**0**	**0**	**4**	**0**	**0**	**16**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ V semester of Third year of the programme**								
Course Objectives	1.Enhance students' communication, leadership, and interpersonal skills for professional and personal growth. 2.Develop critical thinking, problem-solving, and decision-making abilities. 3.Improve self-confidence, time management, and adaptability for career readiness.								
CO1	Understand the importance of personal development and self-improvement strategies.								
CO2	Apply communication and presentation skills effectively in professional settings.								
CO3	Analyze leadership qualities, teamwork dynamics, and conflict resolution techniques.								
CO4	Evaluate stress management, emotional intelligence, and work-life balance strategies								
CO5	Develop career planning, resume building, and interview skills for professional success.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Introduction to Personal Development – Definition, Importance, and Key Areas of Self-Growth.	3	Understand the significance of personal development in professional and personal life.	1, 2
II	Communication Skills – Verbal & Non-verbal Communication, Public Speaking, and Presentation Techniques.	3	Apply effective communication strategies in different professional scenarios.	1, 2, 3, 4
III	Leadership & Teamwork – Leadership Styles, Team Building, Conflict Resolution, and Decision-Making Skills.	3	Analyze leadership qualities and teamwork strategies for better collaboration.	1, 2, 3, 4, 5
IV	Stress Management & Emotional Intelligence – Handling Pressure, Work-Life Balance, and Self-Motivation.	3	Evaluate stress management techniques and emotional intelligence for better productivity.	2, 3, 4
V	Career Readiness – Resume Writing, Interview Skills, Professional Etiquette, and Goal Setting.	3	Develop job readiness skills, career planning strategies, and confidence for professional success.	2, 3, 4, 5

Textbooks

T1: The 7 Habits of Highly Effective People – Stephen R. Covey

T2: How to Win Friends and Influence People – Dale Carnegie

Reference Books

R1: Emotional Intelligence 2.0 – Travis Bradberry & Jean Greaves

R2: The Power of Positive Thinking – Norman Vincent Peale

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand the importance of personal development.	1,2
2	Apply communication and presentation skills effectively.	3,4
3	Analyze leadership and teamwork strategies.	2,5
4	Evaluate stress management and emotional intelligence techniques.	4,6
5	Develop career readiness and job preparation skills.	5,7

SEMESTER – V									
Course Title	**Summer Training**								
Course code	**23BTCE318R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 15T	**0**	**0**	**0**	**0**	**0**	**48**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ V semester of Third year of the programme**								
Course Objectives	1.Provide hands-on industry experience through practical exposure in construction, design, and project management. 2.Develop problem-solving and technical skills by working on real-world engineering projects. 3.Enhance professional skills, including teamwork, communication, and industry ethics, to prepare for future careers.								
CO1	Understand the practical applications of civil engineering concepts in a professional setting.								
CO2	Apply engineering knowledge to analyze and solve industry-related problems.								
CO3	Develop technical and managerial skills through direct involvement in projects.								
CO4	Evaluate industry standards, safety regulations, and best practices in the field.								
CO5	Document experiences, create reports, and present findings from the summer training.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Introduction to Summer Training – Objectives, Industry Expectations, and Learning Outcomes.	3	Understand the significance of summer training in career development.	1, 2
II	Site Visits & Practical Exposure – Understanding Workflows, Construction Processes, and Project Stages.	3	Gain hands-on exposure to real-world projects and industry practices.	1, 2, 3, 4
III	Engineering Analysis – Structural Design, Material Testing, Surveying, and Project Execution Techniques.	3	Apply theoretical knowledge in practical fieldwork and engineering solutions.	1, 2, 3, 4, 5
IV	Safety, Ethics & Professionalism – Industry Safety Standards, Ethical Considerations, and Work Ethics.	3	Evaluate professional responsibilities, safety measures, and ethical concerns.	2, 3, 4
V	Report Writing & Presentation – Documentation of Fieldwork, Report Preparation, and Final Presentation.	3	Develop communication and technical writing skills for professional documentation.	2, 3, 4, 5

Textbooks

T1: Construction Management and Planning – B. Sengupta & H. Guha

T2: Practical Civil Engineering – P.K. Jayasree & K. Balan

Reference Books

R1: Civil Engineering Project Management – Alan Twort & Gordon Rees

R2: Site Engineering for Construction – Edward R. Fisk

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SL N	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand the practical applications of civil engineering.	1,2
2	Apply engineering knowledge to solve industry-related problems.	3,4
3	Develop technical and managerial skills through project involvement.	2,5
4	Evaluate safety standards, ethics, and industry best practices.	4,6
5	Document and present field experiences effectively.	5,7

SEMESTER – V									
Course Title	**EXTRA-CURRICULAR ACTIVITIES**								
Course code	**23UBEC311**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 15P	**0**	**0**	**0**	**4**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech Civil Engineering**								
Semester	**Fall/ fifth semester of 3rd year of the programme**								
Course Objectives	1.To develop soft and social skills 2.To promote a holistic development of the learners 3.To enhance the learning experience in different stages etc.								
CO1	Participants will develop personal skills, such as leadership, communication, time management, and teamwork, contributing to their overall character development and self-confidence.								
CO2	Engagement in Community service and outreach activities will cultivate a sense of social responsibility, empathy, and civic awareness, encouraging students to actively contribute to society								
CO3	Express their ideas, views, In-depth evaluation and analysis clearly in the topic of their interest.								
CO4	The students will be given a platform to earn from invited experts in their respective fields.								
CO5	Demonstrate and practices different activities, by Integrating learning experiences by demonstrating transferable skills.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Different types of activities outside regular curriculum	**10**	AdtU encourages a range of activities outside the regular curriculum intended to meet learner's interest. These activities are aimed to develop the social and soft skills and promote a holistic development of the learners. Keeping in mind the 360-degree learning methodology the students are engaged in different activities headed under different clubs viz. Dance, music, photography, drama, literary etc. The students are encouraged to participate in regular club activities, workshops, competitions as per their interest and hobbies. The student members of the club are trained represent AdtU in various inter University student and national level competitions Renewed personalities are invited to conduct workshops that benefit the members and students by giving them the platform to learn from experts in the respective fields.	1,2,3,4,5

SEMESTER – VI									
Course Title	**Hydrology & Water Resources Engineering**								
Course code	**23BTCE321R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T+30P	**3**	**0**	**2**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ VI semester of Third year of the programme**								
Course Objectives	1.To study occurrence movement and distribution of water that is a prime resource for development of a civilization. 2.To know diverse methods of collecting the hydrological information, which is essential, to understand surface and ground water hydrology. 3.To know the basic principles and movement of ground water and properties of ground water.								
CO1	Remember the key drivers on water resources, hydrological processes and their integrated behaviour in catchments.								
CO2	Apply the knowledge of hydrological models to surface water problems including basin characteristics, runoff and hydrograph								
CO3	Explain the concept of hydrological extremes such as flood and drought and its management strategies								
CO4	Apply the concepts of groundwater for water resources management								
CO5	Understand the importance of spatial analysis of rainfall and design water storage reservoirs.								

Unit -No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Introduction:** hydrologic cycle, water-budget equation, history of hydrology, world water balance, applications in engineering, sources of data	**9**	Understanding the hydrologic cycle and its components is fundamental for assessing global water distribution and its applications in engineering practices.	1, 2
II	**Precipitation:** forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, deptharea-duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India, evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, evapotranspiration equations, potential evapotranspiration over India, actual evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices	**9**	Understanding the characteristics and measurement of precipitation and evapotranspiration processes, including their impact on hydrological systems.	2, 3, 4
III	**Runoff:** runoff volume, SCS-CN method of	**9**	Students will demonstrate an understanding of runoff	1, 2,

	estimating runoff volume, flowduration curve, flow-mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph surface water resources of India, environmental flows.		estimation methods, hydrograph components, and factors influencing surface water resources and environmental flows.	3, 4
IV	**Ground water:** forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.	**9**	Students will demonstrate an understanding of aquifer properties and well hydraulics, including steady state flow and aquifer test analysis.	1, 2
V	**Dam and Spillway:**embankment dams: Classification, design considerations, estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Arch and buttress dams. Spillways: components of spillways, types of gates for spillway crests; Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site.	**9**	Understanding the design considerations and seepage control in embankment dams, gravity dams, arch dams, buttress dams, and spillways, including reservoir capacity, sedimentation, and economic height considerations.	2, 3, 4, 5

TEXT BOOKS:

T1: K Subramanya, Engineering Hydrology, Mc-Graw Hill.
T2: K N Muthreja, Applied Hydrology, Tata Mc-Graw Hill.

REFERENCE BOOKS:

R1: K Subramanya, Water Resources Engineering through Objective Questions, Tata McGraw Hill.
R2: Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill
R3: G L Asawa, Irrigation Engineering, Wiley Eastern

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Remember the key drivers on water resources, hydrological processes and their integrated behavior in catchments.	**1,3 & 4**
2	Apply the knowledge of hydrological models to surface water problems including basin characteristics, runoff and hydrograph	**1,2**
3	Explain the concept of hydrological extremes such as flood and drought and its management strategies	**7.9,10**
4	Apply the concepts of groundwater for water resources management	**5,7**
5	Understand the importance of spatial analysis of rainfall and design water storage reservoirs	**5,8**

SEMESTER – VI									
Course Title	**Design of RC Structure**								
Course code	**23BTCE322R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Civil Engineering**								
Semester	**Winter/ VI semester of third year of the programme**								
Course Objectives	1. Develop an understanding and appreciation for basic concepts in the behavior and design of reinforced concrete systems and elements. 2. Differentiate between working stress design and limit state design. 3. Understand the basic concepts for reinforced concrete sectional design mainly in accordance with ultimate strength.								
CO1	Understand the general mechanical behavior of reinforced concrete in accordance with IS456:2000.								
CO2	Identify and apply the applicable industry design codes relevant to the design of reinforced concrete members.								
CO3	Analyze and design reinforced concrete flexural members with detailing.								
CO4	Design and check for serviceability (crack and deflection) and ultimate limit state conditions.								
CO5	Assess the stresses and design vertical and horizontal shear reinforcements in reinforced concrete members with detailing.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Concepts of RC. Design – Working Stress Method - Limit State method – Material Stress Strain Curves – Safety factors – Characteristic values. Stress Block parameters – IS – 456 –2000. Beams: Limit state analysis and design of singly reinforced, doubly reinforced, T and L beam sections	**10**	Upon completion of the course, students will demonstrate proficiency in applying both the Working Stress Method and the Limit State Method in the design of reinforced concrete structures, including beams, columns, slabs, and footings.	1,2
II	Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing; Design of canopy.	**10**	Students will be able to analyze and design reinforced concrete beams for both flexural and shear capacities using appropriate IS code provisions. They will also be competent in designing various types of columns under axial loads, uniaxial bending, and biaxial bending scenarios.	1,2
III	Short and Long columns – under axial loads, uniaxial bending and biaxial bending – I S Code provisions.	**8**	By the end of the course, students will have acquired skills in detailing reinforced concrete elements such as beams and footings, ensuring compliance with design specifications and structural integrity requirements.	1,2

IV	Footings: Different types of footings – Design of isolated, square, rectangular, circular footings and combined footings.	**7**	Students will be capable of designing different types of footings (isolated, square, rectangular, circular, and combined footings) to support varying loads and soil conditions. They will also be proficient in designing one-way slabs, two-way slabs, and continuous slabs, considering IS coefficients and limit state design principles.	1,2
V	Design of one-way slab, Two-way slabs and continuous slab Using I S Coefficients Limit state design for serviceability for deflection, cracking and codal provision. Design of doglegged staircase.	**10**	Upon completion of the course, students will be able to assess and design reinforced concrete structures while ensuring compliance with safety factors, characteristic values, and codal provisions related to serviceability criteria such as deflection, cracking, and durability.	1,2

Text Books:

T1 Reinforced concrete design by by S. Unnikrishna Pillai & Devdas Menon, Tata McGraw Hill, New Delhi.

T2 Limit state designed of reinforced concrete – P. C. Varghese, Prentice Hall of India,New Delhi.

Reference Books:

R1 Design of Reinforced Concrete Structures by I. C. Syal and A. K. Goel, S. Chand & company.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
Sl No.	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Understand the general mechanical behavior of reinforced concrete in accordance with IS456:2000.	**1,3 & 4**
2	Identify and apply the applicable industry design codes relevant to the design of reinforced concrete members.	**1,2**
3	Analyze and design reinforced concrete flexural members with detailing.	**7.9,10**
4	Design and check for serviceability (crack and deflection) and ultimate limit state conditions.	**5,7**
5	Assess the stresses and design vertical and horizontal shear reinforcements in reinforced concrete members with detailing.	**5,8**

SEMESTER – VI										
Course Title	**Irrigation Engineering**									
Course code	**23BTCE323R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**	
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**	
Pre-requisite	**Nil**	**Co-requisite**	**Nil**							
Programme	**B. Tech in Civil Engineering**									
Semester	**Winter/ VI semester of Third year of the programme**									
Course Objectives	1. To take up the basic concepts of irrigation and construction of various hydraulic structures. 2. To introduce students to basic concepts of water, plants, their interactions, as well as irrigation and drainage systems design, planning and management. 3. The structures involved the elementary hydraulic design of different structures and the concepts of maintenance shall also form part.									
CO1	Summarize the Concepts of irrigation and different hydraulic structures.									
CO2	Summarize the estimation the quantity of water required by crops.									
CO3	Analyze, plan and design irrigation projects.									
CO4	Design channels and other irrigation structures required for irrigation, drainage, soil conservation, flood control and other water-management projects.									
CO5	Apply math, science, and technology in the field of water resource engineering.									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**WATER REQUIREMENTS FOR CROPS** Irrigation requirements in India: Scope, Soil moisture & Plant growth, crop water requirements, Irrigation efficiencies, Duty-Delta-base period & relation between them, Surface & subsurface irrigation method, Irrigation water Quality. Consumptive use of crops.	**9**	Students will be able to determine the water requirements for various crops and understand the factors affecting soil moisture and plant growth. They will calculate irrigation efficiencies and comprehend the relationships between duty, delta, and base period. Additionally, students will assess the quality of irrigation water and its impact on consumptive use by crops.	1, 2
II	**DIVERSION HEAD WORKS** Introduction, layout of diversion headwork and its component, khosla's theory and concept of flow net, safe exit gradient, hydraulic design of weir on Bligh's theory and design of modern barrage on khosla's theory. Necessity & functioning of silt excluder & silt extractor. Classification and selection of cross drainage work, hydraulic design aspects of aqueduct and syphon aqueduct. Canal falls: Necessity and classification of canal falls, hydraulic design of Sarda type and a Straight Glacis fall.	**9**	Students will develop the ability to design and analyze diversion headworks, including the layout and components of such systems. They will apply Khosla's theory and the concept of flow nets for hydraulic design and understand the principles behind weir and barrage design. Furthermore, students will explore the necessity and functioning of silt excluders and silt extractors and design storage headworks like gravity and earth dams considering various stability and hydraulic design criteria.	2, 3, 4
III	**CANALS CANAL WORKS** CANALS: Definition. Types of canals, Design of lined and unlined	**9**	Students will learn to classify and design different types of canals, including lined and unlined channels.	1, 2, 3, 4

	channels, Alignment of canals. Design of canals by Kennedy's and Lacey's methods. CANAL WORKS: Canal regulators: Classification and suitability. Canal drops: Classification. Hydraulic design principles for notch type drop. Cross drainage works: Classification. Hydraulic design principles for an aqueduct.		They will use Kennedy's and Lacey's methods to design canals and understand the alignment considerations. Additionally, students will evaluate and design canal regulators, drops, and cross drainage works, applying hydraulic design principles for various types of canal structures.	
IV	**Storage Head Works** Necessity and classification of Dams, Selection of site of Dam. Gravity Dam: Introduction, Forces acting on Dam, Stability criterion, Elementary profile of dam, Drainage gallery, Hydraulic design of gravity dam. Earth Dam: Introduction, design principle, seepage throughout dam, seepage line, control of seepage, and design of filter.	**9**	Students will understand the various methods of irrigation, including tank and well irrigation, surface and subsurface irrigation, and advanced techniques like drip and sprinkler irrigation. They will design efficient irrigation systems tailored to specific crops and environmental conditions and develop irrigation schedules to optimize water use and distribution systems.	1, 2
V	**IRRIGATION METHODS** Tank irrigation – Well irrigation – Irrigation methods: Surface and Sub-Surface and Micro Irrigation – design of drip and sprinkler irrigation – ridge and furrow irrigation-Irrigation scheduling – Water distribution system- Irrigation efficiencies. **CANAL IRRIGATION** Canal regulations – direct sluice – Canal drop – Cross drainage works-Canal outlets – Design of prismatic canal-canal alignments-Canal lining – Kennedy's and Lacey's Regime theory.	**9**	Students will apply the principles of canal irrigation, including canal regulations and the design of canal drops, cross drainage works, and canal outlets. They will design prismatic canals and align canals using the principles of canal lining and regime theories by Kennedy and Lacey. Additionally, students will understand the implications of canal alignment and lining on the efficiency and effectiveness of canal irrigation systems.	2, 3, 4, 5

TEXT BOOKS:

T1: Irrigation Engineering and Hydraulic Structures, by S. K. Garg, Khanna Publishers, New Delhi.
T2: Irrigation, Water Power and Water Resources Engineering, by K. R. Arora, Standard Publications, New Delhi.

REFERENCE BOOKS:

R1: Irrigation and Water Power Engineering, by Punmia and PandeyLal, Lakshmi Publications, New Delhi.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Summarize the Concepts of irrigation and different hydraulic structures.	**2,6,3**
2	Summarize the estimation the quantity of water required by crops.	**3,9,8**
3	Analyze, plan and design irrigation projects.	**1,3,9**
4	Design channels and other irrigation structures required for irrigation, drainage, soil conservation, flood control and other water-management projects.	**2,9,4**
5	Apply math, science, and technology in the field of water resource engineering.	**10,12**

SEMESTER – VI										
Course Title	**Geospatial Technique in Practice**									
Course code	**23BTCE324R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**	
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**	
Pre-requisite	**Nil**	**Co-requisite**	**Nil**							
Programme	**B. Tech in Civil Engineering**									
Semester	**Winter/ VI semester of Third year of the programme**									
Course Objectives	1. Recall the significance of geospatial technology in daily life and highlighting its relevance in the construction industry. 2. Analyze the principles and scientific foundation underpinning Remote Sensing, Photogrammetry, UAV, LiDAR, RADAR, and SONAR. 3. Comprehend the fundamental of GIS and generate a map layout in a GIS environment, incorporating all necessary cartographic elements.									
CO1	Comprehend the fundamentals of geospatial techniques in the construction industry lifecycle management									
CO2	Utilize different scanning and remote sensing technologies, including Photogrammetry, UAV, LiDAR, RADAR, and SONAR.									
CO3	Create a map layout with all essential cartographic elements in GIS environment									
CO4	Examine case studies demonstrating the realization benefits of geospatial technologies									
CO5	Evaluate spatial data for feature class analysis and terrain analysis using GIS.									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Introduction to Geospatial Technology & Its Relevance in the Construction Industry** Geospatial in Day-to-Day Life, Importance of Spatial Thinking, Evolution of location technology, Importance of spatial information, Logic and Language of Geospatial Technologies, Location perspective of construction industry, Overview of Geospatial technology in tenders, Design and execution and Construction lifecycle management. Fundamentals and components of Geospatial Technologies, Basics of Surveying, Conventional survey equipment Vs Modern surveying equipment Components. Hands on Demonstrations of Auto Levelling and Total Station, GNSS overview, components and working principle, Methods, Benefits and Advantages of GNSS, Processing of GNSS data and its applications in real world..	**9**	Understand the importance of spatial thinking and geospatial technologies in daily life and the construction sector. Explain the evolution of location-based technologies and their significance in construction project management.Identify the role of geospatial technologies in various construction phases, including tendering, design, execution, and lifecycle management. Differentiate between conventional and modern surveying techniques and their impact on construction workflows.	1, 2
II	**Geospatial Engineering and technology**	**9**	Understand the core components of geospatial technologies, including surveying equipment and	2, 3, 4

	Scanning and Remote Sensing Technologies,3D scanning, Sensors and their types, Overview and working of various platforms. Application of sensors & platforms, Principles and the science behind photogrammetry, LiDAR, RADAR, and SONAR. Data Acquisition & Software Processing Hands on Demonstrations of Outdoor & Indoor Terrestrial Lidar Equipment, Bathymetry, Ground Penetrating RADAR. Introduction to Geospatial Engineering Solutions, CORS, Scan to Model-Overview & Use Case,Understanding the need for visualization, UAV in Construction Industry, Quantity Estimation in Construction sites.		methodologies.Compare conventional surveying tools with modern digital surveying technologies like Auto Levelling, Total Station, and GNSS. Demonstrate hands-on knowledge of GNSS technology, including its components, working principles, and real-world applications.Process GNSS data and apply it in construction planning and monitoring.	
III	**Geographic Information System [GIS] & Data Base Management System [DBMS]** GIS: Basics & Components of GIS, GIS Data Models (Vector & Raster), Hardware for GIS, DEM and TIN Data products, Attributes Data, Types & Elements of Maps, Coordinate Systems & Projections. Demonstrations of QGIS Software: Features, Toolbars, Panels, Plugins, Attribute Data- Field Calculator & Selection Feature, Choropleth, Graduated Symbol, Heat & Dot Distribution Maps Preparations, Exploring Base maps and GPS Data, Conversion of Excel to GIS, Conversion of CAD TO GIS, Georeferencing & Digitization Techniques for Toposheet, Open Street Maps and Google Earth Images GIS database management – RDBMS, SQL, Creation, configuration, and enterprise Geodatabase.	**9**	Explain the principles of remote sensing, photogrammetry, LiDAR, RADAR, and SONAR in data acquisition. Utilize 3D scanning and sensor-based technologies for construction site analysis and project monitoring. Conduct hands-on demonstrations of terrestrial LiDAR, bathymetric surveys, and ground-penetrating radar applications. Understand UAV applications in construction, including site surveying and quantity estimation. Analyze real-world use cases of geospatial technologies in construction, such as Scan-to-Model and CORS.	1, 2, 3, 4
IV	**Geospatial Analysis and Engineering Applications** Exploring QGIS Software for Feature Class Analysis: Satellite	**9**	Understand the fundamentals and components of GIS, including vector and raster data models.Explain different GIS data products like DEM	1, 2

	Image Processing, Supervised and Unsupervised Classification, Change Detection Analysis. Harnessing QGIS Software for Spatial Analysis: Overlay Analysis, Buffer Analysis, Cluster Analysis, Hotspot Analysis, Viewshed Analysis. Leveraging QGIS Software for Terrain Analysis: Slope, Aspect & Elevation, Catchment Area delineation, Watershed Analysis. Utilizing QGIS Software for Engineering Analysis: Profiling & Cross sectioning Maps, Building Footprints Extraction, 3D Maps.		and TIN and their applications in engineering. Explore and apply various mapping techniques, including thematic maps, base maps, and GPS data integration.Demonstrate proficiency in using QGIS software for geospatial data visualization, georeferencing, and digitization.Convert and integrate CAD and Excel data into GIS for construction and infrastructure planning. Understand RDBMS and SQL for geospatial database management and enterprise GIS applications.	
V	**Geospatial Information Technology & Future trends** Geospatial IT, Enterprise GIS & its components, Web App Essentials, Web & Mobile GIS, FAMeVol Web application & LMNoP Case Study, Emergency response use cases, Decision Support System, Progress GIS Case Study, Spatial Dashboards, Role of Open-Source GIS Web App. Benefits of Geospatial Technologies, Case Studies in Benefit Realization, Advancements in Modern Survey & Mapping Technologies, Advancements in Spatial Analytics – Geo Intelligence, Future Trends, Digital Twin: GIS with BIM, Geospatial Technology - Way Forward.	**9**	Perform spatial analysis using QGIS, including feature class analysis, supervised and unsupervised classification, and change detection analysis. Conduct spatial operations such as overlay analysis, buffer analysis, cluster analysis, hotspot analysis, and viewshed analysis.Utilize terrain analysis tools for slope mapping, aspect analysis, watershed delineation, and catchment area studies. Generate engineering-related geospatial outputs such as cross-section maps, building footprint extractions, and 3D mapping.	2, 3, 4, 5

TEXTBOOKS:

T1: "Introduction to Geographic Information Systems" by Kang-Tsung Chang.

REFERENCE BOOKS:

R1 "Geospatial Analysis: A Comprehensive Guide" by Michael J. de Smith, Michael F. Goodchild, and Paul Longley

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand the importance of spatial thinking and geospatial technologies in daily life and the construction sector.	**1,2,6,3**
2	Identify the role of geospatial technologies in various construction phases, including tendering, design, execution, and lifecycle management. .	**13,9,8**
3	Compare conventional and modern surveying techniques and evaluate their impact on construction workflows. .	**1,3,9**
4	Explain the principles of remote sensing, photogrammetry, LiDAR, RADAR, and SONAR in data acquisition and their construction applications.	**2,9,4**
5	Demonstrate proficiency in GIS software (QGIS) for geospatial data visualization, georeferencing, and digitization.	**10,12**

SEMESTER – VI										
Course Title	**Career Readiness in Digital era**									
Course code	**23BTCE327R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ VI semester of Third year of the programme**								
Course Objectives	1. To develop digital literacy and career awareness to understand the nature of psychological disorders. 2. To enhance career development and employability skills. 3. To Build Professional Online Presence and Networking Skills.								
CO1	An ability to explain the impact of digital technologies on the workforce identify emerging trends and technologies, and recognize the skills and competencies required for success in the digital era								
CO2	An understanding of demonstrating effective networking skills using digital platforms, communicate professionally and persuasively in digital environments, and build relationships with industry professionals, mentors, and peers.								
CO3	An ability to design and develop a professional online presence								
CO4	An ability to assess their strengths, weaknesses, opportunities, and threats (SWOT analysis), set career goals, and create a tailored plan to achieve those goals, incorporating digital tools and strategies.								
CO5	An ability to understand the scientific method and its application to psychology.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Unit I: Introduction to Career** Readiness in the Digital Era Overview of the digital era and its impact on careers, Defining career readiness in the digital age, Understanding the importance of digital literacy and career awareness, Setting career goals and developing a personalized career development plan	**9**	An understanding of demonstrating effective networking skills using digital platforms, communicate professionally and persuasively in digital environments, and build relationships with industry professionals, mentors, and peers.	1, 2
II	**Unit II: Digital Literacy and** Career Awareness Understanding digital technologies and their applications in various industries, Identifying emerging trends and technologies in the job market, Developing digital skills and competencies for career success, Creating a professional online presence (e.g., LinkedIn profile**)**	**9**	Students will learn to navigate the modern job market, create a personalized career development plan, and build effective networking and communication skills. Through interactive lectures, discussions, and hands-on activities, students will gain the knowledge, skills, and confidence to thrive in the digital workforce..	2, 3, 4
III	**Unit III: Career Development and Employability Skills** Understanding the importance of employability skills in the digital era, Developing effective communication and teamwork skills, Building a professional network and	**9**	Students will be equipped to launch their careers and stay adaptable in a rapidly changing job market. This course is essential for students seeking to future-proof their careers and succeed in the digital era.	1, 2, 3, 4

	establishing mentorship relationships, Creating a personalized career portfolio and resume			
IV	**Unit IV: Professional Online Presence and Networking** Creating a professional website or blog to showcase skills and experience, Developing a social media strategy for career advancement, Building and engaging with a professional online network, Understanding online etiquette and digital citizenship	**9**	Through interactive lectures, discussions, and hands-on activities, students will gain the knowledge, skills, and confidence to thrive in the digital workforce	1, 2
V	**Unit V: Launching and Advancing Your Career in the Digital Era** Developing a job search plan and timeline, Preparing for and acing job interviews in the digital era, Understanding career advancement strategies and opportunities for continuous learning and professional development.	**9**	An ability to explain the impact of digital technologies on the workforce, identify emerging trends and technologies, and recognize the skills and competencies required for success in the digital era. An understanding of demonstrating effective networking skills using digital platforms, communicate professionally and persuasively in digital environments, and build relationships with industry professionals, mentors, and peers.	2, 3, 4, 5

TEXT BOOKS:

T1"Career Development in the Digital Age" by Debra Osborn and Seth C. W. Hayden "The Digital Career: How to Get Ahead in the Digital Age" by James P. Rosenbaum

REFERENCE BOOKS:

R1: "Career Readiness in the Digital Age: A Guide for Students" by Christine H. Nittrouer "Digital Career Management: How to Develop Your Personal Brand and Online Presence" by Katy Tynan

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Comprehend the fundamentals of geospatial techniques in the construction industry lifecycle management.	1,3 & 4
2	Create a map layout with all essential cartographic elements in GIS environment	1,2
3	Utilize different scanning and remote sensing technologies, including Photogrammetry, UAV, LiDAR, RADAR, and SONAR.	7.9,10
4	Evaluate spatial data for feature class analysis and terrain analysis using GIS.	5,7
5	Examine case studies demonstrating the realization benefits of geospatial technologies	5,8

SEMESTER –VI										
Course Title	**Building Planning & Drawing**									
Course code	**23BTCE326R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T+30P	**2**	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ VI semester of Third year of the programme**								
Course Objectives	1. To develop skills in building planning and design. 2. To apply principles of building planning and design to create functional and aesthetically pleasing buildings. 3. To analyze and interpret building plans and drawings.								
CO1	An ability to explain the principles of building planning, including site analysis, climate responsive design, and user needs assessment, and apply these principles to design functional and efficient buildings.								
CO2	An ability to create accurate and detailed building drawings, using various techniques and tools, including hand drafting, computer-aided design (CAD)								
CO3	An ability to analyze and interpret building plans and drawings, identifying key elements such as spatial relationships, building systems, and construction details.								
CO4	An ability to apply relevant building codes and regulations to building design, ensuring that buildings are safe, accessible, and meet minimum building standards.								
CO5	An ability to communicate building design and construction information effectively, using various methods and tools, including drawings, models, and written reports, to stakeholders, including architects, engineers, contractors, and clients.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Unit 1: Introduction to Building Planning and Drawing** Overview of building planning and drawing, Importance of building planning and drawing, Basic drawing techniques and tools, Introduction to CAD and BIM software	**11**	Demonstrate knowledge of building codes, zoning laws, and regulations to ensure compliance in planning and designing structures.	1,2
II	**Unit 2: Building Planning Principles** Site analysis and planning, Building codes and regulations, Climate responsive design, User needs assessment and building programming, Building layout and circulation	**10**	Create accurate architectural drawings, including floor plans, elevations, sections, and site plans, using manual drafting techniques and CAD software	1,2
III	**Unit 3: Building Drawing Techniques** Hand drawing techniques for building plans and elevations, CAD drawing techniques for building plans and elevations, BIM modeling techniques for building design and construction, Dimensioning and annotation techniques, Drawing conventions and standards	**10**	Utilize principles of space planning, orientation, ventilation, and lighting to design functional and aesthetically pleasing buildings.	1,2
IV	**Unit 4: Building Design and Construction** Building design elements: walls, windows, doors, roofs; Building construction systems: foundation, frame, exterior finishes, Building services: plumbing, electrical, HVAC;	**7**	Read and interpret architectural, structural, and service drawings to understand the design intent and construction	1,2

	Sustainability and energy efficiency in building design, Building codes and regulations for accessibility and safety		requirements.	
V	**Unit 5: Building Presentation and Communication** Presentation techniques for building designs, Communication skills for architects and builders, Drawing and rendering techniques for building presentation, Model making and visualization techniques, Final project presentation and critique	**7**	Integrate sustainable design principles, safety measures, and cost-effective planning techniques in building layouts and designs.	1,2

Reference Books:

R1: Building Planning and Drawing **– M. Chakraborti**

Textbooks:

T1: Building Planning and Drawing" **– S. S. Bhavikatti**

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	An ability to explain the principles of building planning, including site analysis, climate responsive design, and user needs assessment, and apply these principles to design functional and efficient buildings.	**1,3 & 4**
2	An ability to create accurate and detailed building drawings, using various techniques and tools, including hand drafting, computer-aided design (CAD)	**1,2**
3	An ability to analyze and interpret building plans and drawings, identifying key elements such as spatial relationships, building systems, and construction details.	**7.9,10**
4	An ability to apply relevant building codes and regulations to building design, ensuring that buildings are safe, accessible, and meet minimum building standards.	**5,7**
5	An ability to communicate building design and construction information effectively, using various methods and tools, including drawings, models, and written reports, to stakeholders, including architects, engineers, contractors, and clients.	**5,8**

SEMESTER –VI									
Course Title	**Build Personal Resilience**								
Course code	**23MOCE322R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 15T	**0**	**0**	**0**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ VI semester of Third year of the programme**								
Course Objectives	1. To identify and understand personal resilience. 2. To develop self-awareness and self-care habits. 3. To build positive relationships and support networks.								
CO1	An ability to cultivate a growth mindset.								
CO2	An ability to practice self-care and prioritize well-being.								
CO3	An ability to develop problem-solving and adaptability skills.								
CO4	An understanding to enhance overall resilience.								
CO5	An ability to develop effective coping strategies.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Overview of personal resilience, Key components of resilience, Assessing personal resilience	**11**	Define personal resilience and recognize its importance in managing stress, setbacks, and challenges effectively.	1,2
II	Understandingself-awareness, Emotional regulation strategies, Mindfulness and self-compassion	**10**	Apply strategies to manage emotions, maintain a positive mindset, and stay composed under pressure.	1,2
III	Effective coping strategies, Stress management techniques, Building a support network	**10**	Utilize critical thinking and adaptive problem-solving techniques to overcome obstacles and setbacks.	1,2
IV	Applying resilience skills, Overcoming obstacles and setbacks, Maintaining resilience	**7**	Identify and implement healthy coping strategies, such as mindfulness, self-care, and social support, to navigate adversity.	1,2
V	Maintaining a resilient mindset, Continuing to build resilience, Finalizing a personalized resilience plan	**7**	Cultivate self-awareness, confidence, and perseverance to embrace challenges as opportunities for growth and personal development.	1,2

Textbooks:

T1: "Resilient: How to Grow an Unshakable Core of Calm, Strength, and Happiness" – Rick Hanson &Forrest Hanson

Reference Books:

R1:"The Road to Resilience" – American Psychological Association (APA)

R2:"The Bounce Back Book: How to Thrive in the Face of Adversity, Setbacks, and Losses" – Karen Salmansohn

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	1. An ability to cultivate a growth mindset.	**1,3 & 4**
2	2. An ability to practice self-care and prioritize well-being.	**1,2**
3	3. An ability to develop problem-solving and adaptability skills.	**7.9,10**
4	4. An understanding to enhance overall resilience.	**5,7**
5	5.An ability to develop effective coping strategies.	**5,8**

SEMESTER –VI									
Course Title	**EFFECTIVE ENGLISH FOR ENGINEERS** (Communicative English & Soft Skills)								
Course code	**23UBPD324R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 60P	**0**	**0**	**4**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Civil Engineering**								
Semester	**Winter/ VI semester of third year of the programme**								
Course Objectives	1.This course will enable the students to acquire the important knowledge on grammar like the formation of sentences. 2.To enable the students to use vocabulary meaningfully for a successful conversation. 3.To establish Reputation and Rapport, a dress code session is much needed								
CO1	Enable students to understand grammar to write effectively and speak flawlessly, knowing correct usage of tenses and rectifying grammatical errors.								
CO2	Students will acquire the technique of expanding vocabulary and creating new words and use them in different contexts.								
CO3	Encouraging and helping them to sharpen their listening skills and to become good listeners.								
CO4	To make them prepare for various public and private sector exams & placement drives.								
CO5	To enhance the analytical skill and problem-solving skill of the students								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Interchange of Interrogative and Assertive Sentences, Interchange of Exclamatory and Assertive Sentences, Analysis of Sentences, Types of Tenses, Exercises on Tense	**12**	Students will be able to analyse and transform the different types of sentences.	1,2
II	Synonyms, Antonyms, Homonyms	**8**	Helpful in integrating the skills of reading and speaking in professional communication.	3,4
III	Techniques of Effective, Reading, Gathering ideas and information from a text, The SQ3R Technique, Interpret the text	**8**	Helps in analyzing the techniques of effective reading, gathering ideas and information from a text	3,4
IV	Introduction to Dress Code Ethics, ii. Purpose and Importance, iii. How to Make FIRST IMPRESSION iv. What to Wear During Interviews or Any Other Formal Meetings – Male & Female Activity:	**6**	Dress code etiquette will boost their confidence.	3,4
V	Introduction To Time Management Purpose And Importance of Time Management, Basic Tips to Maintain Time.	**6**	Students will learn to utilize time effectively.	3,4

Textbooks:

T1: Wren,P.C and Martin,H. 1995. High School English Grammar and Composition, S Chand Publishing.

T2: Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing

References

R1. Mccarthy. (2008) English Vocabulary in Use Upper - Intermediate with CD-ROM, Cambridge University Press

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Enable students to understand grammar to write effectively and speak flawlessly, knowing correct usage of tenses and rectifying grammatical errors.	**9,10**
2	Students will acquire the technique of expanding vocabulary and creating new words and use them in different contexts.	**10**
3	Encouraging and helping them to sharpen their listening skills and to become good listeners.	**9,10,11**
4	To make them prepare for various public and private sector exams & placement drives.	**1,2,12**
5	To enhance the analytical skill and problem- solving skill of the students	**4,5**

SEMESTER –VI									
Course Title	**Technical support Fundamental**								
Course code	**23MOCE321 R**	**Total credits: 1** **Total hours: 15T**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**0**	**0**	**0**	**0**	**1**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Civil Engineering**								
Semester	**Winter/ VI semester of third year of the programme**								
Course Objectives	1.To introduce students to the fundamentals of IT support, including computer hardware, networking, and troubleshooting. 2.To equip students with knowledge of operating systems, system administration, and cybersecurity best practices. 3.To prepare students with professional skills for technical support roles, including customer service and problem-solving techniques.								
CO1	Understand the fundamental concepts of computer hardware, operating systems, and networking.								
CO2	Develop troubleshooting skills to diagnose and resolve hardware and software issues.								
CO3	Gain knowledge of system administration, user account management, and basic scripting.								
CO4	Learn cybersecurity principles, best practices, and methods for securing IT environments.								
CO5	To enhance the analytical skill and problem-solving skill of the students								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Introduction to Technical Support** – Role of IT Support, Importance of Troubleshooting, Overview of Hardware Components (CPU, RAM, Storage, Peripherals).	**12**	Students will understand the basics of IT support, the role of technical support engineers, and hardware fundamentals.	1,2
II	**Operating Systems & System Administration** – Introduction to Windows, Linux, and macOS, File Systems, User Management, Software Installation, System Maintenance.	**8**	Gain hands-on experience with different operating systems, user account management, and basic system administration.	3,4
III	**Networking Basics & Troubleshooting** – IP Addressing, DNS, DHCP, Network Configurations, Common Network Issues, and Troubleshooting Techniques.	**8**	Learn networking fundamentals, diagnose network issues, and apply basic troubleshooting methods.	3,4
IV	**Cybersecurity & IT Best Practices** – Security Principles, Authentication, Firewalls, Common Threats (Malware, Phishing), Data Protection Strategies.	**6**	Understand cybersecurity threats and implement IT security measures to protect systems.	3,4
V	**Technical Support & Customer Service** – Communication Skills, Handling Technical Queries, Ticketing Systems, Remote Support Tools, Industry Case Studies.	**6**	Develop professional and interpersonal skills to provide technical support effectively.	3,4

Textbooks:

T1: Meyers, Mike. CompTIA A+ Certification All-in-One Exam Guide – McGraw-Hill Education**.**

T2: Jean Andrews, A+ Guide to IT Technical Support – Cengage Learning.

References:

R1: Charles Severance, Introduction to Networking – CreateSpace Independent Publishing.
R2: Jason Cannon, Linux for Beginners – Independently Published**.**
R3: William Stallings, Computer Networking with Security Principles – Pearson Education.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Understand the fundamental concepts of computer hardware, operating systems, and networking.	1, 2, 10
2	Develop troubleshooting skills to diagnose and resolve hardware and software issues.	4, 5, 9
3	Gain knowledge of system administration, user account management, and basic scripting.	3, 5, 9
4	Learn cybersecurity principles, best practices, and methods for securing IT environments.	6, 7, 11
5	Improve communication and customer support skills for effective problem resolution.	9, 10, 12

SEMESTER –VI									
Course Title	**EXTRA-CURRICULAR ACTIVITIES**								
Course code	**23UBEC311**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 15P	**0**	**0**	**0**	**4**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech in Civil Engineering**								
Semester	**Winter/ VI semester of 3rd year of the programme**								
Course Objectives	1.To develop soft and social skills 2.To promote a holistic development of the learners 3.To enhance the learning experience in different stages etc.								
CO1	Participants will develop personal skills, such as leadership, communication, time management, and teamwork, contributing to their overall character development and self-confidence.								
CO2	Engagement in Community service and outreach activities will cultivate a sense of social responsibility, empathy, and civic awareness, encouraging students to actively contribute to society								
CO3	Express their ideas, views, In-depth evaluation and analysis clearly in the topic of their interest.								
CO4	The students will be given a platform to earn from invited experts in their respective fields.								
CO5	Demonstrate and practices different activities, by Integrating learning experiences by demonstrating transferable skills.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Different types of activities outside regular curriculum	**10**	AdtU encourages a range of activities outside the regular curriculum intended to meet learner's interest. These activities are aimed to develop the social and soft skills and promote a holistic development of the learners. Keeping in mind the 360-degree learning methodology the students are engaged in different activities headed under different clubs viz. Dance, music, photography, drama, literary etc. The students are encouraged to participate in regular club activities, workshops, competitions as per their interest and hobbies. The student members of the club are trained represent AdtU in various inter University student and national level competitions Renewed personalities are invited to conduct workshops that benefit the members and students by giving them the platform to learn from experts in the respective fields.	1,2,3,4, 5

SEMESTER – VII										
Course Title	**Design of Steel Structures**									
Course code	**23BTCE411R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**	
		Total hours: 60T	**4**	**0**	**0**	**0**	**0**	**0**	**4**	
Pre-requisite	**Nil**	**Co-requisite**	**Nil**							
Programme	**B. Tech in Civil Engineering**									
Semester	**Fall/ VII semester of Fourth year of the programme**									
Course Objectives	1. This course aims at providing students with a solid background on principles of structural engineering design. 2. Students will be exposed to the theories and concepts of both concrete and steel design and analysis both at the element and system levels. 3. Hands-on design and skills will be gained and learned through problem sets and a comprehensive design project.									
CO1	Demonstrate their knowledge of structural mechanics in addressing design problems of structural engineering.									
CO2	Distinguish the varying materials and different loading systems in a structure.									
CO3	Classify structures and explain their behaviour by drawing its components and forces acting on it.									
CO4	Apply the design concepts to develop a R.C.C. members.									
CO5	Explain the basic concepts of special structures.									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction- concepts of energy principles, safety, sustainable development in performance; what makes a structure; principles of stability, equilibrium; what is a structural engineer, role of engineer, architect, user, builder; what are the functions' what do the engineers design, first principles of process of design	**15**	Understanding the foundational principles of energy, safety, sustainability, and design roles in structural engineering for creating stable and functional structures.	1, 2
II	Planning and Design Process; Materials, Loads, and Design Safety; Behaviour and Properties of Concrete and Steel; Wind and Earthquake Loads	**10**	Students will demonstrate an understanding of the interactions between materials, loads, and design safety in structural engineering.	1, 2,
III	Materials and Structural Design Criteria: Introduction to the analysis and design of structural systems. Analyses of determinate and indeterminate trusses, beams, and frames, and design philosophies for structural engineering. Laboratory experiments dealing with the analysis of determinate and indeterminate structures;	**15**	Students will demonstrate proficiency in analyzing determinate and indeterminate trusses, beams, and frames, applying structural design criteria and engineering principles.	1, 2, 3, 4, 5
IV	Design of Structural Elements; Concrete Elements, Steel Elements, Structural Joints; Theories and concepts of both concrete and steel design and analysis both at the element and system levels. Approximate Analysis Methods as a Basis for Design; Design of Reinforced Concrete Beams for Flexure; Design of Reinforced Concrete	**10**	Ability to design and analyze concrete and steel structural elements using approximate methods and ensure serviceability and safety considerations.	2, 3, 4

	Beams for Shear; Bond, Anchorage, and Serviceability; Reinforced Concrete Columns; Reinforced Concrete Slabs; Introduction to Steel Design; Tension Members and Connections; Bending Members; Structural Systems			
V	System Design Concepts; Special Topics that may be Covered as Part of the Design Project Discussions; Cable Structures; Prestressed Concrete Bridges; Constructability and Structural Control; Fire Protection	**10**	Understanding the principles of fire protection in structural design enhances constructability and ensures structural safety.	2, 3, 4, 5

TEXT BOOKS:

T1: Design Of Structures - S. Ramamrutham., DhanpatRai Publishing Co Pvt Ltd
T2: Design Of Steel Structures - N. Subramanian

REFERENCE BOOKS:

R1: Analysis of Indeterminate Structures by C.K. Wang.
R2: Balagopal and Prabhu (1987), "Building Drawing and Detailing", Spades publishing
R3: KDR building, Calicut,
R4: (Corresponding set of) CAD Software Theory and User Manuals.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Demonstrate their knowledge of structural mechanics in addressing design problems of structural engineering.	**1,3 & 4**
2	Distinguish the varying materials and different loading systems in a structure.	**1,2**
3	Classify structures and explain their behaviour by drawing its components and forces acting on it.	**7.9,10**
4	Apply the design concepts to develop a R.C.C. members.	**5,7**
5	Explain the basic concepts of special structures.	**5,8**

SEMESTER – VII										
Course Title	**Mindfulness and Wellbeing: Living with balance an ease**									
Course code	**23MOCE411R**	**Total Credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total Hours: 30	**0**	**0**	**0**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ VII semester of Fourth year of the programme**								
Course Objectives	1. To introduce students to mindfulness techniques for reducing stress and improving emotional well-being. 2. To develop self-awareness and resilience by incorporating mindfulness practices into daily life. 3. To enhance concentration, focus, and cognitive abilities through meditation and breathing exercises. 4. To promote holistic well-being by integrating mindfulness into professional and personal life. 5. To cultivate emotional intelligence and positive relationships through mindful communication and empathy.									
CO1	Demonstrate an understanding of mindfulness principles and their impact on mental health.									
CO2	Apply mindfulness techniques to enhance concentration, focus, and emotional regulation.									
CO3	Develop stress management strategies for improved well-being and productivity.									
CO4	Analyze the role of mindfulness in fostering resilience, empathy, and personal growth.									
CO5	Integrate mindfulness practices into everyday life to maintain a balanced and stress-free lifestyle.									

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Unit I: Introduction** Introduction to Mindfulness and Well-being: Definition, importance, benefits, and applications in daily life.	**10**	Introduction to Mindfulness and Well-being: Definition, importance, benefits, and applications in daily life.	1,2
II	**Unit II: Mindful Living** Techniques for Mindful Living: Breathing exercises, meditation practices, mindful movement, and visualization.	**5**	Techniques for Mindful Living: Breathing exercises, meditation practices, mindful movement, and visualization.	1,2
III	**Unit III: Emotional Intelligence** Emotional Intelligence and Self-Awareness: Understanding emotions, empathy development, resilience, and self-care strategies.	**5**	Emotional Intelligence and Self-Awareness: Understanding emotions, empathy development, resilience, and self-care strategies.	1,2
IV	**Unit IV: Mindfulness in daily life** Mindfulness in Daily Life: Application in personal and professional settings, mindful communication, and managing relationships.	**5**	Mindfulness in Daily Life: Application in personal and professional settings, mindful communication, and managing relationships.	1,2
V	**Unit V:** Advanced Mindfulness Strategies Advanced Mindfulness Strategies: Long-term integration, overcoming challenges, guided practices, and case studies.	**5**	Advanced Mindfulness Strategies: Long-term integration, overcoming challenges, guided practices, and case studies	1,2

Text Books:

T1: Mindfulness in Plain English - Bhante Henepola Gunaratana
T2: The Miracle of Mindfulness - Thich Nhat Hanh

Reference Books:

R1: Wherever You Go, There You Are - Jon Kabat-Zinn
R2: The Headspace Guide to Meditation and Mindfulness - Andy Puddicombe
R3: The Mindful Path to Self-Compassion - Christopher K. Germer

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Demonstrate an understanding of mindfulness principles and their impact on mental health.	1,3 & 4
2	Apply mindfulness techniques to enhance concentration, focus, and emotional regulation.	1,2
3	Develop stress management strategies for improved well-being and productivity.	7,9,10
4	Analyze the role of mindfulness in fostering resilience, empathy, and personal growth.	5,7
5	Integrate mindfulness practices into everyday life to maintain a balanced and stress-free lifestyle.	5,8

SEMESTER – VII									
Course Title	**Elementary Statistical Analysis**								
Course code	**23BTCE415R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**0**	**0**	**0**	**0**	**24**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ VII semester of 4th year of the programme**								
Course Objectives	1.Describe the concept of statistical equation and apply them in understanding complex problems. 2.Apply the concept of ordinary differential equations of higher orders. 3.Analyze: To develop students' skills in basic probability and statistics, including the analysis of probability distributions, measures of central tendency, and statistical parameters, and to apply these concepts to real-world data and hypothesis testing.								
CO1	Solve first-order ordinary differential equations using exact, linear, Bernoulli's, Euler's equations, and those solvable for ppp, yyy, xxx, and Clairaut's type.								
CO2	Analyze and solve second-order linear differential equations with variable coefficients using variation of parameters and the Cauchy-Euler equation.								
CO3	Evaluate complex functions through differentiation, using Cauchy-Riemann equations for analyticity, and identify harmonic functions and their conjugates.								
CO4	Understand and analyze basic probability concepts, including probability spaces, conditional probability, independence, and various distributions.								
CO5	Evaluate statistical methods for measures of central tendency, moments, skewness, kurtosis, probability distributions, and conduct significance tests for large samples.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	***First order ordinary differential equations:*** Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	**10**	First-order ordinary differential equations include understanding and solving exact, linear, and Bernoulli equations, as well as Euler's equations for rigid body dynamics. Students will also learn to handle equations not of the first degree, including those solvable for pp, yy, or xx, and Clairaut's type equations. These outcomes focus on enhancing analytical and problem-solving skills in differential equations.	1,2
II	***Ordinary differential equations of higher orders:*** Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation.	**10**	Method of variation of parameters. Students will also understand and solve the Cauchy-Euler equation, which is a specific type of second-order linear differential equation useful in various applications.	1,2
III	***Complex variable-Differentiation:*** Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions(exponential, trigonometric, logarithm) and their properties.	**5**	Gaining proficiency in solving second-order linear differential equations with variable coefficients using techniques like the variation of parameters. Additionally, students will learn to solve the Cauchy-Euler equation, a particular type of second-order differential equation, and comprehend its applications and solution methods. This expertise prepares students to tackle	1,2

			complex differential equations found in various scientific and engineering contexts	
IV	***Basic probability:*** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution.	**10**	Understanding the foundational concepts of probability spaces and the ability to calculate conditional probability and determine the independence of events. Students will also learn about discrete random variables and how to analyze distributions involving independent random variables. Additionally, they will gain proficiency in working with the multinomial distribution and applying the Poisson approximation to the binomial distribution, equipping them with essential tools for solving a variety of probabilistic problems.	1,2
V	***Basic and applied Statistics:*** ***Basic:*** Measures of central tendency: Moments, skewness and Kurtosis- Probability distributions: Binomial, Poisson and Normal-evaluation of statistical parameters for these three distributions, Correlation and regression. ***Applied:*** Test of significance: Large sample test for single proportion. Difference of proportions, single mean, difference of means and difference of standard deviations.	**10**	Understanding and calculating measures of central tendency such as mean, median, and mode. Students will also learn to compute moments, and analyze skewness and kurtosis to describe data distribution shapes. Additionally, they will gain proficiency in working with key probability distributions (Binomial, Poisson, and Normal), including evaluating their statistical parameters. Furthermore, students will develop skills in correlation and regression analysis to examine relationships between variables.	1,2

TEXT BOOKS:

T1: Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
T2: N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

REFERENCE BOOKS:

R1: S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
R2: S. L. Ross, Differential Equations, 3rd Ed. Wiley India, 1984.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Solve first-order ordinary differential equations using exact, linear, Bernoulli's, Euler's equations, and those solvable for ppp, yyy, xxx, and Clairaut's type.	**1,2**
2	Analyze and solve second-order linear differential equations with variable coefficients using variation of parameters and the Cauchy-Euler equation.	**1,2,3**
3	Evaluate complex functions through differentiation, using Cauchy-Riemann equations for analyticity, and identify harmonic functions and their conjugates.	**2,4,5**
4	Understand and analyze basic probability concepts, including probability spaces, conditional probability, independence, and various distributions.	**1,3,5**
5	Evaluate statistical methods for measures of central tendency, moments, skewness, kurtosis, probability distributions, and conduct significance tests for large samples.	**1,2,3,4,5**

SEMESTER – VII									
Course Title	**Heavy Lifting Techniques & Machinery**								
Course code	**23BTCE414R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ VII semester of 4th year of the programme**								
Course Objectives	1. Introduce the learners to the basic engineering concepts used in heavy lifting and provide basic knowledge about the various types of machinery and techniques used in the industry. 2. Provide the learners an insight on the classification and application of Cranes and tower cranes, Lifting gears, accessories, and equipment for horizontal movement. 3. Give the learners an understanding on design of load bearing structures and how to develop a lift plan including the selection of suitable methods, machineries and lifting gears.								
CO1	Comprehend the basic concepts of heavy lifting								
CO2	Analyze the use of various heavy lifting procedures in different projects								
CO3	Apply the tools, tackles, gears and equipment required for lifting or shifting								
CO4	Create lift plan for heavy equipment based on site conditions								
CO5	Create work plan for heavy equipment based on site conditions								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Evolution of heavy lifts, Examples of heavy lifting in various industries, Application of engineering mechanics in heavy lifting, Machinery for heavy lifting, Mechanical advantage of lifting and shifting, Applications of reeving, Lever principle and calculation of forces on load handling elements.	**10**	Application of engineering mechanics in heavy lifting, Machinery for heavy lifting, Mechanical advantage of lifting and shifting, Applications of reeving, Lever principle and calculation of forces on load handling elements.	1,2
II	Application of shackles, wire rope slings and lifting beams, Right use of shackle and Limitation of pre-engineered product, lifting gear, Calculate of forces on wire rope sling and sling capacity. Applications of Wire Ropes Spreader/Lifting Beam, Basic Elements of Lifting Machines, Various lifting and shifting machines & components, their classification, terminologies, application, and right usage during execution. Classification and components of tower cranes, Load charts, safety and stability of tower cranes. Case studies	**5**	Applications of Wire Ropes Spreader/Lifting Beam, Basic Elements of Lifting Machines, Various lifting and shifting machines & components, their classification, terminologies, application, and right usage during execution.	1,2
III	**Application of hydraulics and equipment for horizontal movement** Hydraulic systems and basic components, types of jacks and applications, principles and control systems. Application of Strand jacks in heavy lifts. Transportation of Over Dimensional Cargos	**10**	Gaining proficiency in Transportation of Over Dimensional Cargos (ODC) and Overweight Cargos (OWC), trailer configuration based on the size & load of the consignment, the basic principle of friction & Skidding	1,2

	(ODC) and Overweight Cargos (OWC), trailer configuration based on the size & load of the consignment, the basic principle of friction & Skidding System, Components and its application in project sites, Wheel bogies & its application, Rail and Sea transport & lashing.		System, Components and its application in project sites, Wheel bogies & its application, Rail and Sea transport & lashing.	
IV	**Design of load bearing structures and lift plan** Design Basis of Handling Provisions, Design procedure for bolted type, welded case, link plates and trunnions. Parameters affecting the Handling Provisions, Design of Lifting lugs- Bolted, welded case, link plates and trunnions. Design of Load Bearing Structures and Enabling Structures, Stress limitation with respect to yield stress of steel structure, standard design procedure for Girders and Lifting beams. multilevel of spreader beam and Grillage.	**10**	Understanding the Design of Lifting lugs- Bolted, welded case, link plates and trunnions. Design of Load Bearing Structures and Enabling Structures, Stress limitation with respect to yield stress of steel structure, standard design procedure for Girders and Lifting beams. multilevel of spreader beam and Grillage	1,2
V	**Alternate methodologies and safety** Pre-cast construction with Case studies, Push Launching and float over installation with method, Hydraulic Lifting Gantries, and their applications. Hydraulic Lifting Gantries, Safety Requirements for Crane and lifting operations, load test procedures and inspection check list, Importance of PPEs and signals used for crane operation, Safe methods to avoid Crane accidents.	**10**	Understanding Pre-cast construction with Case studies, Push Launching and float over installation with method, Hydraulic Lifting Gantries, and their applications. Hydraulic Lifting Gantries, Safety Requirements for Crane and lifting operations, load test procedures and inspection check list, Importance of PPEs and signals used for crane operation, Safe methods to avoid Crane accidents.	1,2

Textbook:

T1. L&T EduTech LMS

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand the significance of literature review in research and academic writing.	**1,2**
2	Develop skills to search, identify, and evaluate scholarly literature.	**1,2,3**
3	Synthesize information from multiple sources to develop coherent arguments.	**2,4,5**
4	Analyze existing research to identify gaps and formulate research questions.	**1,3,5**
5	Apply proper citation and referencing techniques in literature reviews.	**1,2,3,4,5**

SEMESTER – VII									
Course Title	**Literature Review**								
Course code	**23BTCE416R**	**Total Credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total Hours: 45	**0**	**0**	**0**	**0**	**24**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ VII semester of Fourth year of the programme**								
Course Objectives	1. To introduce students to the importance of literature review in academic and research writing. 2. To develop skills in identifying, analyzing, and synthesizing scholarly articles and research papers. 3. To equip students with techniques for critical evaluation of existing research.								
CO1	Understand the significance of literature review in research and academic writing.								
CO2	Develop skills to search, identify, and evaluate scholarly literature.								
CO3	Synthesize information from multiple sources to develop coherent arguments								
CO4	Analyze existing research to identify gaps and formulate research questions.								
CO5	Apply proper citation and referencing techniques in literature reviews.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	Introduction to Literature Review: Definition, Purpose, Types, and Importance in Research. Searching and Identifying Relevant Literature: Research databases, Keywords, Boolean operators, Citation tracking.	**10**	Understand the foundational aspects of literature review. Develop proficiency in literature search and identification.	1,2 1,2
II	Critical Analysis and Synthesis: Evaluating credibility, identifying biases, summarizing key findings. Structuring and Writing a Literature Review: Components, Logical Flow, Thematic and Chronological Approaches.	**5**	Gain the ability to critically analyze and synthesize literature. Learn to structure and present a literature review effectively.	2,3 2,3,4
III	Identifying Research Gaps and Referencing: Formulating research questions, Citation styles (APA, IEEE, etc.), Plagiarism avoidance. Introduction to Literature Review: Definition, Purpose, Types, and Importance in Research.	**10**	Apply research gap identification and proper referencing techniques. Understand the foundational aspects of literature review.	3, 1,2
IV	Searching and Identifying Relevant Literature: Research databases, Keywords, Boolean operators, Citation tracking. Critical Analysis and Synthesis: Evaluating credibility, identifying biases, summarizing key findings.	**10**	Develop proficiency in literature search and identification. Gain the ability to critically analyze and synthesize literature.	1,2 2,3
V	Structuring and Writing a Literature Review: Components, Logical Flow, Thematic and Chronological Approaches.	**10**	Learn to structure and present a literature review effectively.	2,3,4

Text Books:

T1: Mindfulness in Plain English - Bhante Henepola Gunaratana
T2: The Miracle of Mindfulness - Thich Nhat Hanh

Reference Books:

R1: Wherever You Go, There You Are - Jon Kabat-Zinn
R2: The Headspace Guide to Meditation and Mindfulness - Andy Puddicombe
R3: The Mindful Path to Self-Compassion - Christopher K. Germer

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand the significance of literature review in research and academic writing.	1,3 & 4
2	Develop skills to search, identify, and evaluate scholarly literature.	1,2
3	Synthesize information from multiple sources to develop coherent arguments.	7,9,10
4	Analyze existing research to identify gaps and formulate research questions.	5,7
5	Apply proper citation and referencing techniques in literature reviews.	5,8

SEMESTER – VII									
Course Title	**Estimation & Costing**								
Course code	**23BTCE413R**	**Total Credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total Hours: 15T+30P	**0**	**0**	**2**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Fall/ VII semester of Fourth year of the programme**								
Course Objectives	1. To introduce students to the principles of estimation and costing in civil engineering. 2. To develop skills in quantity surveying and rate analysis. 3. To equip students with techniques for preparing detailed estimates for construction projects								
CO1	Understand the principles of estimation and costing in civil engineering.								
CO2	Develop proficiency in quantity surveying and cost estimation techniques.								
CO3	Prepare detailed estimates and analyze project costs.								
CO4	Apply contract procedures and tender documentation in civil engineering projects.								
CO5	Evaluate cost estimates and manage construction budgets effectively.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction to Estimation & Costing: Purpose, Importance, and Types of Estimates.	9	Understand fundamental principles of estimation and costing.	1,2
II	Quantity Surveying: Methods of Measurement, Abstracting, and Bill Preparation.	9	Develop skills in quantity surveying and estimation techniques.	1,2
III	Rate Analysis: Cost of Materials, Labor, Equipment, Overheads, and Profits.	9	Gain proficiency in rate analysis and cost estimation.	2,3
IV	Preparation of Detailed Estimates: Buildings, Roads, and Other Infrastructure Projects.	9	Learn to prepare and evaluate detailed project estimates.	2,3,4
V	Contract Procedures, Tender Documentation, and Budgeting: Legal Aspects, Bidding, Cost Control.	9	Apply contract procedures and manage project budgets effectively.	3,4,5

Text Books:

T1: Estimating and Costing in Civil Engineering - B.N. Dutta
T2: Quantity Surveying and Valuation - Rangwala

Reference Books:

R1: Estimating and Costing - G.S. Birdie
R2: Civil Engineering Contracts and Estimation - S.C. Rangwala
R3: PWD Schedule of Rates and Analysis of Rates (Latest Edition)

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand the principles of estimation and costing in civil engineering.	1,3 & 4
2	Develop proficiency in quantity surveying and cost estimation techniques.	1,2
3	Prepare detailed estimates and analyze project costs.	7,9,10
4	Apply contract procedures and tender documentation in civil engineering projects.	5,7
5	Evaluate cost estimates and manage construction budgets effectively.	5,8

SEMESTER – VIII									
Course Title	**Foundation Engineering**								
Course code	**23BTCE422R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 60T	**4**	**0**	**0**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ VIII semester of fourth year of the programme**								
Course Objectives	1. To introduces to students the fundamental concepts of soil mechanics and foundation analysis. 2. To develop students the ability to interpret field and laboratory data to get design parameter for foundation analysis. 3. To prepare students for the effective use of the commonly used formulas, tables and figures in the design and analysis of shallow and deep foundations.								
CO1	Demonstrate proficiency in classifying foundation types, applying principles of selection, and conducting analysis and design for various foundation systems								
CO2	Understand the principles of footing design, including assessment of bearing capacity, settlement considerations, and the impact of ground movements during construction								
CO3	Analyze lateral earth pressure considering various factors such as earth pressure at rest, Rankine and Coulomb's theories, surcharge, water table, wall friction etc.								
CO4	Analyze factors influencing bearing capacity, addressing eccentric and inclined loads and determining allowable bearing pressure.								
CO5	Design deep foundations considering factors such as bearing capacity, pile load tests, group action, negative skin friction, and settlement according to Indian standards.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction: Classification of foundation types and principles of selection. Analysis and design of foundations, types of foundations.	**5**	Understand the classification of foundation types and the principles for selecting appropriate foundations for various structures.	1, 2
II	Requirements for satisfactory action of footings. Bearing capacity and settlement of foundations; ground movements due to construction	**10**	Evaluate the bearing capacity and settlement characteristics of foundations and analyze ground movements due to construction.	1, 2, 3, 4
III	Lateral earth pressure: Earth pressure at rest, Rankine and Columb's theories for active and passive states, influence of surcharge, water table, wall friction and deformation on earth pressure.	**5**	Apply the principles of earth pressure theories, including Rankine's and Coulomb's, to design retaining structures considering various influencing factors.	1, 2, 3, 4, 5
IV	Shallow foundation: Terzaghis theory, factors affecting bearing capacity, influence of eccentric and inclined loads. Determination of allowable bearing pressure and proportioning of footing on clay and sand.	**5**	Analyze the bearing capacity of shallow foundations using Terzaghi's theory and determine the allowable bearing pressure and proper footing proportions under different load conditions.	2, 3, 4
V	Deep foundation: Uses and types of piles, bearing capacity of single pile in clay and sand, Indian standard pile load test, group action, negative skin friction, settlement of pile groups. Piers and caisson foundations, elements of well foundation, depth of well	**5**	Assess the use and types of deep foundations, including piles, and evaluate their bearing capacity, settlement, and group action, as well as understand the elements and forces acting on well foundations.	2, 3, 4, 5

	foundation, list of forces acting on well.			

TEXT BOOKS:

T1: Soil Mechanics by Craig R.F., Chapman & Hall
T2: Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
T3: Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and Gholamreza Mesri.
T4: Ranjan G., Rao A.S.R (2011), Basic and Applied Soil Mechanics
T5: Saran S. (2015) Analysis and Design of Substructures
T6: Punmia B.C. (2005), Soil Mechanics And Foundation Engineering.

REFERENCE BOOKS:

R1: Singh, Modern Geotechnical Engineering, 3rd Ed., CBS Publishers, New Delhi, 1999.
R2: B.M. Das, Principles of Foundation Engineering, 5th Ed., Thomson Asia, Singapore, 2003.
R3: N. Som, Theory and Practice of Foundation Design, Prentice Hall, New Delhi, 2003
R4: An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Demonstrate proficiency in classifying foundation types, applying principles of selection, and conducting analysis and design for various foundation systems	**1,2,3,4,5,6,7,12**
2	Understand the principles of footing design, including assessment of bearing capacity, settlement considerations, and the impact of ground movements during construction	**1,2,3,4,5,6,7,12**
3	Analyze lateral earth pressure considering various factors such as earth pressure at rest, Rankine and Coulomb's theories, surcharge, water table, wall friction etc.	**1,2,3,4,5,6,7,12**
4	Analyze factors influencing bearing capacity, addressing eccentric and inclined loads and determining allowable bearing pressure.	**1,2,3,4,5,6,7,12**
5	Design deep foundations considering factors such as bearing capacity, pile load tests, group action, negative skin friction, and settlement according to Indian standards.	**1,2,3,4,5,6,7,12**

SEMESTER – VIII									
Course Title	**Application of AI in Engineering**								
Course code	**23BTCE413R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ VIII semester of fourth year of the programme**								
Course Objectives	1. To introduce students to the principles of estimation and costing in civil engineering. 2. To develop skills in quantity surveying and rate analysis. 3. To equip students with techniques for preparing detailed estimates for construction projects.								
CO1	Understand the principles of estimation and costing in civil engineering.								
CO2	Develop proficiency in quantity surveying and cost estimation techniques.								
CO3	Prepare detailed estimates and analyze project costs.								
CO4	Apply contract procedures and tender documentation in civil engineering projects.								
CO5	Evaluate cost estimates and manage construction budgets effectively.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction to Estimation & Costing: Purpose, Importance, and Types of Estimates.	**10**	Understand fundamental principles of estimation and costing.	1,2
II	Quantity Surveying: Methods of Measurement, Abstracting, and Bill Preparation.	**5**	Develop skills in quantity surveying and estimation techniques.	1,2
III	Rate Analysis: Cost of Materials, Labor, Equipment, Overheads, and Profits.	**10**	Gain proficiency in rate analysis and cost estimation.	2,3
IV	Preparation of Detailed Estimates: Buildings, Roads, and Other Infrastructure Projects.	**10**	Learn to prepare and evaluate detailed project estimates.	2,3,4
V	Contract Procedures, Tender Documentation, and Budgeting: Legal Aspects, Bidding, Cost Control.	**10**	Apply contract procedures and manage project budgets effectively.	3,4,5

Text Books:

T1: Estimating and Costing in Civil Engineering - B.N. Dutta
T2: Quantity Surveying and Valuation - Rangwala

Reference Books:

R1: Estimating and Costing - G.S. Birdie
R2: Civil Engineering Contracts and Estimation - S.C. Rangwala
R3: PWD Schedule of Rates and Analysis of Rates (Latest Edition)

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Understand the principles of estimation and costing in civil engineering.	1,3 & 4
2	Develop proficiency in quantity surveying and cost estimation techniques.	1,2
3	Prepare detailed estimates and analyze project costs.	7,9,10
4	Apply contract procedures and tender documentation in civil engineering projects.	5,7
5	Evaluate cost estimates and manage construction budgets effectively.	5,8

SEMESTER – VIII										
Course Title	**Construction Practice & Management**									
Course code	**23BTCE421R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 60T	**4**	**0**	**0**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ VIII semester of 4th year of the programme**								
Course Objectives	1. Develop knowledge of material science and behavior of various building materials used in construction. 2. Identify the construction materials required for the assigned work. 3. Provide procedural knowledge of the simple testing methods of cement, lime and concrete etc.								
CO1	Recognize the various phases associated with simple residential and commercial construction.								
CO2	Identify and use correctly a wide variety of hand and power tools associated with the construction industry.								
CO3	Understand current construction industry trends and become familiar with standards for quality construction and trends in building technology.								
CO4	Understand construction procedure of different components								
CO5	Understand the property, use, advantage and disadvantage of different material used in construction.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**INTRODUCTION-**Objectives, Requirements Of Foundation, Aim Of Superstructure, Types Of Construction, Aim Of Site Inspection, Laying Out The Building Plan At Site For Foundation	**15**	Students will be able to explain the objectives and requirements of building foundations and the aim of superstructures. They will also gain proficiency in site inspection, planning, and the processes involved in laying out a building plan at the site, ensuring accurate foundation placement.	1, 2
II	**CONSTRUCTION PRACTICES** Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick — weather and water proof – roof finishes – acoustic and fire protection.	**15**	Students will learn to describe and sequence construction activities, ensuring proper coordination on-site. They will understand specifications and details for site clearance, earthwork, masonry, concrete block masonry, flooring, damp proofing, and various joint constructions. Additionally, they will be able to manage temporary structures, steel fabrication, and the installation of weatherproof and fire protection systems.	2, 3, 4
III	**SUB STRUCTURE CONSTRUCTION** Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm	**10**	Students will acquire knowledge of advanced substructure construction techniques, including	1, 2, 3, 4

	walls and basement-Tunneling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation.		box and pipe jacking, underwater diaphragm walls, basement construction, tunneling, and piling. They will be skilled in handling deep excavations, dewatering, and installing well points, as well as using stand-by equipment for underground excavations.	
IV	**SUPERSTRUCTURE CONSTRUCTION** Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors -Erection of articulated structures, braced domes and space decks.	**10**	Students will develop the ability to oversee the construction and erection of superstructures, including launching girders, bridge decks, offshore platforms, and special forms for shells. They will be proficient in techniques for handling and erecting heavy decks and lightweight components, supporting high-rise structures, and assembling articulated and braced dome structures.	1, 2
V	**CONSTRUCTION EQUIPMENT** Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers – Equipment for foundation and pile driving. Equipment for compaction, batching and mixing and concreting - Equipment for material handling and erection of structures - Equipment for dredging, trenching, tunnelling.	**10**	Students will be able to identify and select appropriate construction equipment for diverse activities such as earthwork, foundation work, pile driving, and concreting. They will also learn about equipment for compaction, batching, mixing, material handling, structure erection, dredging, trenching, and tunneling.	2, 3, 4, 5

TEXT BOOKS:

T1: Building construction: metric volume 1 by WR McKay.
T2: Fundamentals of building construction: materials and methods by Edward Allen and Joseph Iano.

REFERENCE BOOKS:

R1: Building materials and construction book with reference to B.C.Rangawala, Sushil Kumar, B.P.Bindra, A.Kamala.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Recognize the various phases associated with simple residential and commercial construction.	**1,2,3,4,5,6,7,12**
2	Identify and use correctly a wide variety of hand and power tools associated with the construction industry.	**1,2,3,4,5,6,7,12**
3	Understand current construction industry trends and become familiar with standards for quality construction and trends in building technology.	**1,2,3,4,5,6,7,12**
4	Understand construction procedure of different components	**1,2,3,4,5,6,7,12**
5	Understand the property, use, advantage and disadvantage of different material used in construction.	**1,2,3,4,5,6,7,12**

SEMESTER – VIII									
Course Title	**Research Based Course III**								
Course code	**23BTCE414R**	**Total credits:6**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 15T	**0**	**0**	**0**	**0**	**0**	**64**	**6**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B. Tech in Civil Engineering**								
Semester	**Winter/ VIII semester of 4th year of the programme**								
Course Objectives	1. To develop research skills through an in-depth study of a selected topic. 2. To enable students to conduct literature reviews and identify research gaps. 3. To familiarize students with research methodologies and data analysis techniques.								
CO1	Demonstrate an understanding of research methodologies and techniques.								
CO2	Conduct literature reviews to identify gaps in existing research.								
CO3	Develop problem-solving skills by designing and executing research projects.								
CO4	Analyze and interpret research data using appropriate tools.								
CO5	Communicate research findings effectively through written and oral presentations.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction to Research: Definition, Importance, Types, and Ethics in Research.	18	Understanding fundamental research principles and ethical considerations.	1,2
II	Literature Review and Research Gap Identification: Techniques for reviewing literature and formulating research questions.	18	Develop proficiency in literature review and research gap analysis.	1,2
III	Research Methodologies: Qualitative, Quantitative, and Mixed Methods Approaches.	18	Gain proficiency in selecting and applying appropriate research methodologies.	2,3
IV	Data Collection and Analysis: Techniques, Tools, and Interpretation of Research Data.	18	Learn to analyze research data using statistical and qualitative techniques.	2,3,4
V	Research Writing and Presentation: Structuring a Research Paper, Citation Styles, and Effective Presentation Techniques.	18	Develop skills in academic writing and research presentation.	3,4,5

Text Books:

T1: Research Methodology: Methods and Techniques - C.R. Kothari
T2: The Craft of Research - Wayne C. Booth

Reference Books:

R1: Research Design: Qualitative, Quantitative, and Mixed Methods Approaches - John W. Creswell
R2: Conducting Research Literature Reviews - Arlene Fink
R3: How to Write a Thesis - Umberto Eco

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAMME OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	Demonstrate an understanding of research methodologies and techniques.	1,3 & 4
2	Conduct literature reviews to identify gaps in existing research.	1,2
3	Develop problem-solving skills by designing and executing research projects.	7,9,10
4	Analyze and interpret research data using appropriate tools.	5,7
5	Communicate research findings effectively through written and oral presentations.	5,8

Assam down town University

Curriculum and Syllabus

Bachelor of Technology

in

Mechanical Engineering

OUTCOME BASED EDUCATION FRAMEWORK

CHOICE BASED CREDIT SYSTEM

Version: 2.1

FACULTY OF ENGINEERING

July, 2023

PREAMBLE

Assam down town University is a premier higher educational institution which offers Bachelor, Master, and Ph.D. degree programmes across various faculties. These programmes, collectively embodies the vision and mission of the university. In keeping with the vision of evolutionary changes taking place in the educational landscape of the country, the university has restructured the course curriculum as per the guidelines of National Education Policy 2020. This document contains outline of teaching and learning framework and complete detailing of the courses. This document is a guidebook for the students to choose desired courses for completing the programme and to be eligible for the degree. This volume also includes the prescribed literature, study materials, texts, and reference books under different courses as guidance for the students to follow.

Recommended by the Board of Studies (BOS) meeting of the Faculty of Engineering held on dated 10/06/2023 and approved by the Emergent Academic Council (AC) meeting held on dated 28/07/2023.

Chairperson, Board of Studies

Member Secretary, Academic Council

Vision

To become a Globally Recognized University from North Eastern Region of India, dedicated to the Holistic Development of Students and Making Society Better

Missions

1. Creation of curricula that address the local, regional, national, and international needs of graduates, providing them with diverse and well-rounded education.
2. Build a diverse student body from various socio-economic backgrounds, provide exceptional value-based education, and foster holistic personal development, strong academic careers, and confidence.
3. Achieve high placement success by offering students skill-based, innovative education and strong industry connections.
4. Become the premier destination of young people, desirous of becoming future professional leaders through multidisciplinary learning and serving society better.
5. Create a highly inspiring intellectual environment for exceptional learners, empowering them to aspire to join internationally acclaimed institutions and contribute to global efforts in addressing critical issues, such as sustainable development, Climate mitigation and fostering a conflict-free global society.
6. To be renowned for creating new knowledge through high quality interdisciplinary research for betterment of society.
7. Become a key hub for the growth and excellence of AdtU's stakeholders including educators, researchers and innovators
8. Adapt to the evolving needs and changing realities of our students and community by incorporating national and global perspectives, while ensuring our actions are in harmony with our foundational values and objectives of serving the community.

Programme Details

Programme Overview:
As part of our industry-focused curricula, we, at Assam down town University, with an open collaborative learning ambience offer our students a platform to launch their careers in the right sector. Evolved as one of the best mechanical engineering colleges, we intend to train the skilled workforce to match industry expectations.

I. Specific Features of the Curriculum

The curriculum provides skill enhancement and value-added courses along with the core papers.

II. Eligibility Criteria:

Minimum 45% in 10+2 with Mathematics, Physics & Chemistry.5% relaxation for SC/ST, EWS, and Especially abled candidates.

III. Programme Educational Objectives (PEOs):

PEO-1: AdtU Mechanical Engineering graduates will demonstrate proficiency in core mechanical engineering principles, methodologies, gain knowledge to think, analyze, and solve practical problems in the Mechanical Engineering domain with a holistic approach toward the greater implications of their solutions to society while adhering to ethical standards and professional responsibilities.

PEO-2: AdtU Mechanical Engineering graduates will develop the ability to critically evaluate complex engineering challenges, develop technical and management skills to take on substantial responsibility for engineering projects and research initiatives by inculcating ethical and human values among the students for the betterment of society.

PEO-3: AdtU Mechanical Engineering graduates will exhibit leadership qualities, including effective teamwork, project management, multidisciplinary approach and co-relate engineering challenges to a larger social and human background, in which their engineering assistance will be employed.

IV. Programme Specific Outcomes (PSOs):

PSO1: Research and Reasoning: Enables the graduates to manage all kinds of Mechanical engineering projects requiring analysis, design, cost estimation and execution and also they will be able to comprehend the implications of the project outcomes and roles and responsibilities as Mechanical engineers in global, economic, and societal contexts.

PSO2:Techno-Professional Efficiency: Develop proficiency in modern and emerging subjects of Mechanical Engineering and use them as stepping stones for building their future careers in academics, cooperate, and developmental sectors.

PSO3: Global Competency: Understanding the concepts of Mechanical engineering the graduates will be endowed with soft skills to give them an edge in qualifying for National and International level competitive examinations to excel in their careers through the experiential learning process.

V. Programme Outcome (PO):

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 modelling 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 need for sustainable development.

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

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

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

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

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

VI. Total Credits to be Earned: 175

VII. Career Prospects:

Graduates with B. Tech in Mechanical Engineering have excellent career prospects in research & development, industry, academics and sustainable development. The prospective sectors viz. automobile, oil, aviation, manufacturing, processing industries, Govt. sectors, teaching, IT industries, Entrepreneurship development, etc. welcome graduate in B. Tech Mechanical Engineering.

EVALUATION METHODS

The student performance shall be evaluated through In-semester (Sessional) and semester-end examinations. A weight age of 40% or as prescribed by the programme shall be added to the score of the end-semester examination.

A. INTERNAL ASSESSMENT:

The teacher who offers the course shall be responsible for internal assessment by conducting in-semester (sessional) examination and evaluating the performance of the students pursuing that course. The components for internal assessment are illustrated in the table given below.

SN	Components/ Examinations	Marks Allotted
1.	In-Sem Exam – I (ISE-I) (Written Examination)*	30
2.	In-Sem Exam – II (ISE-II) (Written Examination)*	30
3.	Assignment	10
4.	Presentation (SP)	10
5.	Quiz	5
6.	Class Performance based score*	5

are compulsory

Note: *Total Internal assessment should be out of 40*

INSTRUCTION

1. If a student fails to appear in the any of the component without any valid reason he/she shall be marked zero in that component. However, the course teacher at his discretion may arrange for the missed test on an alternate date for the absentee students after determining ground with genuine/valid reasons for the absent.
2. The report of evaluation of an activity towards the in-semester (sessional) component of a course shall be duly notified by the concerned course teacher within a week of completion.
3. The program coordinators should upload the in-semester marks to the ERP and forward acknowledgement of all the courses of the program to the Controller of Examinations before the start of the End-semester examination.

B. SEMESTER END EXAMINATION:

Time table for end semester examination is published at least 25 days prior to the start of Examination.

I. Pre-Examination:

Eligibility Criteria for a student to appear in University Examinations:

The student shall only be allowed to appear in a University Examination, if:

i) He/ She is a registered student of the University;
ii) He/ She is of good conduct and character;
iii) He/ She has completed the prescribed Programme of study with minimum percentage of attendance as laid down in the Regulations of the Programme concerned.

Under special cases, a student may be allowed to appear for an examination without being registered in the University but the result of the said student will be kept on hold till the registration of the concerned student is completed.

II. Admit Card:

Admit card for the examination may be downloaded through ERP where the system will generate a Unique ID Cards through online.

The University shall have the right to cancel admission for examination of any candidate on valid grounds.

III. Pattern of Question Papers:

The question paper shall follow the principles of Bloom's Taxonomy.

Table

S. N.	Level	Questions /verbs for test
1	Remember	List, Define, tell, describe, recite, recall, identify, show who, when, where, etc.
2	Understand	Describe, explain, contrast, summarize, differentiate, discuss, etc.
3	Apply	Predict, apply, solve, illustrate, determine, examine, modify
4	Analyze	Classify, outline, categorize, analyze, diagrams, illustrate, infer, etc.
5	Evaluate	Assess, summarize, choose, evaluate, recommend, justify, compare etc.
6	Create	Design, Formulate, Modify, Develop, integrate, etc.

Note: No course is to be evaluated on basis of **all 6 knowledge levels.**

The format of the question paper across all the program follow a unique pattern and the total marks is 60

Table 1: Question paper pattern for End semester examination

Sl no	Question pattern	Total marks
1	MCQs (10 Questions)	10
2	2 Marks questions (10 Questions)	20
3	4 Marks questions (5 Questions)	20
4	10 Marks questions (1 Question)	10

IV. Examination Duration:

Each paper of 60 marks shall ordinarily be of two hours duration.

V. Practical Examinations, Viva-Voice etc.:

i) Practical examination shall be conducted in the presence of one external expert and one or more internal examiners.

ii) Viva-Voice, Oral examinations of the Project report, Dissertation etc. shall be undertaken by a Board of Examiners constituted by the respective Dean of Program with the advice of Supervisor(s).

VI. Procedure of Expulsion:

If any candidate is found to be using any unfair-means during the examination, the invigilator may cease his/her answer sheet and report it directly to the Officer-in-Charge. The Office-in-Charge of the center may take appropriate decisions as per the rules and procedure of the examination. The Officer-in-Charge may allow the students to write the exam with new answer sheet or may expel the student from appearing the paper depending on the nature of unfair-means. In case of Computer based test, the students may be directed to write an apology letter and sign in the prescribe expulsion form. The student may not be allowed to write that examination.

VII. Instruction to the Students:

(i) The students shall not bring to the Examination Hall, any electronic gadget used as a means of communication or record except electronic calculator, if required.

(ii) The students shall not receive any book or printed or hand written or photo copy (Xerox) or blank-paper from any other person while he/she is in the examination-room or in laboratory or in any other place to which he/she is allowed to have access during course of examination.

(iii) The students shall not communicate with any other candidate in the examination room or with any other person in and outside the examination-room.

(iv) The students shall not see, read or copy anything written by any other candidate, nor shall he/she knowingly or negligently permit any other candidate to see, read or copy anything written by him/her or conveyed by him/her.

(v) The students shall not write anything on the Question Paper or in other paper or materials during the examination, or pass any kind of paper to any other candidate in the examination-room, or to any person outside the room.

(vi) The students shall not disclose his/her identity to the examiner by writing his/her name or putting any sign / symbol in any part of his answer-script.

(vii) The students shall not use any abusive language or write any objectionable remark or make any appeal to examiner by writing in any part of his answer-script.

(viii) The students shall not detach any page from the answer-script or insert any authorized or unauthorized loose sheet into it. He /she shall also not insert any other answer-script / loose sheet by removing the pins of the origin answer-scripts and re-fixing it.

(ix) The students shall not resort to any disorderly conduct inside the examination-room or misbehave with the invigilator or any other examination official.

VIII. Provision for an Amanuensis (writer):

(i) A candidate may be provided with an Amanuensis (writer) to write down on dictation on his / her behalf on ground of his / her physical disability to write down by himself / herself due to accident or any other reason. The amanuensis may be provided till he / she recovers from the physical disability. The physical disability to write down by himself / herself must be supported by Medical Certificate from a competent Medical Officer.

(ii) The qualifications of the amanuensis so provided must not be equal or higher than that of the candidate. This is also to be supported by Certificate from the Faculty of Study where the Amanuensis is provided.

(iii) Such candidates are to be accommodated in a separate room under the supervision of an invigilator so that the fellow candidates are not disturbed in the process.

C. Credit Point:

It is the product of grade point and number of credits for a course, thus, CP = GP x CR

i. Credit:

A unit by which the course work is measured. It determines the number of hours of instructions required per week. 'Credit' refers to the weight age given to a course, usually in terms of the number of instructional hours per week assigned to it. Credits assigned for a single course always pay attention to how many hours it would take for an average learner to complete a single course successfully.

ii. Grade Point:

Grade Point is a numerical weight allotted to each Grade Letter on a 10-point scale.

iii. Letter Grade:

Letter Grade is an index of the performance of students in a said paper of a particular course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and Abs. Student obtaining Grade F / Grade Abs shall be considered failed/ absent and, will be required to appear in the subsequent ESE. The UGC recommends a 10-point grading system with the following (Table: 1) Letter Grades:

(i) A Letter Grade shall signify the level of qualitative/quantitative academic achievement of a student in a Course, while the Grade Point shall indicate the numerical weight of the Letter Grade on a 10-point scale.

(ii) There shall be 08 (eight) Letter Grades bearing specific Grade Points as listed in Table 1, where the Letter Grades 'O' to 'P' shall indicate successful completion of a course.

(iii) Apart from the 08 (eight) regular Letter Grades listed in Table 1, there shall be 03 (three) additional Letter Grades, which shall be awarded if a Course is withdrawn or spanned over the next Semester or remains incomplete as stated in Table 2.

Table 2: Letter Grades and Grade Points

Letter Grade	Grade Points	Description
O	10	Outstanding
A+	9	Excellent
A	8	Very Good
B+	7	Good
B	6	Above Average
C	5	Average
P	4	Pass
F	0	Fail
Abs	0	Absent
UFM	0	Unfair Means

iv. Grade Point Average:

a. SGPA (Semester Grade Point Average)

The SGPA of a student in a Semester shall be the weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered in that Semester, irrespective of whether he/she could or could not complete the Courses. More specifically, the calculation of SGPA shall take into account the Courses graded with Letter Grades 'O' to 'F' as given in Table 1.

$$\text{SGPA} = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i} \qquad (1.1)$$

The SGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.1) up to two decimal places, where n is the total number of Credit Courses registered by the student in that Semester, Gi is the Grade Point secured in the i^{th} registered Course and Ci is the Credit (weight) of that Course.

b. CGPA (Cumulative Grade Point Average)

(i) The CGPA of a student in a Semester of a Programme shall be the accumulated weighted average of the Grade Points secured by the student in all the Credit Courses (both Core and Elective Courses) he/she registered and successfully completed so far starting from the enrollment in the Programme. In other words, taking into account all the Courses graded with 'O' to 'P' as given in Table 1.1, generally the CGPA of a student shall be calculated starting from the first Semester of his/her enrolled Programme, while the CGPA of a lateral-entry student shall be calculated starting from the Semester of his/her enrollment.

(ii) The CGPA of a student in a Semester shall be calculated on a 10-point scale using Equation (1.2) up to two decimal places, where N is the total number of Credit Courses registered and successfully completed so far by the student, Gi is the Grade Point secured in the ith completed Course and Ci is the Credit (weight)of that Course.

$$\text{CGPA} = \frac{\sum_{i=1}^{N} C_i G_i}{\sum_{i=1}^{N} C_i} \qquad (1.2)$$

(iii) The CGPA shall be convertible into equivalent percentage of marks using Equation Conversion of CGPA to percentage marks: = CGPA*10

D. Post-Examination

i. Transcript or Grade Card or Certificate:

A marking certificate shall be issued to all the registered students after every Semester. The Semester mark sheet will display the course details (code, title, number of credits, grade secured) along with total credit earned in that Semester.

ii. Grievance Readdress Mechanism:

Students with any dissatisfaction or grievance regarding the marks awarded in any of the Papers / Courses may appeal to the Controller of Examinations for remedial action such as Re-evaluation within 10 days of the declaration of result.

(i) A student has options to appeal for re-evaluation of his /her answer script to the Controller of Examination.

(ii) Application for re-evaluation / re-scrutiny of answer scripts shall be made in the definite performa available with the Examination Office through the head of the respective departments within 10 days of declaration of the results of the respective examinations.

(iii) The Controller of Examination may appoint an examiner for re-evaluation and will consider and recognize the evaluation done by a University appointed examiner.

(iv) There shall be no provision for re-evaluation of the Practical Papers, Project Work, and Dissertation etc. However, the students fail in practical examination or viva voce and wish to appear again may apply to be evaluated can do so with the next schedule.

(v) After screening the application for re-evaluation, the CoE may send the answer scripts of the student to the examiners appointed by the CoE with the approval of Vice Chancellor.

(vi) The marks/grades achieved by the students after the re-evaluation shall be final and binding.

(vii) Fresh Marks – sheets / Grade Card shall be issued only if the candidate secures pass marks / passing grade in the re-evaluated paper.

(viii) Revaluation of answer scripts shall be deemed to be an additional facility provided to the students with a view to improving upon their results at the preceding examination result for any reason whatsoever shall not confer any right upon them for admission to next higher class which matters always be regulated in accordance with the relevant rules or regulations framed by the University.

(ix) If as a result of revaluation of the candidate attracts the provision of condonation of deficiency, the same may be applied to his/her only for fresh attempt.

INSTRUCTION TO TEACHERS AND STUDENTS

(Teaching and Learning Methods)

In all the courses the teacher has to select topics for teacher-method which should not be less than 20 percent. The approach will be direct classroom teaching through a series of lectures delivering concepts using ITC facilities, white or blackboard. Notes may also be circulated to the students; however, the students are to be involved in the preparation of the notes. The teacher will be responsible for selecting the best note for circulation. The teacher-centric methodology has recently fallen out of favour because this strategy for teaching is seen to favour passive students.

1. Student- centric / Constructivist Approach:

The topics of the courses may be selected at the start of the class and assigned one topic to each of the students for studying by themselves, prepare presentations, notes, etc., and present at respective class time after consultation and discussion with the course teachers. The teacher facilitates the learning of the students by guiding and providing input and explaining concepts. 60 percent of the course contents may be selected for this purpose. To avoid behaviour problems, teachers must lay a lot of groundwork in student-centric classrooms. Typically, it involves instilling a sense of responsibility in students. In addition, students must learn internal motivation.

a. Project-Based Learning: The teacher may select 5 percent of topics for the purpose and may conduct visits to the laboratory for experiments or field surveys. The selection of the topic may be done considering the available facility for the purpose. However, in the final semester of each of the programme the student has to undergo project-based learning at least 4 months duration. This approach will help the student to think critically, evaluate, analyze, make decisions, collaborate, and more.

b. Inquiry-Based Learning: The teacher/ students are supposed to list at least five questions in each contact hour and student solve these question or search for answer which becomes the home work for the students "question-driven" learning approach. The teacher may look for the correctness of the solution or the best possible answer and discuss in the successive class. This will help in the preparation for various competitive examination and develop a habit for search for solutions.

c. Flipped Classroom: About 10 percent of the course content has to be completed by this method. In this approach the students are asked to watch video or lecture prepared by the teacher or any video available (relevant to the course). A set of questions may be given to the students for searching answers by the students. The idea is that students should have more time in-classroom focusing on achieving these higher levels of thinking and learning. The Flipped classroom is also an acronym. The letters FLIP represent the four pillars included in this type of learning: Flexible environment, Learning culture shift, Intentional content, and Professional educator. As you can see, the second pillar refers to a culture shift from the traditional approach where students are more passive to an approach where students are active participants. As a result, this approach is also a student-centric teaching method.

d. Cooperative Learning: The remaining five percent has to be completed by cooperative learning approach. In this approach, the students are allotted problems. During library hours the students along with the teacher visit the library and search for probable solutions for the assigned problem. The same has to be done in groups so that the students discuss among themselves for the appropriate answers. Essentially, cooperative learning believes that social interactions can improve learning. In addition, the approach recreates real-world work situations in which collaboration and cooperation are required.

The percentage categorization for the completion of a theory course

Teacher-centric or Direct Classroom Teaching: Delivery by series of lectures	20%
Student-centric Approach, Students present and deliver lectures in the presence of teacher and supervised by teacher	60%
Students visit fields or perform experiments or teachers perform demonstration	05%
Flipped Classroom approach	10%
Cooperative learning approach	05%

Inquiry-based approach has to be followed in all of the classes

The teacher has to distribute the topics to be considered for teaching by the above-mentioned approaches and prepare a lesson plan for execution and maintain a file.

Breakdown of Credits

Sl. No	Category		Total number of Credits
1	University Core (UC)	Skill Enhancement Course (SEC)	2
		Ability Enhancement Course (AEC)	5
		Field Training	2
		Discipline Specific Elective (DSE)	2
		Value Added Course (VAC)	4
2	University Elective (UE)	Multidisciplinary Course (MDC)	2
		Value Added Course (VAC)	6
3	Programme Core (PC)	Discipline Specific Core (DSC)	96
		Field Training	4
		Research /Industry Internship	4
		Summer Internship	2
4	Programme Elective (PE)	Discipline Specific Elective (DSE)	24
		Value Added Course (VAC)	6
5	Faculty Core (FC)	Skill Enhancement Course (SEC)	6
		Ability Enhancement Course (AEC)	10
Total			**175**

Breakdown by categories of courses

Sl. no	Category	Credits	%
1	Engineering	120	68.58
2	Science	18	10.29
3	Value added course	20	11.42
4	Humanities	17	9.71
Total		**175**	**100**

SEMESTER WISE COURSE DISTRIBUTION

	S. No.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester I	1	23BTME111R	Calculus and Linear Algebra	DSC	3	0	0	0	0	0	3	40	60	0	100
	2	23BTME112R	Introduction to Basic Mathematics, Logic and Coding	DSC	2	1	2	0	0	0	4	40	60	100	200
	3	23BTME113R	Physics for Engineers	DSC	2	1	2	0	0	0	4	40	60	100	200
	4	23BTME114R	Workshop/Manufacturing Practice	DSE	0	0	2	0	0	0	1	0	0	100	100
	5	23MOCE111R	MOOCS Ethics in Engineering	VAC	1	0	4	0	0	0	3	40	60	100	200
	6	23BTME115R	Industrial Visit		0	0	0	0	0	16	1	0	0	100	100
	7	23UBPD113R	Introductory English for Engineers	SEC	0	0	4	0	0	0	2	0	0	100	100
	8	23UBEC111	Extra-curricular	VAC	0	0	0	4	0	0	1	0	0	100	100
	Total				**8**	**0**	**12**	**4**	**0**	**16**	**19**	**160**	**240**	**700**	**1100**
	S. No.	**Course Code**	**Course Title**	**Course Category**	**Engagement**							**Maximum Marks for**			
					L	**T**	**P**	**S**	**R**	**O**	**C**	**IA***	**SEE***	**PE***	**Total**
Semester II	1	23BTME121R	ODE, Probability and Statistics	DSC	4	0	0	0	0	0	4	40	60	0	100
	2	23BTME122R	Chemistry for Engineers	DSC	2	0	2	0	0	0	3	40	60	100	200
	3	23BTME123R	Engineering Drawing	DSC	0	0	4	0	0	0	2	40	60	100	200
	4	23BTME124R	Problem solving and Python Programming	DSC	2	0	2	0	0	0	3	40	60	100	200
	6	23MOCE122R	MOOCS Ethics, Technology and Engineering	VAC	0	0	0	0	0	0	1	0	0	100	100
	7	23BTME125R	Field-based Training	AEC	0	0	0	0	0	16	1	0	0	100	100
	8	23BTME126R	Environmental Science	AEC	2	0	0	0	0	0	2	40	60	0	100
	9	23UBPD123R	PDP	AEC	0	0	4	0	0	0	2	0	0	100	100
	10	23UBEC121	Extra - Curricular	VAC	0	0	0	4	0	0	1	0	0	100	100
	Total				**10**	**0**	**12**	**4**	**0**	**16**	**19**	**240**	**300**	**600**	**1100**
	S. No.	**Course Code**	**Course Title**	**Course Category**	**Engagement**							**Maximum Marks for**			
					L	**T**	**P**	**S**	**R**	**O**	**C**	**IA***	**SEE***	**PE***	**Total**
Semester III	1	23BTME211R	Biology for Engineers	SEC	2	1	0	0	0	0	3	40	60	0	100
	2	23BTME212R	Transform and Discrete Mathematics	DSC	2	1	0	0	0	0	3	40	60	100	200
	3	23BTME213R	Introduction to Electrical and Electronics Circuit	DSC	2	0	2	0	0	0	3	40	60	0	100
	4	23BTME214R	Engineering Mechanics	DSC	2	1	2	0	0	0	4	0	0	100	100
	5	23BTME215R	Basic Thermodynamics	DSC	2	1	0	0	0	0	3	40	60	0	100
	6	23BTME216R	Techno-Professional Skills II	DSC	0	0	2	0	0	0	1	40	60	0	100
	7	23BTME217R	Field Based Training	DSE	0	0	0	0	0	16	1	0	0	100	100
	8	23BTME218R	Design of Fire & Life Safety System	DSC	3	0	0	0	0	0	3	40	60	100	200
	9	23UBPD213R	English for Employability Skills	MDC	0	0	4	0	0	0	2	0	0	100	100
	10	23UBEC211	Extra-curricular	AEC	0	0	0	4	0	0	1	0	0	100	100
	11	23UULS212R	Basic Life Saving Skills	VAC	0	0	2	0	0	0	1	0	0	100	100
	12	23UUFL211R	Personal Financial Planning	SEC	0	0	2	0	0	0	1	0	0	100	100
	13	23MOSY211R	MOOCS II Computational Thinking for Problem Solving	VAC	0	0	0	0	0	0	1	0	0	0	100
	Total				**13**	**4**	**14**	**4**	**0**	**16**	**27**	**240**	**360**	**800**	**1500**

	S. No.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester IV	1	23BTME221R	Applied Thermodynamics	DSC	3	0	0	0	0	0	3	40	60	0	100
	2	23BTME222R	Fluid Mechanics & Fluid Machines	DSC	3	0	2	0	0	0	4	40	60	100	200
	3	23BTME223R	Strength of Materials	DSC	2	0	2	0	0	0	3	40	60	100	200
	4	23BTME224R	Engineering Materials and Applications	DSC	2	0	2	0	0	0	3	40	60	100	200
	5	23BTME225R	Instrumentation and Control	DSC	2	0	2	0	0	0	3	40	60	100	200
	6	23BTME226R	Ambience Control System Design	DSC	3	0	0	0	0	0	3	40	60	0	100
	7	23UBPD223R	English Language Proficiency for Engineers	AEC	0	0	4	0	0	0	2	0	0	100	100
	8	23UBCC221	Co-curricular	AEC	0	0	0	4	0	0	1	0	0	100	100
	9	23UBEC221	Extra-curricular	AEC	0	0	0	4	0	0	1	0	0	100	100
	10	22BTCE227R	Techno-Professional Skills III	DSC	0	0	2	0	0	0	1	0	0	100	100
	12	23MOCE221R	MOOCS III	VAC	0	0	0	0	0	0	1	0	0	100	100
	14	23UULS221R	Basic Acclimatizing Skills (BAS)	VAC	0	0	2	0	0	0	1	0	0	100	100
	Total				**15**	**0**	**16**	**8**	**0**	**0**	**26**	**240**	**360**	**1000**	**1600**

	S. No.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester V	1	23BTME311R	Heat Transfer	DSC	3	0	2	0	0	0	4	40	60	100	200
	2	23BTME312R	Manufacturing Processes	DSC	3	0	2	0	0	0	4	40	60	100	200
	3	23BTME313R	Kinematics and Dynamics of Machines	DSC	3	0	2	0	0	0	4	40	60	100	200
	4	23BTME314R	Utility Systems for Industrial Facilities	DSC	3	0	0	0	0	0	3	40	60	0	100
	5	23BTME315R	Industrial Piping and Pipeline Engineering	DSC	3	0	0	0	0	0	3	40	60	0	100
	6	23BTME316R	Field Based Training	DSC	3	0	0	0	0	0	3	40	60	0	100
	7	23BTME317R	Summer Internship	DSC	2	0	0	0	0	0	2	40	60	0	100
	8		Professional Practice, Law & Ethics	DSC	0	0	4	0	0	0	2	0	0	100	100
	9	23UBPD314R	Professionability Employability Enhancement Skills	AEC	0	0	0	4	0	0	1	0	0	100	100
	10		Essence of Indian Traditional Knowledge	AEC	0	0	0	4	0	0	1	0	0	100	100
	11	23UBEC311	Storage Learning Plan: Block Storage Or, Infrastructure Security Learning Plan	VAC	0	0	0	0	0	0	1	0	0	0	100
	12	23UBEC312	Extra Curricular	SEC	0	0	0	4	0	0	1	0	0	0	100
	13	23UBPD315R	Competent English for Engineers	AEC	0	0	4	0	0	0	2	0	0	100	100
	Total				**20**	**0**	**10**	**8**	**0**	**0**	**31**	**280**	**420**	**700**	**1600**

	S. No.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester VI	1	23BTME321R	Advanced Manufacturing Processes	DSC	4	0	0	0	0	0	4	40	60	0	100
	2	23BTME322R	Machine Element and System Design	DSC	3	0	2	0	0	0	4	40	60	100	200
	3	23BTME323R	Mechatronics, Robotics and Control	DSC	3	0	0	0	0	0	3	40	60	0	100
	4	23BTME324R	Introduction to Neural Network	DSC	3	0	0	0	0	0	3	40	60	0	100
	5	23BTME325R	Design & Simulation of Process Plant Equipment	DSC	3	0	0	0	0	0	3	40	60	0	100
	6	23MOCE321R	MOOCS	VAC	1	0	0	0	0	0	1	0	0	0	100
	7	23UBEC321	Extra Curricular	SEC	0	0	0	4	0	0	1	0	0	0	100
	8	23UBPD324R	Corporate Proficiency for Engineers	AEC	0	0	4	0	0	0	2	0	0	100	100
	Total				**17**	**0**	**2**	**0**	**0**	**0**	**31**	**240**	**360**	**200**	**900**

	S. No.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester VII	1	23BTME411R	Power Plant Engineering	DSC	3	0	0	0	0	0	3	40	60	0	100
	2	23BTME412R	Production and Operation Management	DSC	3	0	0	0	0	0	3	40	60	0	100
	3	23BTME413R	Design of Static Equipment	DSC	3	0	0	0	0	0	3	40	60	0	100
	4	23BTME414R	Elementary Statistical Analysis	DSC	3	0	0	0	0	0	3	40	60	0	100
	5	23BTME415R	Literature Review	DSC	0	0	0	0	24	0	3	0	0	100	100
	6	23MOCE411R	MOOCS	VAC	0	0	0	0	0	0	2	0	0	100	100
	Total				**12**	**0**	**0**	**0**	**24**	**0**	**17**	**160**	**240**	**200**	**600**

	S. No.	Course Code	Course Title	Course Category	Engagement							Maximum Marks for			
					L	T	P	S	R	O	C	IA*	SEE*	PE*	Total
Semester VIII	1	23BTME421R	Total Quality Management	DSC	4	0	0	0	0	0	4	40	60	0	100
	2	23BTME422R	Renewable Energy Engineering	DSC	4	0	0	0	0	0	4	40	60	0	100
	3	23BTME423R	Application of AI in Engineering	DSC	3	0	0	0	0	0	3	40	60	0	100
	4	23BTME424R	Research	DSC	2	0	0	0	0	0	2	40	60	0	100
	5	23BTME425R	MOOCs	VAC	2	0	0	0	0	0	2	40	60	0	100
	Total				**12**	**0**	**12**	**0**	**0**	**0**	**15**	**200**	**300**	**100**	**600**

***IA: Internal Assessment, SEE: Semester End Examination,**
PE: Practical Examination

SEMESTER – I									
Course Title	**Calculus & Linear Algebra**								
Course code	**23BTME111R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ I semester of first year of the programme**								
Course Objectives	1. To make understand to evaluate definite and improper integrals. Apart from these some special functions like Beta and Gamma function must be introduced. 2. To provide the application of differential and integral calculus. 3. To make understand the convergence and divergence of sequence and series.								
CO1	Understand the concept of definite integrals and Fundamental Theorem of Calculus.								
CO2	Familiarize with the techniques of calculus								
CO3	Understand the concept of different sequence and series								
CO4	Understand the concepts of matrices. to solve systems of linear equations and application problems requiring them.								
CO5	Understand to solve systems of linear equations and application problems requiring them.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Integral Calculus and its applications:** Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	**10**	Enabling solving skills of definite and improper integrals	1,2,3
II	**Application of Differential Calculus:** Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and Minima.	**10**	Understand Rolle's theorem, Mean value theorems and maxima, minima of a function	3,4
III	**Sequences and series:** Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions;	**10**	Introduction to Power series, Taylor's series, Fourier series, Parseval's theorem	3,4
IV	**Matrices** Definition; Types of matrices; Operation of matrices; Symmetric, skew-symmetric and Inverse and rank of a matrix, Determinants;	**5**	Introduction to Differentiation, Limits, Continuity, Gradient, Curl and Divergence	4
V	**Application and algebra of Matrices** System of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem.	**10**	Understanding matrices and their types.	4

TEXT BOOKS:

T1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
T2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

T3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

REFERENCE BOOKS:

R1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint,2008.

R1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

OTHER LEARNING RESOURCES: https://nptel.ac.in

RELATIONSHIP BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Understand the concept of definite integrals and Fundamental Theorem of Calculus.	**PO1,PO2,PO3**
2	Familiarize with the techniques of calculus	**PO3, PO4**
3	Understand the concept of different sequence and series	**PO1, PO2**
4	Understand the concepts of matrices. to solve systems of linear equations and application problems requiring them.	**PO1,PO2,PO3,PO4**
5	Understand to solve systems of linear equations and application problems requiring them.	**PO2,PO3**

SEMESTER – I									
Course Title	**Introduction to Basic mathematics, logic and coding**								
Course code	**23BTME112R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 3OT+30P	**2**	**0**	**2**	**0**	**0**	**0**	**3**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ I semester of first year of the programme**								
Course Objectives	1. To understand and be able to use the language, symbols and notation of mathematics 2. To develop the ability to create a programmable model for a given problem 3. To become confident in using mathematics, logic, reasoning and coding to analyze and solve problems in real-life situations								
CO1	Understand the concepts of mathematics, logic, reasoning and coding.								
CO2	Applications of the concepts in other disciplines such as engineering, computer science, physics, etc.								
CO3	Learn to solve and devise solutions to a range of elementary real-world problems in mathematics and programming.								
CO4	Explore and apply key concepts in logical thinking to business problems								
CO5	Enable students to critically analyze information in order to evaluate evidence and construct reasoned arguments								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Basics of Set Theory and Functions:** **Sets:** Basic definitions, cardinality of a set, principle of exclusion and inclusion, combination of sets: union, intersection, difference, complement etc., De Morgan laws, Venn Diagram Cartesian **Products and Relations:** Basic Definitions, binary relations – composition and inverse, binary relation on a set : properties – reflexive, irreflexive, symmetric, antisymmetric, transitive, equivalence relations, partial order relations **Functions:** Basic definition, domain and co-domain, image and range, identity function, one-to- one and onto functions, bijections, characteristic function, composition of functions, inverse of a function, operations on sets: unary operators – idempotence, binary operators – associativity, commutativity **Number systems:** Natural numbers, whole numbers, integers, rational numbers, real numbers, operations on numbers: addition, subtraction, multiplication and division	**6**	The students will be able to demonstrate the ability to understand the concepts of mathematics, logic, reasoning and coding. They will become confident in using mathematics, logic, reasoning and coding to analyze and solve problems in real-life situations	1,2, 3
II	**Introduction to Mathematical Logic and Induction:**	**6**	The students will be able to demonstrate the ability to understand the	2,3

	Mathematical Logic: Truth values of mathematical statements, formulas in mathematical logic, logical operators - AND, OR, NOT etc, De Morgan Laws, Truth values of formulas, Truth tables **Propositional Logic:** Constants, variables, assignment of variables in a formula, tautology, contradiction and satisfiability, truth table of a formula, equivalence of formulas, proving formulas and equivalences by truth table method **Mathematical Induction:** Principle of mathematical induction – induction basis and induction step, examples		concepts of mathematics, logic, reasoning and coding. They will become confident in using mathematics, logic, reasoning and coding to analyze and solve problems in real-life situations.	
II	**Introduction to Logic and Reasoning:** Alphanumeric series, Direction, Logical Reasoning, Data Sufficiency, Ranking and order , Puzzle, Blood Relations , Analogy, Cube and Dice, Coding Decoding	**6**	The students will be able to demonstrate the ability to understand the concepts of mathematics, logic, reasoning and coding. Explore and apply key concepts in logical thinking to business problems.	3
IV	**Introduction to Coding: C** **Programming constructs:** Types of Programming Languages, Evolution of 'C' Language, Structure of a 'C' Program, Executing and Debugging a 'C' Program, 'C' Tokens: Keywords and Identifiers, Operators, Constants, Variables, Data Types, Precedence of Operators, Scope and Lifetime of Variables, Arithmetic Expressions, Evaluation of Expressions. **Control Statements:** Decision Making using if statement, Types of if ...else block, Switch case Block, GOTO statement. **Looping:** Concept of Loop, For loop, While loop, Do- while loop, jumping in Loop, break and continue statement	**6**	The students will be able to demonstrate the ability to understand the concepts of mathematics, logic, reasoning and coding. Solve and devise solutions to a range of elementary real-world problems in mathematics and programming.	1,3
V	**Introduction to Arrays, Strings and Functions** **Arrays:** One Dimensional Arrays, Two Dimensional Arrays, Multidimensional Arrays, Dynamic Arrays. **Strings:** Implementing String Variables, String handling Functions.	**6**	The students will be able to demonstrate the ability to understand the concepts of mathematics, logic, reasoning and coding. Solve and devise	1,3

	Functions: Concept of Functions, user-defined Functions, System-defined Functions, passing in Functions.		solutions to a range of elementary real- world problems in mathematics and programming.	

TEXT BOOKS:

1. Schaum's Outline of Programming with C by Byron Gottfried, Third Edition
2. Programming in ANSI C by E. Balaguruswamy, Eight Edition
3. Discrete Mathematics by Lipschutz, Lipsonand and Patil, Revised Third Edition
4. A Textbook on Discrete Mathematics by Sastry and Nayak

REFERENCE

1. A Modern Approach To Verbal & Non Verbal Reasoning by R S Agarwal, Revised Edition
2. Analytical and Logical Reasoning by Sijwali B S, Revised Edition
3. The C Programming Language, by Brian W. Kernighan and Dennis M. Ritchie, Second Edition
4. 2000 Solved Problems in Discrete Mathematics by Lipchitz and Lipson

OTHER LEARNING RESOURCES:

https://www.javatpoint.com/discrete-mathematics-tutorial
https://www.khanacademy.org/test-prep/lsat/lsat-lessons/logical-reasoning/a/logical- reasoning
https://www.javatpoint.com/c-programming-language-tutorial

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Understand the concepts of mathematics, logic, reasoning and coding.	PO1,PO8
2	Applications of the concepts in other disciplines such as engineering, computer science, physics, etc.	3,7
3	Learn to solve and devise solutions to a range of elementary real-world problems in mathematics and programming.	6,9,10
4	Explore and apply key concepts in logical thinking to business problems	5,9
5	Enable students to critically analyze information in order to evaluate evidence and construct reasoned arguments	7,1,12

SEMESTER – I										
Course Title	**Physics for Engineers**									
Course code	**23BTME113R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T+30P	**2**	**0**	**2**	**0**	**0**	**0**	**3**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ I semester of first year of the programme**								
Course Objectives	1. To understand the theories of physics. 2. To apply the concepts in practical problems 3. To understand the physics of any process.								
CO1	To make the students in understanding the importance of mechanics								
CO2	To enable the students in understanding the importance of quantum physics								
CO3	To apply quantum ideas at the nanoscale.								
CO4	To understand the materials characterization and instrumentation.								
CO5	To equip the students on the knowledge of new engineering materials.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Unit I: MECHANICS** Moment of inertia (M.I) - Radius of gyration - Theorems of M .I - M.I of circular disc, solid cylinder, hollow cylinder , solid sphere and hollow sphere - K.E of a rotating body – M.I of a diatomic molecule – Rotational energy state of a rigid diatomic molecule - centre of mass – conservation of linear momentum – Relation between Torque and angular momentum -Torsional pendulum.	**6**	• Develop basic knowledge of mechanics • Understand the basic principles of mechanics.	1, 2
II	**BASIC QUANTUM MECHANICS:** Photons and light waves - Electrons and matter waves - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization - Particle in a infinite potential well - Normalization, probabilities and the correspondence principle	**6**	• Apply basic understanding of quantum mechanics • Apply basic principles of quantum mechanics	1, 2, 3, 4
III	**Nanophysics:** Introduction to Nano-materials, Moore's law, Properties of Nano-materials, Quantum confinement, Quantum well, wire &	**6**	• Understand the physics behind the nanomaterials	1, 2, 3, 4, 5
IV	**Electricity and Magnetism: Electricity:** Basic Definitions, ohm‟s law, Voltage and current source. Kirchhoff‟s laws, basic circuit components, series parallel resistance circuits, mesh analysis and nodal analysis **Magnetism:** -Origin of magnetic moment, Bohr magneton, Classification of magnetism, Domain theory, Hysteresis, soft and hard magnetic materials, Anti-ferromagnetic materials, Ferrites Applications of magnetism-magnetic	**6**	• Learning of basics of electricity and magnetism	2 3 4

	recording and readout storage of magnetic data tapes, floppy and magnetic disc drives.			
V	**Material Characterization Techniques and Instrumentation:** Principle, construction and working of X-ray Diffractometer, crystal size determination by Scherrer equation. Principle, construction,working and applications of -Atomic Force Microscope (AFM), X-ray Photoelectron Spectroscope (XPS), Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) Numerical problems.	**6**	• Understand the basics materials characterization • Learning of various characterization techniques and instrumentation	2, 3, 4, 5

TEXT BOOKS:

T1. Arthur Beiser et al., Concepts of Modern Physics, 2013, Sixth Edition, Tata McGraw Hill

T2. Applied Physics for Engineers – K.Venkatramanan, R.Raja, M.Sundarrajan (Scitech

REFERENCE BOOKS:

R1. Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, (Wiley)

OTHER LEARNING RESOURCES: https://nptel.ac.in

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	To make the students in understanding the importance of mechanics	1,2
2	To enable the students in understanding the importance of quantum physics	3,5
3	To apply quantum ideas at the nanoscale.	6,9,10
4	To understand the materials characterization and instrumentation.	5,9
5	To equip the students on the knowledge of new engineering materials.	4,1,11

SEMESTER – I									
Course Title	**Workshop/Manufacturing Practices**								
Course code	**23BTME114R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30P	**0**	**0**	**2**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ I semester of first year of the programme**								
Course Objectives	1. Learning this course will lead you to understand basic concepts of workshop and manufacturing. 2. Apply fundamental knowledge of workshop and manufacturing in day-to-day life. 3. Recognize components using different materials.								
CO1	Infer about various manufacturing methods like casting, forming, machining etc								
CO2	Apply fitting oparation and power tools in manufacturing works								
CO3	Demonstrate to Carpentry & fitting operations and its application in industries								
CO4	Enhance skills in machining operations like material cutting and preparation of mould etc.								
CO5	Critique the different types of welding, metal cassting and its field of application.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Manufacturing Methods:** Casting, Forming, Machining, Joining, Advanced manufacturing methods	**6**	Introduction to various manufacturing methods like casting, Forming, machining etc.	1,2,3
II	**CNC machining, Additive Manufacturing:** Overview of CNC machining process, overview of additive manufacturing	**6**	Application of computer coding in automation of Machines.	3,4
III	**Carpentry & Fitting operations:** Carpentry tools, carpentry perations, fitting tools, fitting operations	**6**	Introduction to Carpentry & fitting operations and its application in industries.	3,4
IV	**Machining operations:** Turning, milling, turning processes, milling processes.	**6**	Introduction to various manufacturing methods like casting, forming, machining, etc.	4
V	**Welding:** Arc welding & gas welding, brazing	**6**	Introduction to safety precautions in welding.	4

Text Books:

T1. Elements of Workshop Technology, Vol. I 2008 and Vol. II 2010, Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy Media promoters and publishers private limited, Mumbai.

REFERENCE BOOKS:

R1. Manufacturing Technology – I Gowri P. Hariharan and A. Suresh Babu Pearson Education, 2008
R2. Processes and Materials of Manufacture Roy A. Lindberg 4th edition, Prentice Hall India, 1998

OTHER LEARNING RESOURCES: https://nptel.ac.in

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Infer about various manufacturing methods like casting, forming, machining etc	1,3,5
2	Apply fitting oparation and power tools in manufacturing works	2,4
3	Demonstrate to Carpentry & fitting operations and its application in industries	6,8
4	Enhance skills in machining operations like material cutting and preparation of mould etc.	7,10,12
5	Critique the different types of welding, metal casting and its field of application.	8,9

SEMESTER – I									
Course Title	**Introductory English for Engineers**								
Course code	**23UBPD113R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30P	**0**	**0**	**2**	**0**	**0**	**0**	**1**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall: Winter/ I semester of first year of the programme**								
Course Objectives	1. To capacitate the students with mastery over Basic English grammar. 2. To enable the students to communicate confidently with a focus on listening and speaking skills. 3. With the help of the basics of Phonetics, the students will be able to pronounce words correctly. 4. To interact successfully and with decorum.								
CO1	Understand and correctly use various grammar elements, including parts of speech, articles, auxiliary verbs, determiners, and degrees of comparison, to construct different types of sentences.								
CO2	Analyze and comprehend written texts through comprehension exercises, demonstrating an understanding of sentence construction and types.								
CO3	Understand the process and purpose of listening, differentiate between listening and hearing, identify factors affecting listening, and implement strategies to improve their listening skills.								
CO4	Develop speaking skills by introducing themselves, practicing self-discovery, improving pronunciation through phonetics, delivering extempore speeches, and using video recordings for self-reflection.								
CO5	Understand the fundamentals of communication, including its types, purposes, barriers, and importance, and apply this knowledge to improve their communication skills in both formal and informal contexts.								

Unit- No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Module 1 - Grammar I. Parts of Speech I. Articles I. Auxiliary Verbs Affirmative and Negative Sentences	**6**	In this module, students will master the foundational elements of grammar. They will explore the parts of speech, including nouns, pronouns, verbs, adjectives, adverbs, prepositions, conjunctions, and interjections. Understanding articles (definite and indefinite) and their correct usage will be emphasized. Students will learn about auxiliary verbs and their role in forming tenses, voices, and moods. The module will also cover the construction of affirmative and negative sentences, helping students to build grammatically correct and meaningful sentences.	1, 2

II	Module 2- Grammar I. Determiners I. Sentence Construction I. Types of Sentences (Assertive, Imperative, etc.) . Degree of Comparison . Comprehension Exercises	**6**	Building on the basics, this module will delve into determiners and their functions in sentences. Students will learn sentence construction techniques and the different types of sentences (assertive, imperative, interrogative, and exclamatory). The concept of the degree of comparison (positive, comparative, and superlative) will be explored. The module will also	2, 3, 4
III	Module 3 - Listening Skills i. What is listening? i. The Process of Listening i. Factors that adversely affect Listening . Difference between Listening and Hearing, .Purpose and Importance of Effective Listening I. How to Improve Listening Process.	**6**	Students will be introduced to the fundamentals of listening, distinguishing it from hearing. They will study the process of listening and identify factors that adversely affect it. The module will highlight the purpose and importance of effective listening and provide strategies to improve the listening process. By understanding these concepts, students will enhance their ability to comprehend and retain spoken information.	1, 2, 3, 4
IV	Module 4 - Speaking Skills I. Introducing yourself I. Self-discovery I. Basics of Phonetics, pronunciation . Extempore speech . Video Recording for Self-reflection	**6**	This module focuses on developing students' speaking abilities. They will learn how to introduce themselves and engage in self-discovery to build confidence. Basics of phonetics and pronunciation will be covered to ensure clear and correct speech. Students will practice extempore speech to improve their ability to speak spontaneously. Video recording for self-reflection will be used as a tool for students to evaluate and improve their speaking skills.	1, 2
V	Module 5- Communication Skills I. Introduction to Communication, I. Importance of Communication Skills, I. Purpose of Communication, . Types of Communication, . Formal and informal communication I. Importance of Communication, I. Barriers to Communication, I. How to improve/ tips to	**6**	Students will gain a comprehensive understanding of communication and its significance. The module will cover the types and purposes of communication, distinguishing between formal and informal contexts. Students will learn about the importance of communication skills and the barriers that can impede effective communication. Tips and strategies to improve communication skills will be provided. The module will also	2, 3, 4, 5

	improve Communication skills. .Responding to different questions in various situations (formal/informal)		include exercises on responding to different questions in various situations, enhancing students' adaptability and effectiveness in both formal and informal interactions.	

Text Books:

T1. Chaturvedi, P.D., Chaturvedi Mukesh, 2011.Business Communication: Concepts, Cases and Applications, second edition, Pearson, Noida

T2. Alex K., Chand, S, 2009. Soft Skills: Know Yourself and Know the World, first edition, S. Chand & Company Ltd.: New Delhi.

Reference Books:

R1. Quirk, Randolp. (2010) A Comprehensive Grammar of the English Language by Randolph Quirk, Sidney Greenbaum, Pearson Education India

R2. Marks, Jonathan. (2017) IELTS Advantage Speaking and Listening Skills: A step-by-step guide to a high IELTS speaking and listening score. Book + CD-ROM, Delta Publishing by Klett

Other Learning Resources:

1. https://youtu.be/bEB8-SWMYhI
2. https://youtu.be/-zZau_dttRY

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

SN	Course Outcome (CO)	Mapped Program Outcome
1	Understand and correctly use various grammar elements, including parts of speech, articles, auxiliary verbs, determiners, and degrees of comparison, to construct different types of sentences.	1,2
2	Analyze and comprehend written texts through comprehension exercises, demonstrating an understanding of sentence construction and types.	3,5
3	Understand the process and purpose of listening, differentiate between listening and hearing, identify factors affecting listening, and implement strategies to improve their listening skills.	6,9,10
4	Develop speaking skills by introducing themselves, practicing self-discovery, improving pronunciation through phonetics, delivering extempore speeches, and using video recordings for self-reflection.	5,9
5	Understand the fundamentals of communication, including its types, purposes, barriers, and importance, and apply this knowledge to improve their communication skills in both formal and informal contexts.	1, 4,11

SEMESTER – I										
Course Title	**EXTRA-CURRICULAR ACTIVITIES**									
Course code	**23UBEC111**	**Total credits:1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**	
			0	**0**	**0**	**4**	**0**	**0**	**1**	
Pre- requisite	**Nil**	**Co- equisite**	**Nil**							
Programme	**B.Tech Mechanical Engineering**									
Semester	**Fall/ I semester of first year of the programme**									
Course Objectives	1. To develop soft and social skills 2. To promote a holistic development of the learners 3. To enhance the learning experience in different stages etc.									
CO1	Participants will develop personal skills, such as leadership, communication, time management, and teamwork, contributing to their overall character development and self-confidence.									
CO2	Engagement in Community service and outreach activities will cultivate a sense of social responsibility, empathy, and civic awareness, encouraging students to actively contribute to society									
CO3	Express their ideas, views, In-depth evaluation and analysis clearly in the topic of their interest.									
CO4	The students will be given a platform to earn from invited experts in their respective fields.									
CO5	Demonstrate and practices different activities, by Integrating learning experiences by demonstrating transferable skills.									

Unit- No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Different types of activities outside regular curriculum	**10**	1. AdtU encourages a range of activities outside the regular curriculum intended to meet learner's interest. These activities are aimed to develop the social and soft skills and promote a holistic development of the learners. 2. Keeping in mind the 360-degree learning methodology the students are engaged in different activities headed under different clubs viz. Dance, music, photography, drama, literary etc. 3. The students are encouraged to participate in regular club activities, workshops, competitions as per their interest and hobbies. 4. The student members of the club are trained represent AdtU in various inter University student and national level competitions 5. Renewed personalities are invited to conduct workshops	1,2,3,4, 5

			that benefit the members and students by giving them the platform to learn from experts in the respective fields.	

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
Course Outcome (CO)		**Mapped Program Outcome**
1	Participants will develop personal skills, such as leadership, communication, time management, and teamwork, contributing to their overall character development and self-confidence.	1,3
2	Engagement in Community service and outreach activities will cultivate a sense of social responsibility, empathy, and civic awareness, encouraging students to actively contribute to society	3,4,7
3	Express their ideas, views, In-depth evaluation and analysis clearly in the topic of their interest.	6,8
4	The students will be given a platform to earn from invited experts in their respective fields.	4,6
5	Demonstrate and practices different activities, by Integrating learning experiences by demonstrating transferable skills.	7,11

SEMESTER – II									
Course Title	**ODE, Probability and Statistics**								
Course code	**23BTME121R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 60T	**4**	**0**	**0**	**0**	**0**	**0**	**4**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ II semester of first year of the programme**								
Course Objectives	1. Describe the concept of first order differential equation and apply them in understanding complex problems. 2. Apply the concept of ordinary differential equations of higher orders. 3. Develop students' skills in basic probability and statistics, including the analysis of probability distributions, measures of central tendency, and statistical parameters, and to apply these concepts to real-world data and hypothesis testing.								
CO1	Understand to solve differential Equations and their applications in engineering problems.								
CO2	Understand the basic principles of set theorem and apply them in solving different complex problems.								
CO3	Apply the concepts of proposition logic.								
CO4	Analyze the concept of basic probability and its application								
CO5	Understand the concept of basic and applied statistics.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	***First order ordinary differential equations:*** Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	**12**	First-order ordinary differential equations include understanding and solving exact, linear, and Bernoulli equations, as well as Euler's equations for rigid body dynamics. Students will also learn to handle equations not of the first degree, including those solvable for pp, yy, or xx, and Clairaut's type equations. These outcomes focus on enhancing analytical and problem-solving skills in differential equations.	**1**
II	***Ordinary differential equations of higher orders:*** Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation.	**12**	Method of variation of parameters. Students will also understand and solve the Cauchy-Euler equation, which is a specific type of second-order linear differential equation useful in various applications.	**3**
III	***Complex variable-Differentiation:*** Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary		Gaining proficiency in solving second-order linear differential equations with variable coefficients using techniques like the variation of parameters.	

	analytic functions (exponential, trigonometric, logarithm) and their properties.	**12**	Additionally, students will learn to solve the Cauchy-Euler equation, a particular type of second-order differential equation, and comprehend its applications and solution methods. This expertise prepares students to tackle complex differential equations	6
IV	***Basic probability:*** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variable-the multinomial distribution, Poisson approximation to the binomial distribution.	**12**	Understanding the foundational concepts of probability spaces and the ability to calculate conditional probability and determine the independence of events. Students will also learn about discrete random variables and how to analyze distributions involving independent random variables. Additionally, they will gain proficiency in working with the multinomial distribution and applying the Poisson approximation to the binomial distribution, equipping them with essential tools for solving a variety of probabilistic problems.	4
V	***Basic and applied Statistics:*** ***Basic:*** Measures of central tendency: Moments, skewness and Kurtosis-Probability distributions: Binomial, Poisson and Normal-evaluation of statistical parameters for these three distributions, Correlation and regression. ***Applied:*** Test of significance: Large sample test for single proportion. Difference of proportions, single mean, difference of means and difference of standard deviations.	**12**	Understanding and calculating measures of central tendency such as mean, median, and mode. Students will also learn to compute moments, and analyze skewness and kurtosis to describe data distribution shapes. Additionally, they will gain proficiency in working with key probability distributions (Binomial, Poisson, and Normal), including evaluating their statistical parameters. Furthermore, students will develop skills in correlation and regression analysis to examine relationships between variables.	3

TEXT BOOKS:

T1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

T2. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint,

2010.

REFERENCE BOOKS:

R1. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
R2. S. L. Ross, Differential Equations, 3rd Ed. Wiley India, 1984.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Understand to solve differential Equations and their applications in engineering problems.	1,2
2	Understand the basic principles of set theorem and apply them in solving different complex problems.	3,4,8
3	Apply the concepts of proposition logic.	6,8,10
4	Analyze the concept of basic probability and its application	4,6
5	Understand the concept of basic and applied statistics.	7,11,12

SEMESTER – II										
Course Title	**Chemistry for Engineers**									
Course code	**23BTME122R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T+30P	**2**	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ II semester of first year of the programme**								
Course Objectives	1 To impart technological aspects of applied chemistry. 2 To lay foundation for practical application of chemistry in engineering aspects.								
CO1	Recall and analyze the issues related to impurities in water and their removal methods and apply recent methodologies in water treatment for domestic and industrial usage								
CO2	Evaluate the causes of metallic corrosion and apply the methods for corrosion protection of metals.								
CO3	Evaluate the electrochemical energy storage systems such as lithium batteries, fuel cells and solar cells, and design for usage in electrical and electronic applications.								
CO4	Assess the quality of different fossil fuels and create an awareness to develop the alternative fuels.								
CO5	Analyze the properties of different polymers and distinguish the polymers which can be degraded and demonstrate their usefulness								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	CORROSION CONTROL**:** Dry and wet corrosion - detrimental effects to buildings, machines, devices & decorative art forms, emphasizing Differential aeration, Pitting, Galvanic and Stress corrosion cracking; Factors that enhance corrosion and choice of parameters to mitigate corrosion. Corrosion protection cathodic protection – sacrificial anodic and impressed current protection methods; Advanced protective coatings: electroplating and electroless plating, PVD and CVD. Alloying for corrosion protection – Basic concepts of Eutectic composition and Eutectic mixtures - Selected examples Ferrous and non-ferrous alloys.	**6**	C1, C2	1
II	POLYMER CHEMISTRY**:** Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Difference between thermoplastics and thermosetting plastics; Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index; Engineering application of plastics - PE, PVC, PC, PTFE, PP, Nylon 6, Nylon 66, Bakelite, Epoxy; Compounding of	**6**	C C1, C2	2

	plastics: moulding of plastics for Car parts, bottlecaps (Injection moulding), Pipes, Hoses (Extrusion moulding), Battery Trays,(Compression moulding), Fibre reinforced polymers, Composites (Transfer moulding), PET bottles(blow moulding); Polymer Coatings and Sealant Conducting polymers- Polyacetylene-Mechanism of conduction – applications (polymers in sensors, self-cleaning windows)			
III	ELECTROCHEMICAL ENERGY SYSTEMS: Brief introduction to conventional primary and secondary batteries; High energy electrochemical energy systems: Lithium batteries – Primary and secondary, its Chemistry, advantages and applications. Fuel cells – Polymer membrane fuel cells, Solid- oxide fuel cells- working principles, advantages, applications. Solar cells – Types – Importance of silicon single crystal, polycrystalline and amorphous silicon solar cells, dye sensitized solar cells - working principles, characteristics and applications. Explosives – classification, examples: TNT, RDX, Dynamite	**6**	C1,C2	3
IV	FUELS AND COMBUSTION**:** Calorific value - Definition of LCV, HCV. Measurement of calorific value using bomb calorimeter and Boy's calorimeter including numerical problems. Controlled combustion of fuels - Air fuel ratio – minimum quantity of air by volume and by weight Numerical problems-three-way catalytic converter- selective catalytic reduction of NOX; Knocking in IC engines-Octane and Cetane number - Ant knocking agents.	**6**	C1,C2	4
V	WATER TECHNOLOGY: Water quality parameters: color, odor, pH, hardness, alkalinity, DS, COD and BOD. Boiler feed water – requirement – troubles (scale &	**6**	C1,C2	6

TEXT BOOKS:

T1. Sashi Chawla, A Text book of Engineering Chemistry, Dhanpat Rai Publishing Co., Pvt. Ltd., Educational and Technical Publishers, New Delhi, 3rd Edition, 2015

T2. O.G. Palanna, McGraw Hill Education (India) Private Limited, 9th Reprint, 2015.

REFERENCE BOOKS:

R1. V. Roussak and H. D. Gesser, ***Applied Chemistry-A Text Book for Engineers and Technologists*** Springer Science Business Media, New York, 2nd Edition, 2013.

R2. S. S. Dara, ***A Text book of Engineering Chemistry,*** S. Chand & Co Ltd., New Delhi, 20thEdition, 2013

OTHER LEARNING RESOURCES:

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Recall and analyze the issues related to impurities in water and their removal methods and apply recent methodologies in water treatment for domestic and industrial usage	1,3
2	Evaluate the causes of metallic corrosion and apply the methods for corrosion protection of metals.	3,4,7
3	Evaluate the electrochemical energy storage systems such as lithium batteries, fuel cells and solar cells, and design for usage in electrical and electronic applications.	6,8,12
4	Assess the quality of different fossil fuels and create an awareness to develop the alternative fuels.	4,6
5	Analyze the properties of different polymers and distinguish the polymers which can be degraded and demonstrate their usefulness	7,11,12

SEMESTER – II										
Course Title	**Problem Solving using Python Programming**									
Course code	**23BTME 124 R**	**Total credits: 3 Total hours: 30T+30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**	
			2	**0**	**2**	**0**	**0**	**0**	**3**	
Pre-requisite	**Nil**	**Co-requisite**	**Nil**							
Programme	**Bachelor of Technology in Mechanical Engineering**									
Semester	**Fall/ II semester of first year of the programme**									
Course Objectives	1. The course "Problem Solving using Python" aims to provide students with a basic foundation in Python programming. 2. The course "Problem Solving using Python" aims to provide students problem-solving skills. 3. Making the Students write efficient, structured, and modular code to solve a few basic real-world computational problems.									
CO1	Understand about the history of Programming Languages, types of programming languages, Basic Syntax of a few programming languages									
CO2	Understand the fundamentals of Python programming language and its syntax, enabling them to write basic to intermediate level programs.									
CO3	Demonstrate proficiency in using data types and conditional statements to make simple Python programs and manipulate data effectively									
CO4	Understand about Loops, functions and various packages in Python.									
CO5	Understand Lambda and user defined functions in Python.									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**History of Programming Languages** Overview of Programming Languages, Basic Syntax of a few programming languages, Advantages and disadvantages of Python, Real-life examples of the application of Python	**6**	Describe, illustrate and explain various programming languages, and their real-world applications.	1,2, 3
II	**Introduction to Python Programming** Introduction to Python Language, Writing and Compiling Python Programs, Basic Structure of a Python Program, Data Types and Constants	**6**	Describe, illustrate and explain Python programming, data types and constants.	3,4
III	**Data types and Variables** Data types, Variable declaration and use, Typecasting in Python, Operators in Python: Assignment, Logical, Arithmetic, Conditional statements: If statement, If else statement, Python Collections: List, Tuple, Sets and Dictionary	**6**	Describe, illustrate and explain Operators in Python, collections, data types and variables.	3,4
IV	**Loops and Functions** Loops in Python: For Loop, While Loop and Nested Loops, User Defined functions	**6**	Describe, illustrate and explain Loops in Python	4
V	**Lambda Functions:** Types of functions, Lambda functions	**6**	Describe, illustrate and explain various types of functions.	4

TEXT BOOKS:

T1 Introduction To Computing And Problem-Solving Using Python, BALAGURUSAMY, 1st Edition, McGraw Hill, ISBN 9789352602582

REFERENCE BOOKS:

R1. Andrew Ngo, Introduction to Python Programming: Beginner to Advanced, Practical Guide, Tips and Tricks, Easy and Comprehensive, 1st Edition, 2017, Kindle Books

R2. Venugopal and Prasad, Python: The Complete Reference, 4th Edition, 2018, Tata McGraw Hill

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Understand about the history of Programming Languages, types of programming languages, Basic Syntax of a few programming languages	1,3
2	Understand the fundamentals of Python programming language and its syntax, enabling them to write basic to intermediate level programs.	3,4,8
3	Demonstrate proficiency in using data types and conditional statements to make simple Python programs and manipulate data effectively	6,8,12
4	Understand about Loops, functions and various packages in Python.	4,6
5	Understand Lambda and user defined functions in Python.	7,11,12

SEMESTER – II									
Course Title	**Environmental Science**								
Course code	**23BTME126R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T	**2**	**0**	**0**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ II semester of first year of the programme**								
Course Objectives	1. This course provides students with a comprehensive overview of fundamental ecological principles, environmental chemistry, biodiversity conservation, and the impacts of human activities on the environment. 2. Through a blend of theoretical knowledge and practical applications, students delve into the complexities of pollution, resource management, and sustainable development. The course emphasizes the interconnectedness of ecological systems, aiming to cultivate an understanding of the delicate balance required for environmental harmony. 3. By studying environmental chemistry, biodiversity, and pollution, students develop the skills needed to critically analyze and propose solutions to contemporary environmental challenges.								
CO1	Develop critical thinking for shaping strategies (scientific, social, economic, administrative, and legal) for environmental protection, conservation of biodiversity, environmental equity, and sustainable development.								
CO2	Develop critical thinking for shaping strategies (scientific, social, economic, administrative, and legal) for environmental protection, conservation of biodiversity, environmental equity, and sustainable development.								
CO3	Understand the consequences of human actions on the web of life, global economy, and quality of human life.								
CO4	Understand about Environment Pollution, Global Environment issues, Impact of Human Population and modern civilization on the Environment								
CO5	Analyse various aspects of human population, and the impact of the population growth on the environment.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction To Environment: Definition and scope, components of environment, atmosphere, hydrosphere, lithosphere and biosphere, structure and composition, Lifesystems, pro and eukaryotic organizations, Metabolic principles; types of plants and animals. Producers, consumers and decomposers.	**6**	Develop a holistic understanding of the environment's components and principles governing life systems, metabolic processes, and biodiversity.	1,2
II	Ecology: Terminology and approach, ecosystem, types of ecosystems; structure and function, mineral cycling, energy flow and trophic chains. Development and evolution. .	**6**	Acquire proficiency in ecological terminology, ecosystem structure, energy flow, trophic chains, and understand the relationships between ecosystem components and their ecological roles.	2,4, 5
III	**Environmental Pollution:** Sources, causes, assessment, effect, prevention	**6**	Develop the ability to analyze environmental pollution	

	and control of water pollution, air pollution noise and land pollution. Strategies of management, concept of sustainability. Energy, environment, and their relationship with human activities. Water Resources and utilization, forest resources.		sources, causes, effects, and prevention methods, emphasizing sustainability and the interplay between energy, environment, and human activities.	2,4, 5
IV	**Global Environmental Problems:** Human health, settlements, management of rivers, lakes, forests, wild life and catchments. Role of society, NGO and Govt. agencies. Concept of urbanization and green cities Global Warming, greenhouse causes and effects, carbon Sequestration.	**6**	Gain knowledge of sustainable water and forest resource management, understand human impacts on the environment, and explore concepts related to urbanization, global warming, and carbon sequestration.	2,4, 5
V	International agreements and protocols, National Forest policy and Environmental laws and acts. EIA	**6**	Develop awareness of international agreements and protocols addressing global environmental challenges, understand the roles of society, NGOs, and government agencies, and familiarize oneself with national environmental policies and laws, including Environmental Impact Assessment processes.	2,4, 5

Text Books:

T1-H.S. Peavy, D.R. Rowe and G. Tchobanoglous, Environmental Engineering, McGraw Hill International.

T2-J. G. Henry and G.H. Heinke, Environmental Science and Engineering, Prentice Hall International.

Reference Books:

R1-G.M. Masters, Introduction to Environmental Engineering and Science, Pearson Education.

R2-R.T. Wright and D.F. Bourse, Environmental Science Towards a Sustainable Future, PHI Learning.

R3-P.A. Vesilind and S.M. Morgan, Introduction to Environmental Engineering, Thomson Books.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Develop critical thinking for shaping strategies (scientific, social, economic, administrative, and legal) for environmental protection, conservation of biodiversity, environmental equity, and sustainable development.	**1,3**
2	Develop critical thinking for shaping strategies (scientific, social, economic, administrative, and legal) for environmental protection, conservation of biodiversity, environmental equity, and sustainable development.	**1**
3	Understand the consequences of human actions on the web of life, global economy, and quality of human life.	**1,3**
4	Understand about Environment Pollution, Global Environment issues, Impact of Human Population and modern civilization on the Environment	**1,3**
5	Analyse various aspects of human population, and the impact of the population growth on the environment.	**1,3&4**

SEMESTER – II									
Course Title	**Engineering Drawing**								
Course code	**23BTME123R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 60P	**0**	**0**	**4**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ II semester of first year of the programme**								
Course Objectives	• Develop the ability to communicate with others through the language of technical drawing and sketching. • Enable the students with various concepts like dimensioning, conventions and standards related to working drawings in order to become professionally efficient. • Enable the students with various concepts like dimensioning, conventions and standards related to working drawings in order to become professionally efficient.								
CO1	To understand principles of engineering graphics and usage of drawing instruments								
CO2	To discuss orthographic projections.								
CO3	To classify different dimensioning methods and scales.								
CO4	To understand sectional views for different geometrical solids, CAD drawing.								
CO5	To give examples of isometric views by using isometric scales, annotations and layering.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, numbering	**12**	Understand principles of engineering graphics and usage of drawing instruments	2,4
II	Plain, Diagonal and Vernier Scales. Conic sections - Rectangular Hyperbola; Cycloid, Epicycloid, Hypocycloid and Involute; Projection of regular solids	**12**	Discuss orthographic projections	2,4, 5
III	Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes	**12**	Classify different dimensioning methods and scales.	2,4, 5
IV	Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone	**12**	Understand sectional views for different geometrical solids, CAD drawing.	2,4, 5
V	Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa	**12**	Give examples of isometric views by using isometric scales, annotations and layering.	2,4, 5

TEXT BOOKS:

T1: Venugopal K and Prabhu Raja V, "Engineering Graphics", New AGE International Publishers, 2015.
T2: N. D. Bhatt, Engineering Drawing, Charotar publishing House, 2012.

REFERENCE BOOKS:

R1: Natarajan, K. V., A Text book of Engineering Graphics, Dhanalakshmi Publishers, 2012.

OTHER LEARNING RESOURCES:

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	To understand principles of engineering graphics and usage of drawing instruments	**1,3**
2	To discuss orthographic projections.	**1**
3	To classify different dimensioning methods and scales.	**1,3**
4	To understand sectional views for different geometrical solids, CAD drawing.	**1,3**
5	To give examples of isometric views by using isometric scales, annotations and layering	**1,3&4**

SEMESTER – II									
Course Title	**EFFECTIVE ENGLISH FOR ENGINEERS** (Communicative English & Soft Skills)								
Course code	**23UBPD123R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 60P	**0**	**0**	**4**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ II semester of first year of the programme**								
Course Objectives	This course will enable the students to acquire the important knowledge on grammar like the formation of sentences. To enable the students to use vocabulary meaningfully for a successful conversation. To establish Reputation and Rapport, a dress code session is much needed								
CO1	Enable students to understand grammar to write effectively and speak flawlessly, knowing correct usage of tenses and rectifying grammatical errors.								
CO2	Students will acquire the technique of expanding vocabulary and creating new words and use them in different contexts.								
CO3	Encouraging and helping them to sharpen their listening skills and to become good listeners.								
CO4	To make them prepare for various public and private sector exams & placement drives.								
CO5	To enhance the analytical skill and problem-solving skill of the students								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Interchange of Interrogative and Assertive Sentences, Interchange of Exclamatory and Assertive Sentences, Analysis of Sentences, Types of Tenses, Exercises on Tense	**12**	Students will be able to analyse and transform the different types of sentences.	1,2
II	Synonyms, Antonyms, Homonyms	**12**	Helpful in integrating the skills of reading and speaking in professional communication.	3,4
III	Techniques of Effective, Reading, Gathering ideas and information from a text, The SQ3R Technique, Interpret the text	**12**	Helps in analyzing the techniques of effective reading, gathering ideas and information from a text	3,4
IV	Introduction to Dress Code Ethics, ii. Purpose and Importance, iii. How to Make FIRST IMPRESSION iv. What to Wear During Interviews or Any Other Formal Meetings – Male & Female Activity:	**12**	Dress code etiquette will boost their confidence.	3,4
V	Introduction To Time Management Purpose And Importance of Time Management, Basic Tips to Maintain Time.	**12**	Students will learn to utilize time effectively.	3,4

Textbooks:

T1: Wren,P.C and Martin,H. 1995. High School English Grammar and Composition, S Chand Publishing.
T2: Barrett, Grant. 2016. Perfect English Grammar: The Indispensable Guide to Excellent Writing

References

R1. Mccarthy. (2008) English Vocabulary in Use Upper - Intermediate with CD-ROM, Cambridge University Press

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Enable students to understand grammar to write effectively and speak flawlessly, knowing correct usage of tenses and rectifying grammatical errors.	**9,10**
2	Students will acquire the technique of expanding vocabulary and creating new words and use them in different contexts.	**10**
3	Encouraging and helping them to sharpen their listening skills and to become good listeners.	**9,10,11**
4	To make them prepare for various public and private sector exams & placement drives.	**1,2,12**
5	To enhance the analytical skill and problem- solving skill of the students	**4,5**

SEMESTER – II									
Course Title	**EXTRA-CURRICULAR ACTIVITIES**								
Course code	**23UBEC121**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**0**	**4**	**0**	**0**	**1**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech Mechanical Engineering**								
Semester	**Fall/ II semester of first year of the programme**								
Course Objectives	1. To develop soft and social skills 2. To promote a holistic development of the learners 3. To enhance the learning experience in different stages etc.								
CO1	The students will be engaged in different activities headed under different clubs namely dance, music, photography, drama, literacy, etc								
CO2	The students will participate in regular club activities like workshops, competitions as per their interest and hobbies.								
CO3	The students will be trained to represent ADTU in various inter university, state and national level competitions.								
CO4	The students will be given a platform to earn from invited experts in their respective fields.								
CO5	The students will get an exposure of 360 degree learning methodology considering the overall growth along with the academics.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Different types of activities outside regular curriculum	**10**	1. AdtU encourages a range of activities outside the regular curriculum intended to meet learner's interest. These activities are aimed to develop the social and soft skills and promote a holistic development of the learners. 2. Keeping in mind the 360 degree learning methodology, the students are engaged in different activities headed under different clubs viz. Dance, music, photography, drama, literary etc. 3. The students are encouraged to participate in regular club activities, workshops, competitions as per their interest and hobbies. 4. The student members of the club are trained represent AdtU in various inter University student and national level competitions. 5. Renewed personalities are invited to conduct workshops that benefit the members and students by giving them the platform to learn from experts in the respective fields.	1,2,3,4,5

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	The students will be engaged in different activities headed under different clubs namely dance, music, photography, drama, literacy, etc	1,3
2	The students will participate in regular club activities like workshops, competitions as per their interest and hobbies.	3,4,7
3	The students will be trained to represent ADTU in various inter university, state and national level competitions.	6,8
4	The students will be given a platform to earn from invited experts in their respective fields.	4,6
5	The students will get an exposure of 360 degree learning methodology considering the overall growth along with the academics.	7,11

SEMESTER – III									
Course Title	**Biology for Engineers**								
Course code	**23BTME211R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**2**	**1**	**0**	**0**	**0**	**0**	**3**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ III semester of second year of the programme**								
Course Objectives	1. To introduce the students about the biological concepts from an engineering perspective. 2. To enable the students to have a strong knowledge of functioning of an ecosystem and identification of organisms. 3. To introduce with the concepts of genetics and mechanisms related to it.								
CO1	Discuss biological sciences, its scope and perspectives.								
CO2	Discuss regarding the ecological energetics, its working mechanism, identification of organisms.								
CO3	Analyse the mechanism of transfer of character from parent to next generation.								
CO4	Explain the genetic code and production of proteins.								
CO5	Interprets the relation between various physiological processes of our body								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction Importance and scope of Biology as an important scientific discipline. **1.** Branches of biological sciences. **2.** Fundamental differences between science and engineering. **3.** Comparison between the working mechanism of eye and camera, Bird flying and aircraft. **4.** Biological observations of 18th century that lead to major discoveries in the world **5.** Steps in scientific research works. **6.** Brownian motion in biological sciences.	**10**	Discuss biological sciences, its scope and perspectives.	1,2,5
II	**Classification & Ecology** 1. Classification of organisms, Basis of classification: Morphological, biochemical or ecological, level of organization, symmetry, germ layer organization, segmentation, notochord. 2. Concept of unicellular and multicellular organisms; prokaryotes and eukaryotes; Habitat & Adaptations. 3. Concept of Ecosystem: Structure & Function. 4. Energy flow in an ecosystem: Lindemann ten percent law. 5. Types of excretion: Ammonotelism,	**10**	Discuss regarding the ecological energetics, its working mechanism, identification of organisms.	2,3

	Ureotelism and Uricotelism. 6. Animal Kingdom: Characters of phylum with examples.			
III	**Genetics & Biomolecules** 1. Concept of Allele; Dominance & Recessive; Monohybrid, Dihybrid & Trihybrid cross; Mitosis & Meiosis. 2. Mendel's laws, Concept of Segregation and Independent assortment. 3. Concept of co-dominance and incomplete dominance with illustrations. 4. Sex determination in human. 5. Genetic disorders in human beings. 6. DNA & RNA as genetic material. **Enzymes:** Classification; Mechanism of enzyme action	**5**	Analyse the mechanism of transfer of character from parent to next generation.	2,6
IV	**Information Transfer & Metabolism** **1.** Genetic code: Properties **2.** Structure of DNA **3.** Concept of recombination and crossing over **4.** Proteins: Primary secondary, tertiary and quaternary structure. **5.** Concept of Central dogma **6.** ATP as an energy currency of cell. Concept of docking: Protein Ligand interaction	**10**	Explain the genetic code and production of proteins..	1,3
V	**Physiology** **1.** Human Circulatory System: Heart and its working mechanism; Blood groups; Erythroblastosis fetalis **2.** Neuroendocrine system of human: Endocrine glands and their functions. **3.** Human Excretory system: Structure of Kidney and Nephron **4.** Nervous system of human: Structure of neuron; Resting Membrane Potential; Origin and conduction of nerve impulse. **5.** Human Respiratory System: 4Structure of lungs and exchange of gases. **6.** Human digestive enzymes: Components and enzymes. Mechanism of muscle contraction.	**10**	Interprets the relation between various physiological processes of our body	2,3,5

TEXT BOOKS:

T1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd

T2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons.

T3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company

REFERENCE BOOKS:

R1. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

R2. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C.

RELATIONSHIP BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Discuss biological sciences, its scope and perspectives.	**7,12**
2	Discuss regarding the ecological energetics, its working mechanism, identification of organisms.	**7,12**
3	Analyse the mechanism of transfer of character from parent to next generation.	**8,9**
4	Explain the genetic code and production of proteins.	**8,9**
5	Interprets the relation between various physiological processes of our body	**7,12**

SEMESTER – III									
Course Title	**Engineering Mechanics**								
Course code	**23BTME214R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T+30P	**2**	**1**	**2**	**0**	**0**	**0**	**4**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ III semester of second year of the programme**								
Course Objectives	1. Confidently tackle equilibrium equations, moments and inertia problems. 2. Master calculator/computing basic skills to use to advantage in solving mechanics problems. 3. Gain a firm foundation in Engineering Mechanics for furthering the career in Engineering.								
CO1	Use scalar and vector analytical techniques for analysing forces in statically determinate structures.								
CO2	Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.								
CO3	Apply basic knowledge of maths and physics to solve real-world problems.								
CO4	Understand basic structural analysis covering and review of particle dynamics								
CO5	Understanding the concepts of Virtual Work and introduction to Kinetics of Rigid Bodies								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Introduction to Engineering Mechanics covering:** Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminancy	**10**	To understand force systems, resultant, equilibrium of forces, equations of equilibrium of Coplanar systems.	2,3
II	**Friction covering&Mechanical Vibrations covering:** Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.	**10**	To understand Friction covering and Mechanical Vibrations covering	2,3
III	**Basic Structural Analysis covering & Review of particle dynamics:** Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple	**10**	To understand basic structural analysis covering and review of particle dynamics	

	Trusses; Zero force members; Beams & types of beams; Frames & Machines; Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy.Impulse-momentum (linear, angular); Impact (Direct and oblique).			2,4
IV	**Centroid and Centre of Gravity covering:** Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook	**10**	To understand the concept of Centroid and Centre of Gravity.	3,4,5
V	**Virtual Work and Energy Method&Introduction to Kinetics of Rigid Bodies covering:** Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation	**5**	Understanding the concepts of Virtual Work and introduction to Kinetics of Rigid Bodies	2,3,4

Text Books:

T1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
T2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill

Reference Books:

R1. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics Pearson Press.

RELATIONSHIP BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Use scalar and vector analytical techniques for analyzing forces in staticallydeterminate structures.	**1,2,3&4**
2	Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.	**1,2,3&4**
3	Apply basic knowledge of maths and physics to solve real-world problems.	**3,4**
4	Understand basic structural analysis covering and review of particle dynamics	**3,4**
5	Understanding the concepts of Virtual Work and introduction to Kinetics of Rigid Bodies	**3,4**

SEMESTER – III									
Course Title	**Basic Thermodynamics**								
Course code	**23BTME215R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**2**	**1**	**0**	**0**	**0**	**0**	**3**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ III semester of second year of the programme**								
Course Objectives	1. To learn about work and heat interactions, and balance of energy between system and its surroundings. 2. To learn about application of I law to various energy conversion devices. 3. To evaluate the changes in properties of substances in various processes. 4. To understand the difference between high grade and low grade energies and II law limitations on energy conversion.								
CO1	After completing this course, the students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions								
CO2	Students can evaluate changes in thermodynamic properties of substances.								
CO3	The students will be able to evaluate the performance of energy conversion devices								
CO4	The students will be able to differentiate between high grade and low grade energies								
CO5	The students will understand Clausius Inequality, Entropy, Availability, unavailability, Exergy analysis, Brayton cycle, Rankine cycle, Carnot cycle								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work - Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.	**10**	Students can evaluate changes in thermodynamic properties of substances.	2,3
II	Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E ; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy	**10**	The students will be able to evaluate the performance of energy conversion devices	2,3
III	Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables and R134a tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart	**10**	To understand the properties of pure substance	3,4
IV	First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices;	**10**	To understand the concept of Centroid	3,4

	Unsteady processes; examples of steady and unsteady I law applications for system and control volume		and Centre of Gravity.	
V	Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of s from steam tables- Principle of increase of entropy; Illustration of processes in T-s coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles- Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Exergy balance equation and Exergy analysis, Thermodynamic cycles - Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle	**5**	Understanding the concepts of Virtual Work and introduction to Kinetics of Rigid Bodies	3,4

Text Books:

T1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.

T2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India

Reference books:

R1. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

R2. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd

RELATIONSHIP BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	After completing this course, the students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions	**1,2&3**
2	Students can evaluate changes in thermodynamic properties of substances.	**2,3&4**
3	The students will be able to evaluate the performance of energy conversion devices	**1,3&4**
4	The students will be able to differentiate between high grade and low-grade energies	**2,3&4**
5	The students will understand Clausius Inequality, Entropy, Availability, unavailability, Exergy analysis, Brayton cycle, Rankine cycle, Carnot cycle	**1,3&4**

SEMESTER – III									
Course Title	**Techno professional Skills II**								
Course code	**23BTME216R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30P	**0**	**0**	**2**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ III semester of second year of the programme**								
Course Objectives	1. This course will help the students to learn about the different engineering graphical view in 2D as well as 3D. 2. Different types of machining processes used in the industry can be learnt through this course 3. Learn the importance of critical thinking								
CO1	Illustrate various projected views of objects of engineering graphics and design.								
CO2	Demonstrate various machining processes in workshop.								
CO3	Learn real time applications of logic and coding								
CO4	Encourage the students towards Non-traditional thinking								
CO5	Effectively communicate scientific and technical knowledge in a professional manner								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Different types of projected view in engineering application.	**6**	Illustrate various projected views of objects of engineering graphics and design.	1,2
II	Different types of machining processes	**6**	Demonstrate various machining processes in workshop.	1,2
III	Applications of logic and coding	**6**	Learn real time applications of logic and coding	3,4
IV	Critical thinking and learning	**6**	Encourage the students towards Non- traditional thinking	3,4
V	Communication in a scientific and professional way	**6**	Effectively communicate scientific and technical knowledge in a professional manner	3,4

Text Books:

T1. Workshop Technology, Hazra and Choudhury

Reference books:

R1. Fundamentals of C programming, by Abubeker K M

References: www.nptel.ac.in

RELATIONSHIP BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Illustrate various projected views of objects of engineering graphics and design.	**1,2,3&4**
2	Demonstrate various machining processes in workshop.	**1,2,3&4**
3	Learn real time applications of logic and coding	**3,4**
4	Encourage the students towards Non-traditional thinking	**3,4**
5	Effectively communicate scientific and technical knowledge in a professional manner	**3,4**

SEMESTER – III									
Course Title	**Design of Fire and Life Safety Systems**								
Course code	**23BTME218R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			3	**0**	**0**	**0**	**0**	**0**	**3**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech Mechanical Engineering**								
Semester	**Fall/ III semester of first year of the programme**								
Course Objectives	1. Provide students with an understanding of the principles of fire science, building codes, and standards related to fire and life safety in buildings. 2. Associate the Basics of Fire, Active and Passive Fire protection Systems 3. Classify the Need, Role and Aspect of Compartmentation in a Building								
CO1	Recall the various Codes & Standards related to fire protection and life safety								
CO2	List the Codes & Standards for Fire Brigade Apparatus								
CO3	Define the concepts of Fire Protection in Buildings, Resistance Rating, and Restrictions								
CO4	Analyse and evaluate the effectiveness of fire and life safety systems in different building scenarios and identify areas for improvement.								
CO5	Evaluate the compliance of fire and life safety systems with relevant codes, standards, and regulations.								

Unit- No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Basics of Fire Protection System and Life Safety System** • Basics of Life Safety Systems, Fire Codes and Standards, Building Characteristics and Components, Case Study on Life Safety Evacuation for an IT Park, Means of Egress and Fire Rating Requirements of Buildings, Fire Resistance and Fire Resistance Rating, Stages in Fire Safety and Fire Resistance Rating Standards, Construction Details for Fire Resistant walls/structure, Egress Components and their Sizing Fire Protection in Buildings, Resistance Rating, and Restrictions	**10**	List the different Codes and Standards associated with fire protection and life safety.	1,2
II	**Design of Compartmentation in a Building** • Needs, Roles, and Aspects of Compartmentation in a Building, Designing of Compartmentation, Smoke Control and Management in Fire Zoning, Case Study on Compartmentation, Smoke Extraction in a Fire Compartment, Fire Zoning, Interfacing with Other Services	**10**	Enumerate the Codes and Standards applicable to Fire Brigade Apparatus.	2,3
III	**Fire Fighting Pump & Sump Capacity and Pipes & Fittings** • Fire Pump Room, Pump Capacity Calculation, Listings and Approvals of Fire Pumps, Fire Water Sump Calculation, Classification of Tanks, Piping and Instrumentation Diagram, Piping and Instrumentation Diagram and Pump General Arrangement, Basis of Design of Water Distribution and Types of Pipes	**10**	Explain the principles of Fire Protection in Buildings, Resistance Rating, and Associated Restrictions.	2,4

	used for Firefighting, Types of Pipe Protection, Codes and Standards, Introduction to Pipe Fittings, types, codes & standards			
IV	**Fire Protection, Detection & Alarm Systems, and its Accessories** • **Introduction to Fire Hydrants** - Introduction to Sprinkler System, Sprinkler Location, Design Calculation of Sprinkler System, Introduction to Foam Suppression Systems, Working Principle of Foam Suppression Systems, Types of Foam Suppression Systems, Classification and Types of Extinguishers, Location and Coverage of Fire Extinguishers, Introduction to Fire Safety Signages, Location and Size of Fire Safety Signages, Luminescent Photo Safety signages • **Fire Detection Systems** - Purpose of Fire detection and Alarm System, Types of Fire Detection Systems, Selection of Detectors Based on the Hazard, Applications of Heat, Smoke, and Aspirating Detectors, Introduction and Terminologies of Fire Alarm Notification Devices, Location of Notification Devices	**10**	Assess and critique the efficiency of fire and life safety systems across various building scenarios, highlighting areas for enhancement.	3,5
V	**Special type of fire protection and fire alarm system** • Introduction of Local and Total Flooding Fire trace system – Working Principle, Advantages, Types and Applications of Fire Trace System, Kitchen Hood Fire Suppression System, Application, Description and Operation, Fire Brigade Apparatus, Aspiration Smoke Detection System, Working principle of Aspiration smoke detection, Introduction Gas Suppression System, Regulatory Codes and Types, Clean Agent Fire Suppression System Design with various Cleaning Agents, Detection, Actuation, Alarm and Control systems, Introduction to Water Spray systems, Types and advantages of Water Spray systems, Design of Water Spray systems, Case Study Design of Water Spray systems for Transformers, Introduction, Requirement and Types of Water Mist Systems, Benefits and Limitations of Water Mist Systems	**5**	Assess the adherence of fire and life safety systems to applicable codes, standards, and regulations.	4,5

Reference Books:

1. Marsha P. Geisler (S), Fire & Life Safety, Educator: Principle & practices; SECOND EDITION/2016
2. Jones & Bartlett, Fundamentals of Fire Fighter Skills, revised-edition- 2017
3. A Handbook of Fire Technology by RS Gupta- 2nd edition - Universities press
4. NFPA, Fundamentals of Fire Fighter Skills and Hazardous Materials Response, 4th EDITION-2018
5. Fire & Life Safety (iafc.org), https://www.iafc.org/learn-and-develop/online-learning/
6. https://www.dgfscdhg.gov.in/national-building-code-india-fire-and-life-safety
7. The NFPA Fire & Life Safety Ecosystem | NFPA

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Recall the various Codes & Standards related to fire protection and life safety	**1,2&3**
2	List the Codes & Standards for Fire Brigade Apparatus	**2,3&4**
3	Define the concepts of Fire Protection in Buildings, Resistance Rating, and Restrictions	**1,3&4**
4	Analyse and evaluate the effectiveness of fire and life safety systems in different building scenarios and identify areas for improvement.	**2,3&4**
5	Evaluate the compliance of fire and life safety systems with relevant codes, standards, and regulations.	**1,3&4**

SEMESTER – III									
Course Title	**EXTRA-CURRICULAR ACTIVITIES**								
Course code	**23UBEC211**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**0**	**4**	**0**	**0**	**1**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech Mechanical Engineering**								
Semester	**Fall/ III semester of first year of the programme**								
Course Objectives	1. To develop soft and social skills 2. To promote a holistic development of the learners 3. To enhance the learning experience in different stages etc.								
CO1	The students will be engaged in different activities headed under different clubs namely dance, music, photography, drama, literacy, etc								
CO2	The students will participate in regular club activities like workshops, competitions as per their interest and hobbies.								
CO3	The students will be trained to represent ADTU in various inter university, state and national level competitions**.**								
CO4	The students will be given a platform to earn from invited experts in their respective fields.								
CO5	The students will get an exposure of 360 degree learning methodology considering the overall growth along with the academics.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Different types of activities outside regular curriculum	**10**	1. AdtU encourages a range of activities outside the regular curriculum intended to meet learner's interest. These activities are aimed to develop the social and soft skills and promote A holistic development of the learners. 2. Keeping in mind the 360-degree learning methodology the students are engaged in different activities headed under different clubs viz. Dance, music, photography, drama, literary etc. 3. The students are encouraged to participate inregular club activities, workshops, The student members of the club are trained represent AdtU in various inter University student and national level competitions. Renewed personalities are invited to conduct workshops that benefit the members and students by giving them the platform to learn from experts in the respective fields.	1,2,3,4 ,5

RELATIONSHIP BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Programme Outcome**
1	The students will be engaged in different activities headed under different clubs namely dance, music, photography, drama, literacy, etc	1,3
2	The students will participate in regular club activities like workshops, competitions as per their interest and hobbies.	3,4,7
3	The students will be trained to represent ADTU in various inter university, state and national level competitions**.**	6,8
4	The students will be given a platform to earn from invited experts in their respective fields.	4,6
5	The students will get an exposure of 360 degree learning methodology considering the overall growth along with the academics.	7,11

SEMESTER – III										
Course Title	**English for Employability Skills**									
Course code	**23UBPD213R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**	
		Total hours: 60P	**0**	**0**	**4**	**0**	**0**	**0**	**2**	
Pre- requisite	**Nil**	**Co-requisite**	**Nil**							
Programme	**Bachelor of Technology in Mechanical Engineering**									
Semester	**Fall: Winter/ III semester of second year of the programme**									
Course Objectives	1. To capacitate the students with mastery over Basic English grammar. 2. To enable the students to communicate confidently with a focus on listening and speaking skills. 3. With the help of the basics of Phonetics, the students will be able to pronounce words correctly. 4. To interact successfully and with decorum.									
CO1	The mastery of Basic English grammar will make the students confident to use English for all professional purposes.									
CO2	The communication skills facilitated in this course will help them make meaningful and successful conversations.									
CO3	The students will have their communication improved in all domains.									
CO4	Develop and deliver professional presentations using appropriate engineering language and communication techniques.									
CO5	Analyze and adapt communication strategies for diverse engineering workplace scenarios, demonstrating cross-cultural competence.									

Unit- No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	I. Parts of Speech I. Articles I. Auxiliary Verbs Affirmative and Negative Sentences	**12**	In this module, students will master the foundational elements of grammar. They will explore the parts of speech, including nouns, pronouns, verbs, adjectives, adverbs, prepositions, conjunctions, and interjections. Understanding articles (definite and indefinite) and their correct usage will be emphasized. Students will learn about auxiliary verbs and their role in forming tenses, voices, and moods. The module will also cover the construction of affirmative and negative sentences, helping students to build grammatically correct and meaningful sentences.	1, 2
II	I. Determiners I. Sentence Construction I. Types of Sentences Assertive, Imperative, etc.) .Degree of Comparison .Comprehension Exercises	**12**	Building on the basics, this module will delve into determiners and their functions in sentences. Students will learn sentence construction techniques and the different types of sentences (assertive, imperative, interrogative, and exclamatory). The concept of the degree of	2, 3, 4

			comparison (positive, comparative, and superlative) will be explored. The module will also include comprehension exercises designed to enhance students' ability to	
III	I. Introducing yourself I. Self-discovery I. Basics of Phonetics, pronunciation . Extempore speech . Video Recording for Self-reflection	**12**	This module focuses on developing students' speaking abilities. They will learn how to introduce themselves and engage in self-discovery to build confidence. Basics of phonetics and pronunciation will be covered to ensure clear and correct speech. Students will practice extempore speech to improve their ability to speak spontaneously. Video recording for self-reflection will be used as a tool for students to evaluate and improve their speaking skills.	1, 2
IV	I. Introduction to Communication, I. Importance of Communication Skills, I. Purpose of Communication, .Types of Communication, .Formal and informal communication I. Importance of Communication, I. Barriers to Communication, I. How to improve/ tips to improve Communication skills. Responding to different questions in various situations (formal/informal)	**12**	Students will gain a comprehensive understanding of communication and its significance. The module will cover the types and purposes of communication, distinguishing between formal and informal contexts. Students will learn about the importance of communication skills and the barriers that can impede effective communication. Tips and strategies to improve communication skills will be provided. The module will also include exercises on responding to different questions in various situations, enhancing students' adaptability and effectiveness in both formal and informal interactions.	2, 3, 4, 5

Text Books:

T1. Chaturvedi, P.D., Chaturvedi Mukesh, 2011.Business Communication: Concepts, Cases and Applications, second edition, Pearson, Noida.

T2. Alex K., Chand, S, 2009. Soft Skills: Know Yourself and Know the World, first edition, S. Chand & Company Ltd.: New Delhi

Reference Books:

R1. Quirk, Randolp. (2010) A Comprehensive Grammar of the English Language by Randolph Quirk, Sidney Greenbaum, Pearson Education India

R2. Marks, Jonathan. (2017) IELTS Advantage Speaking and Listening Skills: A step-by-step guide to a

high IELTS speaking and listening score. Book + CD-ROM, Delta Publishing by Klett

Other Learning Resources: https://youtu.be/bEB8-SWMYhI

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	The mastery of Basic English grammar will make the students confident to use English for all professional purposes.	**6,10**
2	The communication skills facilitated in this course will help them make meaningful and successful conversations.	**6,10**
3	The students will have their communication improved in all domains.	**6,10**
4	Develop and deliver professional presentations using appropriate engineering language and communication techniques.	**6,10**
5	Analyze and adapt communication strategies for diverse engineering workplace scenarios, demonstrating cross-cultural competence.	**6,10**

SEMESTER – III										
Course Title	**Basic Life Saving Skills**									
Course code	**23UULS212R**	**Total credits: 1 Total hours: 30P**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
			0	**0**	**2**	**0**	**0**	**0**	**1**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall: Winter/ III semester of second year of the programme**								
Course Objectives	1. Equip students with essential knowledge and skills in basic life-saving techniques, including CPR and first aid. 2. Develop the ability to assess emergency situations and respond effectively to various types of injuries and medical conditions. 3. Foster an understanding of preventive measures and safety protocols to minimize the occurrence of emergencies and enhance overall community safety.									
CO1	Demonstrate proficiency in performing CPR, administering first aid, and using automated external defibrillators (AEDs).									
CO2	Exhibit the ability to quickly assess emergency situations and make informed decisions to provide immediate care									
CO3	Understand and apply basic safety protocols to prevent accidents and handle emergencies efficiently.									
CO4	Display confidence and competence in handling a range of medical emergencies, from minor injuries to life-threatening conditions.									
CO5	Advocate for and promote safety and preventive measures within the community, contributing to a safer environment.									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Unit 1: Introduction to Life-Saving Skills** • Importance of life-saving skills • Basic principles of first aid • Legal and ethical aspects of providing first aid • Personal safety and use of protective equipment • Assessing the scene of an emergency	**6**	This unit covers the importance of life- saving skills and the basic principles of first aid. It discusses the legal and ethical aspects of providing first aid, emphasizing the importance of personal safety and the use of protective equipment. Students will learn how to assess the scene of an emergency to ensure safety and efficiency in providing aid.	1, 2
II	**Unit 2: Cardiopulmonary Resuscitation (CPR) and Automated External Defibrillators (AED)** • Anatomy and physiology relevant to CPR • Steps for performing CPR on adults, children, and infants • Use of an AED: principles and procedures • Hands-on practice sessions for CPR and AED use Recognizing and responding to cardiac emergencies	**6**	Students will delve into the anatomy and physiology relevant to CPR, learning the steps for performing CPR on adults, children, and infants. This unit includes the principles and procedures for using an AED, with hands-on practice sessions to ensure proficiency. The unit also focuses on recognizing and responding to cardiac emergencies.	2, 3, 4

III	**Unit 3: First Aid Techniques** • Managing bleeding, wounds, burns, and fractures • Providing first aid for choking, poisoning, and shock Practical sessions for bandaging, splinting, and other first aid procedures	**6**	This unit teaches essential first aid techniques for managing bleeding, wounds, burns, and fractures. Students will learn how to provide first aid for choking, poisoning, and shock. The unit includes practical sessions to practice bandaging, splinting, and other first aid procedures	1, 2, 3, 4
IV	**Unit 4: Emergency Medical Conditions** • Recognizing symptoms of heart attacks, strokes, asthma attacks, and diabetic emergencies • Immediate response actions for medical emergencies • Ongoing care until professional help arrives Importance of staying calm and effective communication during emergencies	**6**	Students will explore common medical emergencies such as heart attacks, strokes, asthma attacks, and diabetic emergencies. This unit covers the recognition of symptoms, immediate response actions, and ongoing care until professional help arrives. Emphasis is placed on staying calm and effective communication during emergencies.	1, 2
V	**Unit 5: Safety and Prevention** 1. Home and workplace safety measures 2. Fire prevention and electrical safety 3. Accident prevention strategies 4. Community safety programs Advocating for safety an preventive measures within the community	**6**	The final unit focuses on preventive measures to minimize the occurrence of emergencies. Students will learn about home and workplace safety, including fire prevention, electrical safety, and accident prevention. The unit also covers community safety programs and how to advocate for safety and preventive measures within the community.	2, 3, 4, 5

Textbooks:

T1. "First Aid Manual" by British Red Cross, St John Ambulance, St Andrew's First Aid, 2016.

T2. "Emergency Care and Transportation of the Sick and Injured" by American Academy of Orthopedic Surgeons (AAOS), 2016.

T3. "Advanced First Aid, CPR, and AED" by American Academy of Orthopaedic Surgeons (AAOS), 2011.

Reference Books:

R1. "Wilderness First Responder: How to Recognize, Treat, and Prevent Emergencies in the Backcountry" by Buck Tilton, 2010.

R2."Prehospital Trauma Life Support" by National Association of Emergency Medical Technicians (NAEMT), 2014.

R3. "Fundamentals of Basic Emergency Care" by Richard W. O. Beebe, Deborah L. Funk, 2013.

R4. "CPR and AED" by Alton L. Thygerson, Steven M. Thygerson, 2011.

R5. "Basic Life Support (BLS) Provider Manual" by American Heart Association, 2020.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Demonstrate proficiency in performing CPR, administering first aid, and using automated external defibrillators (AEDs).	**6,9**
2	Exhibit the ability to quickly assess emergency situations and make informed decisions to provide immediate care	**6,9**
3	Understand and apply basic safety protocols to prevent accidents and handle emergencies efficiently.	**6,9**
4	Display confidence and competence in handling a range of medical emergencies, from minor injuries to life-threatening conditions.	**6,9**
5	Advocate for and promote safety and preventive measures within the community, contributing to a safer environment.	**6,9**

SEMESTER – III										
Course Title	**Personal Financial Planning**									
Course code	**23UUFL211R**	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30P	**0**	**0**	**2**	**0**	**0**	**0**	**1**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall: Winter/ III semester of second year of the programme**								
Course Objectives	1. Understand the fundamental principles and concepts of personal financial planning. 2. Develop skills in setting SMART financial goals and creating effective budget plans. 3. Gain knowledge of various investment vehicles, their risks, returns, and suitability for different financial goals. 4. Learn strategies for tax-efficient financial planning and retirement savings. 5. Acquire knowledge of estate planning essentials and legal considerations for asset distribution.									
CO1	Ability to create comprehensive personal financial plans aligned with individual goals and values.									
CO2	Proficiency in analyzing and selecting appropriate investment options based on risk tolerance and financial objectives.									
CO3	Competence in managing cash flow, budgeting effectively, and optimizing financial resources.									
CO4	Capability to navigate tax laws and regulations to minimize tax liabilities and maximize savings.									
CO5	Understanding of estate planning strategies to protect and transfer wealth according to personal wishes and legal requirements.									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	UNIT 1- Fundamentals of Financial Planning 1. Principles of financial planning Setting financial goals 2. Budgeting and cash flow management	**6**	This unit covers the foundational principles of financial planning, including setting financial goals, creating budgets, and managing cash flow effectively. It emphasizes the importance of understanding personal financial statements and the role of financial planning in achieving long-term financial security.	1, 2
II	UNIT 2- Investment Planning 1. Types of investments (stocks, bonds, mutual funds, etc.) Risk and return analysis 2. Portfolio management strategies	**6**	This unit focuses on different types of investments such as stocks, bonds, mutual funds, and real estate. It explores risk and return analysis, asset allocation strategies, and portfolio management techniques to help individuals build and manage their investment portfolios effectively.	2, 3, 4
III	1. Social Security and Medicare considerations	6	Retirement planning addresses the process of saving and investing for retirement. It covers retirement savings vehicles like 401(k) plans and IRAs, estimating retirement needs based on lifestyle expectations, and navigating Social Security and Medicare benefits to	1, 2, 3, 4

			optimize retirement income.	
IV	UNIT 4- Tax Planning 1. Tax-efficient investment strategies 2. Tax deductions and credits Tax implications of retirement distributions	**6**	Tax planning involves strategies to minimize tax liabilities and maximize after-tax income. This unit discusses tax- efficient investment strategies, deductions, credits, and tax implications related to retirement contributions, distributions, and estate planning.	1, 2
V	UNIT 5 -Estate Planning 1. Wills, trusts, and probate Power of attorney and healthcare directives Charitable giving and legacy planning	**6**	Estate planning encompasses the process of managing and distributing assets in accordance with an individual's wishes upon death. It covers essential topics such as wills, trusts, probate, power of attorney, healthcare directives, charitable giving, and strategies for minimizing estate taxes.	2, 3, 4, 5

Textbooks:

T1. "Personal Finance" by Jeff Madura, 2016.

T2. "Personal Financial Planning" by Lawrence J. Gitman, Michael D. Joehnk, and Randy Billingsley, 2013.

T3. "Fundamentals of Financial Planning" by Michael A. Dalton, James F. Dalton, 2011.

Reference Books:

R1. "The Bogleheads' Guide to Retirement Planning" by Taylor Larimore, Mel Lindauer, Richard A. Ferri, Laura F. Dogu, 2009.

R2. "The Financial Planning Workbook: A Practical Guide to Creating Your Own Financial Plan" by Coventry House Publishing, 2018.

1. "The Millionaire Next Door: The Surprising Secrets of America's Wealthy" by Thomas J. Stanley, William D. Danko, 2010.
2. **"Your Money or Your Life: 9 Steps to Transforming Your Relationship with Money and Achieving Financial Independence"** by Vicki Robin, Joe Dominguez, 2008.
3. **"Smart Couples Finish Rich: 9 Steps to Creating a Rich Future for You and Your Partner"** by David Bach, 2009.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Ability to create comprehensive personal financial plans aligned with individual goals and values.	**11,12**
2	Proficiency in analyzing and selecting appropriate investment options based on risk tolerance and financial objectives.	**10,11**
3	Competence in managing cash flow, budgeting effectively, and optimizing financial resources.	**9,11**
4	Capability to navigate tax laws and regulations to minimize tax liabilities and maximize savings.	**11,12**
5	Understanding of estate planning strategies to protect and transfer wealth according to personal wishes and legal requirements.	**11,12**

SEMESTER – III										
Course Title	**Introduction to Electrical and Electronics Engineering**									
Course code	**23BTME213R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T+30P	**2**	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech in Mechanical Engineering**								
Semester	**III semester of the Second year of the programme**								
Course Objectives	• To provide basic knowledge about electrical components. • To learn about various circuit design laws. • To learn about semiconductor fabrication. • To integrate the different types of Electrical Installation.								
CO1	Apply fundamental concepts and circuit laws to solve simple DC electric circuits								
CO2	Introduce the overview of Transformers and Electric Machines.								
CO3	Apply the fundamental laws of electrical engineering to solve simple AC circuits in steady-state.								
CO4	Describe the overview of Semiconductor devices.								
CO5	Outline the principle of an Electrical installation and three-phase AC systems.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Elementary concepts of DC electric circuits:** Basic Terminology including voltage, current, power, resistance, Capacitance, emf; Resistances in series and parallel; Current and Voltage Division Rules; Capacitors & Inductors: V-I relations and energy stored. Ohms Law and Kirchhoff's Laws-Problems; Star-delta conversion (resistive networks only-derivation not required)-problems, Norton's theorem, Thevenin's Theorem, Superposition theorem, Numerical problems. **Power converter and electrical installation:** DC-DC buck and boost converter, single phase and three phase voltage source inverter, Fuse, MCB, ELCB, MCCB, Earthing, wires and cables, types of batteries	**6**	Understand and explain voltage, current, resistance, power, and energy in the context of DC circuits. Apply Ohm's Law to relate voltage, current, and resistance in simple DC circuits. Analyze and solve series, parallel, and series-parallel resistor networks.	1,2
II	**Alternating Current fundamentals:** Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period, Average, RMS values and form factor of waveforms-Numerical Problems. **AC Circuits:** Phasor representation of sinusoidal quantities. Analysis of simple AC circuits: Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance. Average Power factor. Analysis of RL, RC, and RLC series circuits-active, reactive, and apparent power. Simple numerical problems, **Three-phase AC systems:** Generation of three-phase voltages; advantages of three-phase systems, star and delta connections (balanced only), relation	**6**	Understand the nature of alternating current (AC) and how it differs from direct current (DC). Describe sinusoidal waveforms and understand key parameters such as amplitude, frequency, period, and phase angle.	2,4

	between line and phase voltages, line and phase currents- Numerical problems			
III	**Transformer:** Magnetic materials, ideal and practical transformer, equivalent Circuit, losses in transformer, regulation and efficiency, auto transformer, three phase transformer connection. **Electrical machines:** Generation of rotating magnetic fields, construction, and working of three-phase induction motor, torque-slip characteristics, losses and efficiency, Single phase induction motor, working of synchronous generator.	**6**	Understand the fundamental principles of electromagnetic induction as they apply to transformers. Explain the concepts of mutual inductance and magnetic coupling.	3,4
IV	**Introduction to Semiconductor Devices:** Evolution of electronics – Vacuum tubes to nanoelectronics. Resistors, Capacitors, and Inductors (constructional features not required): types, specifications. Standard values, color coding. PN Junction diode: Principle of operation, V-I characteristics, principle of avalanche breakdown. Bipolar Junction Transistors: PNP and NPN structures, Principle of operation, the relation between current gains in CE, CB, and CC, input and output characteristics of common emitter configuration.	**6**	Understand the principles of electromechanical energy conversion. Describe DC generators' and motors' construction, components, and working principles.	4,5,6
V	**Basic electronic circuits:** 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: Circuit diagram and working of the common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing.	**6**	Understand the basic principles of power electronics and power conversion. Differentiate between various types of power converters (AC-DC, DC-DC, DC-AC, AC-AC) and their applications.	5,6

TEXTBOOKS:

T1: D P Kothari and I J Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
T2: D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
T3: Chinmoy Saha, Arindham Halder and Debarati Ganguly, Basic Electronics - Principles and Applications, Cambridge University Press, 2018.

REFERENCE BOOKS:

R1: Del Toro V, "Electrical Engineering Fundamentals", Pearson Education.
R2: T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford Higher Education.
R3: Hayt W H, Kemmerly J E, and Durbin S M, "Engineering Circuit Analysis", Tata McGraw-Hill

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Apply the laws in the analysis of Semiconductor Fabrication.	**1,3 & 4**
2	Explain the construction and operation of the Diode and Zener Diode.	**1,2**
3	Understand the construction and operation of transistors and different circuit configurations.	**7.9,10**
4	Overview of the OPAMP and application.	**5,7**
5	Outline the principle of an Electronic Digital System.	**5,8**

SEMESTER – IV										
Course Title	**Fluid Mechanics and Fluid Machines**									
Course code	**23BTME222R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T+30P	**3**	**0**	**2**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Winter/ IV semester of second year of the programme**								
Course Objectives	1. To learn about the application of mass and momentum conservation laws for fluid flows 2. To understand the importance of dimensional analysis 3. To obtain the velocity and pressure variations in various types of simple flows								
CO1	Learn to discover the importance of various fluid properties at rest and in transit.								
CO2	Learn to outline the students to classify the importance of dimensional analysis.								
CO3	Learn to point out to choose the velocity and pressure variations in various types of simple flows.								
CO4	Learn to relate the students to analyze the flow in water pumps and turbines.								
CO5	Learn to utilize mathematically to analyze fluid dynamic properties.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Definition of fluid, Newton's law of viscosity, Units and dimensions- Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume- application of continuity equation and momentum equation, Incompressible flow, Bernoulli's equation and its applications.	**10**	Learning about the types of fluid, units and measurement. Derivation of bernoulli's equation and its application.	2,4
II	Exact flow solutions in channels and ducts, Couette and Poisuielle flow, laminar flow through circular conduits and circular annuli- concept of boundary layer – measures of boundary layer thickness – Darcy Weisbach equation, friction factor, Moody's diagram	**10**	Learning about the flow of fluid in channels and ducts. Derivation of Darcy-Weisbach equation	2,4, 5
III	Need for dimensional analysis – methods of dimension analysis – Similitude – types of similitude Dimensionless parameters – application of dimensionless parameters – Model analysis	**10**	Learning about the dimensional analysis through different methods.	2,4, 5
IV	Euler's equation – theory of Rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor, velocity triangles – Centrifugal pumps, working	**10**	Learning about the different types of pumps and working principles. Derivation of Euler's equation and its application	2,4, 5

	principle, work done by the impeller, performance curves – Cavitation in pumps Reciprocating pump – working principle			
V	Classification of water turbines, heads and efficiencies, velocity triangles- Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines, working principles – draft tube- Specific speed, unit quantities, performance curves for turbines – governing of turbines.	**5**	Learning about the different types of turbines and its parts.	2,4, 5

TEXT BOOKS:

T1. Fluid Mechanics and hydraulic machines, R. K. Bansal

T2. Fluid Mechanics by YunusCengel, JhonCimbala, Tata Macgraw Hill, New Delhi

REFERENCE BOOKS:

R1. Fluid Mechanics by Streeter & Wylie, Tata McGraw Hill

OTHER LEARNING RESOURCES:

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Learn to discover the importance of various fluid properties at rest and in transit.	**1&2**
2	Learn to outline the students to classify the importance of dimensional analysis.	**2,3**
3	Learn to point out to choose the velocity and pressure variations in various types of simple flows.	**1,2**
4	Learn to relate the students to analyze the flow in water pumps and turbines.	**2,4**
5	Learn to utilize mathematically to analyze fluid dynamic properties.	**2,3**

SEMESTER – IV										
Course Title	**Strength of Materials**									
Course code	**23BTME223R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T+30P	**2**	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ IV semester of second year of the programme**								
Course Objectives	1. To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads. 2. To calculate the elastic deformation occurring in various simple geometries for different types of loading								
CO1	Analyze and calculate different types of stresses and strains, including axial, torsional, bending, and shear stresses.								
CO2	Determine material properties such as elasticity, plasticity, and creep, and their effects on the behavior of materials under various loading conditions.								
CO3	Analyze and calculate the deformation and stability of structural elements, such as beams, columns, and shafts.								
CO4	Choose appropriate materials for specific engineering applications based on their mechanical properties, durability, and cost.								
CO5	Identify and analyze the different failure criteria of materials and their effects on the performance and safety of structures.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses- elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle.	**6**	Learn about Hooke's law. To find the shear stress and shear strain by graphical method (Mohr's Circle)	1
II	Beams and types, transverse loading on beams- shear force and bend moment diagrams- Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads.	**6**	Lean about different types of beams and their analysis.	2
III	Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems.	**6**	Learn about Maxwell's reciprocal theorems, moment of inertia etc.	3
IV	Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs.	**6**	Learn about different types of helical springs and their analysis.	4
V	Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal	**6**	Learn about thick cylinders and their analysis	6

	pressure.			
Practical	Impact Test (Izod) Impact Test (Charpy) Torsion Test of Metal rod Hardness (Rockwell & Brineil)	**30**	Learn about the hardness and toughness of the materials through different methods.	1,2, 3,4

Text Books/ Reference Books:

T1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
R1. Subramanian, Strength of Materials, Oxford University Press, 2007.
R2. erdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGraw Hill Publishing Co. Ltd., New Delhi 2005.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Analyze and calculate different types of stresses and strains, including axial, torsional, bending, and shear stresses.	**2,3**
2	Determine material properties such as elasticity, plasticity, and creep, and their effects on the behavior of materials under various loading conditions.	**1,2**
3	Analyze and calculate the deformation and stability of structural elements, such as beams, columns, and shafts.	**1,3&4**
4	Choose appropriate materials for specific engineering applications based on their mechanical properties, durability, and cost.	**1,4&5**
5	Identify and analyze the different failure criteria of materials and their effects on the performance and safety of structures.	**1,3&4**

SEMESTER – IV									
Course Title	**Engineering Materials and Applications**								
Course code	**23BTME224R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T+30P	**2**	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Winter/ IV semester of second year of the programme**								
Course Objectives	1. To provide knowledge of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria. 2. To provide a detailed interpretation of equilibrium phase diagrams. 3. To learn about different phases and heat treatment methods to tailor the properties of Fe-C alloys								
CO1	Learn to identify the crystal structures of different materials and understand the defects in such structures.								
CO2	Learn the different mechanical property measurement methods and evaluate their performances.								
CO3	Learn how to tailor the material properties of ferrous and non-ferrous alloys.								
CO4	Learn to identify and understand different heat treatment processes and determine their specific application in different manufacturing processes.								
CO5	Learn to evaluate the performance of alloying steels in manufacturing applications.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Crystal Structure :** Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.	**6**	Learn to identify the crystal structures of different materials and understand the defects in such structures.	2,4
II	**Mechanical Property measurement:** Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength	**6**	Learn the different mechanical property measurement methods and evaluate their performances.	2,4, 5
III	**Static failure theories:** Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb; Fracture mechanics: Introduction to Stress-intensity factor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of mean stress using the Modified Goodman diagram; Fracture with fatigue, Introduction to nondestructive testing (NDT)	**6**	Learn how to tailor the material properties of ferrous and non-ferrous alloys.	2,4, 5
IV	**Alloys, substitutional and interstitial solid solutions:** Phase diagrams: Interpretation of	**6**	Learn to identify and understand different	

	binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstrctural aspects of ledeburite, austenite, ferrite and cementite, cast iron.		heat treatment processes and determine their specific application in different manufacturing processes.	2,4, 5
V	**Heat treatment of Steel:** Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties-austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening, Alloying of steel, properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al-Cu – Mg alloys-Nickel based superalloys and Titanium alloys	**6**	Learn to evaluate the performance of alloying steels in manufacturing applications.	2,4, 5

TEXT BOOKS

T1:Willam Calliister,2002, Materials Science and Engineering.

REFERENCE BOOKS

- V. Raghavan, 1974, Materials Science and Engineering.
-

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Learn to identify the crystal structures of different materials and understand the defects in such structures.	**1,4**
2	Learn the different mechanical property measurement methods and evaluate their performances.	**3,4**
3	Learn how to tailor the material properties of ferrous and non-ferrous alloys.	**1,3**
4	Learn to identify and understand different heat treatment processes and determine their specific application in different manufacturing processes.	**1,3&4**
5	Learn to evaluate the performance of alloying steels in manufacturing applications.	**1,3&4**

SEMESTER – IV									
Course Title	**Instrumentation and Control**								
Course code	**23BTME225R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30T+30P	**2**	**0**	**2**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Winter/ IV semester of second year of the programme**								
Course Objectives	1. Equip students with the knowledge to critically evaluate the proformance of various measurement systems, focusing on key parameters such as accuracy, range, resolution and potential error sources. 2. Teach and fundamental principles of control systems between open- loop and closed-loop configurations and guied students through the design of block diagrams representing control processes. 3. Provide hands- on experience in selecting and integrating actuators (pneumatic, hydraulic, electric) for correction elements and in choosing and tuning control methods (P, PI, PID) to achieve desired system performance.								
CO1	The uses of Measurement systems and performance								
CO2	To generalization of the Instrumentation system elements								
CO3	Analysis of the Signal processing and conditioning; correction elements								
CO4	Outlining the Control systems								
CO5	To learn the other Controlling methods								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Measurement system and performance-** accuracy, range, resolution, error sources	**6**	The uses of Measurement systems and performance.	2,4
II	**Instrumentation system element-**sensors for common engineering measurement	**6**	To generalization of the Instrumentation system elements	2,3, 4,5
III	**Signal processing and conditioning correction element-**actuators, pneumatic, hydraulic, electric	**6**	Analysis of the Signal processing and conditioning; correction elements	2,4, 5
IV	**Control system**-basic elements, open/closed loop, design of block diagram	**6**	Outlining the Control systems	2,4, 5
V	**Control method-** P, PI,PID, when to choose what, tuning of controllers, system models, transfer function and system response, frequency response, Nyquist diagram and their uses	**6**	To learn the other Controlling methods.	2,4, 5

Text Books/ Reference Books:

1. Instrumentation and control system by W.Bolton, 2nd edition, Newnes,200Bishnoi OP. 2007. Principles of Agricultural Meteorology. Oxford Book Co.
2. Thomas G Beckwith, Roy D. Maragoni, JohnHLienhardV, Mechanical Measurements 6th edition , Pearson Education India 2007Bishnoi OP. 2007. Principles of Agricultural Meteorology. Oxford Book Co.
3. Gregory K. McMillan, Process/ Industrial Instruments and controls Handbook, 5th edition, McGrow-Hill: New York, 1999

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	The uses of Measurement systems and performance	**1,2&3**
2	To generalization of the Instrumentation system elements	**2,3&4**
3	Analysis of the Signal processing and conditioning; correction elements	**3,4&5**
4	Outlining the Control systems	**1,2&3**
5	To learn the other Controlling methods	**1,2&3**

SEMESTER – IV										
Course Title	**Ambience Control System Design**									
Course code	**23BTME226R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Winter/ IV semester of second year of the programme**								
Course Objectives	1. Recall the fundamental principles and concepts related to psychrometry and various heat loads 2. Understand the concepts of HVAC system design for buildings 3. Apply the concepts of HVAC equipment's to solve the Real-World Applications								
CO1	Describe the basic concept of psychrometric, significance of various air properties and psychrometric processes.								
CO2	Explain the concepts of HVAC system design for buildings, including the factors that affect design decisions								
CO3	Apply the concepts of HVAC equipment's such as chillers, cooling towers, pumps, and air handling units to solve real								
CO4	Illustrate the design of lift well & lift lobby pressurization system for a given building layout as per code standard NBC 2016								
CO5	Evaluate the heat load calculation for an office building using standard codes, such as ASHRAE, ISHRAE etc.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Fundamentals of Air-conditioning & Refrigeration & Heat load Calculation** • Introduction to air conditioning & refrigeration, Properties of air and vapor, Psychrometry and its importance, Infiltration & Ventilation, Sensible & Latent Heat, Factors to be considered to calculate Heat load, External & Internal Heat gains, Heat load estimation, Sample Heat Load Calculation.	**5**	Explain the fundamental concept of psychrometrics, the importance of various air properties, and the key psychrometric processes.	1,2
II	**Ventilation & Life safety system, Smoke Extraction system, Piping & Duct Design** • Introduction & Types of Ventilation system, Air flow rate calculation, Life Safety in a Building, Fire Tower, Pressurization System, Lift well and lift lobby pressurization system, Smoke extraction system, Chilled water pipe sizing, Duct system and design, Duct Sizing Methods, Pressure losses in Air Distribution System	**10**	Describe the principles of HVAC system design for buildings, highlighting the key factors influencing design decisions.	1,3
III	**Chiller & Cooling tower design, Air Handling Units & Chilled water pumps** Concept of Chiller performance and selection, Vapor absorption refrigeration system and absorption chiller, Cooling tower design, Air Handling Unit, Fundamental terms and characteristics of pumps, Piping and Pumping Arrangement, Important Terminologies in Pump Head Calculations, Piping Circuit in HVAC.	**10**	Utilize the principles of HVAC equipment, including chillers, cooling towers, pumps, and air handling units, to address real-world challenges.	2,4
IV	**Demand Control Ventilation, VAV and**	**10**	Demonstrate the design of a lift	2,5

	Fans, External Static Pressure, High and Low Side Equipment's • Applying DCV to CAV system, Fan Performance curves, Velocity Pressure and Total Pressure, Friction Loss and Dynamic Losses in Duct System, Loss of Coefficient for Duct Fittings, Critical Path in Static Pressure Calculation, Introduction - High Side Equipment's, Need of Air Distribution system, Components of air distribution system, Ductwork, Duct & Pipe Accessories.		well and lift lobby pressurization system for a specified building layout in compliance with NBC 2016 standards.	
V	**Valves, VARIABLE REFRIGERANT FLOW (VRF) SYSTEMS** • Introduction to Valves, Valve Fundamentals, Globe Valve, Gate Valve, Ball Valve, Butterfly Valve, Check Valves, Balancing Valves, Multi-Purpose Valves, Y - strainers, PIBCV, Motorized valves, VRF system, Evolution of VRF system, Need for VRF system, Selection of VRF Systems, VRF Salient features	**10**	Assess the heat load calculation for an office building based on standard codes, such as ASHRAE, ISHRAE, and others.	3,5

Reference Books:

1. R S Khurmi, Refrigeration & Air conditioning, S Chand, Revised Edition/2018
2. C P Arora, Refrigeration & Air conditioning, McGraw Hill, Fourth Edition/2019
3. Free Online Course: Refrigeration and air-conditioning from Swayam | Class Central

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Describe the basic concept of psychrometric, significance of various air properties and psychrometric processes.	**2,3**
2	Explain the concepts of HVAC system design for buildings, including the factors that affect design decisions	**1,2**
3	Apply the concepts of HVAC equipment's such as chillers, cooling towers, pumps, and air handling units to solve real	**1,3&4**
4	Illustrate the design of lift well & lift lobby pressurization system for a given building layout as per code standard NBC 2016	**1,4&5**
5	Evaluate the heat load calculation for an office building using standard codes, such as ASHRAE, ISHRAE etc.	**1,3&4**

SEMESTER – IV									
Course Title	**Applied Thermodynamics**								
Course code	**23BTME221R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ IV semester of second year of the programme**								
Course Objectives	1. To understand the application of 1st law and 2nd law of thermodynamics 2. To understand the conversion of available energy 3. To create a bridge between theory and practical application of thermodynamics								
CO1	Learn to apply energy balance to systems and control volumes								
CO2	Learn to compute the changes in thermodynamic properties of substances								
CO3	Learn to classify the performance of energy conversion devices								
CO4	Learn to differentiate between high grade and low-grade energies								
CO5	Learn to associate work and heat interactions, and the balance of energy between the system and its surroundings								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Availability:** Available and unavailable energy, Available energy referred to a cycle, Availability in non-flow or closed system (Non-cyclic), Availability of steady-flow systems, Helmohltz and Gibb's functions, Irreversibility and loss in availability, Effectiveness.	**10**	Learn to apply energy balance to systems and control volumes	2,4
II	**Boiler:** Classification of boilers, mountings, accessories, evaporation capacity, equivalent evaporation, boiler efficiency, selection of a boiler, boiler feed water treatment and boiler troubles.	**5**	Learn to compute the changes in thermodynamic properties of substances	2,4, 5
III	**Basic steam power cycles:** Carnot and Rankine cycles, Modified Rankine cycle, Regenerative and Reheat cycles	**10**	Learn to classify the performance of energy conversion devices	2,4, 5
IV	**Steam nozzles:** Expansion of steam through nozzles, velocity and pressure variation in nozzles, Critical pressure ratio, mass flow rate and maximum mass flow rate, Representation of heat drop in nozzles in Mollier diagram, Nozzle efficiency.	**10**	Learn to differentiate between high grade and low-grade energies	2,4, 5
V	**Steam turbines & condensers:** Classification, Flow of steam through impulse and reaction turbines, Velocity diagrams, Reheating, Bleeding, Reheat factor, Compounding and governing of steam turbines, Back pressure turbines, Pass out turbines, Function of steam condenser, Elements of a condenser	**10**	Learn to associate work and heat interactions, and the balance of energy between the system and its surroundings	2,4, 5

	plant, vacuum production, Delton's law of partial pressure, Classification of condensers, Removal of air from the condensers, Vacuum efficiency and condenser efficiency, Determination of cooling water, Cooling towers and cooling ponds.			

Text Books/ Reference Books:

1. Domkundwar, Kothendaraman, Khajuria,Arora, "A Course in Thermodynamics and Heat Engines", Dhanpat Rai and Sons.
2. Rajput, "Thermal Engineering", Laxmi Publications.
3. Patel, Karamchandani, "Elements of Heat Engines"

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Learn to apply energy balance to systems and control volumes	**1,3&7**
2	Learn to compute the changes in thermodynamic properties of substances	**1,2&4**
3	Learn to classify the performance of energy conversion devices	**1&7**
4	Learn to differentiate between high grade and low-grade energies	**7&12**
5	Learn to associate work and heat interactions, and the balance of energy between the system and its surroundings	**3&7**

SEMESTER – IV									
Course Title	**BASIC ACCLIMATIZING SKILLS (BAS)**								
Course code	**23UULS221R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30P	**0**	**0**	**2**	**0**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ IV semester of second year of the programme**								
Course Objectives	1. To impart knowledge of the fundamentals of Hospitality industry and its applications. 2. Students will be able to familiarize with the cooking equipment's & Utensils. 3. Students will be able to handle different modes of reservations.								
CO1	Students will have basic knowledge of cooking methods.								
CO2	Students will gain the knowledge of organizing & Cleaning of Rooms.								
CO3	Students will be able to gain the travel management concept.								
CO4	Students will be able to acquire the knowledge of basic households amenities for day- to-day use.								
CO5	Learn to associate work and heat interactions, and the balance of energy between the system and its surroundings								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Introduction to Accommodation Management** 1. Telephone handling technique 2. Organizing of Rooms. 3. Cleaning agents. 4. Cleaning equipment's and uses. **5.** Bed making Process.	**5**	Learn the art of handling telephone, organizing rooms, cleaning equipments and bed making.	2,4
II	**Fundamentals of Cooking:** 1. Definition of cookery –Aim & Objectives of cooking. 2. Use of basic Cooking equipment's 3. Personal Hygiene and Safety 4. Use of Fire & Fuels	**5**	Learning the fundamentals of cooking, using basic cooking equipment's.	2,4, 5
III	**Methods of Cooking:** Different Cuts. 1. Use of Herbs and Spices. 2. Basic Food and Beverage Preparation. 3. Regional food Habits.	**10**	Understanding the different methods of Cooking, cutting techniques and learning the food habits in different regions.	2,4, 5
IV	**Forms & Format's:** C –form 1. Reservation form 2. Registration form 3. Passport Application for Legal Rent Agreement	**10**	Learning different forms and formats.	2,4, 5

Text Books:

1. Arora K (2011). Theory of cookery, Frank brothers & company (pub) pvt ltd-New Delhi.
2. Bruce H. Axler, Carol A. Litrides (2010) Food and Beverage Service Volume 1 of Wiley Professional Restauranteur, Guides.
3. Mohammed Zulfikar (2010) - Introductions to Tourism and Hotel Industry Introduction to

Tourism and Hotel Industry. Vikas Publishing.
4. Sudhir Andrews (2013) Food and Beverage Service: A Training Manual, Tata McGraw Hill, 2013.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Students will have basic knowledge of cooking methods.	**9&12**
2	Students will gain the knowledge of organizing & Cleaning of Rooms.	**9&12**
3	Students will be able to gain the travel management concept.	**9&12**
4	Students will be able to acquire the knowledge of basic households amenities for day- to-day use.	**9&12**
5	Learn to associate work and heat interactions, and the balance of energy between the system and its surroundings	**9&12**

SEMESTER – IV									
Course Title	**ENGLISH LANGUAGE PROFICIENCY FOR ENGINEERS**								
Course code	**23UBPD223R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 60P	**0**	**0**	**4**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech Mechanical Engineering**								
Semester	**Fall/ IV semester of second year of the programme**								
Course Objectives	1. Develop students' abilities in technical writing, speaking, and presentations to effectively convey engineering concepts and solutions.Analyze electronic applications in civil engineering for designing, constructing, and maintaining infrastructure. 2. Focus on crafting professional resumes and cover letters tailored for engineering positions, improving students' chances of securing employment. 3. Strengthen teamwork abilities and prepare students for job interviews through practical exercises and targeted training, enhancing their readiness for engineering careers.								
CO1	Demonstrate clear and concise technical communication in both written and oral formats, incorporating industry-specific terminology.								
CO2	Develop expertise in crafting resumes, cover letters, and technical reports to effectively showcase engineering qualifications.								
CO3	Acquire proficiency in creating and delivering impactful presentations, utilizing visual aids to convey engineering concepts to diverse audiences.								
CO4	Cultivate effective interpersonal skills for collaborative teamwork, emphasizing active listening, conflict resolution, and clear communication within engineering contexts.								
CO5	Prepare for engineering job interviews by articulating qualifications, experiences, and career goals, addressing both technical and behavioral questions confidently.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Writing Skills** **i.** Paragraph Writing & Narratives ii. Letter Writing iii. Technical Writing **Pipe and cistern** ii. Introduction of pipes and cistern iii.Solving different types of questions iv. Worksheet1 and Worksheet 2	**12**	Develop proficiency in various forms of writing, including paragraph and narrative construction, letter writing, and technical documentation.	1,2
II	**Self-Management Skills** 1. SWOT Analysis Goal Setting and Personal Hygiene **Mixture allegation and Clock** i.Introduction of basics Solving questions on mixture and alligationion. 2. Worksheet1 and Worksheet 2	**12**	Gain competency in solving practical problems related to pipes and cisterns, mixtures and alligations, clocks, and profit, loss, and discounts through targeted practice and worksheets.	1,2
III	**Vocabulary Development** i.Understanding different aspects of a word (such as the use of say, tell, speak) . ii. Learning strategies to develop vocabulary iii Contextual vocabulary learning iv. Use of phrasal verbs and idioms in a conversation	**12**	Enhance personal effectiveness through SWOT analysis, goal setting, and maintaining personal hygiene.	

	v. Effectively using dictionary, thesaurus **Statement and Course of action** i.Revision of syllogism ii.Statement and conclusion Iii. Course of action based on statement Iv. Worksheet1 and Worksheet 2			1,2
IV	**Interview Skills & Dress Code Ethics** Types of interview- telephonic, virtual & face to face online interview, personal interview, Panel interview, Group interview Common interview questions and answering strategies i. Dress Code Ethics during Interviews ii. Mock Interview Session **Sitting arrangement (puzzle)** i.Linear arrangement puzzle ii.Circular arrangement puzzle iii.Matrix Iv. Worksheet1	**12**	Improve vocabulary through understanding word usage, contextual learning, and effective dictionary use, and strengthen logical reasoning with practice in syllogisms, statements, conclusions, and courses of action.	1,2
V	**Grammar (Flipped Classroom)** 1.Word-stress, Syllables Practice Session: Common Errors (testing the students' grammar already learnt) **Profit loss and discount** i.Introduction to basics ii. Introduction to discount iii.Probems related on the topics Iv. Worksheet1 and Worksheet 2	**12**	Master interview techniques for various formats, understand dress code ethics, and improve performance through mock interviews and puzzle-solving exercises in linear, circular, and matrix arrangements.	1,2

Text Books:

1. Barrett, Grant. 2016. *Perfect English Grammar: The Indispensible Guide to Excellent Writing and Speaking*, Zephyros Press.
2. McDowell, Gayle Laakmann.2008.*Cracking the Coding Interview* (Indian EditionA Modern Approach to Logical Reasoning All Exams
3. General Mental Ability & Logical Reasoning Compendium

Reference Books:

- Zinsser, William. (2006) *On Writing Well: The Classic Guide to Writing Nonfiction*
- Fast track Objective mathematics for Competitive exam by Arihant
- General Mental Ability & Logical Reasoning Compendium By R.S. Agarwala

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Demonstrate clear and concise technical communication in both written and oral formats, incorporating industry-specific terminology.	**5, 7**
2	Develop expertise in crafting resumes, cover letters, and technical reports to effectively showcase engineering qualifications.	**8**
3	Acquire proficiency in creating and delivering impactful presentations, utilizing visual aids to convey engineering concepts to diverse audiences.	**7.9,10**
4	Cultivate effective interpersonal skills for collaborative teamwork, emphasizing active listening, conflict resolution, and clear communication within engineering contexts.	**11,12**
5	Prepare for engineering job interviews by articulating qualifications, experiences, and career goals, addressing both technical and behavioral questions confidently.	**10**

SEMESTER – V										
Course Title	**Heat Transfer**									
Course code	**23BTME311R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours:45T+ 30P	**3**	**0**	**2**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ V semester of 3rd year of the programme**								
Course Objectives	1. The aim of the course is to build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation. 2. Rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations. 3. The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers.									
CO1	Understand the basic modes of heat transfer.									
CO2	Discuss conduction heat transfer for steady and unsteady flows.									
CO3	Summarize the correlations for forced and free convection.									
CO4	Explain the interaction of radiations with materials.									
CO5	Solve numerical by applying gained theoretical knowledge.									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, heat transfer through pin fins- Two dimensional conduction solutions for both steady and unsteady heat transfer- approximate solution to unsteady conduction heat transfer by the use of Heissler charts	**10**	Analyze the basic modes of heat transfer	1,2
II	Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer- Dimensionless parameters for forced and free convection heat transfer- Correlations for forced and free convection- Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.	**10**	Analyze different types of convection methods	3,4
III	Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation, Calculation of radiation heat	**10**	Explain the interaction of radiations with materials.	3,4

IV	Types of heat exchangers, Analysis and design of heat exchangers using both LMTD and ε-NTU methods.	**10**	Design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary.	5,6
V	Boiling and Condensation heat transfer, Pool boiling curve. Introductionmass transfer, Similarity between heat and mass transfer.	**5**	Students will learn to understand boiling and condensation phenomenon	5,6
Practical	1.Emissivity measurement 2.Heat transfer through composite wall Natural convection and forced convection	**30**	Study to find out the emissivity of black body and grey body, Study to find out the heat transfer coefficient of composite wall, Study to find out the convection coefficient.	

Text Books:

T1. A. Bejan, Heat Transfer John Wiley, 1993

T2. J.P.Holman, Heat Transfer, Eighth Edition, McGraw Hill, 1997.

T3. F.P.Incropera, and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley, Sixth Edition, 2007.

Reference Books:

R1. MassoudKaviany, Principles of Heat Transfer, John Wiley, 2002

R2. Yunus A Cengel, Heat Transfer : A Practical Approach, McGraw Hill, 2002

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Understand the basic modes of heat transfer.	**1&2**
2	Discuss conduction heat transfer for steady and unsteady flows.	**1,2,3**
3	Summarize the correlations for forced and free convection.	**1,2,3,4**
4	Explain the interaction of radiations with materials.	**1&2**
5	Solve numericals by applying gained theoretical knowledge.	**1,2,3**

SEMESTER – V										
Course Title	**Manufacturing Processes**									
Course code	**23BTME312R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**	
		Total hours: 45T+30P	**3**	**0**	**2**	**0**	**0**	**0**	**4**	
Pre-requisite	**Nil**	**Co-requisite**	**Nil**							
Programme	**Bachelor of Technology in Mechanical Engineering**									
Semester	**Fall/ V semester of 3rd year of the programme**									
Course Objectives	1. To motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods. 2. Understand the application of machining processes 3. Application of the non-conventional machining processes.									
CO1	Understand different casting processes and their application for producing different products									
CO2	Analyze the different forming processes and their application									
CO3	Understand the mechanism of metal cutting processes and their application in different machining operations									
CO4	Understand the additive manufacturing and the welding principles, design and application									
CO5	Distinguish between different non-conventional manufacturing processes and study their working principle, mechanism of metal removal and the effect of various process parameters									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Casting and molding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses.	**10**	Learn the different process of casting, molding and forming	1,2
II	Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy	**5**	Learn the different forming processes and their application	3,4
III	Metal cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining	**10**	Understand the mechanism of metal cutting processes	3,4
IV	Additive manufacturing: Rapid prototyping and rapid tooling,	**10**	Learn the application of additive	5,6

	Joining/fastening processes: Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding		manufacturing, and different joining processes	
V	Unconventional Machining Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters, Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Electro-chemical machining (ECM), etchant &maskant, process parameters, MRR and surface finish, Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining	**10**	Application of non-conventional machining processes	5,6

Text Books:

T1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)- Pearson India, 2014

T2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems

Reference Books:

R1 Degarmo, Black &Kohser, Materials and Processes in Manufacturing

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Understand different casting processes and their application for producing different products	**1,2&3**
2	Analyze the different forming processes and their application	**1,2,3,4**
3	Understand the mechanism of metal cutting processes and their application in different machining operations	**1,2,3**
4	Understand the additive manufacturing and the welding principles, design and application	**1,2&3**
5	Distinguish between different non-conventional manufacturing processes and study their working principle, mechanism of metal removal and the effect of various process parameters	**1,2&3**

SEMESTER – V										
Course Title	**Kinematics and Dynamics of Machines**									
Course code	**23BTME313R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T+30P	**3**	**0**	**2**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ V semester of 3rd year of the programme**								
Course Objectives	1. To understand the kinematics and rigid- body dynamics of kinematically driven machine components 2. To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link. 3. To be able to design some linkage mechanisms and cam systems to generate specified output motion. 4. To understand the kinematics of gear trains.									
CO1	Ability to conduct static and dynamic force analysis and equilibrium of forces for mechanical systems.									
CO2	Apply basic principles of mechanisms in mechanical systems.									
CO3	Perform balancing of rotating and reciprocating masses.									
CO4	Illustrate gear operation									
CO5	Know the various link mechanism									

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	Classification of mechanisms- Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains-Limit positions- Mechanical advantage Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line generators- Universal Joint- Rocker mechanisms.	**5**	Ability to conduct static and dynamic force analysis and equilibrium of forces for mechanical systems.	1,2
II	Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations- kinematic analysis of simple mechanisms- slider crank mechanism dynamics Coincident points- Coriolis component of acceleration- introduction to linkage synthesis three position graphical synthesis for motion and path generation.	**10**	Apply basic principles of mechanisms in mechanical systems.	1,2 3,4
III	Classification of cams and followers- Terminology and definitions- Displacement diagrams-Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions- specified contour cams- circular and tangent cams- pressure angle and undercutting, sizing of cams, graphical and analytical disc cam	**10**	Perform balancing of rotating and reciprocating masses.	3,4

	profile synthesis for roller and flat face followers.			
IV	Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting- helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.	**10**	Illustrate gear operation	3,4 5,6
V	Surface contacts- sliding and rolling friction- friction drives- bearings and lubrication, friction clutches- belt and rope drives- friction in brakes.	**10**	Know the various link mechanism	3,4, 5,6

Text Books

T1. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers & Distributors, 2005. T2. Cleghorn W.L. , Mechanisms of Machines, Oxford University Press, 2005.

Reference Books:

R1. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill, 2009.

R2. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East- West Pvt. Ltd, New Delhi, 1988.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Ability to conduct static and dynamic force analysis and equilibrium of forces for mechanical systems.	**1,2&3**
2	Apply basic principles of mechanisms in mechanical systems.	**1,2&4**
3	Perform balancing of rotating and reciprocating masses.	**1,2&4**
4	Illustrate gear operation	**1,2&4**
5	Know the various link mechanism	**1,2&4**

SEMESTER – V										
Course Title	**Utility Systems in Industrial Facilities**									
Course code	**23BTME314R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ V semester of 3rd year of the programme**								
Course Objectives	1. Differentiate the equipment involved in a given utility 2. Select the material of construction of the components of the utility systems 3. Design the utility system of Chemical Process Industries								
CO1	Interpret the equipment involved in a given utility								
CO2	Select the material of construction of the components of the utility systems								
CO3	Design the utility system of Chemical Process Industries								
CO4	Categorize the required engineering documents for the utility design								
CO5	Integrate with the layout considerations, and procurement strategy.								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Introduction, Compressed Air & Nitrogen Systems** • **Introduction:** Continuous & Batch Plants; Various Types of Utilities and their Schematics • **Compressed Air Systems:** Sizing of Air Compressors; Industry Specifications for various Compressed Air Types; Codes & Standards; Material of Construction; Location of Compressed Air system in the Plot Plan; Engineering Documents for Design • **Nitrogen Systems**: Codes & Standards; Usage of Nitrogen; Sources of Nitrogen; Overall & Cost Comparison of the Three Technologies Engineering Documents for Design	**5**	Analyze the equipment used in a specified utility.	
II	**Fuel and Thermic Fluid Systems** • **Fuel Systems:** Usage of fuel; Equipment Involved in Solid; Liquid and Gaseous Fuels, & their Advantages and Disadvantages; Fuel Emissions & Air Pollution Control • **Thermic Fluid Systems**: Types; Applications; Fuel Selection; Flow Schematics; Schematics of Liquid Fuel Systems; Burners; Soot Blowers; Procurement Strategy; Pollution and its Abatement	**10**	Choose the appropriate materials for constructing the components of utility systems.	
III	**Water and ETP Systems** • **Water Systems:** Sources of Water; Types of Water Systems; Water Composition & its Interpretation; Sources, MOC, & Chemicals for - Raw Water, Potable Water, Soft Water, DM Water, Fire Water, & Sea Water; Standards & Codes; Procurement Strategy for Equipment	**10**	Develop the design for the utility system in Chemical Process Industries.	

	& Packages • **ETP Systems**: Codes & Regulations; Effluent Sources; Primary, Secondary, & Tertiary Treatment; Recycling in Zero Liquid Discharge (ZLD) Plant; MOC; Inputs for Design, & Deliverables			
IV	**Steam, Condensate, Safety Relief & Flare, and Other Systems** • **Introduction to Steam and Condensate System**: Steam Pressure & temperature levels; Codes, & Regulations; • Major, & Minor Components in Steam System; BFW, & Condensate treatment; MOC of Burners; Pollution and Abatement; Steam Velocities; Design Input; Deliverables; Procurement Strategy • **Safety Relief & Flare Systems:** Codes, Standards & Regulations; Equipment; PSV Types; Flare Types; Components; MOC; Control of Flare System; Piping Network; Procurement Strategy; Design Input; Deliverables • **Miscellaneous Utilities**: Co-Gen Plant - Codes & Regulations, Configuration, Equipment; OWS – Codes, Schematics, MOC; CBD – Codes, Schematics, MOC; CRWS – Codes, Schematics, MOC; Sewage System - Codes, Schematics, MOC; RWHS - Codes, Schematics, MOC, Waste Incinerators, Case Studies on Sugar Plant	**10**	Classify the necessary engineering documents for utility system design.	
V	**Refrigeration, HVAC & Electrical Power Systems** • **Refrigeration Systems:** Codes, & Regulations; Refrigerant Types; Refrigeration Methods; Equipment Used; MOC; Insulation; Location of Refrigeration Package; Procurement Strategy; Design Inputs; Deliverables • **HVAC Systems:** Psychrometric Chart; Codes; Design Criteria; Refrigeration Cycles; HVAC Systems; Load Calculation; AC Duct Design; MOC for HVAC; Procurement Strategy; Design Inputs; Deliverables • **Electrical Power Systems:** Electrical Power System in CPI; Sources of Power; Power Requirements; Load Types, & Analysis; Classification; Layout; Electrical Equipment Selection; Cathodic Protection; Electrical Heat Tracing	**10**	Incorporate layout considerations and procurement strategy into the design.	

Reference Books:

1. Y. V. C. Rao, "Chemical Engineering Thermodynamics," University Press, India, 1997
2. Yunus A. Çengel & Michael A. Boles "Thermodynamics – *An Engineering Approach*," McGraw-Hill, New York, 2015
3. Sathiyamoorthy M., "Chemical Plant Utilities," Lambert Academic Publishing, London, 2016
4. Mostafa A. Radwan, and Hany El., "Chemistry for Engineers," Lambert Academic Publishing, London, 2019

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Interpret the equipment involved in a given utility	**1&2**
2	Select the material of construction of the components of the utility systems	**1,2,3**
3	Design the utility system of Chemical Process Industries	**1,2,3,4**
4	Categorize the required engineering documents for the utility design	**1&2**
5	Integrate with the layout considerations, and procurement strategy.	**1,2,3**

SEMESTER – V										
Course Title	**Industrial Piping and Pipeline Engineering**									
Course code	**23BTME315R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ V semester of 3rd year of the programme**								
Course Objectives	1. To explain the liquid & gas two-phase phenomena through a pipeline (BT2) 2. To predict the pressure, drop of both single & two-phase flows through the pipe, pipe fittings, orifice, nozzle, venturi, valves, and pipe networks (BT3) 3. To distinguish the set forth engineering requirements necessary for the safe design and construction of piping systems covered in ASME B31.1, B31.3, and 31.4 codes (BT4)									
CO1	Explain the liquid & gas.									
CO2	Predict the pressure drop of both single & two.									
CO3	Distinguish the set forth engineering requirements necessary for the safe design and construction of piping systems covered in ASME B31.1, B31.3, and 31.4 codes (BT4)									
CO4	Judge the two.									
CO5	Design the piping system for the given process requirement, and comply with international codes & standards (BT6)									

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Single-Phase: Pipe Hydraulics, Sizing & Pressure Drop** • **Regimes:** Flow Regime Identification • **Pressure Drop:** Derivation of Pressure Drop in Pipe, Darcy & Fanning Friction Factor, Friction Factor Correlations, Pipe Sizing, Pressure Drop Calculation in Piping Components, Pressure Drop Calculations in Pipe Network, Pressure Drop Calculation in Header & Branching Pipes • ***Case Studies:*** Three categories (1, 2 & 3) of practical problems that are encountered in a single-phase fluid flow through pipes (Demonstration through an iterative method for categories 2 & 3)	**10**	Clarify the concepts of liquids and gases, including their properties and behaviors.	1,3
II	**Two-Phase Flow: Regimes, Notations & Pressure Drop Models** • **Regimes:** Formation of Two-Phase Flow Regimes in Horizontal & Vertical Pipes, Influence of Bend on Upstream & Downstream Two-Phase Flow Regime Formation • **Notations:** Two-Phase Terminologies, Relationships for Two-Phase Parameters, Flow Pattern Maps for Identification of Two-Phase flow Regimes • **Models:** Homogeneous Model, Two-Phase Multiplier, Evaluation of Pressure Drop, Separated Model, Drift Flux Model, Slip Ratio	**5**	Estimate the pressure drop for both single-phase and two-phase flow.	2,3

	Correlations, $K\alpha_H$ Correlations, Drift Flux Correlations • ***Case Studies:*** Practical problems to identify the flow regimes in a pipe for a given geometrical size and operating parameters using flow pattern maps when it is subjected to a two-phase flow			
III	**Two-Phase Flow Pressure Drop, Pipes, Pipe Fittings, Flanges & Valves Two-Phase** • **Pressure Drop:** Sudden Enlargement & Contraction, Orifice, Nozzle, Venturi, Bend, Fittings, Parallel Pipes, Series Pipes & Pipe Network • **Pipes & Fittings:** Pipe End Connections, Pipe Size & Schedule Numbers, Pipe Types based on Manufacturing, Materials, Ends & Joints, Fitting Types & End Connections • **Flanges:** Flanges (Types, End Connections, Facing, Materials, Temperature & Pressure Rating), Gaskets & Bolting • **Valves:** Description & Functioning of Valves (Isolation, Regulating, Non-Return, Special Purpose Valves), Manufacturing & Assembly of Valves • ***Case Studies:*** Practical problems to predict the two-phase pressure drop in the pipeline, pipe components and various pipe networks using HEM, SFM and DFM and various two-phase correlations	**10**	Identify and differentiate the engineering requirements essential for the safe design and construction of piping systems as outlined in the ASME B31.1, B31.3, and B31.4 codes (BT4).	3,5
IV	**Piping Drawings, Symbols, Stresses, Flexibility Analysis, Transient Analysis, Water & Steam Hammer** • **Drawings:** PFDs, P&IDs, Orthographic & Isometric Views • **Symbols:** Symbols, Abbreviations, 3D Modelling Software • **Stresses:** Induced Stresses, Pipe Stress Analysis, Stress Analysis Demonstration using Software • **Transient:** Transient Fluid Flow Analysis, Water Hammer, Steam Hammer, Gravity Flow of Liquids • ***Case Studies:*** Practical problems on water hammer and steam hammer, when the pipes are subjected to transients and practical problems when the flow of liquid happens in a pipe due to gravity (fully and partly filled sloped pipes)	**10**	Compare and evaluate the two.	**4,5**
V	**Pipe Supports, ASME B31 Standards,**	10	Develop the piping system	**3,5**

	Pipeline Construction • **Supports & Hangers:** Pipe Supports, Expansion Joints, Design of Jacketed Piping, Vibration, Insulation, Buried Pipe, Cathodic Protection • **ASME B31 Code:** Interpretation of the various ASME codes such ASME 31.1 - Power Piping, ASME B31.3 - Process Piping, and ASME B31.4 - Pipeline Transportation • **Pipeline Construction:** Right of Way, Stringing, Trenching, Bending, Coating, Lowering, Back Filling, Markers, Clan-up, HDD Method, Thrust Boring, Micro Tunneling, Hot Tapping Work		based on the given process requirements, ensuring compliance with international codes and standards (BT6).	

Reference Books:

1. Mohinder L. Nayyar, "Piping Handbook," McGraw-Hill, New York, 2000
2. Yunus A. Çengel, and John M. Cimbala, "Fluid Mechanics: *Fundamentals and Applications,"* McGraw-Hill, New York, 2014
3. Robert W. Fox, Alan T. McDonald, and Philip J. Pritchard, "Introduction to Fluid Mechanics," John Wiley & Sons, Inc. NJ, 2020
4. Subramanyam, "Strength of Materials," Oxford University Press, 2010
5. ASME B 31.1: Power Piping, The American of Society of Mechanical Engineers, New York, 2018
6. ASME B 31.3: Process Piping, The American of Society of Mechanical Engineers, New York, 2020
7. ASME B 31.4: Liquid Transportation, The American of Society of Mechanical Engineers, New York, 2002

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Explain the liquid & gas.	**1&2**
2	Predict the pressure drop of both single & two.	**1,2,3**
3	Distinguish the set forth engineering requirements necessary for the safe design and construction of piping systems covered in ASME B31.1, B31.3, and 31.4 codes (BT4)	**1,2,3,4**
4	Judge the two.	**1&2**
5	Design the piping system for the given process requirement, and comply with international codes & standards (BT6)	**1,2,3**

SEMESTER – V									
Course Title	**Extra-curricular Activities**								
Course code	23UBEC312	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 15P	0	0	0	4	0	0	1
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech Mechanical Engineering**								
Semester	**Fall/ V semester of third year of the programme**								
Course Objectives	Equip students with effective time management and prioritization skills, fostering leadership qualities and a commitment to their endeavors. Encourage exploration of interests beyond academics and participation in co-curricular activities, cultivating well-rounded individuals capable of making meaningful community contributions. Enhance students' abilities to express ideas clearly and engage in in-depth evaluation and analysis, while integrating learning experiences to practice transferable skills across various activities.								
CO1	Learn to a plan so that they can make meaningful contributions, maintain a commitment, and manage their time and priorities.								
CO2	Transform passionate students who demonstrate leadership and pursue interests beyond their academics.								
CO3	Learn to participate in various co-curricular activities leading to their multifaceted personality development.								
CO4	Express their ideas, views, In-depth evaluation and analysis clearly in the topic of their interest.								
CO5	Demonstrate and practices different activities, by Integrating learning experiences by demonstrating transferable skills.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	AdtU encourages a range of activities outside the regular curriculum intended to meet learner's interest, These activities are aimed to develop the social and soft skills and promote a holistic development of the learners, Keeping in mind the 360 degree learning methodology the students are engaged in different activities headed under different clubs viz. Dance, music, photography, drama, literary etc., The students are encouraged to participate in regular club activities, workshops, competitions as per their interest and hobbies, The student members of the club are trained represent AdtU in various inter University student and national level competitions, Renewed personalities are invited to conduct workshops that benefit the members and students by giving them the platform to learn from experts in the respective fields.	**15**	Participate in diverse club activities to develop social and soft skills, achieve holistic development, and gain exposure through workshops and competitions led by experts.	1,2

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Learn to a plan so that they can make meaningful contributions, maintain a commitment, and manage their time and priorities.	**5, 7**
2	Transform passionate students who demonstrate leadership and pursue interests beyond their academics.	**8**
3	Learn to participate in various co-curricular activities leading to their multifaceted personality development.	**7.9,10**
4	Express their ideas, views, In-depth evaluation and analysis clearly in the topic of their interest.	**11,12**
5	Demonstrate and practices different activities, by Integrating learning experiences by demonstrating transferable skills.	**10**

SEMESTER – V									
Course Title	Competent English for Engineers								
Course code	23UBPD315R	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30P	0	0	4	0	0	0	2
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech Mechanical Engineering**								
Semester	**Fall/ V semester of Third year of the programme**								
Course Objectives	1. Develop students' abilities in technical writing, speaking, and presentations to effectively convey engineering concepts and solutions. Analyze electronic applications in civil engineering for designing, constructing, and maintaining infrastructure. 2. Focus on crafting professional resumes and cover letters tailored for engineering positions, improving students' chances of securing employment. 3. Strengthen teamwork abilities and prepare students for job interviews through practical exercises and targeted training, enhancing their readiness for engineering careers.								
CO1	Demonstrate clear and concise technical communication in both written and oral formats, incorporating industry-specific terminology.								
CO2	Develop expertise in crafting resumes, cover letters, and technical reports to effectively showcase engineering qualifications.								
CO3	Acquire proficiency in creating and delivering impactful presentations, utilizing visual aids to convey engineering concepts to diverse audiences.								
CO4	Cultivate effective interpersonal skills for collaborative teamwork, emphasizing active listening, conflict resolution, and clear communication within engineering contexts.								
CO5	Prepare for engineering job interviews by articulating qualifications, experiences, and career goals, addressing both technical and behavioral questions confidently.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Writing Skills** **1.**Paragraph Writing & Narratives 2. Letter Writing 3. Technical Writing **Pipe and cistern** ii. Introduction of pipes and cistern iii.Solving different types of questions iv. Worksheet1 and Worksheet 2	**6**	Develop proficiency in various forms of writing, including paragraph and narrative construction, letter writing, and technical documentation.	1,2
II	**Self-Management Skills** **1.**SWOT Analysis Goal Setting and Personal Hygiene **Mixture allegation and Clock** i.Introduction of basics 1. Solving questions on mixture and alligationion. 2. Worksheet1 and Worksheet 2	**6**	Gain competency in solving practical problems related to pipes and cisterns, mixtures and allegations, clocks, and profit, loss, and discounts through targeted practice and worksheets.	1,2
III	**Vocabulary Development** i.Understanding different aspects of a word (such as the use of say, tell, speak) . ii. Learning strategies to develop vocabulary iii Contextual vocabulary learning		Enhance personal effectiveness through SWOT analysis, goal setting, and maintaining personal hygiene.	

	iv. Use of phrasal verbs and idioms in a conversation v. Effectively using dictionary, thesaurus **Statement and Course of action** i.Revision of syllogism ii.Statement and conclusion Iii. Course of action based on statement Iv. Worksheet1 and Worksheet 2	**6**		1,2
IV	**Interview Skills & Dress Code Ethics** i. Types of interview- telephonic, virtual & face to face online interview, personal interview, Panel interview, Group interview ii. Common interview questions and answering strategies iii. Dress Code Ethics during Interviews iv. Mock Interview Session **Sitting arrangement (puzzle)** i.Linear arrangement puzzle ii.Circular arrangement puzzle iii.Matrix Iv. Worksheet1	**6**	Improve vocabulary through understanding word usage, contextual learning, and effective dictionary use, and strengthen logical reasoning with practice in syllogisms, statements, conclusions, and courses of action.	1,2
V	**Grammar (Flipped Classroom)** i. Word-stress, Syllables Practice Session: Common Errors (testing the students' grammar already learnt) **Profit loss and discount** i.Introduction to basics ii.Introduction to discount iii.Probems related on the topics Iv. Worksheet1 and Worksheet 2	**6**	Master interview techniques for various formats, understand dress code ethics, and improve performance through mock interviews and puzzle-solving exercises in linear, circular, and matrix arrangements.	1,2

Text Books:

- Barrett, Grant. 2016. *Perfect English Grammar: The Indispensible Guide to Excellent Writing and Speaking*, Zephyros Press.
- McDowell, Gayle Laakmann.2008.*Cracking the Coding Interview* (Indian Edition)
- A Modern Approach to Logical Reasoning All Exams
- General Mental Ability & Logical Reasoning Compendium

Reference Books:

- Zinsser, William. (2006) On Writing Well: The Classic Guide to Writing Nonfiction
- Fast track Objective mathematics for Competitive exam by Arihant
- General Mental Ability & Logical Reasoning Compendium By R.S. Agarwala

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Demonstrate clear and concise technical communication in both written and oral formats, incorporating industry-specific terminology.	**5, 7**
2	Develop expertise in crafting resumes, cover letters, and technical reports to effectively showcase engineering qualifications.	**8**
3	Acquire proficiency in creating and delivering impactful presentations, utilizing visual aids to convey engineering concepts to diverse audiences.	**7, 9&10**
4	Cultivate effective interpersonal skills for collaborative teamwork, emphasizing active listening, conflict resolution, and clear communication within engineering contexts.	**11,12**
5	Prepare for engineering job interviews by articulating qualifications, experiences, and career goals, addressing both technical and behavioral questions confidently.	**10**

SEMESTER – VI									
Course Title	**Advanced Manufacturing Processes**								
Course code	**23BTME321R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 60T	**4**	**0**	**0**	**0**	**0**	**0**	**4**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ VI semester of third year of the programme**								
Course Objectives	1. Understanding about the operating principles and characteristics of manufacturing technologies. 2. Learn how to machine parts by use of appropriate manufacturing technique. 3. Enable students to learn the use of rapid prototyping technologies and microwave processing of materials.								
CO1	Enable to understand an overview of manufacturing systems								
CO2	Enable to understand the use of advanced metal cutting processes								
CO3	Enable to understand the interdisciplinary concepts of advanced machining processes								
CO4	Enable to understand advanced welding processes								
CO5	Enable to understand microwave processing of materials								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Introduction:** Manufacturing and Manufacturing systems, Manufacturing Trends and challenges, Manufacturing aspects, selection and classification, Description and Taxonomy of the Manufacturing processes	**12**	To understand and remember various Manufacturing and Manufacturing systems	1,2
II	**Advanced Metal casting processes:** Metal casting basics, gating and risering design, Evaporative pattern casting processes (EPC), Continuous, Permanent mold, Centrifugal and Pressure die casting	**12**	To understand and remember the basics of advanced metal casting processes	1,2
III	**Advanced Machining Processes:** Abrasive flow machining, Mechanism of material removal in AFM, Abrasive Jet Machining (AJM), Abrasive water jet machining (AWJM), Ultrasonic machining processes (USM), Mechanism, Process variants, applications of USM, Electric Discharge machining (EDM) Processes, Electro chemical discharge machining (ECDM), Laser beam machining, electron beam, plasma beam, ion beam machining	**12**	To remember and understand various advanced machining processes	1,2
IV	**Advanced Welding processes**: Submerged arc welding, Resistance welding processes, Solid state welding processes, Friction welding Process, Electron beam and Plasma welding process, Laser beam welding and Diffusion welding process	**12**	To remember and understand non-conventional welding processes	1,2
V	**Other Advanced Processes**: High energy rate forming processes, Rapid prototyping technology, Microwave processing of materials, Applications and new trends in Microwave material processing	**12**	To remember and understand rapid prototyping technologies and microwave	1,2

			processing of materials	

Text Books:

1. Advanced Manufacturing Processes, Prashant K. Ambadekar
2. Manufacturing Science, Ghosh and Mallick

Reference Books:

1. Advanced Manufacturing Processes, Yashvir Singh

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Enable to understand an overview of manufacturing systems	1,3
2	Enable to understand the use of advanced metal cutting processes	3,4,8
3	Enable to understand the interdisciplinary concepts of advanced machining processes	6,8,12
4	Enable to understand advanced welding processes	4,6
5	Enable to understand microwave processing of materials	7,11,12

SEMESTER – VI									
Course Title	**Machine elements and system design**								
Course code	**23BTME322R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T+30P	**3**	**0**	**2**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ VI semester of third year of the programme**								
Course Objectives	1. To introduce the principles and techniques used to design machine components. 2. To provide an understanding of stress and strain analysis and the selection of appropriate materials for machine design. 3. To teach students how to apply failure criteria and factor of safety concepts to design machine components that meet specific functional requirements.								
CO1	An ability to design machine components that meet specific functional requirements and consider factors such as material selection, loading conditions, and failure criteria.								
CO2	An understanding of lubrication and wear of machine elements and how it affects the design process.								
CO3	An ability to design power transmission systems.								
CO4	An ability to consider manufacturing and assembly considerations in the design of machine elements.								
CO5	An ability to apply the concepts learned in class to a real-world design project.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Unit I: Introduction** Design considerations - limits, fits and standardization, Review of failure theories for static and dynamic loading (including fatigue failure)	**10**	**CO 1**	**1,2,3**
II	**Unit II: Design of Joints & Couplings** Design of joints: threaded fasteners, pre- loaded bolts and welded joints, Analysis and applications of power screws and couplings	**10**	**CO 2**	**1,2,3**
III	**Unit III: Design of Shafts & Bearings** Design of shafts under static and fatigue loadings, Analysis and design of sliding and rolling contact bearings	**10**	**CO 3**	**1,2 ,3**
IV	**Unit IV: Design of Gears, Brakes & Clutches** Design of transmission elements: spur, helical, bevel and worm gears; Analysis of clutches and brakes	**10**	**CO 4**	**1,2,3**
V	**Unit V: Design of Belt Drives & Springs** Design of belt and chain drives, Design of springs: helical compression, tension, torsional and leaf springs	**5**	**CO 5**	**1,2,3**

Text Books/ Reference Books:

1. Shigley, J.E. and Mischke, C.R., Mechanical Engineering Design, Fifth Edition, McGraw-Hill International; 1989.
2. Deutschman, D., Michels, W.J. and Wilson, C.E., Machine Design Theory and Practice, Macmillan, 1992.
3. Juvinal, R.C., Fundamentals of Machine Component Design, John Wiley, 1994.
4. Spottes, M.F., Design of Machine elements, Prentice-Hall India, 1994.
5. R. L. Norton, Mechanical Design – An Integrated Approach, Prentice Hall, 1998.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	An ability to design machine components that meet specific functional requirements and consider factors such as material selection, loading conditions, and failure criteria.	**1,**2,**3**
2	An understanding of lubrication and wear of machine elements and how it affects the design process.	**1,**2,**3**
3	An ability to design power transmission systems.	**2,3**
4	An ability to consider manufacturing and assembly considerations in the design of machine elements.	**1,2,4**
5	An ability to apply the concepts learned in class to a real-world design project.	**2,3,4**

SEMESTER – VI									
Course Title	**Mechatronics, robotics and control**								
Course code	**23BTME323R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ VI semester of third year of the programme**								
Course Objectives	1. Learn about the application of mechatronics 2. Understand the importance of mechatronic systems 3. Comprehend the interdisciplinary nature of mechatronics								
CO1	Explain the core of Mechatronic systems								
CO2	Reproduce the devices of mechatronic system								
CO3	Develop and utilize the automated systems								
CO4	Classify the various smart materials								
CO5	Devise the facilities for application of mechatronic systems								

Unit-No.	Content	Contact Hour	Learning Outcome	KL
I	**Unit I: Sensors and transducers:** classification, Development in Transducer technology, Optoelectronics- Shaft encoders, CD Sensors, Vision System, etc.	**10**	**CO 1**	**1,2,3**
II	**Unit II: Drives and Actuators:** Hydraulic and Pneumatic drives, Electrical Actuators such as servo motor and Stepper motor, Drive circuits, open and closed loop control; Embedded Systems: Hardware Structure, Software Design and Communication, Programmable Logic Devices, Automatic Control and Real Time Control Systems	**10**	**CO 2**	**1,2,3**
III	**Unit III: Smart materials:** Shape Memory Alloy, Piezoelectric and Magnetostrictive Actuators: Materials, Static and dynamic characteristics, illustrative examples for positioning, vibration isolation, etc.	**10**	**CO 3**	**1,2,3**
IV	**Unit IV: Basic concepts of robot technology** Direct and inverse kinematics, Manipulator differential motion and statics, Path planning, Dynamics and control	**10**	**CO 4**	**1,2,3**
V	**Unit V: Control systems** Introduction, PID Control, Independent joint control, Independent joint control, Force control,	**5**	**CO 5**	**1,2,3**

TEXT BOOKS:

T1: Richard Paul, Robot Manipulators: Mathematics, Programming and Control, MIT Press, 1981. Robert Shilling, Fundamentals Robotics, Prentice-Hall , 2003

REFERENCE BOOKS:

R1: M. Felix Orlando, Ashish Dutta, Anupam Saxena, Laxmidhar Behera, Tomoya Tamei and Tomohiro Shibata, “Manipulability Analysis of Human Thumb, Index and Middle Finger in Cooperative 3D

Rotational Movements of a Small Object", Robotica, vol. 31, pp. 797-809, 2013

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Explain the core of Mechatronic systems	**2&3**
2	Reproduce the devices of mechatronic system	**1,2&4**
3	Develop and utilize the automated systems	**2,3**
4	Classify the various smart materials	**2&3**
5	Enable to understand drives and actuators, embedded systems, programmable logic devices	**2&3**

SEMESTER – VI									
Course Title	**Introduction to Neural Network**								
Course code	**23BTME324R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ VI semester of third year of the programme**								
Course Objectives	1. Grasp the basic principles and mathematical foundations of neural networks, including their structure, learning processes, and function approximation capabilities. 2. Explore various architectures, such as feed forward neural networks, convolutional neural networks (CNNs), recurrent neural networks (RNNs), and deep learning models. 3. Learn how to handle challenges such as large datasets, imbalanced data, and scalability issues.								
CO1	Demonstrate a solid understanding of the theoretical foundations of neural networks, including perceptron's, activation functions, and the principles of learning algorithms								
CO2	Design and construct various neural network architectures, such as feedforward, convolutional, and recurrent networks, tailored to specific tasks.								
CO3	Train neural networks effectively using backpropagation and optimization techniques like stochastic gradient descent (SGD), Adam, and RMSProp. of inertia								
CO4	Apply advanced techniques like transfer learning, attention mechanisms, and reinforcement learning to complex problems.								
CO5	Evaluate the ethical implications of neural network applications, ensuring responsible use in areas like privacy, fairness, and societal impact.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Unit I: Introduction to Artificial Neural Network** Artificial Neuron Model and Linear Regression, Gradient Descent Algorithm, Nonlinear Activation Units and Learning Mechanisms, Learning Mechanisms-Hebbian, Competitive, Boltzman	**10**	**CO 1**	**1,2,3**
II	**Unit II: Associative memory** Associative Memory Model, Condition for Perfect Recall in Associative Memory, Statistical Aspects of Learning, V.C. Dimensions: Typical Examples, Importance of V.C. Dimensions Structural Risk Minimization	**10**	**CO 2**	**1,2,3**
III	**Unit III: Single-Layer Perceptions** Unconstrained Optimization: Gauss-Newton's Method, Linear Least Squares Filters, Least Mean Squares Algorithm, Perceptron Convergence Theorem, Bayes Classifier & Perceptron: An Analogy,	**10**	**CO 3**	**1,2,3**
IV	**Unit IV: Back Propagation Algorithm** Practical Consideration in Back Propagation Algorithm, Solution of Non-Linearly Separable Problems Using MLP, Heuristics For Back-Propagation, Multi-Class Classification Using Multi- layered Perceptrons	**10**	**CO 4**	**1,2,3**
V	**Unit V: Radial Basis Function Networks** Cover's	**5**	**CO 5**	**1,2,3**

	Theorem, Radial Basis Function Networks: Separability & Interpolation, Solution of Regularization Equation: Greens Function, Regularization Networks and Generalized RBF, Comparison Between MLP and RBF, Learning Mechanisms in RBF			

TEXT BOOKS:

"Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall "Pattern Recognition and Machine Learning" by Christopher M. Bishop

REFERENCE BOOKS:

"Introduction to Artificial Neural Networks and Deep Learning: A Practical Guide with Applications in Python" by Daniel Graupe

OTHER LEARNING RESOURCES: NPTEL, Science Direct

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Demonstrate a solid understanding of the theoretical foundations of neural networks, including perceptron's, activation functions, and the principles of learning algorithms	**2&3**
2	Design and construct various neural network architectures, such as feedforward, convolutional, and recurrent networks, tailored to specific tasks.	**1,2&4**
3	Train neural networks effectively using backpropagation and optimization techniques like stochastic gradient descent (SGD), Adam, and RMSProp. of inertia	**2,3**
4	Apply advanced techniques like transfer learning, attention mechanisms, and reinforcement learning to complex problems.	**2&3**
5	Evaluate the ethical implications of neural network applications, ensuring responsible use in areas like privacy, fairness, and societal impact.	**2&3**

SEMESTER – VI									
Course Title	**Design and Simulation of Process Plant Equipment**								
Course code	**23BTME325R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ VI semester of third year of the programme**								
Course Objectives	1. Recall, understand & demonstrate the thermal engineering concepts in Oil & Gas Industry and other Chemical Process Industries (BT1, BT2, BT3) 2. Explain and design the Distillation Column (BT2, BT6) 3. Analyse & compare the thermal design of various heat exchangers based on international standards and perform their thermal design for a given process requirement (BT4, BT5, BT6)								
CO1	Recall, understand & demonstrate the thermal engineering concepts in Oil & Gas Industry and other Chemical Process Industries (BT1, BT2, BT3)								
CO2	Explain and design the Distillation Column (BT2, BT6)								
CO3	Analyse & compare the thermal design of various heat exchangers based on international standards and perform their thermal design for a given process requirement (BT4, BT5, BT6)								
CO4	Implement the mechanical design methodology and perform the mechanical design of process equipment and comply with the international codes and standards (BT3, BT6)								
CO5	Perform the design, analysis, and evaluation using PV Elite software (BT6)								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**HMT Concepts, Conduction & Convection Heat Transfer** • **HMT Concepts:** Recap of Heat & Mass Transfer Concepts • **Conduction Heat Transfer:** Heat Conduction in Cartesian, Cylinder, & Spherical Coordinates; Boundary & Initial Conditions; Transient Analysis; Lumped Capacitance; Insulation • **Convection Heat Transfer:** Forced Convection; Correlations; Free Convection; Correlations • ***Case Studies:*** *Thermal contact resistance calculation method* ***Problem Solving:*** • *Industrial Problem on Forced Convection* • *Industrial Problem on Free Convection*	**10**	Review, comprehend, and showcase the application of thermal engineering concepts in the Oil & Gas Industry and other Chemical Process Industries (BT1, BT2, BT3).	
II	**Shell and Tube Heat Exchangers** • **Shell and Tube Heat Exchangers:** Classification based on TEMA Standards; Thermal Design – Tube Side Design & Shell Side Design; End Connections Sizing; Fouling Effect & Control; Economic Penalties; Material Selection; Corrosion & its Monitoring Methods; Liquid-Liquid, Gas-Gas & Gas-Liquid Heat Exchangers • ***Case Examples:*** *Material Selection based on Process Requirement*	**10**	Describe and design a Distillation Column, applying relevant principles (BT2, BT6).	
III	**Condensers, Evaporators, and Non-Tubular Heat Exchangers** • **Condensers:** Classification; Thermal	**10**	Evaluate and contrast the thermal design	

	Design; Applications • **Evaporators:** Classification; Laminar Falling Film & Wavy Falling Film Evaporation; Falling Film Evaporator; Climbing Film Evaporator • **Non-Tubular Heat Exchangers:** Air Cooled Heat Exchangers; Plate Type Heat Exchangers ***Problem-Solving:*** • *Thermal Design of Evaporators*		of different heat exchangers according to international standards, and perform their thermal design based on a given process requirement (BT4, BT5, BT6).	
IV	**Mass Transfer, Reboilers, and Distillation Column** • **Mass Transfer:** Vapor Liquid Equilibrium; Absorption; Stripping; Distillation; Azeotropic Distillation; Liquid-Liquid Extraction • **Reboilers:** Classification; Thermosyphon Reboiler; Case Study; Kettle Type Reboiler • **Distillation Column:** Types; Components; Basic Design; Selection of Operating Parameters; Minimum Reflux Ration Calculation; Theoretical Stages; Correlations; Tower Selection; Tray Selection; Design of Tray Tower; Total Pressure Drop in Tray Tower; Design of Downcomers; Tray Efficiency; Height Equivalent Theoretical Plate of Packings ***Problem-Solving:*** • *Industrial Practices in Sizing Typical Thermosyphon Reboiler* ***Case Studies:*** • *Operation Difficulties in Distillation Column* • *Trouble Shooting of Distillation Column* • *Process Design of Light & Heavy Crude Distillation Column*	**10**	Apply mechanical design methodology and conduct the mechanical design of process equipment, ensuring compliance with international codes and standards (BT3, BT6).	
V	**Mechanical Design of Process Equipment, and Process Simulation** • **Mechanical Design of Process Equipment:** Design Parameters; Design of unfired Pressure Vessels: ***ASME Section VIII Division 1***; Design of Pressure Vessels; Types of Vessel Supports & their Design; Atmospheric Pressure Storage Tank – API 650 International Standard; Low Pressure Storage Tank – API 620 International Standard; Types; Design of Storage Tanks; Introduction on Agitated Vessels; Types of Agitators; Agitator Power Requirement; Design of Heat Exchangers • **Process Simulation:** Simulation of Chemical Process using ASPENPLUS or equivalent Software ***Problem Solving:*** • *Mechanical Design of*	**5**	Conduct the design, analysis, and evaluation processes using PV Elite software (BT6).	

	• *Pressure Vessel* • *Vessel Support* • *Storage Tank* • *Agitated Vessel, and* • *Heat Exchanger* ***Demonstration of ASPENPLUS Software or equivalent SW, and*** • ***Hands on Practice using Pipe Stress and Vessel Analysis Software of Bentley Product***			

Reference Books:

1. P. Chattopadhyay, "Engineering Thermodynamics," Oxford University Press, 2015
2. Y. V. C. Rao, "Chemical Engineering Thermodynamics," University Press, India, 1997
3. Yunus A. Çengel & Michael A. Boles "Thermodynamics – *An Engineering Approach*," McGraw-Hill, New York, 2015
4. B. C. Punmia, A. K. Jain, and A. K. Jain, "Strength of Materials," Laxmi Publications, 10th Edition, 2018
5. S. S. Rattan, "Strength of Materials," Tata McGraw Hill Education Publication Pvt. Ltd, 2nd Edition, New Delhi, 2011
6. Yunus A. Çengel, and John M. Cimbala, "Fluid Mechanics: *Fundamentals and Applications,"* McGraw-Hill, New York, 2014
7. Robert W. Fox, Alan T. McDonald, and Philip J. Pritchard, "Introduction to Fluid Mechanics," John Wiley & Sons, Inc. NJ, 2020
8. R.C. Hibbeler, "Fluid Mechanics," Pearson India Education Services Pvt. Ltd., 2017
9. G. F. Hewitt, G. L. Shires, and T. R. Bott, "Process Heat Transfer," CRC Press, Taylor & Francis Group LLC, NewYork, 1994
10. Frank P. Incropera, David P. Dewitt, Theodere L. Bergman, and Adrienne S. Lavine, "Principles of Heat and Mass Transfer," Wiley India Pvt. Ltd., New Delhi, 2019
11. S. Kakaç, H. Liu, and A. Pramuanjaroenkij, "Heat Exchangers – Selection, Rating, and Thermal Design," CRC Press, Taylor & Francis Group LLC, NewYork, 2012

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Recall, understand & demonstrate the thermal engineering concepts in Oil & Gas Industry and other Chemical Process Industries (BT1, BT2, BT3)	**2&3**
2	Explain and design the Distillation Column (BT2, BT6)	**1,2&4**
3	Analyse & compare the thermal design of various heat exchangers based on international standards and perform their thermal design for a given process requirement (BT4, BT5, BT6)	**2,3**
4	Implement the mechanical design methodology and perform the mechanical design of process equipment and comply with the international codes and standards (BT3, BT6)	**2&3**
5	Perform the design, analysis, and evaluation using PV Elite software (BT6)	**2&3**

SEMESTER – VI									
Course Title	**CORPORATE PROFICIENCY FOR ENGINEERS**								
Course code	**23UBPD324R**	**Total credits: 2**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30P	**0**	**0**	**4**	**0**	**0**	**0**	**2**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech Mechanical Engineering**								
Semester	**Fall/ VI semester of third year of the programme**								
Course Objectives	1. Develop students' abilities in technical writing, speaking, and presentations to effectively convey engineering concepts and solutions. Analyze electronic applications in civil engineering for designing, constructing, and maintaining infrastructure. 2. Focus on crafting professional resumes and cover letters tailored for engineering positions, improving students' chances of securing employment. 3. Strengthen teamwork abilities and prepare students for job interviews through practical exercises and targeted training, enhancing their readiness for engineering careers.								
CO1	Demonstrate clear and concise technical communication in both written and oral formats, incorporating industry-specific terminology.								
CO2	Develop expertise in crafting resumes, cover letters, and technical reports to effectively showcase engineering qualifications.								
CO3	Acquire proficiency in creating and delivering impactful presentations, utilizing visual aids to convey engineering concepts to diverse audiences.								
CO4	Cultivate effective interpersonal skills for collaborative teamwork, emphasizing active listening, conflict resolution, and clear communication within engineering contexts.								
CO5	Prepare for engineering job interviews by articulating qualifications, experiences, and career goals, addressing both technical and behavioral questions confidently.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Writing Skills** **i.** Paragraph Writing & Narratives ii. Letter Writing iii. Technical Writing **Pipe and cistern** iii. Introduction of pipes and cistern iii. Solving different types of questions iv. Worksheet1 and Worksheet 2	**7**	Develop proficiency in various forms of writing, including paragraph and narrative construction, letter writing, and technical documentation.	1,2
II	**Self-Management Skills** **i.** SWOT Analysis ii. Goal Setting and Personal Hygiene **Mixture allegation and Clock** i. Introduction of basics ii. Solving questions on mixture and alligationion. iii. Worksheet1 and Worksheet 2	**7**	Gain competency in solving practical problems related to pipes and cisterns, mixtures and alligations, clocks, and profit, loss, and discounts through targeted practice and worksheets.	1,2
III	**Vocabulary Development** i. Understanding different aspects of a word (such as the use of say, tell, speak) . ii. Learning strategies to develop vocabulary iii Contextual vocabulary learning iv. Use of phrasal verbs and idioms in a conversation	**7**	Enhance personal effectiveness through SWOT analysis, goal setting, and maintaining personal hygiene.	1,2

	v. Effectively using dictionary, thesaurus **Statement and Course of action** i.Revision of syllogism ii.Statement and conclusion Iii. Course of action based on statement Iv. Worksheet1 and Worksheet 2			
IV	**Interview Skills & Dress Code Ethics** i. Types of interview- telephonic, virtual & face to face online interview, personal interview, Panel interview, Group interview ii. Common interview questions and answering strategies iii. Dress Code Ethics during Interviews iv. Mock Interview Session **Sitting arrangement (puzzle)** i.Linear arrangement puzzle ii.Circular arrangement puzzle iii.Matrix Iv. Worksheet1	**7**	Improve vocabulary through understanding word usage, contextual learning, and effective dictionary use, and strengthen logical reasoning with practice in syllogisms, statements, conclusions, and courses of action.	1,2
V	**Grammar (Flipped Classroom)** i. Word-stress, Syllables Practice Session: Common Errors (testing the students' grammar already learnt) **Profit loss and discount** i.Introduction to basics ii.Introduction to discount iii.Probems related on the topics Iv. Worksheet1 and Worksheet 2	**7**	Master interview techniques for various formats, understand dress code ethics, and improve performance through mock interviews and puzzle- solving exercises in linear, circular, and matrix arrangements.	1,2

Text Books:

- Barrett, Grant. 2016. *Perfect English Grammar: The Indispensible Guide to Excellent Writing and Speaking*, Zephyros Press.
- McDowell, Gayle Laakmann.2008.*Cracking the Coding Interview* (Indian Edition)
- A Modern Approach to Logical Reasoning All Exams
- General Mental Ability & Logical Reasoning Compendium

Reference Books:

- Zinsser, William. (2006) On Writing Well: The Classic Guide to Writing Nonfiction
- Fast track Objective mathematics for Competitive exam by Arihant
- General Mental Ability & Logical Reasoning Compendium By R.S. Agarwala

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Demonstrate clear and concise technical communication in both written and oral formats, incorporating industry-specific terminology.	**5, 7**
2	Develop expertise in crafting resumes, cover letters, and technical reports to effectively showcase engineering qualifications.	**8**
3	Acquire proficiency in creating and delivering impactful presentations, utilizing visual aids to convey engineering concepts to diverse audiences.	**7.9,10**
4	Cultivate effective interpersonal skills for collaborative teamwork, emphasizing active listening, conflict resolution, and clear communication within engineering contexts.	**11,12**
5	Prepare for engineering job interviews by articulating qualifications, experiences, and career goals, addressing both technical and behavioral questions confidently.	**10**

SEMESTER – VI									
Course Title	**Extra-curricular Activities**								
Course code	23UBEC321	**Total credits: 1**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 30P	**0**	**0**	**0**	**4**	**0**	**0**	**1**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**B.Tech Mechanical Engineering**								
Semester	**Fall/ VI semester of third year of the programme**								
Course Objectives	1. Equip students with effective time management and prioritization skills, fostering leadership qualities and a commitment to their endeavors. 2. Encourage exploration of interests beyond academics and participation in co-curricular activities, cultivating well-rounded individuals capable of making meaningful community contributions. 3. Enhance students' abilities to express ideas clearly and engage in in-depth evaluation and analysis, while integrating learning experiences to practice transferable skills across various activities.								
CO1	Learn to a plan so that they can make meaningful contributions, maintain a commitment, and manage their time and priorities.								
CO2	Transform passionate students who demonstrate leadership and pursue interests beyond their academics.								
CO3	Learn to participate in various co-curricular activities leading to their multifaceted personality development.								
CO4	Express their ideas, views, In-depth evaluation and analysis clearly in the topic of their interest.								
CO5	Demonstrate and practices different activities, by Integrating learning experiences by demonstrating transferable skills.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	AdtU encourages a range of activities outside the regular curriculum intended to meet learner's interest, These activities are aimed to develop the social and soft skills and promote a holistic development of the learners, Keeping in mind the 360 degree learning methodology the students are engaged in different activities headed under different clubs viz. Dance, music, photography, drama, literary etc., The students are encouraged to participate in regular club activities, workshops, competitions as per their interest and hobbies, The student members of the club are trained represent AdtU in various inter University student and national level competitions, Renewed personalities are invited to conduct workshops that benefit the members and students by giving them the platform to learn from experts in the respective fields.	**30**	Participate in diverse club activities to develop social and soft skills, achieve holistic development, and gain exposure through workshops and competitions led by experts.	1,2

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Learn to a plan so that they can make meaningful contributions, maintain a commitment, and manage their time and priorities.	**5, 7**
2	Transform passionate students who demonstrate leadership and pursue interests beyond their academics.	**8**
3	Learn to participate in various co-curricular activities leading to their multifaceted personality development.	**7.9,10**
4	Express their ideas, views, In-depth evaluation and analysis clearly in the topic of their interest.	**11,12**
5	Demonstrate and practices different activities, by Integrating learning experiences by demonstrating transferable skills.	**10**

SEMESTER – VII									
Course Title	**Power Plant Engineering**								
Course code	**23BTME411R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ VII semester of 3rd year of the programme**								
Course Objectives	1. To provide an overview of power plants and the associated energy conversion. 2. To understand the concept of renewable energy for sustainable development 3. To understand basics of thermodynamics								
CO1	Illustrate the working of steam power plants and its different components.								
CO2	Explain the working of gas turbine and combined cycle power plants.								
CO3	Analyze the basics of nuclear energy conversion and its different reactors.								
CO4	Classify various hydroelectric power plants.								
CO5	Understand various energy, economic and environmental issues.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**BL**
I	Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems	**5**	Upon completion of the course, the students can understand the principles of operation for different power plants and their economics.	1,2
II	Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.	**10**	the students can understand power plants economics	1,2
III	Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures For nuclear power plants.	**10**	Learn and develop skills for operating boiler	1,2
IV	Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems	**10**	Enable to understand the setting up of an boiler industry	1,2
V	Energy, economic and environmental		Demonstrate power generation	

	issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.	**10**	in power plants.	1,2

TEXT BOOKS:

T1 Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.

T2 El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.

REFERENCE BOOKS:

R1: Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998Tripathy PC & Reddy PN, Principles of Management, Tata McGraw Hill, 1999

OTHER LEARNING RESOURCES:

https://www.sciencedirect.com/science/article/abs/pii/S0360319923006523

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Illustrate the working of steam power plants and its different components.	**1,2, 3,4**
2	Explain the working of gas turbine and combined cycle power plants.	**5, 6, 7**
3	Analyze the basics of nuclear energy conversion and its different reactors.	**3,4,5**
4	Classify various hydroelectric power plants.	**1,2,3**
5	Understand variousenergy, economicand environmental issues.	**1,2,3**

SEMESTER – VII									
Course Title	**Production & Operation Management**								
Course code	**23BTME412R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre- requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ VI semester of third year of the programme**								
Course Objectives	1. To develop a thorough understanding of the role and scope of production and operations management in both manufacturing and service organizations. 2. To understand workflow management, capacity planning, and layout planning. 3. To study methods to optimize the use of resources such as labor, materials, machines, and capital. 4. To analyze real-world problems using techniques such as forecasting, scheduling, and production planning.								
CO1	To demonstrate a clear understanding of the basic concepts, principles, and scope of linear programming.								
CO2	To comprehend the structure, assumptions, and objectives of transportation problems in optimization.								
CO3	To formulate real-world transportation problems as linear programming models, including supply, demand, and cost constraints.								
CO4	To understand the fundamental concepts, characteristics, and components of queuing systems, such as arrival rates, service rates, and queue disciplines.								
CO5	Learn the fields of application of optimization tools								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Unit I: Linear Programming** Introduction, Requirements for a linear programming problem, Assumptions in Linear Programming Problems, Formulation of Linear Programming Problems, General Linear Programming Problem, Canonical and Standard Forms of Linear Programming Problem, Theory of Simplex Method	**10**	**CO 1**	**Remember, Understand, Apply & Analyze**
II	**Unit II: The Transportation Model** Introduction, Assumptions in the Transportation Model, Definition of the Transportation Model, Matrix Terminology, Formulation and Solution of Transportation Models, Variants in Transportation Problems	**10**	**CO 2**	**Remember, Understand, Apply & analyze**
III	**Unit III: The Assignment Model** Definition of the Assignment Model, Mathematical Representation of the Assignment Model, Comparison with the Transportation Model, Solution of the Assignment Models	**10**	**CO 3**	**Understand & Apply**
IV	**Unit IV: Queuing Models** Applications of Queuing Models, Introduction, Elements of a Queuing System, Operating Characteristics of a	**10**	**CO 4**	**Understand, Apply& Analyze**

	Queuing System, Waiting Time and Idle Time Costs, Transient and Steady States of the System			
V	**Unit V: Inventory Models** Necessity for Maintaining Inventory, Inventory Costs, Inventory Control Problem, Forecasting of Demand, Forecasting Methods, Selective Inventory Management Techniques	**5**	**CO 5**	**Understand, Apply & Analyze**

TEXT BOOKS:
T1. Operations Research by Prem Kumar Gupta, D.S. Hira Operations Research by R. Panneerselvam

REFERENCE BOOKS:
R1. Operations Research Theory and Applications by J K Sharma

OTHER LEARNING RESOURCES: NPTEL, Sciencedirect

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	To demonstrate a clear understanding of the basic concepts, principles, and scope of linear programming.	**1,2, 3,4**
2	To comprehend the structure, assumptions, and objectives of transportation problems in optimization.	**5, 6, 7**
3	To formulate real-world transportation problems as linear programming models, including supply, demand, and cost constraints.	**3,4,5**
4	To understand the fundamental concepts, characteristics, and components of queuing systems, such as arrival rates, service rates, and queue disciplines.	**1,2,3**
5	Learn the fields of application of optimization tools	**1,2,3**

SEMESTER – VII									
Course Title	**Design of Static Equipment**								
Course code	**23BTME413R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ VI semester of third year of the programme**								
Course Objectives	1. To Explain Upstream, Refinery, Petrochemical and Fertilizer Processes and their Equipment, and apply the Mechanical Design Concepts in Designing the Static Equipment for a given Process Requirement (BT 2) 2. To Explain Upstream, Refinery, Petrochemical and Fertilizer Processes and their Equipment, and apply the Mechanical Design Concepts in Designing the Static Equipment for a given Process Requirement (BT 2) 3. To Explain Upstream, Refinery, Petrochemical and Fertilizer Processes and their Equipment, and apply the Mechanical Design Concepts in Designing the Static Equipment for a given Process Requirement (BT 2)								
CO1	Demonstrate a comprehensive understanding of upstream, refinery, petrochemical, and fertilizer processes, and their associated equipment, enabling effective process analysis and optimization.								
CO2	Apply mechanical design concepts to develop static equipment for various process requirements, ensuring functionality and safety in compliance with industry standards.								
CO3	Gain proficiency in manual and software								
CO4	Design storage tanks adhering to API standards, utilizing advanced stress analysis techniques with ANSYS software to ensure structural integrity and operational reliability.								
CO5	Develop expertise in designing reaction vessels, agitators, and equipment foundations while performing advanced stress analysis for saddle supports and nozzles with reinforcing pads using ANSYS.								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**KL**
I	**Intro*duction & Codes*** • **Processes, Concepts & Static Equipment Description:** Basics of Oil & Gas, Chemical Processes & Equipment – Upstream Processes, Refinery Processes, Petrochemical Processes and Major Equipment of All Processes; Concepts & Description of Reactors; Concepts & Description of Distillation Column; Concepts & Description of Packed Tower Distillation Column; Concepts & Description of Heat Exchangers; Selection of Material • **Theory of Elasticity & Finite Element Method:** Theory of Elasticity – Stress Analysis, Strain Analysis, Stress & Strain Relations, Plastic Deformation, Criterion for Failure & Strain Hardening; Finite Element Method – Formulation Methods, Interpolation Functions, Element Matrix, Assembly, Loadings and Boundary Conditions, Generation, Estimation, Choice of New Mesh, Transfer Variables, Applications of	**10**	Show a thorough understanding of upstream, refinery, petrochemical, and fertilizer processes, along with their related equipment, to facilitate effective process analysis and optimization.	**1,2**

	FEM, Typical FEAs of various Components • **ASME BPVC & Other Codes:** ASME BPVC Codes – Introduction, Development of ASME BPVC Codes, ASME Section VIII Division 1: Structure/Layout; ASME Section VIII Division 1: General Requirements – UG, UHX, UCS, ASME Section VIII Division 2 & 3, ASME Section II: Material Specification, ASME Section V: Nondestructive Examinations; Other Codes – BS PD 5500, European Standard EN 13445, ASME B16.5, ASME B16.47, ASME B16.2, API 579, EN 1591			
II	**Design Procedure of Pressure Vessels** • **Design Procedure of Pressure Vessels:** Design of Pressure Vessel Shell – Internal Pressure, External Pressure; Design of Pressure Vessel Heads – Hemispherical Head, Ellipsoidal & Torispherical Heads, Conical, Toriconical & Flat Heads, and Covers; Design of Nozzle – Circular Hole - Stress Concentration, Reinforcement, Nozzles; Design of Flange Joints – Flange Types & Design, Gasket Types & Design, Nut & Bolts; Other Aspects – Buckling of Cylindrical Shell, Vessel & Components of Vessel Weight Calculation, Tall Towers – Vibration Analysis, Fabrication; Partial Liquid Volume Determination – Horizontal Cylinder & Various Horizontal Heads, Various Vertical Heads • **Design of Pressure Vessels:** Design of Vertical Pressure Vessel – Problem Statement & Data, Shell Design, Head Design, Nozzle Design, Flange Joint Design; Design of Horizontal Pressure Vessel – Problem Statement & Data, Shell Design, Head Design, Nozzle Design, Flange Joint Design, Mechanical Datasheet • **Design of High-Pressure (Thick Wall) Vessels:** Design Procedure of High Pressure Vessel – Radial, Hoop, Axial Stresses, Distribution of Radial & Hoop Stresses through Cylinder Wall, Design Procedure - Single Shell & Multi Shell, Types of Closures; Design of Vertical	**10**	Utilize mechanical design principles to create static equipment for different process requirements, ensuring functionality, safety, and compliance with industry standards.	**1,3**

	High-Pressure Vessel • ***Case Studies***			
III	**Design of Storage Tanks and Vessel Supports** • **API & Other Codes & Description of Storage Tanks:** Codes & Standards for Design of Storage Tank – Layout of API 650, Layout of API 620, Layout of API 653, Layout of - API 579, Layout of UL 142; Description of Storage Tank – Classification of Storage Fluids and Storage Tanks, Layout of Tank Farm & Criteria to Select Tank Type, Tank Components, Spills, Leaks, Prevention, Material Selection, Tank Corrosion, Corrosion Prevention Methods, Seismic Analysis & Retrofitting of Existing Tanks, Storage Tank Erection • **Design of Storage Tanks, Safety & Other Important Aspects:** General Design of Storage Tank – Design of Bottom Plate & Shell, Wind Girder and Roof, Design of Storage Tanks & Analysis – Design of Open Roof Cylindrical Tank, Fixed Conical Roof Cylindrical Tank, Fixed Umbrella Roof Cylindrical Tank, Floating Roof Cylindrical Tank and Stainless Steel Storage Tanks, Mechanical Datasheet; Safety & Other Important Aspects of Storage Tanks – Tank Fire Protection, Tank Emission, Settlement of Tank, Storage Tank Farm Dyke, Flexible Piping System for Roofs, Weld Inspection & Testing • **Design of Vessel Supports:** Introduction – Types of Supports & their Description, Loads on Supports; Design of Saddle Support – Design Methodology; Design of Lug Support – Design Methodology; Design of Leg Support – Design Methodology; Design of Skirt Support – Design Methodology • ***Case Studies***	**10**	Develop expertise in both manual and software-based techniques.	**2,4**
IV	**Design of ST Heat Exchangers, Reaction Vessels, Agitators, DT & NTD** • **Design of Shell & Tube Heat Exchanger:** TEMA Mechanical Standards for Class R C B – Design Parameters, Corrosion Allowance, Service, Tube Dimensions & Arrangement, Shell	**10**	Design storage tanks in compliance with API standards, employing advanced	**4,5**

	Design, Geometrical Shape, Orientation & Arrangement of Baffles & Support Plates, Floating Heads & Construction, Gaskets, Tube Sheet Design and Joints, Flexible Shell Elements, Channels, Covers & Bonnets; Design of Fixed Tubesheet Shell & Tube Heat Exchanger – Design Data, Design of Channel Shell, Cover Head, Main Shell, Tube, Tube Sheet, Nozzle, Flange Joint; Design of Floating Head Shell & Tube Heat Exchanger – Design Data, Design of Channel Shell, Cover Head, Main Shell, Tube, Tube Sheet, Nozzle, Flange Joint; Data Sheet & Fabrication – Mechanical Datasheet for Fixed Tubesheet & Floating Head, Procedure Fabrication • **Design of Reaction Vessels & Agitators:** Reaction Vessels – Design Procedure & Design, Design using Software, Agitators – Description of Paddle, Turbine, Propeller, Helical Screw, Cone, Radial & High-Speed Disc Agitators, Determination of Power Consumption of Agitator, Design Methodology, Design of Agitation System • **Measurements, DT, NDT & Foundation Design for Static Equipment:** Measurements – Concepts of Measurement, Advance Measurement Techniques, Optical Measurements; Destructive Testing – Tensile, Bend, Impact, Hardness, Fatigue, Fracture Toughness, Corrosion & Creep Tests; Non Destructive Testing Test Test – Radiography, Ultrasonic, Magnetic Particle / Dye Penetrate, Eddy Current Tests; Foundation Design – Types, Description, Design and Anchorage; Design of Lifting Lug for Equipment • ***Case Studies***		stress analysis methods using ANSYS software to ensure structural integrity and operational reliability.	
V	**Design of Static Equipment using PV Elite Software** • **Design, Analysis & Evaluation of Pressure Vessels using Software:** Exploring Software Tool Bar; Design of Vertical Pressure Vessel – Input to Create Pressure Vessel, Error Check & Analysis (ASME Section VIII Div 1, Div 2, PD	**5**	Gain expertise in designing reaction vessels, agitators, and equipment foundations, while	**2,5**

	5500, EN 13445), 'Reports - Review & Generation' • **Design, Analysis & Evaluation of Heat Exchanger using Software:** Design of Fixed Tubesheet Shell & Tube Heat Exchanger - Horizontal Orientation; Design of Floating Head Shell & Tube Heat Exchanger - Horizontal Orientation • **Design, Analysis & Evaluation of Vessel Supports using Software:** Saddle Support – Input to Create Saddle Support, Error Check & Analysis, Reports - Review & Generation; Lug Support – Input to Create Lug Support, Error Check & Analysis, Reports - Review & Generation; Leg Support – Input to Create Leg Support, Error Check & Analysis, Reports - Review & Generation; Skirt Support – Input to Create Skirt Support, Error Check & Analysis, Reports - Review & Generation • ***Case Studies***		conducting advanced stress analysis for saddle supports and nozzle reinforcing pads using ANSYS.	

Reference Books:

1. Keith E. A., "Mechanical Design of Process Systems," Vol. I & II, Gulf Publishing Company, Houston, 1986
2. Joshi M. V., "Process Equipment Design*,"* The Macmillan Company of India Limited, Delhi, 1976
3. Gavin T., and Ray S., "Chemical Engineering Design," Elsevier, New York, 2008
4. Somnath C., "Pressure Vessels – Design and Practice," CRC Press, 2005
5. Dennis M., "Pressure Vessel Design Manual," Elsevier, Burlington, MA, 2004
6. Subhash R. G., Design of Pressure Vessels," Taylor & Francis, CRC Press, 2021
7. James R. F. and Maan H. J. "Guide Book for the Design of ASME Section VIII Pressure Vessels," ASME Press, New York, 2001
8. Lloyd E. B., and Edwin H. Y., "Process Equipment Design,' John Wiley & Sons, Inc., 1959
9. "ASME BPVC Section VIII Division I & II," American Society of Mechanical Engineers, New York, 2019
10. "API 650: Welded Steel Tanks for Oil Storage," Americal Petroleum Institute, 2007
11. "API 620: Design and Construction of Large, Welded, Low-Pressure Storage Tanks," Americal Petroleum Institute, 2013

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Demonstrate a comprehensive understanding of upstream, refinery, petrochemical, and fertilizer processes, and their associated equipment, enabling effective process analysis and optimization.	**1,2, 3,4**
2	Apply mechanical design concepts to develop static equipment for various process requirements, ensuring functionality and safety in compliance with industry standards.	**5, 6, 7**
3	Gain proficiency in manual and software	**3,4,5**
4	Design storage tanks adhering to API standards, utilizing advanced stress analysis techniques with ANSYS software to ensure structural integrity and operational reliability.	**1,2,3**
5	Develop expertise in designing reaction vessels, agitators, and equipment foundations while performing advanced stress analysis for saddle supports and nozzles with reinforcing pads using ANSYS.	**1,2,3**

SEMESTER –VII									
Course Title	**Elementary Statistical Analysis**								
Course code	**23BTME414R**	**Total credits: 3**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 45T	**3**	**0**	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ 1st semester of fourth year of the programme**								
Course Objectives	1. Understand the basic concepts of statistics and data analysis. 2. Apply descriptive and inferential statistical methods to analyze data. 3. Interpret statistical results and make data-driven decisions. 4. Utilize statistical software for data analysis.								
CO1	Summarize and visualize data using descriptive statistics.								
CO2	Apply probability concepts to real-life scenarios								
CO3	Perform hypothesis tests and interpret results.								
CO4	Conduct simple linear regression analysis.								
CO5	Use statistical tools and software for data analysis.								

Unit-No.	Content	Contact Hour	Learning Outcome	BL
I	**Introduction to Statistics:** Definition and scope of statistics**,** Types of data and scales of measurement**,** Sampling methods and data collection techniques, Organizing data: tables and charts	**5**	CO1	1,2
II	**Descriptive Statistics:** Measures of central tendency: mean, median, mode, Measures of dispersion: range, variance, standard deviation, Data visualization: histograms, box plots, scatter plots	**10**	CO1	2,3
III	**Probability and Probability Distribution:** System integration and optimization, Case studies of hybrid systems Basic probability concepts, Probability rules and counting techniques, Discrete and continuous probability distributions, Binomial and normal distributions	**10**	CO2	3.4
IV	**Inferential Statistics** Sampling distributions, Central Limit Theorem, Estimation: confidence intervals for means and proportions	**10**	CO3	3,4
V	**Hypothesis Testing, Co-relation and Regression Analysis** Null and alternative hypotheses, Type I and Type II errors, t-tests, chi-square tests, and ANOVA, Correlation coefficients and interpretation, Simple linear regression: model building and analysis	**10**	CO5	3,4

Recommended Textbooks:

1. Statistics for Business and Economics by Paul Newbold, William L. Carlson, Betty Thorne
2. Introduction to the Practice of Statistics by David S. Moore, George P. McCabe, Bruce Craig
3. Elementary Statistics by Mario F. Triola

Additional Resources:

- Online statistical tools and data repositories for hands-on practice.
- Supplementary readings from academic journals and case studies.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Summarize and visualize data using descriptive statistics.	**2&3**
2	Apply probability concepts to real-life scenarios	**1,2&4**
3	Perform hypothesis tests and interpret results.	**2,3**
4	Conduct simple linear regression analysis.	**2&3**
5	Use statistical tools and software for data analysis.	**2&3**

SEMESTER – VIII									
Course Title	**Total Quality Management**								
Course code	**23BTME421R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 60T	**4**	**0**	**0**	**0**	**0**	**0**	**4**
Pre-requisite	**Nil**	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ VIII semester of 4th year of the programme**								
Course Objectives	1. To facilitate the understanding of total quality management principles and processes. 2. To facilitate the understanding of TQM tools and techniques. 3. To facilitate the understanding of Quality systems								
CO1	To understand the basic components of total quality management								
CO2	To discuss about quality and the processes of continuous improvement								
CO3	To summarize the concept of six sigma								
CO4	To understand the various tools and techniques of TQM								
CO5	To distinguish different ISO systems								

Unit-No.	**Content**	**Contact Hour**	**Learning Outcome**	**BL**
I	**Introduction**, need for quality, evolution of quality; Definitions of quality, product quality and service quality; Basic concepts of TQM, TQM framework, contributions of Deming, Juran and Crosby. Barriers to TQM; Quality statements, customer focus, customer orientation & satisfaction, customer complaints, customer retention; costs to quality.	**12**	To understand the basic components of total quality management	1,2
II	**TQM principles**; leadership, strategic quality planning; Quality councils- employee involvement, motivation; Empowerment; Team and Teamwork; Quality circles, recognition and reward, performance appraisal; Continuous process improvement; PDCE cycle, 5S, Kaizen; Supplier partnership, Partnering, Supplier rating & selection.	**12**	To discuss about quality and the processes of continuous improvement	2,3, 4
III	**TQM tools and techniques I**, The seven traditional tools of quality; New management tools; Six sigma- concepts, methodology, applications to manufacturing, service sector including IT, Bench marking process; FMEA- stages, types.	**12**	To summarize the concept of six sigma	5,6
IV	**TQM tools and techniques II**, control charts, process capability, concepts of six sigma, Quality Function Development (QFD), Taguchi quality loss function; TPM- concepts, improvement needs, performance measures.	**12**	To understand the various tools and techniques of TQM	1,2, 5,6
V	**Quality systems**, need for ISO 9000, ISO	**12**	To distinguish different ISO	1,2,

	9001-9008; Quality system elements, documentation,; Quality auditing, QS 9000, ISO 14000- concepts, requirements and benefits; TQM implementation in manufacturing and service sectors.		systems	3,4

TEXT BOOKS:

T1 Besterfield D.H. et al., Total qualityManagement, 3rd ed., Pearson Education Asia, 2006.

T2 Evans J.R. and Lindsay W.M., The management and Control of Quality, 8th ed., first Indian edition, Cengage Learning, 2012.

REFERENCE BOOKS:

R1: Janakiraman B. and Gopal R.K., Total Quality Management, Prentice Hall India, 2006.

RELATIONSHIP BETWEEN COURSE OUTCOMES (CO) AND PROGRAM OUTCOMES

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	To understand the basic components of total quality management	**2,9,10**
2	To discuss about quality and the processes of continuous improvement	**3,6,8,9**
3	To summarize the concept of six sigma	**9,10,11**
4	To understand the various tools and techniques of TQM	**2,5,11**
5	To distinguish different ISO systems	**9,10,11**

SEMESTER –VIII									
Course Title	**Renewable Energy Engineering**								
Course code	**23BTME422R**	**Total credits: 4**	**L**	**T**	**P**	**S**	**R**	**O/F**	**C**
		Total hours: 60T	**4**	**0**	**0**	**0**	**0**	**0**	**4**
Pre-requisite	Basic Electrical Engineering, Thermodynamics	**Co-requisite**	**Nil**						
Programme	**Bachelor of Technology in Mechanical Engineering**								
Semester	**Fall/ VIII semester of fourth year of the programme**								
Course Objectives	1. Understand the fundamental concepts of renewable energy sources. 2. Analyze the working principles of various renewable energy technologies. 3. Design basic renewable energy systems considering efficiency and sustainability. 4. Evaluate the environmental and economic impacts of renewable energy systems.								
CO1	Explain the scientific principles behind renewable energy sources.								
CO2	Apply mathematical and engineering principles to design renewable energy systems								
CO3	Assess the feasibility and performance of renewable energy projects.								
CO4	Discuss the environmental, economic, and social implications of renewable energy.								

Unit-No.	Content	Contact Hour	Learning Outcome	BL
I	**Introduction to Renewable Energy and Energy Fundamentals:** Energy demand and supply trends, Importance of renewable energy, Energy units and conversions, Thermodynamics and energy efficiency	**12**	CO1	1,2,
II	**Renwable Energy Technologies:** **Solar Energy:** Solar radiation principles, Photovoltaic (PV) systems, Solar thermal energy and applications **Wind Energy:** Wind energy principles, Wind turbine design and operation, Site selection and resource assessment **Hydropwer:** Types of hydropower systems, Design of small-scale hydro plants, Environmental impacts **Biomass Energy:** Biomass resources and conversion technologies, Biofuels production and applications **Geothermal Energy:** Geothermal resources and extraction methods, Power generation and direct-use applications **Ocean Energy:** Tidal, wave, and ocean thermal energy conversion, Technology and deployment challenges	**12**	CO1	2,3
III	**Hybrid Renewable Energy Systems** System integration and optimization, Case studies of hybrid systems	**12**	CO2	2, 3,4,
IV	**Energy Storage and Smart Grids** Battery technologies and energy storage solutions, Role of smart grids in renewable energy integration	**12**	CO3	4.5
V	**Policy, Economics, and Future Trends** Renewable energy policies and incentives, Economic analysis and sustainability assessment, Emerging technologies and future perspectives	**12**	CO4	2.3

Recommended Textbooks:

1. Renewable Energy: Power for a Sustainable Future by Godfrey Boyle
2. Fundamentals of Renewable Energy Processes by Aldo V. da Rosa
3. Solar Engineering of Thermal Processes by John A. Duffie and William A. Beckman

Additional Resources:

- Research papers, case studies, and government reports on renewable energy advancements.
- Software tools for system design and simulation (e.g., HOMER, RETScreen)

CO PO Mapping		
SN	**Course Outcome (CO)**	**Mapped Program Outcome**
1	Explain the scientific principles behind renewable energy sources.	**1,2, 3,4**
2	Apply mathematical and engineering principles to design renewable energy systems	**5, 6, 7**
3	Assess the feasibility and performance of renewable energy projects.	**3,4,5**
4	Discuss the environmental, economic, and social implications of renewable energy.	**1,2,3**