Faculty of Engineering & Technology

Syllabus

For

Bachelor of Technology (B. Tech.)

in

Civil Engineering

(Program Code: ET0141CE)

(2022-23)

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1. INTRODUCTION

The quality of technical education should be improved in such a manner that engineering graduates are able to compete globally in terms of their knowledge and skills and serve for the society and nation. And for this purpose Learning Outcome-based Curriculum Framework (LOCF) is developed.

Incorporation of Learning Outcome-based Curriculum Framework (LOCF) in the Graduate program like B. Tech. makes it student-centric, interactive and outcome-oriented to achieve well-defined aims, objectives and goals. The learning outcomes are attained by students through development of skills acquired during the program of study by providing them practical exposure. Program learning outcomes will include subject-specific skills and generic skills, including transferable global skills and competencies. It would also focus on knowledge and skills that prepare students for further study, employment and society development. LOCF help ensure comparability of learning levels and academic standards across colleges/universities.

At present, the goal of technical education may be achieved using the following measures:

i. Curriculum reform based on learning outcome-based curriculum framework (LOCF).
ii. Improving learning environment and academic resources.
iii. Elevating the quality of teaching and research.
iv. Involving students in discussions, problem-solving and out of box thinking about various ideas and their applicability, which may lead to empowerment and enhancement of the social welfare.
v. Motivating the learners to understand various concepts of their educational program keeping in view the regional context.
vi. Enabling learners to create research atmosphere in their colleges/ institutes/ universities.
vii. Teach courses based on Choice Based Credit System (CBCS).

2. LEARNING OUTCOME-BASED APPROACH TO CURRICULUM PLANNING

The Bachelor of Technology (B. Tech.) degree is awarded to the students on the basis of knowledge, understanding, skills, values and academic achievements. Hence, the learning outcomes of this program are aimed at facilitating the learners to acquire these attributes, keeping in view of their preferences and aspirations for knowledge.

The course for B. Tech. is designed according to outcome based approach in the light of graduate attributes, description of qualifications, courses and program learning outcomes. It may lead to all round development and delivery of complete curriculum planning. Hence, it provides specific guidelines to the learners to acquire sufficient knowledge during this program.

The program has been planned in such manner that there is scope of flexibility and innovation in

i. Modifications of prescribed syllabi.

ii. Teaching-learning methodology.

iii. Assessment technique of students and knowledge levels.

iv. Learning outcomes of courses.

v. Addition of new elective courses subject to availability of experts in colleges/institutes/universities across the country.

2.1. Nature and Extent of Undergraduate Program

As a part of effort to enhance employability of engineering graduates the outcomes based curriculum are very essential in present day perspective. Therefore, higher education degrees must formulate Graduate Attributes (GAs), qualification descriptors, learning outcomes and course learning outcomes which will help in curriculum planning and development in the form of design and delivery of courses. The overall formulation of the degree program must equip learner to have competencies to provide deliverables to the industry.

2.2. Aims of undergraduate program (B. Tech.)

The overall aims of B. Tech. program are to:

ii. Create deep interest in Practical learning.Develop broad and balanced knowledge and understanding of definitions, concepts and principles.

iii. Familiarize the students with suitable tools related to designing, modeling etc.

iv. Enhance the ability of learners to apply the knowledge and skills acquired by them during the program to solve specific problems of their courses.

v. Provide learners sufficient knowledge and skills enabling them to undertake higher studies in technical field.

vi. Encourage the students to develop a range of generic skills helpful in employment, internships and social activities.

2.3. Motive behind curriculum planning and development

The committee considered and discussed the following factors for LOCF for the graduates:

1) Framing of syllabi
2) Learners attributes
3) Qualification descriptors
4) Program learning outcomes
5) Course learning outcomes
6) Necessity of having elective courses
7) Academic standards

3. PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

The program educational objectives are set in line with Institutional and Departmental mission statements. The program educational objectives of Bachelor of Technology is to produce engineers who later take the responsibility of engineering professionals and researchers with following qualities:

- **PEO1.** Apply basic knowledge of mathematics, principles of physics and chemistry, and interdisciplinary engineering for the design and development.
- **PEO2.** Demonstrate the application of exploration practices and engineering principles through development of innovative tools that are beneficial in production.
- **PEO3.** Exhibit skills of design and construct machineries based on requirement and need of Technology operations.
- **PEO4.** Exhibit strong, independent learning, analytical and problem solving skills with special emphasis on design, communication, and ability to work in teams.
- **PEO5.** To have successful career as engineering professional or a researcher through lifelong learning in the field of Bachelor of Technology.

4. GRADUATION ATTRIBUTES (GAs)

The graduate attributes in B. Tech. are the summation of the expected course learning outcomes mentioned in the end of each course. Some of them are stated below.

GA1: Discipline-specific Knowledge: Capability of demonstrating comprehensive knowledge of B. Tech. program and understanding of core branch so that it forms a foundation for a graduate program of study.

GA2: Critical Thinking & Analytical Reasoning: Ability to employ critical thinking in understanding the concepts relevant to the various branches of engineering. Ability to analyze the results and apply them in various problems appearing in different streams.

GA3: Problem Solving: Capability to solve problems by using research-based knowledge and research methods including innovative thinking, design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

GA4: Research-related skills: To develop a sense of inquiry and capability for asking relevant and intelligent questions, problem identification, synthesizing and articulating; ability to recognize and establish cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.

GA5: Usage of Modern Tools (Information/digital literacy): To create, select, and apply appropriate techniques, resources, and modern science and IT tools including prediction and modeling to complex science activities with an understanding of the limitations.

GA6: Social Responsibilities: Ability to work with contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

GA7: Self-directed learning with environment: Ability to work independently and doin-depth study of various problems and requirements of society with natural available resources which leads to sustainable development.

GA8. Moral and ethical awareness/reasoning: Ability to identify unethical behavior such as falsification or misrepresentation of data and adopting objective, unbiased and truthful actions in all aspects of their program.

GA9. Leadership Readiness/Qualities: Capability for mapping out the tasks in a team or an organization, self-motivating and inspiring team members to engage with the team objectives/vision; and using management skills to follow the mapped path to the destination in a smooth and efficient way.

GA10: Communication skills:

a. Ability to communicate various concepts of technical education effectively using practical approach and their geometrical visualizations.

b. Ability to use courses as a precise language of communication in other branchesof human knowledge.

c. Ability to resolve unsolved problems and requirements of industries and societies.

d. Ability to show the importance of their technical knowledge as precursor to various scientific developments since the beginning of the civilization.

GA11: Project Management and Finance: Ability to 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

GA12: Lifelong learning: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.

5. QUALIFICATION DESCRIPTORS (QDs)

The qualification descriptor suggests the generic outcomes and attributes to be obtained while obtaining the degree of B. Tech. The qualification descriptors indicate the academic standards on the basis of following factors:

1. Level of knowledge
2. Understanding
3. Skills
4. Competencies and attitudes
5. Values.

These parameters are expected to be attained and demonstrated by the learners after becoming graduates in this program. The learning experiences and assessment procedures should be so designed that every graduate may achieve the program learning outcomes with equal opportUnity irrespective of the class, gender, commUnity and regions. Each graduate in engineering should be able to:

I. Demonstrate fundamental systematic knowledge and its applications. It should also enhance the subject specific knowledge and help in creating jobs in various sectors.

II. Demonstrate educational skills in areas of their program.

III. Apply knowledge, understanding and skills to identify the difficult/unsolved problems in courses of their program and to collect the required information in possible range of sources and try to analyze and evaluate these problems using appropriate methodologies.

IV. Apply one's disciplinary knowledge and skills in newer domains and uncharted areas.

V. Identify challenging problems and obtain well-defined solutions.

VI. Exhibit subject-specific transferable knowledge relevant to job trends and employment opportUnities.

6. PROGRAM OUTCOMES (PO)

Students graduating with the B. Tech. degree should be able to acquire with following PLOs

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

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

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

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

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

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

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

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

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

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

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

PO12. **Lifelong 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.

Mapping of Graduate Attributes (GAs) and Program Outcomes (POs):

PO/GA	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
PO1	■											
PO2		■										
PO3			■									
PO4				■								
PO5					■							
PO6						■						
PO7							■					
PO8								■				
PO9									■			
PO10										■		
PO11											■	
PO12												■

7. PROGRAM SPECIFIC OUTCOMES (PSO's) :

PSO1: Professionally empowering the student as technical manpower in industry or an entrepreneur for production analytics and innovation.

PSO2: Able to excel in various technological challenges and contribute for self-reliant society.

8. TYPE OF COURSES

Courses in a program may be of four kinds: Core, Elective, Ability Enhancement and Skill Enhancement.

a) Core Course:-

There may be a Core Course in every semester. This is the course which is to be compulsorily studied by a student as a requirement to complete the program in a said discipline of study.

b) Elective Course:-

Elective course is a course which can be chosen from a pool of papers. It may be

1) Supportive to the discipline of study
2) Providing an expanded scope
3) Enabling an exposure to some other discipline/domain
4) Nurturing student's proficiency/skill.

An Elective Course may be 'Discipline Centric/Specific' & Generic Elective

Discipline Centric/Specific Elective (DSE): Elective courses offered under the main discipline/subject of study are referred to as Discipline Centric/Specific.

Generic/Open Elective (GE): An elective course chosen from an unrelated discipline/subject is called Generic/Open Elective. These electives will be focusing on those courses which add generic proficiency of students.

c) Ability Enhancement Compulsory Courses (AECC):-

AECC courses are based upon the content that leads to knowledge enhancement, for example: English Communication, Environment Science/ Studies, etc.

d) Skill Enhancement Courses (SEC):-

SEC Courses provide value based and/or skill based knowledge and may content both Theory and Lab/Training/Field Work. The main purpose of these courses is to provide students life- skills in hands- on mode so as to increase their employability.

2. List of Course

a) Core Course:-

- Engineering Mathematics-I
- Engineering Physics
- Engineering Physics Lab
- Engineering Mathematics-II
- Engineering Chemistry
- Engineering Chemistry Lab
- Advance Engineering Mathematics-I
- Engineering Mechanics
- Surveying
- Fluid machanics
- Buliding materil counstruction

- Engineering geology
- Surveying Lab
- Fluid Mechanics Lab
- Computer Aided Civil Engineering Drawing
- Civil Engineering Materials Lab
- Geology Lab
- Industrial Training
- Probability and Sampling Theory
- Strength Of Materials
- Hydraulics Engineering
- Building Planning
- Concrete Technology
- Material Testing Lab
- Hydraulics Engineering Lab
- Building Drawing
- Concrete Lab
- Sketch Up 3D Lab
- Construction Technology and Equipment
- Structure Analysis-I
- Design of Concrete Structures
- Geotechnical Engineering
- Water Resource Engineering
- Concrete Structures Design Lab
- Geotechnical Engineering Lab
- Water Resources Engineering Design Lab
- Python Lab
- Industrial Training
- Wind & Seismic Analysis
- Structural Analysis-II
- Environmental Engineering
- Design of Steel Structures
- Estimating & Costing
- Research writing & Ethics
- Environmental Engineering Design and Lab
- Steel Structure Design Lab
- Quantity Surveying and Valuation Lab
- Water and Earth Retaining Structures Design Lab
- Foundation Design Lab
- Transportation Engineering
- Road Material Testing Lab
- Professional Practices & Field Engineering Lab
- Practical Training

- Seminar
- Project Planning and Construction Management
- Project Planning and Construction Management lab
- Pavement Design
- Project

b) Elective Course:-

- Basic Electrical Engineering
- Basic Civil Engineering
- Basic Electrical Engineering Lab
- Basic Civil Engineering Lab
- Air & Noise Pollution and Control
- Disaster Management
- Town Planning
- Machine Learning
- Machine Learning LAB
- Repair and Rehabilitation of Structures
- Ground Improvement Techniques
- Energy Science and Engineering
- Pre-Stressed Concrete
- Solid and Hazardous Waste Management
- Traffic Engineering and Management
- Bridge Engineering
- Rock Engineering
- Geographic Information System & Remote Sensing
- Human Engineering and Safety
- Environmental Engineering and Disaster Management
- Non Destructive Testing

c) Ability Enhancement Compulsory Courses (AECC):-

- Communication Skills
- ANANDAM
- Human Values
- Advanced English
- Human Values Activities
- Managerial Economics & Financial Accounting
- Professional Skills
- Environmental Studies
- Object Oriented Programming
- Object Oriented Programming Lab
- Leadership & Management Skills

- Technical Communication

d) Skill Enhancement Courses (SEC):-

- Programming for Problem Solving
- Language Lab
- Computer Programming Lab
- Computer Aided Engineering Graphics
- Basic Mechanical Engineering
- Manufacturing Practices Workshop
- Computer Aided Machine Drawing
- Basic Electronics for Civil Engineering Applications
- Professional Skills
- Leadership & Management Skills
- Soft Skill Lab
- Energy Management
- Waste And By Product Utilization
- Disaster Management

Computation of Workload:

Lecture (L) : 1 Credit = 1 Theory period of one hour duration
Tutorial (T) : 1 Credit = 1 Tutorial period of one hour duration
Practical (P) : 1 Credit = 1 Practical period of two hour duration

9. PROGRAM STRUCTURE B. Tech. (Common for All)

Semester - I

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC101	Engineering Mathematics-I	Core	30	70	100	3	1	-	4
BTBSC102	Engineering Physics	Core	30	70	100	3	1	-	4
BTHSMC103	Communication Skills (Jeevan Kaushal-I)	AECC	30	70	100	2	-	-	2
BTESC104	Programming for Problem Solving	SEC	30	70	100	3	-	-	3
BTESC 105	Basic Civil Engineering	Elective	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC106	Engineering Physics Lab	Core	30	20	50	-	-	1	1
BTHSMC107	Language Lab	SEC	30	20	50	-	-	1	1
BTESC108	Computer Programming Lab	SEC	30	20	50	-	-	1	1
BTESC 109	Basic Civil Engineering Lab	Elective	30	20	50	-	-	1	1
BTESC110	Computer Aided Engineering Graphics	SEC	30	20	50	-	-	1	1
BTSODECA11	Social Outreach, Discipline & Extra Curricular Activities		**50**		50	-	-	-	1
BTBSC 112	ANANDAM	AECC	**50**	**50**	100	**1**		**1**	2
	Total		**400**	**500**	**900**	**14**	**2**	**6**	**23**

Semester - II

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 201	Engineering Mathematics-II	Core	30	70	100	3	1	-	4
BTBSC 202	Engineering Chemistry	Core	30	70	100	3	1	-	4
BTHSMC203	Human Values	AECC	30	70	100	2	-	-	2
BTESC204	Basic Mechanical Engineering	SEC	30	70	100	2	-	-	2
BTESC205	Basic Electrical Engineering	Elective	30	70	100	2	-	-	2
BTHSMC206	Environment Studies	AECC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC 207	Engineering Chemistry Lab	Core	30	20	50	-	-	1	1
BTHSMC208	Human Values Activities	AECC	30	20	50	-	-	1	1
BTESC209	Manufacturing Practices Workshop	SEC	30	20	50	-	-	1	1
BTESC210	Basic Electrical Engineering Lab	Elective	30	20	50	-	-	1	1
BTESC211	Computer Aided Machine Drawing	SEC	30	20	50	-	-	1	1
BTSODECA212	Social Outreach, Discipline & Extra Curricular Activities		50	-	50	-	-	-	1
BTBSC 213	ANANDAM	AECC	**50**	**50**	100	**1**	**-**	**1**	**2**
	Total		**430**	**570**	**1000**	**15**	**2**	**6**	**24**

Semester - III

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCEBSC 301	Engineering Mathematics–III	Core	30	70	100	3	0	-	3
BTCEHSMC302	Object Oriented Programming	AECC	30	70	100	3	0	-	3
BTCEESC 303	Engineering Mechanics	Core	30	70	100	3	-	-	3
BTCEPCC 304	Surveying	Core	30	70	100	3	-	-	3
BTCEPCC 305	Fluid Mechanics	Core	30	70	100	3	-	-	3
BTCEPCC 306	Building Materials and Construction	Core	30	70	100	3	-	-	3
BTCEPCC 307	Engineering Geology	Core	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCEPCC 308	Surveying Lab	Core	30	20	50	-	-	1	1
BTCEPCC 309	Fluid Mechanics Lab	Core	30	20	50	-	-	1	1
BTCEPCC 310	Computer Aided Civil Engineering Drawing	Core	30	20	50	-	-	1	1
BTCEPCC 311	Civil Engineering Materials Lab	Core	30	20	50	-	-	1	1
BTCEPCC 312	Geology Lab	Core	30	20	50	-	-	1	1
BTCEPCC 313	Object Oriented Programming Lab	AECC	30	20	50	-	-	-	1
BTCESODECA 314	Social Outreach, Discipline & Extra Curricular Activities		**50**		50	-	-	--	**1**
BTBSC 315	ANANDAM	AECC	**50**	**50**	100	**1**		**1**	**2**
	Total		**490**	**660**	**1150**	**22**	**0**	**6**	**30**

Semester - IV

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCEBSC401	Probability and Sampling Theory	Core	30	70	100	3	-	-	3
BTCEHSMC402	Managerial Economics & Financial Accounting/ Technical Communication	AECC	30	70	100	3	-	-	3
BTCEESC403	Basic Electronics for Civil Engineering Applications	SEC	30	70	100	3	-	-	3
BTCEPCC404	Strength Of Materials	Core	30	70	100	3	-	-	3
BTCEPCC405	Hydraulics Engineering	Core	30	70	100	3	-	-	3
BTCEPCC406	Building Planning	Core	30	70	100	3	-	-	3
BTCEPCC407	Concrete Technology	Core	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCEPCC 408	Material Testing Lab	Core	30	20	50	-	-	1	1
BTCEPCC 409	Hydraulics Engineering Lab	Core	30	20	50	-	-	1	1
BTCEPCC 410	Building Drawing	Core	30	20	50	-	-	1	1
BTCEPCC 411	Sketch Up 3D Lab	Core	30	20	50	-	-	1	1
BTCEPCC 412	Concrete Lab	Core	30	20	50	-	-	1	1
BTCESODECA 413	Social Outreach, Discipline & Extra Curricular Activities		50		50	-	-	-	1
BTBSC 414	ANANDAM	AECC	**50**	**50**	100	**1**	**-**	**1**	**2**
	Total		**460**	**640**	**1100**	**22**	**0**	**6**	**29**

Semester – V

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCEESC 501	Construction Technology and Equipment	Core	30	70	100	3	-	-	3
BTCEPCC 502	Structure Analysis-I	Core	30	70	100	3	-	-	3
BTCEPCC 503	Design of Concrete Structures	Core	30	70	100	3	-	-	3
BTCEPCC 504	Geotechnical Engineering	Core	30	70	100	3	-	-	3
BTCEPCC 505	Water Resource Engineering	Core	30	70	100	3	-	-	3
BTCEPEC 506A	Air & Noise Pollution and Control	Elective	30	70	100	3	-	-	3
BTCEPEC 506B	Disaster Management	Elective	30	70	100	3	-	-	3
BTCEPEC 506C	Town Planning	Elective	30	70	100	3	-	-	3
BTCEPEC 507A	Repair and Rehabilitation of Structures	Elective	30	70	100	3	-	-	3
BTCEPEC 507B	Ground Improvement Techniques	Elective	30	70	100	3	-	-	3
BTCEPEC 507C	Energy Science and Engineering	Elective	30	70	100	3	-	-	3
BTBSC 508	Professional Skills	SEC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCEPCC 509	Concrete Structures Design Lab	Core	30	20	50	-	-	1	1
BTCEPCC510	Geotechnical Engineering Lab	Core	30	20	50	-	-	1	1
BTCEPCC 511	Water Resources Engineering Design Lab	Core	30	20	50	-	-	1	1
BTCEPCC 512	Python Lab	Core	30	20	50	-	-	1	1
BTCESODECA 513	Social Outreach, Discipline & Extra Curricular Activities		50		50	-	-	1	1
BTBSC 514	ANANDAM	AECC	**50**	**50**	100	**1**	**-**	**1**	**2**
	Total		**460**	**690**	**1150**	**24**	**0**	**6**	**30**

Semester –VI

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCEESC 601	Wind & Seismic Analysis	Core	30	70	100	3	-	-	3
BTCEPCC 602	Structural Analysis-II	Core	30	70	100	3	-	-	3
BTCEPCC 603	Environmental Engineering	Core	30	70	100	3	-	-	3
BTCEPCC 604	Design of Steel Structures	Core	30	70	100	3	-	-	3
BTCEPCC 605	Estimating & Costing	Core	30	70	100	3	-	-	3
BTCEPEC 606A	Pre-Stressed Concrete	Elective	30	70	100	3	-	-	3
BTCEPEC 606B	Solid and Hazardous Waste Management	Elective	30	70	100	3	-	-	3
BTCEPEC 606C	Traffic Engineering and Management	Elective	30	70	100	3	-	-	3
BTCEPEC 607A	Machine Learning	Elective	30	70	100	3	-	-	3
BTCEPEC 607B	Rock Engineering	Elective	30	70	100	3	-	-	3
BTCEPEC 607C	Geographic Information System & Remote Sensing	Elective	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCEPCC 608	Environmental Engineering Design and Lab	Core	30	20	50	-	-	1	1
BTCEPCC 609	Steel Structure Design Lab	Core	30	20	50	-	-	1	1
BTCEPCC 610	Quantity Surveying and Valuation Lab	Core	30	20	50	-	-	1	1
BTCEPCC 611	Water and Earth Retaining Structures Design Lab	Core	30	20	50	-	-	1	1
BTCEPCC 612	Machine Learning Lab	Core	30	20	50	-	-	1	1
BTCESODECA 613	Social Outreach, Discipline & Extra Curricular Activities		50		50	-	-	-	1
BTBSC 614	ANANDAM	AECC	**50**	**50**	100	**1**	**-**	**1**	**2**
	Total		**460**	**640**	**1100**	**22**	**0**	**6**	**29**

Semester – VII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCEPCC701	Transportation Engineering	Core	30	70	100	3	-	-	3
BTCEPEC702A	Human Engineering and Safety	Elective	30	70	100	3	-	-	3
BTCEPEC702B	Environmental Engineering and Disaster Management	Elective	30	70	100	3	-	-	3
BTCEPEC702C	Non Destructive Testing	Elective	30	70	100	3	-	-	3
BTCEPCC703	Geographic information system & remote sensing	Core	30	70	100	3	-	-	3
BTCEPCC704	Pre-stressed concrete	Core	30	70	100	3	-	-	3
BTEESEC705	Research and Publication Ethics	Core	30	70	100	3	-	-	3
BTBSC 706	Leadership & Management Skills	SEC	30	70	100	2			2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCEPCC707	Road Material Testing Lab	Core	30	20	50	-	-	1	1
BTCEPCC708	Professional Practices & Field Engineering Lab	Core	30	20	50	-	-	1	1
BTCEPSIT709	Practical Training	Core	60	40	100	2	-	-	2
BTCEPCC710	Seminar	Core	60	40	100	2	-	-	2
BTCESODECA711	Social Outreach, Discipline & Extra Curricular Activities		**50**	**-**	50	**-**	**-**	**-**	**1**
BTBSC 712	ANANDAM	AECC	**50**	**50**	100	**1**		**1**	**2**
	Total		**460**	**590**	**1050**	**22**	**0**	**3**	**26**

Semester – VIII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCEPCC801	Project Planning and Construction Management	Core	30	70	100	3	-	-	3
BTCEPEC802A	Energy Management	Elective	30	70	100	3	-	-	3
BTCEPEC802B	Waste And By Product Utilization	Elective	30	70	100	3	-	-	3
BTCEPEC802C	Disaster Management	Elective	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCEPCC803	Project Planning and Construction Management lab	Core	30	20	50	-	-	1	1
BTCEPCC804	Pavement Design	Core	30	20	50	-	-	1	1
BTCEPSIT805	Project	Core	210	140	350	3	-	4	7
BTCESODECA806	Social Outreach, Discipline & Extra Curricular Activities		50		50	-	-	1	1
BTBSC 807	ANANDAM	AECC	50	50	100	1	-	1	2
	Total		430	370	800	10	-	8	18

Note:

- A student is required to obtain min. 40% marks in individual paper to pass.
- The total credit of B.Tech. (CE) Programme is 209. However, the minimum credit required for award of degree shall be 203.
- The credit relaxation will be applicable only on the elective course from different semester (i.e. the student can opt out only elective subject).
- Out of the total credits, 20% of the credits may be earned by the student through MOOCs (SWAYAM, NPTEL, Coursera etc.). However, the choice of online courses to be approved in advance by Dean/ HoD and Coordinator SWAYAM keeping in view the latest guidelines of the UGC/ respective regulatory body guidelines.

10. COURSE-WISE LEARNING OBJECTIVES, STRUCTURES AND OUTCOMES (CLOSOs)

PROGRAM STRUCTURE B. Tech. (Common for All)

Semester - I

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC101	Engineering Mathematics-I	Core	30	70	100	3	1	-	4
BTBSC102	Engineering Physics	Core	30	70	100	3	1	-	4
BTHSMC103	Communication Skills (Jeevan Kaushal-I)	AECC	30	70	100	2	-	-	2
BTESC104	Programming for Problem Solving	SEC	30	70	100	3	-	-	3
BTESC 105	Basic Civil Engineering	Elective	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC106	Engineering Physics Lab	Core	30	20	50	-	-	1	1
BTHSMC107	Language Lab	SEC	30	20	50	-	-	1	1
BTESC108	Computer Programming Lab	SEC	30	20	50	-	-	1	1
BTESC 109	Basic Civil Engineering Lab	Elective	30	20	50	-	-	1	1
BTESC110	Computer Aided Engineering Graphics	SEC	30	20	50	-	-	1	1
BTSODECA11	Social Outreach, Discipline & Extra Curricular Activities		**50**		50	-	-	-	1
BTBSC 112	ANANDAM	AECC	**50**	**50**	100	**1**		**1**	2
	Total		**400**	**500**	**900**	**14**	**2**	**6**	**23**

BTBSC101: Engineering Mathematics-I

Course Objectives:

- To familiarize the prospective engineers with techniques in calculus, multivariate analysis and differential equations.
- To equip the students with standard concepts and tools at an intermediate to advanced level
- To understand Vector Calculus with three important theorems.

Course Content:

Unit I: Differential Calculus:

Partial derivatives, directional derivatives, total derivative, Jacobians and properties. Leibnitz's Rule of differentiation under integral sign. Maxima And Minima , saddle points; Method of Lagrange multipliers,

Unit II: Integral Calculus:

Improper integrals (Beta and Gamma functions), Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals (Cartesian), change of order of integration Change of variables (Cartesian to), areas and volumes by double integration, Triple integrals (Cartesian), Simple applications

Unit III: Differential Equations:

First Order and First degree ordinary differential equations: Linear and Bernoulli's equations, Exact equations, Linear Differential Equations of Higher order with constant coefficients.

Unit IV: Differential equations with variable Coefficients:

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy- Euler equation; Power series solutions including Legendre differential equation and Bessel differential equations.

Unit V: Vector Calculus:

Scalar line integrals, vector line integrals, scalar surface integrals, surface integrals, Theorems of Green, Gauss and Stokes.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwinkreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. F201
3. Veerarajan T., Engineering Mathematics for firstyear, Tata Mc Graw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata Mc Graw Hill New Delhi, 11th Reprint, 2010.
5. N.P. Baliand Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Apply the Concepts of the differential calculus.
CO2:	Understand the calculation and Applications of Multi variable integrals.
CO3:	Understand and apply the concept of differential equations with constant coefficients.
CO4:	Understand and apply the concept of differential equations with variable coefficients and power series.
CO5:	Understand and apply the concept of vector calculus.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO4	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO5	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	CO1, CO2, CO4, CO5
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTBSC102: Engineering Physics

Course Objective:

- To understand the concepts of interference, Diffraction and Polarization.
- To know about wave particle duality.
- To know applications of Optical fibre.
- To know applications of Lasers in Science, engineering and medicine.
- To know classification of Solid.

Course Contents:

Unit I: Wave Optics

Newton's Rings, Michelson's Interferometer, Fraunhofer Diffraction from a Single Slit. Diffraction grating: Construction, theory and spectrum, Resolving power and Rayleigh criterion for limit of resolution, Resolving power of diffraction grating, X-Ray diffraction and Bragg's Law.

Unit II: Quantum Mechanics

Introduction to quantum Mechanics, Wave-particle duality, Matter waves, Wave function and basic postulates, Time dependent and time independent Schrodinger's Wave Equation, Physical interpretation of wave function and its properties, Applications of the Schrodinger's Equation: Particle in one dimensional and three dimensional boxes.

Unit III: Coherence and Optical Fibers

Spatial and temporal coherence: Coherence length; Coherence time and 'Q' factor for light, Visibility as a measure of Coherence and spectral purity, Optical fiber as optical wave guide, Numerical aperture; Maximum angle of acceptance and applications of optical fiber.

Unit IV: Laser

Einstein's Theory of laser action; Einstein's coefficients; Properties of Laser beam, Amplification of light by population inversion, Components of laser, Construction and working of He-Ne and semiconductor lasers, Applications of Lasers in Science, engineering and medicine.

Unit V: Material Science & Semiconductor Physics

Bonding in solids: covalent and metallic bonding, Energy bands in solids: Classification of solids as Insulators, Semiconductors and Conductors, Intrinsic and extrinsic semiconductors, Fermi dirac distribution function and Fermi energy, Conductivity in semiconductors, Hall Effect: Theory, Hall Coefficient and applications.

References:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
7. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Guptaon NPTEL

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Enhance the basic skills required to understand, develop, and design various engineering applications involving Wave Optics.
CO2:	Understand Quantum Mechanics and apply them to diverse engineering problems.
CO3:	Analyze the nature of light propagation in guided medium for engineering applications and study in Coherence and Optical Fibers.
CO4:	Describe different Laser problems.
CO5:	Describe Material Science & Semiconductor Physics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	H	-	H	-	M	-	-	-	-	L	H	M
CO2	L3	H	H	H	H	-	M	-	-	-	-	-	-	M	M
CO3	L4	M	L	M	-	L	-	L	-	-	-	-	-	H	H
CO4	L2	H	M	H	H	M	-	M	L	-	L	-	L	H	M
CO5	L2	H	M	H	H	M	-	M	L	-	L	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	CO1, CO2, CO4, CO5
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTHSMC103 Communication Skills

Course Objectives:

- To identify common communication problems that may be holding learners back
- To identify what their non-verbal messages are communicating to others
- To understand role of communication in teaching-learning process
- To learn to communicate through the digital media
- To understand the importance of empathetic listening

Course Contents

Unit I Listening

Techniques of effective listening, Listening and comprehension, Probing questions, Barriers to listening

Unit II Speaking andNon-verbal communication

Speaking: Pronunciation, Enunciation, Vocabulary, Fluency, Common Errors

Meaning of non-verbal communication, Introduction to modes of non-verbal communication, Breaking the misbeliefs, Open and Closed Body language, Eye Contact and Facial Expression

Hand Gestures, Do's and Don'ts, Learning from experts, Activities-Based Learning

Unit III Reading

Techniques of effective reading, Gathering ideas and information from a given text: Identify the main claim of the text, Identify the purpose of the text, Identify the context of the text, Identify the concepts mentioned, Evaluating these ideas and information: Identify the arguments employed in the text, Identify the theories employed or assumed in the text, Interpret the text: To understand what a text says, To understand what a text does, To understand what a text means.

Unit IV Writing and different modes of writing

Clearly state the claims, Avoid ambiguity, vagueness, unwanted generalisations and oversimplification of issues, Provide background information, Effectively argue the claim, Provide evidence for the claims, Use examples to explain concepts, Follow convention, Be properly sequenced, Use proper signposting techniques, Be well structured: Well-knit logical sequence, Narrative sequence, Category groupings, Different modes of Writing: E-mails, Proposal writing for Higher Studies, Recording the proceedings of meeting: Any other mode of writing relevant for learners

Unit V **Digital Literacy and Effective use of Social Media**

Role of Digital literacy in professional life: Trends and opportUnities in using digital technology in workplace, Internet Basics, Introduction to MS Office tools: Paint, Office, Excel, PowerPoint

Introduction to social media websites, Advantages of social media, Ethics and etiquettes of social media, How to use Google search better, Effective ways of using Social Media, Introduction to Digital Marketing

Text Books:

1. Sen Madhucchanda (2010), *An Introduction to Critical Thinking*, Pearson, Delhi
2. Silvia P. J. (2007), *How to Read a Lot*, American Psychological Association, Washington DC

Suggested Readings:

1. Public Speaking, Michael Osborn and Suzanne Osborn, Biztantra
2. Handbook of Practical Communication Skills-Chrissie Wrought, published by Jaico Publishing House.

Course Outcomes:

COs	Statement
	After completion of this course, students will be able to:
CO1	Adapt effective listening skills
CO2	Learn and demonstrate effective speech.
CO3	Learn and demonstrate effective reading skills
CO4	Know and practice effective writing skills
CO5	Understand and recognize the importance of digital literacy and social media

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Levels	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L3	**L**	**M**	**L**	**-**	**-**	**-**	**-**	**M**	**H**	**H**	**M**	**-**	**-**	**-**
CO2	L3	**H**	**M**	**L**	**L**	**-**	**M**	**-**	**M**	**M**	**H**	**M**	**-**	**-**	**-**
CO3	L3	**-**	**H**	**M**	**M**	**-**	**L**	**-**	**-**	**M**	**H**	**M**	**-**	**-**	**-**
CO4	L3	**M**	**M**	**M**	**M**	**-**	**L**	**-**	**-**	**-**	**H**	**L**	**-**	**-**	**L**
CO5	L2	**L**	**L**	**M**	**L**	**M**	**-**	**-**	**-**	**L**	**M**	**-**	**-**	**-**	**L**

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1,CO2,CO3, CO4,CO5
CD3	Seminars	CO2,CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1, CO2,CO3, CO4
CD5	Industrial visit	CO5

BTESC104: Programming for Problem Solving

Course Objective:

- To learn the fundamentals of computers.
- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

Course Contents:

Unit I: Fundamentals of Computer:

Stored program architecture of computers, Storage device- Primarymemory, and Secondary storage, Random, Direct, Sequential access methods.

Unit II: Concepts of High-level, Assembly and Low-level languages,Representing algorithms through flowchart and pseudo code.

Unit III: Number system:

Data representations, Concepts of radix and representation ofnumbers in radix r with special cases of r=2, 8, 10 and 16 withconversion from radix r1 to r2, r's and (r-1)'s complement, Binaryaddition, Binary subtraction, Representation of alphabets.

Unit IV: C Programming:

Problem specification, flow chart, data types, assignment statements,input output statements, developing simple C programs, Ifstatement, for loops, while loops, do-while loops, switch statement,break statement, continue statement.

Unit V: Development of C programs using

Arrays, functions, parameter passing,recursion, Programming in C using these statements, Structures,files, pointers and multi file handling.

Text / Reference Books

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Know and understand the conventions of Fundamentals of Computer.
CO2:	Represent algorithms through flowchart and pseudo code.
CO3:	Learn Number system and apply these skills in developing new products.
CO4:	Understand and learn C Programming.
CO5:	Comprehend the Development of C programs using- Arrays, functions.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	**Bloom's Level**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**P0 11**	**PO 12**	**PSO1**	**PSO2**
CO1	L2	H	H	M	-	M	L	-	-	-	-	-	L	H	M
CO2	L2	H	H	M	L	M	L	-	-	-	L	-	L	M	M
CO3	L3	H	L	M	L	M	L	-	-	-	L	-	L	H	H
CO4	L2	M	H	L	M	H	-	-	-	-	M	-	M	H	M
CO5	L2	M	H	H	M	H	-	-	-	-	M	-	M	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTESC 105: Basic Civil Engineering

Course Objective:

- To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering.
- To provide students the significance of the Civil Engineering Profession in satisfying societal needs.

Course Contents:

Unit I **Introduction to objective, scope and outcome the subject**
Scope and Specialization of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.

Unit II **Buildings** Selection of site for Buildings, Layout of Building Plan, Types of buildings, Plinth area, carpet area, floor space index, Introduction to building byelaws, concept of sun light and ventilation. Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation.

Unit III **Transportation** Introduction to Transportation Engineering; Traffic and Road Safety: Types and Characteristics of Various Modes of Transportation; Various Road Traffic Signs, Causes of Accidents and Road Safety Measures

Unit IV **Surveying** Object, Principles & Types of Surveying; Site Plans, Plans& Maps; Scales & Unit of different Measurements. Linear Measurements: Instruments used. Linear Measurement by Tape, Ranging out Survey Lines and overcoming Obstructions; Measurements on sloping ground; Tape corrections, conventional symbols. Angular Measurements: Instruments used; Introduction to Compass Surveying,Bearings and Longitude & Latitude of a Line, Introduction to total station. Levelling: Instrument used, Object of leveling, Methods of leveling in brief, and Contour maps.

Unit V **Environment**
Environmental Pollution, Environmental Acts and Regulations**,** Air & Noise Pollution: Primary and Secondary air pollutants, Harmful effects of Air Pollution, Control of Air Pollution. Noise Pollution, Harmful Effects of noise pollution, control of noise pollution, Global warming& Climate Change, Ozone depletion, Green House effect

Text Books:

1. Gopi, S., Basic Civil Engineering, Pearson Publishers
2. Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house
3. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
4. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house

References Books:

1. Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England
2. Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England
3. McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services
4. Minu, S., Basic Civil Engineering, Karunya Publications

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Illustrate the fundamental aspects of Civil Engineering.
CO2:	Understand the scope of civil engineering.
CO3:	Explain the concepts of surveying for making horizontal and vertical measurements.
CO4:	Describe plan and set out of a building, also illustrate the uses of various building materials and explains the method of construction of different components of a building.
CO5:	Understand the modes of Traffic and Road Safety and Road Safety Measures

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	-	-	-	-	M	L	-	-	-	-	M	M	M
CO2	L2	H	M	M	L	-	M	L	-	-	L	-	L	M	M
CO3	L2	M	H	M	L	H	-	H	-	-	L	-	L	L	L
CO4	L2	M	H	M	L	H	-	H	-	-	L	-	L	M	M
CO5	L2	M	M	L	H	M	L	-	H	-	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO5
CD5	Industrial visit	CO3, CO4, CO5

BTBSC106: Engineering Physics Lab

Course Objective:

- To understand the concepts of interference.
- To know about wavelength of light.
- To know about depletion layer and band gap of semiconductor.
- To know dispersion of light through prism.
- To understand the concept of magnetic field.

LIST OF EXPERIMENTS:

1. To determine the wave length of sodium light by Newton's Ring.
2. To determine the wave length of monochromatic light with the help of Fresnel's Biprism.
3. To determine the wave length of prominent lines of mercury by plane diffraction grating with the help of spectrometer.
4. Determination of band gap using a P-N junction diode.
5. To determine the height of given object with the help of sextant.
6. To determine the dispersive power of material of a prism with the help of spectrometer.
7. To study the charge and discharge of a condenser and hence determine the time constant for which both current and voltage graphs are to be plotted.
8. To determine the coherence length and coherence time of laser using He – Ne laser.
9. To measure the numerical aperture of an optical fibre.
10. To study the variation of magnetic field at the center of coil using tangent galvanometer.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the usage of common Ammeter, Voltmeter and Multimeter.
CO2:	Deep learning of optical phenomenon such as Interference, diffraction and dispersion of light.
CO3:	Understand the usage of common electrical measuring instruments.
CO4:	Gain knowledge about the concept of optical fiber and Laser.
CO5:	Understand the usage of optical instruments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	-	H	-	M	-	-	H	-	L	H	L
CO2	L4	H	H	-	H	-	M	-	-	-	-	-	-	M	M
CO3	L2	M	L	-	-	L	-	L	-	-	L	-	-	M	L
CO4	L2	H	M	-	H	M	-	M	L	-	M	-	L	M	M
CO5	L2	H	M	-	H	M	-	M	L	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO1,CO2, CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTHSMC107: Language Lab

Course Objective:

- To understand concepts of basic English language fundamentals.
- To understand the communication skills.
- To develop Dialogue Writing and Listening comprehension.

Detailed Syllabus

1. Phonetic Symbols and Transcriptions.
2. Extempore.
3. Group Discussion.
4. Dialogue Writing.
5. Listening comprehension.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the Phonetic Symbols and Transcriptions.
CO2:	Understand the skills required in Extempore.
CO3:	Improve their communication skills for Group Discussion.
CO4:	Improve their technical communication skills.
CO5:	Understand Dialogue Writing and Listening skills.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	-	-	-	H	M	-	-	-	H	-	M	H	M
CO2	L2	M	-	-	-	-	M	-	-	H	H	-	L	M	L
CO3	L6	M	-	-	-	-	M	-	-	H	H	-	M	M	L
CO4	L6	M	-	-	-	M	M	-	-	-	H	-	M	M	M
CO5	L2	M	-	-	-	M	M	-	-	M	H	-	H	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO4,CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	-

BTESC 108: Computer Programming Lab

Course Objective(s):

- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

LIST OF EXPERIMENTS:

1. To learn about the C Library, Preprocessor directive, Input-outputstatement.
2. Programs to learn data type, variables, If-else statement
3. Programs to understand nested if-else statement and switch statement
4. Programs to learn iterative statements like while and do-while loops
5. Programs to understand for loops for iterative statements
6. Programs to learn about array and string operations
7. Programs to understand sorting and searching using array
8. Programs to learn functions and recursive functions
9. Programs to understand Structure and Union operation
10. Programs to learn Pointer operations
11. Programs to understand File handling operations
12. Programs to input data through Command line argument

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Learn about the C Library, Preprocessor directive, Input-output statement.
CO2:	Learn data type, variables, and conditional statement.
CO3:	Learn about array and string operations.
CO4:	Understand File handling operations.
CO5:	Learn programs related to C Programming and apply them to solve real world problems.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	H	-	-	M	L	-	-	-	L	-	L	M	L
CO2	L2	H	H	M	L	M	L	-	-	-	L	-	L	M	M
CO3	L2	H	L	M	L	M	L	-	-	-	L	-	L	H	M
CO4	L2	M	H	L	M	H	L	L	-	-	L	-	M	H	M
CO5	L3	M	H	H	M	H	M	L	-	-	M	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTESC 109: Basic Civil Engineering Lab

Course Objective(s):

- To Introduce The Various Activities Regarding Measurement And Leveling
- To Water Supply Procedure And Various Discharge And Pressure Measuring Apparatuses

LIST OF EXPERIMENTS:

1. Linear Measurement by Tape:
   a) Ranging and Fixing of Survey Station along straight line and across obstacles.
   b) Laying perpendicular offset along the survey line
2. Compass Survey: Measurement of bearing of linesusing Surveyor's and Prismatic compass
3. Levelling: Using Tilting/ Dumpy/ Automatic Level
   a) To determine the reduced levels in closed circuit.
   b) To carry out profile levelling and plot longitudinal and cross sections for road by Height of Instrument and Rise & Fall Method.
4. To study and take measurements using various electronic surveying instruments like EDM, Total Station etc.
5. To determine pH, hardness and turbidity of the given sample of water.
6. To study various water supply Fittings.
7. To determine the pH and total solids of the given sample of sewage.
8. To study various Sanitary Fittings.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Conduct survey and collect field data.
CO2:	Review field notes from survey data.
CO3:	Interpret survey data and compute areas and volumes.
CO4:	Describe Total station and measurement
CO5:	Describe various water fittings and find out the various fluids properties

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	L	L	L	H	M	L	-	L	L	-	M	H	M
CO2	L2	H	M	M	M	-	M	L	-	L	M	-	L	M	L
CO3	L4	M	H	M	H	H	M	H	-	L	H	-	L	L	H
CO4	L2	M	H	M	H	H	M	H	-	L	H	-	L	-	M
CO5	L2	M	M	L	H	M	M	-	-	L	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTESC110: Computer Aided Engineering Graphics

Course Objectives:

- To Increase ability to communicate with people
- To learn to sketch and take object dimensions.
- To learn to take data and transform it into graphic drawings.

Introduction: Principles of drawing, lines, type of lines, usage of Drawinginstruments, lettering, Conic sections including parabola, hyperbola, RectangularHyperbola (General method only); Scales-Plain, Diagonal and Vernier Scales.

Projections of Point & Lines: Position of Point, Notation System, SystematicApproach for projections of points, front view & Top view of point, Position ofstraight lines, line parallel to Both the RPs, Line perpendicular to either of the RPs,Line inclined to one RP and parallel to the other, Line inclined to Both the RPs,Traces of a line (One drawing sheet, one assignment in sketch book).

Projection of Planes: Positions of planes, Terms used in projections of planes,plane parallel to RP, plane inclined to one RP and perpendicular to the other RP,plane perpendicular to Both the RPs, plane Inclined to Both the RPs, True shape ofthe plane, Distance of a point from plane, Angle between two planes.

Projections of Regular Solids: frustum and truncated solids, those inclined toboth the Planes-Auxiliary Views.

Section of Solids: Theory of sectioning, section of prisms and cubes, section ofpyramids and Tetrahedron section of Cylinders, section of cones, section ofspheres (One drawing sheet, one assignment in sketch book)

Overview of Computer Graphics : Covering theory of CAD software [such as: Themenu System, Toolbars (standard, Object Properties, Draw, Modify andDimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialogboxes and windows, Shortcut menus (Button Bars), Command Line (whereapplicable), The Status Bar, Different methods of zoom as used in CAD, Select anderase objects.: Isometric Views of lines, Planes, Simple and compound Solids.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Know and understand the conventions and the method of engineering drawing.
CO2:	Interpret engineering drawings using fundamentals of different views to construct basic and intermediate geometry.
CO3:	Know the Theory of sectioning and Section of Solids.
CO4:	Comprehend the theory of projection.
CO5:	Improve their drawing skill in the form of Computer Graphics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	L	M	L	L	-	-	L	M	-	L	L	M
CO2	L4	H	M	L	M	L	L	-	-	-	M	-	L	L	M
CO3	L1	H	M	L	M	L	L	-	-	L	M	-	L	L	L
CO4	L2	H	H	M	H	L	L	-	-	L	H	-	M	M	M
CO5	L2	H	M	M	M	L	L	-	-	L	M	-	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO2
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	CO5

BTSODECA111: Social Outreach, Discipline & Extra Curricular Activities

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Develop their self-confidence, leadership qualities, and their responsibilities towards the commUnity.
CO2:	Have an impact on academic development, personal development, and civic responsibility
CO3:	Understand the value of Social Work.
CO4:	Understand the Significance of Discipline in student's Life
CO5:	Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PS O1	PS O2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

BTBSC 112: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of CommUnity based motivation videos, CommUnity based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

Semester - II

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 201	Engineering Mathematics-II	Core	30	70	100	3	1	-	4
BTBSC 202	Engineering Chemistry	Core	30	70	100	3	1	-	4
BTHSMC203	Human Values	AECC	30	70	100	2	-	-	2
BTESC204	Basic Mechanical Engineering	SEC	30	70	100	2	-	-	2
BTESC205	Basic Electrical Engineering	Elective	30	70	100	2	-	-	2
BTHSMC206	Environment Studies	AECC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC 207	Engineering Chemistry Lab	Core	30	20	50	-	-	1	1
BTHSMC208	Human Values Activities	AECC	30	20	50	-	-	1	1
BTESC209	Manufacturing Practices Workshop	SEC	30	20	50	-	-	1	1
BTESC210	Basic Electrical Engineering Lab	Elective	30	20	50	-	-	1	1
BTESC211	Computer Aided Machine Drawing	SEC	30	20	50	-	-	1	1
BTSODECA212	Social Outreach, Discipline & Extra Curricular Activities		50	-	50	-	-	-	1
BTBSC 213	ANANDAM	AECC	**50**	**50**	100	**1**	**-**	**1**	**2**
	Total		**430**	**570**	**1000**	**15**	**2**	**6**	**24**

BTBSC201: Engineering Mathematics-II

Course Objective:

- To provide detailed of **matrices** which is applied for solving system of linear equations and useful in various fields of technology.
- To understand the course is an introduction to partial differential equations.
- To understand the various numerical methods and techniques used to find solutions to differential equations and linear programming problems.

Course Content:

Unit I: **Partial Differential Equations –**Linear Partial differential equations of First order, Lagrange's Form, Non Linear Partial Differential equations of first order, Charpit's method, Standard forms.Separation of variables method to solve the simple problems in Cartesian coordinates.

Unit II: **Linear Algebra:** Vectors and Matrices, Addition and Multiplication, Norms, Linear Independence, Linear Transformation, Bases, Dimensions, Inner Product, Rank, Inverse, Orthogonality, Matrix factorizations, Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations.

Unit III: **Linear Algebra:** Rank of matrix System of linear equations; Symmetric, skew symmetric and orthogonal matrices; Eigen values and Eigen vectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Unit IV: **Numerical Methods:** Finite differences, Relation between operators, Methods to solve algebraic and transcendental equations, numerical methods to solve ordinary differential equations, finite difference methods, Finite element method.

Unit V: **Linear Programming Problems:** Linear Programming Problems, Graphical Approach, simplex method, Assignment and Transportation problems

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9thEdit ion, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Determine the solutions to partial differential equations.
CO2:	Understand the concepts of vector space and linear transformations.
CO3:	Understand and to solve the matrices, Rank of a matrix, Eigen values and Eigen vectors, System of linear equations.
CO4:	Use various numerical methods and techniques to solve algebraic and differential equations.
CO5:	Understand and to solve linear programming problems.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO4	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO5	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	-
CD4	Project Discussions	-
CD5	Self- learning advice using internets	CO1,CO2,CO4,CO5

BTBSC202: Engineering Chemistry

Course Objective:

- To acquire the knowledge about impurities in water, their determination and purification.
- To learn about different types of fuel and lubricant and their applications.
- To gain the basic knowledge, applications and control methods of corrosion.
- To get the knowledge of preparation and significance of explosives, cement, refractories and glass.
- To get the knowledge of organic reaction mechanism and their uses with different types of drugs

Course Contents:

Unit I: Water

Common impurities, hardness, determination of hardness by complexometric (EDTA method), Degree of hardness, Units of hardness Municipal water supply: Requisite of drinking water, Purification of water; sedimentation, filtration, disinfection, breakpoint chlorination. Boiler troubles: Scale and Sludge formation, Internal treatment methods, Priming and Foaming, Boiler corrosion and Caustic embrittlement Water softening; Lime-Soda process, Zeolite (Permutit) process, Demineralization process. Numerical problems based on Hardness, EDTA, Lime-Soda and Zeolite process.

Unit II: Organic Fuels

Solid fuels: Coal, Classification of Coal, Proximate and Ultimate analyses of coal and its significance, Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter. Metallurgical coke, Carbonization processes; Otto-Hoffmann byproduct oven method. Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking, Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas, Determination of calorific value of gaseous fuels by Junker's calorimeter Numerical problems based on determination of calorific value (bomb calorimeter/Junkers calorimeter/Dulongs formula, proximate analysis & ultimate and combustion of fuel.

Unit III: Corrosion and its control

Definition and significance of corrosion, Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion. Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.

Unit IV: Engineering Materials

Portland Cement; Definition, Manufacturing by Rotary kiln. Chemistry of setting and hardening of cement. Role of Gypsum. Glass: Definition, Manufacturing by tank furnace, significance of annealing, Types and properties of soft glass, hard glass, borosilicate glass, glass wool, safety glass Lubricants: Classification, Mechanism, Properties; Viscosity and viscosity index, flash and fire point, cloud and pour point. Emulsification and steam emulsion number.

Unit V: Organic reaction mechanism and introduction of drugs

Organic reaction mechanism: Substitution; SN1, SN2, Elecrophilic aromatic substitution in benzene, free radical halogenations of alkanes, Elimination; elimination in alkyl halides, dehydration of alcohols, Addition: electrophilic and free radical addition in alkenes, nucleophilic addition in aldehyde and ketones, Rearrangement; Carbocation and free radical rearrangements Drugs : Introduction, Synthesis, properties and uses of Aspirin, Paracetamol

Suggested Text / Reference Books

1. Morrison R.T & Boyn R. N ; Organic Chemistry; Prentice Hall of India 1999
2. Lee J. D. ; Inorganic Chemistry ;Blackwell Science
3. Gopalan R., Venkappayya D., Nagarajan S. "Engineering Chemistry" Vikas Publishing House Pvt Ltd 2000.
4. Jain & Jain " Engineering Chemistry" Dhanpat Rai publishing company
5. Dara S. S. , " A Text Book of Engineering Chemistry" S. Chand and Company Ltd, 2008
6. Keeler J and Wolhess P, Why Chemical Reaction Happen Oxford Press.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Gain knowledge about impurities in water, their determination and purification.
CO2:	Understand organic fuels and various emerging new areas of organic chemistry.
CO3:	Learn about Corrosion and its control.
CO4:	Get knowledge about the chemistry of some Engineering Materials like Portland Cement.
CO5:	Understand and study Organic reaction mechanisms.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	-	M	-	-	-	-	-	-	M	-	H	M	M
CO2	L2	M	-	-	-	L	-	-	-	-	L	-	M	M	M
CO3	L1	M	-	-	-	-	-	-	-	-	L	-	M	M	L
CO4	L2	M	-	-	-	-	-	-	-	-	L	-	M	H	M
CO5	L2	M	-	-	-	-	-	-	-	-	-	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO1, CO5

BTHSMC203: Human Values

Course Objective:

- To Know the basic guidelines, content and Process for Value Education
- To develop understanding different Harmony concept.
- To understand professional ethics and natural acceptance of human values.

Course Contents:

Unit I: Course Introduction - Need, Basic Guidelines, Content andProcess for Value Education

Understanding the need, basic guidelines, Self Exploration – itscontent and process; 'Natural Acceptance' and Experiential Validation,Continuous Happiness and Prosperity- Human Aspirations, Rightunderstanding, Relationship and Physical Facilities,UnderstandingHappiness and Prosperity correctly- A critical appraisal of the currentscenario.Method to fulfill the above human aspirations: understanding andliving in harmony at various levels

Unit II: Understanding Harmony in the Human Being - Harmony in Myself

Understanding human being as a co-existence of the sentient 'I' andthe material 'Body'Understanding the needs of Self ('I') and 'Body' - Sukh and SuvidhaUnderstanding the Body as an instrument of 'I',Understanding thecharacteristics and activities of 'I' and harmony in 'I' Understandingthe harmony of I with the Body: Sanyam and Swasthya; correctappraisal of Physical needs, meaning of Prosperity in detail, Programsto ensure Sanyam and Swasthya.

Unit III: Understanding Harmony in the Family and Society- Harmony inHuman-Human Relationship

Understanding harmony in the Family, Understanding values inhuman-human relationship; meaning of Nyaya and program for itsfulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect(Samman) , meaning of Vishwas; Difference between intention and competence, meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, harmony in the society , Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals ,Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family.

Unit IV: Understanding Harmony in the Nature and Existence – Whole existence as Coexistence

Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting Units in allpervasive Space. Holistic perception of harmony at all levels of existence

Unit V: Implications of the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values

Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models. Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers. Case studies related to values in professional life and individual life.

Suggested Text / Reference Books

1. Gaur R.R., Sangal R. and. Bagaria, G.P: "A Foundation Course in Human Values Professional Ethics," Excel Books, 2010.
2. Sadri S & Sadri, J Business Excellence Through Ethics & Governance, 2ndedition, 2015.
3. Mathur, U C CorporateGovernance and business ethics,MacMillan India Ltd, 2009.
4. Baxi, C V: CorporateGovernance, Excel Books, 2009
5. Sadri S, Sinha A K and Bonnerjee, P: Business Ethics: concepts and cases, TMH, 1998.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand and analyze Basic Guidelines, Content and Process for Value Education.
CO2:	Understand Harmony in the Human Being - Harmony in Myself.
CO3:	Understand Harmony in the Family and Society- Harmony in Human-Human Relationship.
CO4:	Understand Harmony in the Nature and Existence – Whole existence as Coexistence.
CO5:	Understand of Harmony on Professional Ethics. Natural acceptance of human values.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	L	L	M	H	L	M	-	L	M	M
CO2	L2	-	-	-	-	-	L	M	M	M	M	-	L	M	M
CO3	L2	-	-	-	-	-	L	M	H	L	M	-	L	M	L
CO4	L2	-	-	-	-	L	L	L	M	M	L	L	H	M	M
CO5	L2	L	-	-	-	-	M	M	H	L	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	

BTESC 204: Basic Mechanical Engineering

Course Objectives:

- To Increase ability to understand machine working
- To Learn to understand fundamentals of mechanical systems
- To Learn to make different mechanical aspects of engineering

Course Contents:

Unit I: Fundamentals:

Introduction to mechanical engineering, concepts of thermalengineering, mechanical machine design, industrial engineering andmanufacturing technology.Steam Boilers classification and types of steam boilers and steamturbines. Introduction and Classification of power plants.

Unit II: Pumps and IC Engines:

Applications and working of Reciprocating and Centrifugal pumps.Introduction, Classification of IC Engines, Main Components of ICEngines, Working of IC Engines and its components.

Unit III: Refrigeration and Air Conditioning:

Introduction, classification and types of refrigeration systems andair-conditioning. Applications of refrigeration and Air-conditioning.

Unit IV: Transmission of Power:

Introduction and types of Belt and Rope Drives, Gears.

Unit V: Primary Manufacturing Processes:Metal Casting Process: Introduction to Casting Process, Patterns,Molding, Furnaces. Metal Forming Processes: Introduction toForging, Rolling, Extrusion, Drawing. Metal Joining Processes:Introduction to various types of Welding, Gas Cutting, Brazing, andSoldering.

Text Books:

- Agarwal C M, Agarwal Basant “Basic Mechanical Engineering” 2019

Reference Books

- Shanmugam G, Ravindran S “Basic Mechanical Engineering” TMH Publication , 2019
- Bansal R K “Basic Mechanical Engineering” Laxmi Publication 2019

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Know and understand the Fundamentals of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology.
CO2:	Understand the Refrigeration and Air Conditioning.
CO3:	Understand the Applications and working of Reciprocating and Centrifugal pumps.
CO4:	Know the Transmission of Power through Belt and Rope Drives, Gears.
CO5:	Understand of Primary Manufacturing Processes.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	L	M	L	-	-	-	-	M	-	L	M	M
CO2	L2	H	M	L	M	L	-	L	-	-	M	-	L	M	M
CO3	L2	H	L	L	L	M	-	-	-	-	L	-	L	M	M
CO4	L2	H	L	L	L	L	-	L	-	-	L	-	L	M	M
CO5	L2	M	L	L	L	-	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3,
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTESC205: Basic Electrical Engineering

Course Objective:

- To Understand the basic concept of Electrical engineering instruments for engineering applications.
- To Understand the basic electrical engineering parameters and their importance.
- To Understand the concept of various laws and principles associated with electrical systems.
- To Develop the knowledge to apply concepts in the field of electrical engineering, projects and research.

Course Contents:

Unit I: DC Circuits:

Electrical circuit elements (R, L and C), voltage and current sources,Kirchhoff current and voltage laws, Series-Parallel circuits, Nodevoltage method, Mesh current method, Superposition, Thevenin's,Norton's and Maximum power transfer theorems.

Unit II: AC Circuits:

Representation of sinusoidal waveforms, peak and r.m.s values,phasor representation, real power, reactive power, apparent power,power factor. Analysis of single-phase AC circuits consisting of R, L,C, RL, RC and RLC combinations (series and parallel), resonance.Three phase balanced circuits, voltage and current relations in starand delta connections.

Unit III: Transformers:

Ideal and practical transformer, EMF equation, equivalent circuit,losses in transformers, regulation and efficiency.

Unit IV: Electrical Machines:

Generation of rotating magnetic fields, Construction and working ofa three-phase induction motor, Significance of torque-slipcharacteristic. Starting and speed control of induction motor, singlephaseinduction motor. Construction, working, torque-speedcharacteristic and speed control of separately excited DC motor.Construction and working of synchronous generators.

Unit V: Power Converters:

Semiconductor PN junction diode and transistor (BJT).Characteristics of SCR, power transistor and IGBT. Basic circuits ofsingle phase rectifier with R load, Single phase Inverter, DC-DCconverter.

Suggested Text / Reference Books

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, " Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Apply basic skills for designing various instruments for engineering applications.
CO2:	Determine error in laboratory measurements and techniques used to minimize such error.
CO3:	Gain knowledge regarding the various laws and principles associated with electrical systems.
CO4:	Understand electrical machines and apply them for practical problems.
CO5:	Understand the concepts in the field of electrical engineering, projects and research.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	-	-	-	-	-	M	-	L	M	M
CO2	L5	L	M	H	M	L	-	-	-	-	M	-	M	M	M
CO3	L1	M	H	H	H	-	-	-	-	-	H	-	M	M	M
CO4	L2	H	L	M	L	-	-	-	-	-	L	-	L	H	M
CO5	L2	M	H	H	H	-	-	-	-	-	H	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO3, CO4, CO5
CD5	Industrial visit	CO5

BTHSMC206: Environmental Studies

Course Objective:

- To understand the basics of ecosystem and environment
- To understand about different types of pollution.
- To learn about waste, energy sources and sustainable energy.

Course Contents:

Unit-I **Basics of Environment:** Components and types of ecosystem, Structure and functions of ecosystem, Energy flow in ecosystem .Type and levels of Biodiversity, Values, Causes of extension, and Conservation methods of biodiversity.

Unit-II **Pollution:** Types of Pollutants, air pollution, harmful effects of air pollution, control of air pollution, water pollution, harmful effects of water pollution, control of water pollution, noise Pollution harmful effects of noise pollution, control of noise pollution, radioactive pollution, harmful effects of radioactive pollution, control of radioactive pollution.

Unit-III **Solid Waste Management:** Classification of solid waste, Collection, transportation, treatment, and disposal methods of solid waste, economic recovery of solid waste.

Unit-IV **Renewable Energy Sources:**Introduction, renewable sources of energy: solar energy, wind energy, energy from ocean, energy from biomass, geothermal energy and nuclear Energy.

Unit-V **Issues of Environment:** Sustainable development**,** water conservation, environmental education, environmental acts. Types of disasters, their causes, impact and preventive measures.

Recommended Books:

1. A.K. De, Environmental Chemistry, Wiley Eastern Ltd.
2. D.K.Sinha, Towards Basics of Natural Disaster Reduction, Research co Book Center, Delhi.
3. M.N.Rao and H.V.N.Rao, Air Pollution, Tata McGraw-Hill, ISBN-13 978-0-07-451871-7, 2013.
4. Ranjeeta Soni, Environmental Studies and Disaster managementNew India Publication Agency (NIPA), New Delhi, ISBN: 978-93-91383-02-2, October 2021.
5. R.C.Gaur, Basic Environmental Engineering New Age International Publication.

Course Outcomes

At the end of the course, the student will be able to:

CO1:	To understand the basic concepts and components of ecosystem and environment. Ecosystem Links between environmental components and their role.
CO2:	To understand the basic concepts of pollution and their sources and effects and to apply the control technologies related pollutions.
CO3:	To understand the types of wastes and their generation sources and to also know disposal technologies of waste and reuse and recycle of the waste.
CO4:	To know the concepts of renewable energy resources and their types and create the various applications of renewable resources and current potentials of energy resources.
CO5:	To understand the concept of sustainable development and create the methods for water conservation and apply the disaster control technologies.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments,Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	**Bloom Level**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	-	L	H	-	-	M	H	H	-	-	M	-	L
CO2	L3	H	H	H	H	H	H	H	M	H	M	M	H	H	H
CO3	L2	H	H	H	M	H	H	M	M	H	L	M	M	H	H
CO4	L6	L	L	H	L	H	H	H	L	M	L	H	H	M	H
CO5	L3	L	H	H	L	M	H	H	M	L	H	H	H	H	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2,CO5
CD5	Industrial visit	CO1,CO2, CO3, CO4

BTBSC 207: Engineering Chemistry Lab

Course Objective:

- To understand the method for the determination of hardness in water and purification process.
- To understand about different types of volumetric analysis.
- To learn about properties of lubricant oil.
- To Synthesize a small drug molecule and analyse a salt sample

List of Experiments:

1. Determination the hardness of water by EDTA method
2. Determination of residual chlorine in water
3. Determination of dissolved oxygen in water
4. Determination of the strength of Ferrous Ammonium sulphate solution with the help of K2Cr2O7 solution by using diphenyl amine indicator
5. Determination of the strength of CuSO4 solution iodometrically by using hypo solution
6. Determination of the strength of NaOH and Na2CO3 in a given alkali mixture
7. Proximate analysis of Coal
8. Determination of the flash & fire point and cloud & pour point of lubricating oil
9. Determination of the kinematic viscosity of lubricating oil by Redwood viscometer no. 1 at different temperature
10. Synthesis of Aspirin/ Paracetamol

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the method for the determination of hardness in water and purification process.
CO2:	Understand about different types of volumetric analysis.
CO3:	Learn about properties of lubricant oil.
CO4:	Synthesize a small drug molecule and analyse a salt sample
CO5:	Determine quantitative estimation of dissolve chemicals in water.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2	H	M	-	M	-	-	L	-	-	M	-	-	M	L
CO2	L1	L	H	M	H	-	-	L	-	-	H	-	-	M	M
CO3	L1	M	L	H	L	L	-	M	-	-	L	-	L	M	M
CO4	L3	L	L	H	L	L	-	L	-	-	L	-	L	M	L
CO5	L3	L	L	H	L	L	-	L	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/ LCD projectors/ OHP projectors	-
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets / Experiments	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTHSM208: Human Values Activities

Course Objective:

- To Understand the basic guidelines, content and process for value education.
- To develop understanding different Harmony concept.
- To understand professional ethics and natural acceptance of human values.

Course Contents:

PS 1:

Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your salient achievements and shortcomings in your life? Observe and analyze them.

PS 2:

Now-a-days, there is a lot of talk about many technogenic maladies such as energy and material resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. - all these seem to be manmadeproblems, threatening the survival of life Earth - What is the root cause of these maladies & what is the way out in opinion? On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression & suicidal attempts etc. - what do you think, is the root cause of these threats to human happiness and peace - what could be the way out in your opinion?

PS 3:

1. Observe that each of us has the faculty of 'Natural Acceptance', based on which one can verify what is right or not right for him. (As such we are not properly trained to listen to our 'Natural Acceptance' and may a time it is also clouded by our strong per-conditioning and sensory attractions). Explore the following:
   (i) What is Naturally Acceptable' to you in relationship the feeling of respect or disrespect for yourself and for others?
   (ii) What is 'naturally Acceptable' to you - to nurture or to exploit others? Is your living in accordance with your natural acceptance or different from it?
2. Out of the three basic requirements for fulfillment of your aspirations – right understanding, relationship and physical facilities - observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine.

PS 4:

List down all your important desires. Observe whether the desire is related to Self (I) the Body. If it appears to be related to both, visualize which part of it is related to Self (I) and which part is related to Body.

PS 5:

1. a. Observe that any physical facility you use, follows the given sequence with time: Necessary and tasteful - unnecessary but still tasteful - unnecessary and tasteless - intolerable
   b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If not acceptable, you want it continuously and if not acceptable, you do not want it any moment!
2. List down all your important activities. Observe whether the activity is of 'I' or of Body or with the participation of both or with the participation of both 'I' and Body.

3. Observe the activities within 'i'. Identify the object of your attention for different moments (over a period of sy 5 to 10 minutes) and draw a line diagram connecting these points. Try observe the link between any two nodes.

PS 6:

1. Chalk out some programs towards ensuring your harmony with the body – in terms of nurturing, protection and right utilization of the body.
2. Find out the plants and shrubs growing in and around your campus, which can be useful in curing common diseases.

PS 7:

Form small groups in the class and make them carry out a dialogue focusing on the following eight questions related to 'TRUST';

1a. Do I want to make myself happy?

2a. Do I want to make the other happy?

3a. Does the other want to make himself/herself happy?

4a. Does the other want to make me happy?

What is the answer?

Intention (Natural Acceptance)

1b. Am I able to always make myself happy?

2b. Am I able to always make the other happy?

3b. Is the other able to always make himself/herself happy?

What is the answer?

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate yourself and others on the basis of intention/competence.

PS 8:

1. Observe, on how many occasions, you are able to respect your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under-evaluation, over-evaluation or otherwise evaluation.
2. Also, observe whether your feeling of respect is based on treating the other as you would treat yourself or on differentiations based on body, physical facilities or belieds.

PS 9:

1. Write a narration in the form of a story, poem, skit or essay to clarify a salient Human Value to the children.
2. Recollect and narrate an incident in your life where you were able to exhibit willful adherence to values in a difficult situation.

PS 10:

List down some common Units (things) of Nature which you come across in your daily life and classify them in the four orders of Nature. Analysis and explain the aspect of mutual fulfillment of each Unit with other orders.

PS 11:

Make a chart to show the whole existence as co-existence. With the help of this chart try to identify the role and the scope of some of the courses of your study. Also indicate the areas which are being either over-emphasized or ignored in the present context.

PS 12:

Identify any two important problems being faced by the society today and analyze the root cause of these problems. Can these be solved on the basic of natural acceptance of human values. If so, how should one proceed in this direction from the present situation?

PS 13:

1. Suggest ways in which you can use your knowledge of Science/Technology/Management etc. for moving towards a universal human order.
2. Propose a broad outline for humanistic Constitution at the level of Nation.

PS 14:

The course is going to be over now. It is time to evaluate what difference in your thinking it has made. Summarize the core massage of this course grasped by you. How has this affected you in terms of;

a. Thought

b. Behavior

c. Work and

d. Relization

What practical steps are you able to visualize for the transition of the society from its present state.

Project:

Every student required to take-up a social project e.g. educating children in needy/weaker section, services in hospitals, NGO's and other such work i.e. social work at villages adopted by respective institute/ college.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Analyze Basic Guidelines, Content and Process for Value Education.
CO2:	Understanding Harmony in the Human Being - Harmony in Myself.
CO3:	Understand Harmony in the Family and Society- Harmony in Human-Human Relationship. Recollect and narrate an incident in your life.
CO4:	Understand Harmony in the Nature and Existence – Whole existence as Coexistence. Summarize the core massage of this course grasped by you.
CO5:	List ac and Implicate the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L4	-	-	-	-	L	L	M	H	L	M	-	L	M	L
CO2	L2	-	-	-	-	-	L	M	M	M	M	-	L	M	M
CO3	L2	-	-	-	-	L	L	M	H	L	M	-	L	M	M
CO4	L2	-	-	-	-	L	L	L	M	M	L	L	H	M	L
CO5	L1	-	-	-	-	L	M	M	H	L	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	

BTESC 209: Manufacturing Practices Workshop

Course Objectives:

- To discuss the modules include training on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood andother metal pieces.
- To develop machining skills in students.

Carpentry Shop

1. T – Lap joint
2. Bridle joint

Foundry Shop

3. Mould of any pattern
4. Casting of any simple pattern

Welding Shop

5. Lap joint by gas welding
6. Butt joint by arc welding
7. Lap joint by arc welding
8. Demonstration of brazing, soldering & gas cutting

Machine Shop Practice

9. Job on lathe with one step turning and chamfering operations

Fitting and Sheet Metal Shop

10. Finishing of two sides of a square piece by filing
11. Making mechanical joint and soldering of joint on sheet metal
12. To cut a square notch using hacksaw and to drill a hole and tapping

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Describe cast different parts through Carpentry.
CO2:	Define control manufacturing via computers.
CO3:	Understanding use power tools and fitting tools.
CO4:	Knowledge of various welding operations
CO5:	Understanding different metallic and non-metallic objects.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	L	L	L	L	-	-	-	L	L	-	L	H	M
CO2	L2	H	M	L	M	M	-	-	-	-	M	-	L	M	L
CO3	L2	H	M	L	M	M	-	-	-	-	M	-	L	H	M
CO4	L2	H	M	L	M	M	-	L	-	L	M	-	L	H	M
CO5	L2	H	M	L	M	M	-	L	-	L	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	

BTESC 210: Basic Electrical Engineering Lab

Course Objectives:

- To understand training on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood and other metal pieces.
- To develop machining skills in students.

List of Experiments

1. Basic safety precautions. Introduction and use of measuring instruments –voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitorsand inductors.
2. Transformers: Observation of the no-load current waveform on anoscilloscope. Loading of a transformer: measurement of primary andsecondary voltages and currents, and power.
3. Three-phase transformers: Star and Delta connections. Voltage and Currentrelationships (line-line voltage, phase-to-neutral voltage, line and phasecurrents).Phase-shifts between the primary and secondary side.
4. Demonstration of cut-out sections of machines: dc machine (commutate orbrusharrangement), induction machine (squirrel cage rotor), synchronous(field winging - slip ring arrangement) and single-phase induction
5. Torque Speed Characteristic of separately excited dc motor.
6. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d)Components of LT switchgear.

Course Outcomes:

At the end of the course, the student will be able to:

CO1.	Adapt knowledge regarding the various laws and principles associated with electrical systems.
CO2:	Adapt knowledge regarding electrical machines and apply them for practical problems.
CO3:	Understand various types' Electrical Equipments.
CO4:	Understanding digital measuring equipments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	H	M	M	M	M	-	-	-	-	M	-	L	H	M
CO2	L3	L	M	H	M	M	-	-	-	-	M	-	M	M	M
CO3	L2	M	H	H	H	M	-	-	-	-	H	-	M	H	H
CO4	L2	H	L	M	L	M	-	-	-	-	L	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	

BTESC 211: Computer Aided Machine Drawing

Course Objective:

- To design, develop and analyze simple linear and non linear computer based drawing.
- To identify and apply the suitable knowledge of computers to understand the shape and size of Drawing Objects.

Course Contents:

Introduction: Principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, rules ofdimensioning.

Conversion of pictorial views into orthographic views: (1 drawing sheet)Introduction to orthographic prdcojection, concept of first angle and third angleprojection, drawing of simple machine elements in first angle projection, missingview problems covering Principles of Orthographic Projections.

Sectional views of mechanical components: (1 drawing sheet) Introduction,cutting plane line, type of sectional views-full section, half section, partial orbroken section, revolved section, removed section, offset section, sectioningconventions-spokes, web rib, shaft, pipes, different types of holes, conventions ofsection lines for different metals and materials.

Fasteners and other mechanical components: (Free hand sketch) Temporaryand permanent fasteners, thread nomenclature and forms, thread series,designation, representation of threads, bolted joints, locking arrangement of nuts,screws, washers, foundation bolts etc., keys, types of keys, cotter and knucklejoints. Riveted joints, rivets and riveting, type of rivets, types of riveted joints etc.Bearing: Ball, roller, needle, foot step bearing. Coupling: Protected type, flange, andpin type flexible coupling. Other components: Welded joints, belts and pulleys,pipes and pipe joints, valves etc.

Overview of Computer Graphics: (2 drawing sheets) Covering theory of CADsoftware such as: The menu System, Toolbars (Standard, Object Properties, Draw,Modify and Dimension), Drawing Area (Background, Crosshairs, CoordinateSystem), Dialog boxes and windows, Shortcut menus (Button Bars), CommandLine (Where applicable), The Status Bar, Different methods of zoom as used inCAD, Select and erase objects.: Isometric Views of Lines, Planes, Simple andcompound Solids.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the conventions and the method of engineering drawing.
CO2:	Interpret engineering drawings using fundamentals of different views to construct basic and intermediate geometry.
CO3:	Adapt theory of sectioning and Section of Solids.
CO4:	Classify the theory of projection.
CO5:	Understand drawing skill in the form of Computer Graphics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	L	L	L	L	-	-	-	L	L	-	L	L	M
CO2	L4	H	L	H	L	L	-	-	-	-	L	-	L	L	L
CO3	L3	H	H	H	H	L	-	-	-	-	H	-	L	L	M
CO4	L4	H	M	H	M	L	-	-	-	L	M	-	L	M	L
CO5	L2	H	M	H	M	L	-	-	-	L	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	-----

BTSODECA212: Social Outreach, Discipline & Extra Curricular Activities

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Develop their self-confidence, leadership qualities, and their responsibilities towards the commUnity.
CO2:	Have an impact on academic development, personal development, and civic responsibility
CO3:	Understand the value of Social Work.
CO4:	Understand the Significance of Discipline in student's Life
CO5:	Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

BTBSC213: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of CommUnity based motivation videos, CommUnity based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

Semester - III

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCEBSC 301	Engineering Mathematics–III	Core	30	70	100	3	0	-	3
BTCEHSMC302	Object Oriented Programming	AECC	30	70	100	3	0	-	3
BTCEESC 303	Engineering Mechanics	Core	30	70	100	3	-	-	3
BTCEPCC 304	Surveying	Core	30	70	100	3	-	-	3
BTCEPCC 305	Fluid Mechanics	Core	30	70	100	3	-	-	3
BTCEPCC 306	Building Materials and Construction	Core	30	70	100	3	-	-	3
BTCEPCC 307	Engineering Geology	Core	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCEPCC 308	Surveying Lab	Core	30	20	50	-	-	1	1
BTCEPCC 309	Fluid Mechanics Lab	Core	30	20	50	-	-	1	1
BTCEPCC 310	Computer Aided Civil Engineering Drawing	Core	30	20	50	-	-	1	1
BTCEPCC 311	Civil Engineering Materials Lab	Core	30	20	50	-	-	1	1
BTCEPCC 312	Geology Lab	Core	30	20	50	-	-	1	1
BTCEPCC 313	Object Oriented Programming Lab	AECC	30	20	50	-	-	-	1
BTCESODECA 314	Social Outreach, Discipline & Extra Curricular Activities		**50**		50	-	-	--	**1**
BTBSC 315	ANANDAM	AECC	**50**	**50**	100	**1**		**1**	**2**
	Total		**490**	**660**	**1150**	**22**	**0**	**6**	**30**

BTCEBSC301: Engineering Mathematics-III

Course Objective:

- To familiar with the Laplace transform techniques to solve differential equations.
- To familiar with the Fourier transform techniques.
- To familiar with the Z transform techniques
- To familiar with various Numerical techniques and apply them .

Course Content:

Unit-I: **Laplace Transform:** Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace transforms method.

Unit-II: **Fourier Transform:** Fourier Complex, Sine and Cosine transform, properties and formulae, inverse Fourier transforms, Convolution theorem, application of Fourier transforms to partial ordinary differential equation (One dimensional heat and wave equations only).

Unit-III: **Z-Transform:** Definition, properties and formulae, Convolution theorem, inverse Z-transform, application of Z-transform to difference equation.

Unit-IV: **Numerical Methods – 1:** Finite differences, Relation between operators,Interpolation using Newton's forward and backward difference formulae. Gauss's forward and backward interpolation formulae. Stirling's Formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange'sformulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

Unit-V **Complex Analysis:** Complex Variable. Complex Function, Analytic Function, Harmonic functions, Milne Thomson method, Complex integration, Cauchy integral formula, Cauchy integral formula for derivatives, Taylor theorems and Laurent Theorems, Residues theorem.

Textbooks:

1. Murray R. Spiegel, (1981), "Vector Analysis" Schaum Publishing Co.
2. Grewal B.S. (2006) "Higher Engg. Mathematics", Khanna Publishers, 39th Edition.

References Books:

1. Erwin Kre yszig (2006) "AdvanCEd Engg. Mathematics", Wiley Eastern Ltd. 8th Edition
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2008.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the Laplace transforms theory and use this theory to solve ordinary and partial differential equations
CO2:	Understand the Fourier transforms theory and use this theory to solve ordinary and partial differential equations.
CO3:	Understand the Z- transforms theory and use this theory to solve difference equations.
CO4:	Understand and apply to solve various problems of science and engineering.
CO5:	Understand and to use the concepts of differentiation and integration of complex functions.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO4	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO5	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	-
CD4	Project Discussions	-
CD5	Self- learning advice using internets	CO1,CO2,CO4,CO5

BTCSPCC 302 : Object Oriented Programming

Course Objective:

- To Perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs.
- To Demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.
- To Demonstrate ability to implement one or more patterns involving realization of an abstract interface and utilization of polymorphism in the solution of problems which can take advantage of dynamic dispatching.
- To Learn syntax, features of, and how to utilize the Standard Template Library. Learn other features of the C++ language including templates, exceptions, forms of casting, conversions, covering all features of the language.

Course Contents:

Unit-I Introduction to different programming paradigm, characteristics ofOOP, Class, Object, data member, member function, structures in C++, different access specifies, defining member function inside and outside class, array of objects.

Unit-II Concept of reference, dynamic memory allocation using new and delete operators, inline functions, function overloading, function with default arguments, constructors and destructors, friend function and classes, using this pointer.

Unit-III Inheritance, types of inheritance, multiple inheritance, virtual base class, function overriding, abstract class and pure virtual function

Unit-IV Constant data member and member function, static data member and member function, polymorphism, operator overloading, dynamic binding and virtual function

Unit-V Exception handling, Template, Stream class, File handling.

Textbooks/References:

- E. Balagurusamy, Object Oriented programming, Tata McGraw Hill.
- K R Venugopal, Rajkumar, T Ravishankar, Mastering C++, Tata McGraw Hill.
- C. Thomas Wu, An Introduction to OOP with Java, McGraw Hill.
- Timothy Wood, An Introduction to Object Oriented Programming, Addison Wesley.
- John R. Hubbard, Programming with C++, McGraw Hill International.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Underline the features of C++ supporting object oriented programming.
CO2:	Describe the relative merits of C++ as an object oriented programming language.
CO3:	Use how to produce object-oriented software using C++.
CO4:	Describe how to apply the major object-oriented concepts to implement object oriented programs in C++, encapsulation, inheritance and polymorphism.
CO5:	Understand advanced features of C++ specifically stream I/O, templates and operator overloading.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	H	M	H	-	-	-	L	M	L	L	L	L
CO2	L2	H	M	M	M	M	-	-	-	L	M	-	M	M	L
CO3	L3	H	M	L	M	M	-	-	-	L	M	L	L	M	L
CO4	L1	M	M	M	M	M	L	-	-	L	M	-	M	L	M
CO5	L2	H	M	H	H	L	L	-	-	L	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO5
CD5	Industrial visit	CO4, CO5

BTCEESC 303: Engineering Mechanics

Course Objective:

- To get the knowledge of Dynamic Equilibrium of particles and rigid bodies.
- To understand the effect of friction, kinematics, kinetics of particle and rigid body, related principles.
- To implant the above knowledge to solve the practical problems.

Course Content:

Unit-I: **Statics of particles and rigid bodies:** Fundamental laws of mechanics,Principle of transmissibility, System of forces (conservative and non conservative),Resultant force, Resolution of force, Moment and Couples,Resolution of a force into a force and a couple, Free body diagram,Equilibrium, Conditions for equilibrium, Lami's theorem

Unit-II: **Plane trusses:** Types of structures, Trusses, Support Conditions, Types of Loadings, Classification of trusses, Determinacy of trusses, Basic assumptions of truss analysis (zero force member, tension or compression member), Method of joints, Method of sections. **Centroid & Moment of inertia (M.I.):** Location of centroid, Moment of inertia (mass and area), Parallel axis and perpendicular axis theorems, M.I of composite section, M.I. of solid bodies, Polar moment of inertia, principle axis and principle moment of inertia.

Unit-III: **Virtual work:** Principle of Virtual Work, Active forces and active force diagram, Stability of equilibrium. **Work, Energy and Power:** Work of a force, weight and couple, Power, Efficiency, Energy, Kinetic energy of rigid body, Principle of work and energy, Conservation of energy.

Unit-IV: **Friction:** Types of Friction, Laws of friction, Angle of friction, Angle of repose, Ladder, Wedge, Belt Friction. **Springs**: Stiffness of springs, springs in series and parallel, Introduction to laminated plate springs, leaf spring, close coiled helical springs, open coiled springs.

Unit-V: **Simple Stresses and Strains:** Concept of stress and strain in three dimensions and generalized Hooke’s law; Young’s modulus, Shear stress, Shear strain, Modulus of rigidity, Complementary shear stress; Poisson’s ratio, Volumetric strain, Bulk modulus, relation between elastic constants, Stress and strain thin cylinder and spherical cell under internal pressure.

Text/Reference Books:

1. Irving H. Shames (M006), Engineering Mechanics, 4th Edition, Prentice Hall M. F. P. Beer and E. R. Johnston (M011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibbler (M006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and RudraPratap (M011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (M006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (M010),Engineering Mechanics (Statics, Dynamics) by Pearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(M010), Singer’s Engineering Mechanics
8. Bansal R.K.(M010), A Text Book of Engineering Mechanics, Laxmi Publications
9. Khurmi R.S. (M010), Engineering Mechanics, S. Chand & Co.

10. Tayal A.K. (M010), Engineering Mechanics, Umesh Publications

Course Outcome

At the end of the course, the student will be able to:

CO1:	Understand the types of forces and their applications.
CO2:	Understand the concept of centre of gravity.
CO3:	Get the Knowledge of types of friction.
CO4:	Understand the fundamental principles and concept of Newton's law of motion.
CO5:	Get the knowledge of work, power and energy.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	L	M	M	L	M	-	-	L	M	-	M	H	H
CO2	L2	H	M	L	M	-	L	-	-	M	L	-	L	M	L
CO3	L1	H	M	L	M	-	L	-	-	L	M	-	L	M	L
CO4	L2	M	L	M	L	L	L	-	-	M	L	-	-	L	M
CO5	L1	M	L	L	L	L	M	-	-	-	M	-	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 304: Surveying

Course Objective:

- To prepare the student to plan and conduct field work and application of scientific methodology in handling field samples by using machine.
- To know the art, science and technology of cartography and applications of GIS in Mapping Resources. .
- To develop the skills in surveying and thematic mapping.

Course Content:

Unit-I: **Linear and Angular Measurements:** Method of linear measurements, Correction to length measured with achain/tape, Ranging a survey line; direct and indirect Angularmeasurement by compass, Designation of bearing, Traversing with tape And compass, Correction to measured bearing,Angular measurement by theodolite; Temporary adjustments, measure and adjust the angles of a braced quadrilateral, Method of horizontal angle measurement and vertical angle, Traverse computation,plotting of traverse and determining the closing error, Balancing traverse.

Unit-II: **Leveling:** Measurements of elevations methods of levelling; direct/differential, Indirect/Trigonometrical, and Profile/Cross sectional levelling. Digital and Auto level, Errors in levelling, contours and contour lines; methods of contouring; direct and indirect, characteristics, uses, area and vol. measurements.

Unit-III: **Curve Surveying:** Elements of simple and compound curves, Types of curves, Elements of circular, reverse, and transition curves. Method of setting out simple, circular, transition and reverse curves, Types of vertical curves, length of vertical curves, setting out vertical curves. Tangent corrections.

Unit-IV: **Tacheometry and Photogrammetry Surveying:** Advantages of tacheometric surveying, different systems of tacheometricmeasurements, Stadia system of tacheometry, distance elevationformulae for horizontal sights. Introduction to GPS, Differential GPS, Remote sensing techniques and application in land use change and mapping, arial surveying, photogrametery

Unit-V: **Modern Field Survey Systems: Total station, parts of total station, advantages and application.** Principle of E.D.M. (Electronic Distance Measurements), Modulation, Types of E.D.M.

Text/Reference Books:

1 Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, M006.

2 MManoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, M011

3 Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, M010

4 Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, M00M

Course Outcome:

At the end of the course, the student will be able to:

CO1	Solve the mathematical problems using algebraic and trigonometric functions.
CO2	Analyze the projects using visualization and current industry methods.
CO3	Demonstrate the fundamental knowledge of the systems and processes used to construct the built environment.
CO4	Perform the basic land surveying instruments and related calculations. Perform the basic concepts of highway design and sub-division design.
CO5	Practice the professional and ethical responsibilities of the profession.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	L	M	M	L	M	-	L	M	L	-	L	H	H
CO2	L4	H	M	M	M	L	H	-	-	M	L	-	L	M	M
CO3	L3	M	M	M	M	L	M	M	-	L	M	-	-	L	L
CO4	L3	M	L	L	L	L	H	-	-	L	L	-	L	-	M
CO5	L3	H	M	M	M	L	M	-	-	L	M	-	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTCEPCC 305: Fluid Mechanics

Course Objective:

- To get the fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
- To develop the understanding of hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow
- To know the fundamentals of stagnant, flowing fluid and flow through different conduits.
- To develop the steady state mechanical energy balance equation for fluid flow systems, estimate pressure drop in fluid flow systems and determine performance characteristics of fluid machinery.

Course Content:

Unit-I: **Fluids**: Definition, Type of fluids, Ideal fluids, real fluids, Newtonian and non-Newtonian fluids. **Properties of Fluids:** Units of measurement, Mass density, Specific weight, Specific volume, Specific Gravity, Viscosity, Surface tension and Capillarity, Compressibility and Elasticity.

Unit-II: **Principles of Fluid Statics**: Basic equations, Pascal Law, Type of pressure:- atmospheric pressure, Gauge pressure, vacuum pressure, absolute pressure, manometers, Bourdon pressure gauge

Unit-III: **Buoyancy**; Forces acting on immersed plane surface. Centre of pressure, forces on curved surfaces. Conditions of equilibrium for floating bodies, meta-centre and analytical determination of meta centric height.

Unit-IV: **Kinematics of Flow**: Visualisation of flow, Types of flow: Steady and unsteady, uniform and non-uniform, rotational and irrotaional flow, Laminar and turbulent flow, streamline, path line, streak line, principle of conservation of mass, equation of continuity, acceleration of fluid particles local and convective, velocity, acceleration, velocity potential and stream function, elementary treatment of flow net, vorticity, circulation, free and forced vortex. Fluid mass subject to horizontal and vertical acceleration and uniform rotation

Unit-V: **Fluid Dynamics**: Control volume approach, Euler's equation, Bernoulli's equation and its applications, venture-meter, orificemeter, orifices & mouthpieces, time of emptying of tanks by orifices, momentum and angular momentum equations and their applications, pressure on flat plates and nozzles.

Laminar Flow through Pipes: Laminar flow through pipes, Relation between shear & pressure gradient. Flow between plates & pipes. Hagen- Poiseuille equation, Equations for velocity distribution, pressure difference velocity distribution over a flat plate and in a pipe section,

Darcy-Weisbach equation, friction factor , minor losses, pipe networks

Course Outcome :

At the end of the course, the student will be able to:

CO1:	Understand the stress-strain relationship in fluids, classify their behaviour and also establish force balance in static systems.
CO2:	Apply Bernouli's principle and compute pressure drop in flow systems of different configurations.
CO3:	Compute power requirement in fixed bed system and determine minimum fluidization velocity in fluidized bed .
CO4:	Describe function of flow metering devices and apply Bernoulli equation to determine the performance of flow-metering devices.
CO5:	Determine and analyze the performance aspects of fluid machinery specifically for centrifugal pump and reciprocating pump.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	M	L	L	M	-	M	M	L	L	H	H
CO2	L3	H	M	L	H	L	M	L	-	L	M	L	M	M	M
CO3	L3	M	L	L	M	L	L	M	-	L	L	-	-	M	L
CO4	L2	M	M	-	M	-	M	L	-	-	L	L	L	M	L
CO5	L4	H	L	M	L	L	M	M	-	M	L	L	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 306: Building Materials and Construction

Course Objective:

- To know the properties of wood, cement, admixtures used for buildings and construction process.
- To develop the building walls, foundations, form work and finishing work.
- To know the building arches, roofs, doors, windows and ventilators and how they are provided for buildings.
- To explain the material which we want to use and how we want to use and how to give a good building for ma using purpose.

Course Content:

Unit-I: **Basic Civil Engineering Materials (Properties, Types and Uses):** Stone: Compressive strength, Water absorption, Durability, Impact value, Tensile strength; Bricks: Water absorption, Compressive strength, Effloresces, Dimension and Tolerance; Tiles: Water absorption, Tolerance, Impact value and Glazing; Light weight concrete blocks.

Lime: classification as per IS, properties, standard tests and uses in construction.

Fly-ash: Properties and Use in manufacturing of bricks & cement;

Miscellaneous: Gypsum, Plaster of Paris, PVC materials, Paints, Varnish and Distemper.

Unit-II: **Timber & Steel:** Timber: Definitions of related terms, Classifications and Properties, Defects in Conversion of wood, Seasoning wood, Preservation, Fire proofing, Ply woods, Fibre boards; Steel: Mild steel and HYSD steel, Properties and their use, common tests on steel.

Mortar and Plaster: Mortar preparation methods**:** Functions and tests & their uses in various types of pointing & plastering

Unit-III: **(A) Brick and Stone Masonry**: Basic principle of masonry work, different types of bonds, relative merits and demerits of English, Single Flemish and Double Flemish bond. Comparison between stone and brick masonry. General principles, classification of stone masonry and their relative merits and demerits.

(B): **Building Requirements & Construction System:** Building components, their functions and requirements. Types of construction: load bearing and framed structure construction, RCC beam, column and slab construction, Precast and In-situ construction, Relative merits and demerits. Fire resistance construction, FRC.

Ground & Upper floors: Floor components and their functions, Floor types and Selection of flooring, construction details of ground and upper floors, merits and demerits.

Unit- IV: **(A): Foundation & Site Preparation:** Purpose, types of foundation: like shallow, deep, pile, raft, grillage foundation and their suitability. Depth of foundation, Sequence of construction activity and co-ordination, site clearance, layout of foundation plan.

Temporary structures: Types & methods of shoring, underpinning and scaffolding.

(B) **Damp Proofing:** Causes and Effects of dampness, Methods and materials for damp proofing, Methods and materials for anti-termite treatment.

Construction and Expansion Joints: Requirements, Types material used, Construction details.

Unit- V: **(A): Arches and Lintels:** Terms used, types of arches and their construction detail, types of lintels and constructions.

Partition Wall: Types, purpose and use of partition wall.

Stairs: Terms used, requirements of good staircase, classification, construction details and suitability of different types of stairs, Lifts and Ramps.

(B): Roof and Roof Covering: Purposes, classification of roofs, terms used. Introduction to Solid slab, Flat slab, Shell Roofs and Pitched roofs, and their constructional features. Types of pitched roofs and Trusses, typical constructional details; Roof covering materials, types and typical constructional details.

Text Books

1. Building Materials and construction – Arora & Bindra, Dhanpat Roy Publications.
2. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain (2005), Building Construction, Laxmi Publications (P) ltd., New Delhi, India. 3. Building materials , construction and planning by S. MAHABOOB BASHA

References Books:

1. Building materials by Duggal, New age Internations.
2. Building construction by PC verghese PHI.
3. Construction technology –vol -1 &2 by R. chuddy, Longman UK.
4. Basics of civil Engg by Subhash chander; Jain brothers

Course Outcome

At the end of the course, the student will be able to:

CO1.	Know about different materials such as stones, bricks, Tiles, wood, aluminum, glass & paints and their classification , manufacture and structural requirements
CO 2.	Know about the materials used in making of concrete such as cement and admixtures.
CO3.	Know about tests on cement such as field and lab tests and uses of cement and admixtures.
CO4.	Understand various building components such as lintels, arches, types of roofs and joinery such as doors, windows and the materials used in making.
CO5.	Demonstrate various building services such as plumbing services, sanitary and ventilations.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	L	M	M	L	M	M	-	H	L	L	L	H	H
CO2	L1	H	L	L	M	L	H	L	-	M	M	M	L	M	L
CO3	L1	H	M	L	H	L	M	M	-	L	M	M	L	M	M
CO4	L2	M	M	M	M	L	L	M	-	M	M	L	M	L	M
CO5	L3	M	L	L	L	-	M	H	-	M	L	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 307: Engineering Geology

Course Objective:

- To study and identify different types natural materials like rocks & minerals and soil.
- To understand the various natural dynamic processes their influence on the surfacial features, natural material and their consequences.
- To know the Geological structures (Joint, veins, crack, faults, and fold), reasons of formation for each type and their side effects on the engineering projects.
- To know the Sedimentary processes (Weathering, erosion, deposition), Metamorphism and volcanic eruptions.
- To identify the minerals types of clay minerals their properties and effects on engineering project.

Course Content:

Unit-I: **General Geology**: Branches and Scope of Geology, Types of Weathering & Geological work of natural agencies like River & Wind. Geological Time Scale. Physical Properties of Minerals.

Unit-II: **Petrology:** Formation, Texture, Structure and Classification of Igneous, Sedimentary and Metamorphic Rocks. Engineering Properties of Rocks for Building & Road Material. Laboratory and Field & in-situ Test for Site Construction.

Unit-III: **Structural Geology:** Causes, Terminology, Classification, Recognition, Effects and Engineering consideration of Fold, Fault, Joints and Unconformities.

Unit-IV: **Engineering Geology:** Geophysical methods as applied to Civil Engineering for Subsurface Analysis (Electrical and Seismic methods). Terminology, Types and Geological consideration for site selection of Dam & Tunnel.

Unit-V: **Remote Sensing & GIS:** Application of Remote Sensing and GIS in Various fields of Civil Engineering.

Text/Reference Books:

1. Engineering and General Geology, Parbin Singh, 8th Edition (M010), S K Kataria& Sons.
2. M. Text Book of Engineering Geology, N. ChennaKesavulu, Mnd Edition (M009), Macmillan Publishers India.
3. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (198M).

Course Outcome

At the end of the course, the student will be able to:

CO1:	Understand issues concerning the geological basement and structure of a region
CO2:	Distinguish the characteristics of the most important geological formations and problems that may arise in the various public works.
CO3:	Describe and interpret the geological structures in the geological maps and cross sections.
CO4:	Assess and appropriately adjust the results of geological study in order to secure construction and operation of a technical project.
CO5:	Analyze and evaluate data and appropriately solve problems both technical and environmental.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	M	M	M	L	H	H	-	-	M	-	M	H	H
CO2	L4	H	M	L	M	L	M	H	-	-	L	-	M	M	M
CO3	L2	H	H	L	H	L	M	M	-	-	L	-	H	L	L
CO4	L3	M	M	M	H	-	H	L	-	L	M	-	L	L	M
CO5	L4	M	M	L	H	L	M	M	-	L	L	-	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTCEPCC 308: Surveying Lab

Course Objective:

- To determine the relative position of any objects or points of the earth.
- To determine the distance and angle between different objects.
- To prepare a map or plan to represent an area on a horizontal plan.
- To develop methods through the knowledge of modern science and the technology and use them in the field.
- To solve measurement problems in an optimal way.

List of Experiments:

1. Linear Measurement by Tape **and chain.**

a. Ranging and Fixing of Survey Station.

b. Plotting Building Block by offset with the help of cross staff.

2. Compass Survey: Using Surveyor's and Prismatic compass

a. Measurement of bearing of lines

b. Adjustment of included angles of compass traverse.

3. Levelling: Using Tilting/ Dumpy/ Automatic Level

a. To determine the reduced levels in closed circuit.

b. To carry out profile levelling and plot longitudinal and cross sections for road.

4. To measure the horizontal and vertical angles by Theodolite.

5. To determine the Height of an object by trigonometric leveling (Instruments in different vertical planes and same vertical planes).

6. Tacheometry Survey:

a. To determine the tachometric constant.

b. To determine the horizontal and vertical distance by tachometric survey.

7. To prepare the map of given area by plane tabling.

8. Measurement of area of a traverse by Total Station

Course Outcome:

At the end of the course, the student will be able to:

CO1	Analyze a topographical map which shows the hills, valleys, rivers, villages, towns, forests, etc. of a country.
CO2	Analyze a cadastral map showing the boundaries of fields, houses and other properties.
CO3	Study an engineering map which shows the details of engineering works such as roads, railways, reservoirs, irrigation canals, etc.
CO4	Understand a military map showing the road and railway communications with different parts of a country. Such a map also shows the different strategic points important for the defense of a country.
CO5	Analyze a contour map to determine the capacity of a reservoir and to find the best possible route for roads, railways, etc

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L4	H	M	M	M	L	L	-	-	L	M	L	H	H	H
CO2	L4	M	L	M	L	L	M	-	-	H	L	-	M	M	M
CO3	L2	M	M	M	M	L	L	-	-	M	L	-	M	L	M
CO4	L2	M	L	M	L	-	M	-	-	L	M	L	L	-	L
CO5	L4	H	H	L	H	L	L	-	-	L	L	L	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 309: Fluid Mechanics Lab

Course Objective:

- To know the concept of fluid mechanics and hydraulic machines.
- To demonstrate the classical experiments in fluid mechanics and hydraulic machinery.
- To correlate various flow measuring devices such as Venturimeter, orifice meter and notches etc.
- To discuss the performance and characteristics of turbines and pumps.

List of Experiments:

1. To study the various pressure measuring devices
2. To verify the Bernoulli's theorem.
3. To calibrate the Venturi-meter.
4. To calibrate the Orifice-meter.
5. To determine Metacentric Height.
6. To determine Cc, Cv, Cd of an orifice.
7. To determine Cd of a mouthpiece.
8. To determine Cd of a V-notch.
9. To determine viscosity of a given fluid.
10. To study the velocity distribution in pipes.

Course Outcome

At the end of the course, the student will be able to:

CO1.	Understand the basic physics of fluids.
CO2.	Calculate and design engineering applications involving fluid.
CO3.	Understand and analyze the flow systems in terms of mass, momentum, and energy balance.
CO4.	Know the current research topics of fluid mechanics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	-	L	L	-	L	M	-	M	H	H
CO2	L4	M	M	M	M	L	M	-	-	M	M	-	M	M	L
CO3	L4	M	H	H	H	-	M	M	-	M	L	-	M	M	L
CO4	L1	M	L	L	L	L	M	L	-	L	L	-	H	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,
CD2	Tutorials/Assignments	CO2, CO3, CO4,
CD3	Seminars / Presentations	CO3, CO4,
CD4	Project Discussions	CO2, CO3
CD5	Self- learning advice using internets	CO2, CO4, CO1

BTCEPCC 310: Computer Aided Civil Engineering Drawing

Course Objective:

- To know the basic concepts and the use of engineering drawing in the design and manufacturing field.
- To acquire the basic knowledge and skills in engineering drawings and the capability to read and interpret blue prints for manufacturing.
- To develop an understanding of 2D and 3D computer aided drafting with the requirements of good engineering drawings and be able to apply them to their work.

List of Experiments :

1. To study the basics of Auto Cadd.

2. To study and draw the labelled sketch of different Building Components on sheets with exposure to CAD:

a. Drawing of walls

b. Brick and Stone masonry

c. Cross section of external wall from foundation to parapet

d. Partition wall, cavity wall and

3. Pointing, Arches, Lintels and Floors

4. Doors and Windows

5. Stairs, Cross section of Dog legged stairs

6. Roofs: Flat and Pitched roof (Steel truss)

7. Development of Front Elevation and Sectional Elevation from a given plan

8. Development of Plan, Front Elevation and Sectional Elevation from line Diagram

Course Outcome

At the end of the course, the student will be able to:

CO1:	Analyze the technical drawings using both CAD and basic manual tools.
CO2:	Create the mechanical parts for different applications.
CO3:	Apply the stages of the design process from scratch using engineering graphics techniques such as sectional projections, dimensioning and computer-generated drawings (2D). Apply principles of technical drawings to create different 3D models.
CO4:	Utilize the Solid Works surfacing features and methods to create complex solid geometry.
CO5:	Produce the structural drawing of Reinforced Concrete Elements such as Beams, Slabs, Develop Structural Drawings of steel elements such as Connections, Tension Members, Compression Members, Beams, Column Base, and Roof Trusses. , Understand various connection details.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L4	H	M	M	M	L	L	L	-	H	-	M	M	H	H
CO2	L4	M	L	M	M	-	M	-	-	M	L	L	M	M	M
CO3	L3	M	H	H	H	L	L	L	-	M	L	M	M	M	M
CO4	L3	M	L	M	M	L	-	L	-	M	M	H	H	L	M
CO5	L3	M	H	H	H	M	L	M	-	M	L	M	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 311: Civil Engineering Materials Lab

Course Objective:

- To investigate the properties and behavior of materials and assemblies.
- To familiarize with ASTM specifications and testing procedures and with construction field monitoring and testing practices.
- To develop the skills for analyzing experimental data and working in teams.
- To design and conduct a custom laboratory experiment,
- To analyze and interpret the data, and make a presentation on the results of the testing

List of Experiments :

1. To determine properties of following materials:

A. STONE:

a. Compressive strength,

b. Water absorption,

c. Impact value,

d. Tensile strength;

B. Bricks:

a. Water absorption,

b. Compressive strength,

c. Dimension and Tolerance;

C. Tiles:

a. Water absorption,

b. Tolerance,

c. Impact value

D. Timber: Compressive and Tensile Strength of Timber across and along the Grain

2. To Study the Properties & Utilization of Fly Ash in Construction
3. To Study the Different Aluminum and Steel Sections
4. To Study the Manufacturing and Use of Concrete Hollow Blocks

Course Outcome

At the end of the course, the student will be able to:

CO1	Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion
CO2	Identify, formulate and solve engineering problems of structural elements subjected to flexure
CO3	Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials
CO4	Learn different properties of materials used I n Civil Engineering.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom 's level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	L	M	-	L	M	-	M	M	L	M	H	H
CO2	L3	M	L	M	H	L	M	M	-	L	L	L	L	M	L
CO3	L4	M	H	H	H	-	L	M	-	H	M	-	M	M	L
CO4	L1	M	L	M	L	L	M	L	-	L	M	L	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,
CD2	Tutorials/Assignments	CO2, CO3, CO4,
CD3	Seminars / Presentations	CO3, CO4,
CD4	Project Discussions	CO2, CO3, CO4,
CD5	Self- learning advice using internets	CO2, CO4, CO1

BTCEPCC 312: Geology Lab

Course Objective:

- To acquire practical Knowledge on geology and on various types of rocks and minerals.

List of Experiments:

1. Physical Properties of Minerals
2. Physical Properties of Rocks
3. Identification of Minerals in Hand Specimen
4. Identification of Rocks in Hand Specimen
5. Identification of Geological features through wooden Models

a. Structural Geological Diagrams
b. Petrological Diagrams
c. Engineering Geological Diagrams

6. Interpretation of Geological Map (10 Nos.)
7. Dip & Strike Problems (8 Nos.)

Course Outcome

At the end of the course, the student will be able to:

CO1:	Categorize rocks and minerals by their origin and engineering properties.
CO2:	Apply geological principles to rock masses and discontinuities for use in engineering design e.g. rock slopes, foundation.
O3:	Identify minerals and rocks
CO4:	Get the knowledge of strike and dip of the bedding planes.
CO5:	Interpret geological maps.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P011	PO 12	PSO1	PSO2
CO1	L4	M	M	M	M	L	H	H	-	-	M	-	M	H	H
CO2	L3	H	M	L	M	L	M	H	-	-	L	-	M	M	M
CO3	L2	H	M	L	M	L	M	M	-	-	L	-	H	L	L
CO4	L2	M	M	M	M	-	H	L	-	L	M	-	L	L	M
CO5	L1	M	L	L	L	L	M	M	-	L	L	-	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4
CD3	Seminars / Presentations	CO3, CO1
CD4	Project Discussions	CO2, CO3, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTCSPCC 313: Object Oriented Programming Lab

Course Objective:

- To Perform object oriented programming for develop solutions to problems, demonstrating usage of control structures, modularity, I/O and other standard language constructs.
- To Demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.

List of Experiments:

1 Understand the basics of C++ library, variables, and data input-output.
2 C++ program using with the concept of structures.
3 Implement class and object concepts and function overloading.
4 Write programs to understand dynamic memory allocation and array of objects.
5 Program to understand different types of constructors and destructor.
6. Implement friend function to access private data of a class and usage of this Pointer.
7. Write programs to understand the usage of constant data member and member function, static data member and member function in a class.
8. Implement different types of inheritance, function overriding and virtual function
9. Implement Operator overloading concepts.
10. Write programs to understand function template and class template.
11. Write programs to understand exception handling techniques.
12. Write programs to understand file handling techniques.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Apply OOPs features to program design and implementation.
CO2:	Create Classes according to the problem and implement programs in C++
CO3:	Implement Object Oriented Programs using templates and exceptional handling concepts.
CO4:	Perform console operations, applications and file handling.
CO5:	Implement applications using C++.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	H	M	M	-	-	-	L	L	-	L	M	M
CO2	L6	M	M	H	M	L	-	-	-	M	L	-	L	M	M
CO3	L3	M	M	H	M	L	-	-	-	L	M	-	L	H	L
CO4	L3	H	H	H	H	-	-	-	-	M	M	-	L	M	M
CO5	L3	H	M	H	M	M	-	-	-	M	L	-	L	M	M

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO5

BTCESODECA 314: Social Outreach, Discipline & Extra Curricular Activities

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Develop their self-confidence, leadership qualities, and their responsibilities towards the comm. Unity.
CO2:	Have an impact on academic development, personal development, and civic responsibility
CO3:	Understand the value of Social Work.
CO4:	Understand the Significance of Discipline in student's Life
CO5:	Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PS O1	PS O2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

BTBSC315: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of CommUnity based motivation videos, CommUnity based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

Semester - IV

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCEBSC401	Probability and Sampling Theory	Core	30	70	100	3	-	-	3
BTCEHSMC402	Managerial Economics & Financial Accounting/ Technical Communication	AECC	30	70	100	3	-	-	3
BTCEESC403	Basic Electronics for Civil Engineering Applications	SEC	30	70	100	3	-	-	3
BTCEPCC404	Strength Of Materials	Core	30	70	100	3	-	-	3
BTCEPCC405	Hydraulics Engineering	Core	30	70	100	3	-	-	3
BTCEPCC406	Building Planning	Core	30	70	100	3	-	-	3
BTCEPCC407	Concrete Technology	Core	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCEPCC 408	Material Testing Lab	Core	30	20	50	-	-	1	1
BTCEPCC 409	Hydraulics Engineering Lab	Core	30	20	50	-	-	1	1
BTCEPCC 410	Building Drawing	Core	30	20	50	-	-	1	1
BTCEPCC 411	Sketch Up 3D Lab	Core	30	20	50	-	-	1	1
BTCEPCC 412	Concrete Lab	Core	30	20	50	-	-	1	1
BTCESODECA 413	Social Outreach, Discipline & Extra Curricular Activities		50		50	-	-	-	1
BTBSC 414	ANANDAM	AECC	**50**	**50**	100	**1**	**-**	**1**	**2**
	Total		**460**	**640**	**1100**	**22**	**0**	**6**	**29**

BTCEBSC 401: Probability and Sampling Theory

Course Objective:

- To learn basics of probability in connection with discrete and continuous instances along with real world phenomenon of standard distributions.
- To understand and apply two dimensional random variables.
- To understand and apply the sampling theory.

Course Content:

Unit-I: **PROBABILITY AND RANDOM VARIABLES:** Introduction to probability, Axioms of probability - Conditional probability - Total probability – Baye's theorem Random variable - Probability mass function - Probability density function - Properties – Moments - Moment generating functions and their properties.

Unit-II: **STANDARD DISTRIBUTIONS** Binomial, Poisson, Geometric, Uniform, Exponential, Weibull and Normal distributions and their properties.

Unit-III: **TWO DIMENSIONAL RANDOM VARIABLES:** Joint distributions - Marginal and conditional distributions – Covariance – Correlation and regression - Transformation of random variables - Central limit theorem

Unit-IV: **SAMPLING THEORY**: Parameter, statistic, parameter estimation, hypothesis testing Sampling distributions of the means, Sampling distributions of the differences of the means, Sampling distributions of the proportions.

Unit-V **SAMPLING THEORY**: Introduction, Test of significance, t- test, Chi square test: for goodness of fit and independence of attributes and F- test.

Text Books:

1. Ross, S., "A first course in probability", 9th Edition, Pearson Education, Delhi, 2019.
2. Medhi J., "Stochastic Processes", New Age Publishers, New Delhi, 2017. (Chapters 2, 3,4)
3. T. Veerarajan, "Probability, Statistics and Random process", Second Edition, Tata McGraw Hill, New Delhi, 2017.

Reference Books:

1. Allen A.O., "Probability, Statistics and Queuing Theory", Academic press, New Delhi, 2010.
2. Taha H. A., "Operations Research-An Introduction", Seventh Edition, Pearson Education Edition Asia, Delhi, 2014.
3. John F. Shortle , James M. Thompson, Donald Gross, Carl M. Harris Fundamentals of Queueing Theory; Wiley Series 2018.
4. Meyer P.L. "*Introduction to probability and statistical applications*", 2nd edn., American Publishing Co.
5. Hogg and craig , *Introduction to mathematical statistics*, 6th Edn,2012, Pearson education, New Delhi.
6. Ross Sheldon M, "*Introduction to Probability and Statistics for Engineers and Scientists*", Elseveir, 2010.
7. William J. Stewart, *Probability, Markov Chains, Queues and Simulation*.
8. S. Narayanan, T. K. Manicavachagom Pillay, G. Ramanaiah, *Advanced mathematics for engineering students*, S. Viswanathan Pvt.. Ltd., 1985.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Explain the basic perceptions of probability of an event and associated random variables.
CO2:	Compare and contrast various standard distributions with suitable statistical analysis. Apply and
CO3:	Solve two dimensional random variable problems through joint distributions and central limit theorem.
CO4:	Use the sampling theory to determine the significance of the differences.
CO5:	Apply the test of Chi square, t test and F-test.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO4	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO5	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	-
CD4	Project Discussions	-
CD5	Self- learning advice using internets	CO1,CO2,CO4,CO5

BTCEHSMC402: Technical Communication

Course Objectives: -

- To understand the characteristics of technical writing
- To understand complex engineering ideas for targeted audiences.
- To understand the advance technical writing in professional documents.
- To write effective technical and business documents that are grammatically and stylistically correct

Course Content:

Unit-I: **Introduction to Technical Communication-** Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.

Unit-II: **Comprehension of Technical Materials/Texts and Information Design & development-** Reading of technical texts, Reading andcomprehending instructions and technical manuals, Interpreting andsummarizing technical texts, Note-making. Introduction of differentkinds of technical documents, Information collection, factors affectinginformation and document design, Strategies for organization,Information design and writing for print and online media.

Unit-III: **Technical Writing, Grammar and Editing**- Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.

Unit-IV: Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals,

Unit-V: **Advanced Technical Writing**- Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.

Text/Reference Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, M004
2. M. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, M003. (ISBN031M406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, M003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, M004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, M004. (ISBN:078M8357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi M00M.
7. Xebec, Presentation Book, TMH New Delhi, M000. (ISBN 040MM13)

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand basic communication skills used in technical areas.
CO2:	Understand technical materials, texts and information design & development.
CO3:	Adapt an effective oral presentation, displaying the ability to engage the audience by employing a suitable delivery style, appropriate language and quality visual aids.
CO4:	Interpret Technical Reports and its types & features
CO5:	Understand the structure and formats of technical articles and proposals

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	L	L	-	-	L	M	L	H	H	H
CO2	L2	-	-	-	-	M	L	-	-	L	M	L	H	H	M
CO3	L3	-	-	-	-	L	L	-	-	L	M	L	H	M	M
CO4	L4	-	-	-	-	L	L	-	-	L	M	L	H	L	M
CO5	L2	-	-	-	-	M	L	-	-	L	M	L	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

TCEHSMC402: Managerial Economics and Financial Accounting

Course Objective:-

- To discuss the economic concepts, theories, tools, and methodologies to solve practical problems in a business.
- To provide the student with basic understanding of financial accounting that can be used in decision making techniques.

Course Content:

Unit-I: **Basic economic concepts-**Meaning, nature and scope of economics,deductive vs inductive methods, static and dynamics, Economicproblems: scarcity and choice, circular flow of economic activity, nationalincome-concepts and measurement.

Unit-II: **Demand and Supply analysis**-Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting – purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.

Unit-III: **Production and Cost analysis**-Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts explicit and implicit cost, fixed and variable cost, opportUnity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation

Unit-IV: **Market structure and pricing theory**-Perfect competition, Monopoly, Monopolistic competition, Oligopoly.

Unit-V: **Financial statement analysis**-Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash flow analysis, funds-flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.

Text Books

1. Managerial Economics and Financial Accounting, M. KASI REDDY, S. SARASWATHI, PHI Learning Pvt. Ltd
2. Managerial Economics and Financial Accounting, Prof. B.K. Garg,Dr. Surabhi Garg Dr. Kusumlata Bhardwaj , Ashirwad Publication, ISBN- 9788193796207

Reference Books:

1. Managerial Economics, R.L.Varshney & K.L Maheswari",. 5th Edition, S.Chand Publishers,
2. Managerial Economics And Financial Analysis, Kumar, P. Vijaya & Rao

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Understand the conceptual knowledge of accounting
CO2	Sharpen the analytical skills through integrating their knowledge of economic theories with decision making techniques.
CO3	Analyze different market structures and pricing theories.
CO4	Discuss the accounting process and preparation of final accounts of sole trader
CO5	Understand the mechanism of demand and supply.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	-	-	-	-	-	L	M	L	H	H
CO2	L3	-	-	-	-	-	-	-	L	L	-	M	M	M	L
CO3	L4	-	L	L	-	-	L	-	M	-	L	H	M	M	-
CO4	L5	-	-	-	-	-	-	-	L	L	-	M	M	-	M
CO5	L2	-	L	L	-	-	M	-	L	-	-	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTCEESC403: Basic Electronics for Civil Engineering Applications

Course Objective:

- To understand operation of semiconductor devices.
- To understand DC analysis and AC models of semiconductor devices.
- To apply concepts for the design of Regulators and Amplifiers
- To verify the theoretical concepts through laboratory and simulation experiments.
- To implement mini projects based on concept of electronics circuit concepts.

Course Content:

Unit-I: **Basic Electronics**: Number systems & Their conversion used in digital electronics, Demorgan's theorem, Logic Gates, half and full adder circuits, R-S flip flop, J-K flip flop. Introduction to Semiconductors, Diodes, V-I characteristics, Bipolar junction transistors (BJT) and their working, introduction to CC, CB & CE transistor configurations.

Unit-II: **Instrumentation**: mechanical, electrical, electronic system and their calibration, Use of automatic and digital levels, electronic theodolites, total stations; Control surveys using GNSS, Total station and traversing methods (adjustment and computations of coordinates).

Unit-III: **Measurement errors, Data acquisition system and data processing**: Gross error and systematic errors, absolute and relative errors, accuracy, precision, resolution and significant figures. Full-field measurements. Analog systems, digital systems using personal computers, dynamic measurement, numerical and graphical data processing and archiving.

Unit-IV: **Sensors & Transducers**: various types of sensors for displacement, velocity, acceleration, pressure, loads, strains, Displacement sensors, Mass & Piezoeletric, strain gauges, Temperature sensors thermocouple, flow sensors: Ultrasonic, electromagnetic, laser and thermal

Unit-V: **Sensor types characteristics and Digital Image Processing** : types of resolution, FOV, IFOV, PSF; Geometric and radiometric distortions, Geo-referencing, re-sampling methods; Atmospheric errors and removal; Satellite orbits and characteristics; Applications of optical and microwave remote sensing techniques in Civil Engineering. Digital image, introduction to digital image processing, pre-processing, enhancement, classification, accuracy assessment.

Course Outcome:-

At the end of the course, the student will be able to:

CO1:	Comprehend the fundamentals of construction of the digital components and semiconducting materials.
CO2:	Analyze the concept of mechanical, electrical and electronic system.
CO3:	Analysis the concept of measurement and data processing.
CO4:	Understand the concept of Sensors & Transducers.
CO5:	Analyze the concept of Sensor characteristics and Digital Image Processing.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	H	M	L	M	L	-	-	-	L	M	-	L	H	H
CO2	L2	H	M	L	M	L	-	-	-	M	M	-	-	H	M
CO3	L2	H	L	L	L	L	-	-	-	L	L	-	L	M	M
CO4	L3	H	M	L	M	M	L	-	-	M	L	-	-	L	M
CO5	L3	M	M	L	H	M	L	-	M	M	L	-	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,
CD2	Tutorials/Assignments	CO2, CO3, CO4,CO5
CD3	Seminars / Presentations	CO3, CO4,
CD4	Project Discussions	CO2, CO3, CO4,
CD5	Self- learning advice using internets	CO2, CO4,CO5

BTCEPCC404: Strength of Materials

Course Objectives:-

- To establish an understanding of the fundamental concepts of mechanics of deformable solids; including static equilibrium, geometry of deformation, and material constitutive behavior.
- To provide students with exposure to the systematic methods for solving engineering problems in solid mechanics.
- To discuss the basic mechanical principles underlying modern approaches for design of various types of structural members subjected to axial load, torsion, bending, transverse shear, and combined loading.
- To build the necessary theoretical background for further structural analysis and design courses.

Course Content:

Unit-I: **Simple Stresses and Strains in different members:** Stresses in prismatic & non prismatic members and in composite members; Thermal stresses; Stresses in composite members, Compatibility condition.

Compound Stress: Two dimensional stress system: stress resultant, principal planes and principal stresses, state of pure shear maximum shear stress, Mohr's circle &its application. Introduction to theories of failures.

Unit-II: **Bending of Beams:** Bending moment, Shear force and Axial thrust diagrams for statically determinate beams subjected to various types of loads and moments, Point of Contra-flexure, relation between load, SF and BM.

Theory of simple bending: Distribution of bending and shear stresses for simple and composite sections, Combined direct and bending stress,

Unit-III: **Torsion:** Elementary concepts of torsion, shear stress in solid and hollow circular shafts, angle of twist, power transmitted by a shaft, combined bending and torsion;

Unit-IV: **Columns:** Short and long columns, slenderness ratio, crushing and buckling of column, short column subjected to axial and eccentric loads; Euler's theory and its limitation, concept of effective length of columns; Rankine & Secant formulae, middle third rule, core of a section.

Unit-V: **Deflection of Beams:** Differential relation between load, shear force, bending moment, slope deflection. Slope & deflection in determinate beams using double integration method, Macaulay's method, area moment method and conjugate beam method and their application to statically determinate prismatic beams.

Course Outcome:-

At the end of the course, the student will be able to:

CO1	Understand the basics of material properties, stress and strain.
CO2	Apply knowledge of mathematics, science, for engineering applications
CO3	Identify, formulate, and solve engineering & real life problems
CO4	Design and conduct experiments, as well as to analyze and interpret data
CO5	Design a component to meet desired needs within realistic constraints of safety.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	M	L	M	-	-	L	L	-	M	H	H
CO2	L3	H	M	L	M	-	L	-	-	M	M	-	L	M	L
CO3	L4	H	M	L	M	-	L	-	-	L	M	-	L	M	H
CO4	L6	M	L	M	H	L	L	-	-	M	L	-	L	L	M
CO5	L6	M	L	L	H	L	M	-	-	-	L	-	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC405: Hydraulics Engineering

Course Objectives:

- To share the knowledge regarding the different hydraulic machines and the various types of flows and factors, parameters affecting flow in channels.
- To learn about the Non-Uniform flow in Open Channel**.**
- To gain the knowledge Mobile Bed Channel Hydraulics.
- To share the knowledge Hydraulic Jump, Surges, Water Waves.
- To study about Hydraulic Turbines

Course Content:

Unit-I: **Dimensional Analysis & Models:** Dynamical Similarity and Dimensional Homogeneity Model experiment, geometric, Kinematic and Dynamic similarity. Reynold's, froudes, Weber's, Euler and Mach numbers. Distorted river models and undistorted models, proper choice of scale ratios. Scale effect. Principle of dimensional analysis Rayleigh method, Buckingham theorem.

Unit-II: **Turbulent flow**, Reynolds equations, Prandtl's mixing length theory, Equations of velocity distribution and friction coefficient

Boundary Layer Theory: Concept of boundary layer, laminar and turbulent boundary layers, boundary layer thickness, von Karman integral equation, laminar sub-layer, hydro-dynamically smooth and rough boundaries, separation of flow and its control, cavitation.

Open channel Flow Uniform, Non-Uniform and variable flow. Resistance equations of Chezy and Manning. Section factor for uniform flow. Most Efficient rectangular, triangular and trapezoidal sections. Velocity distribution in open channels.

Unit-III: **Gradually varied flow** in Prismatic channels. Specific energy of flow. Critical depth in prismatic channels. Alternate depths. Rapid, critical and sub critical Flow Mild, steep and Critical Slopes. Classification of surface curves in prismatic channels and elementary computation

Rapidly varied flow: Hydraulic jump or standing wave in rectangular channels. Conjugate or sequent depths Losses in jump, location of jump. velocity distribution in open channels. Energy correction factor. Moment correction factor

Unit-IV: **Impact of free Jets:** Impact of a jet on a flat or a curved vane, moving and stationary vane.

Introduction of Hydraulic machine – Type of pumps and turbine and its brief description. Draft tube and its principle

Hydrology: Definition, Hydrologic cycle, Application to Engineering problems, measurement of rainfall, rain gauge, peak flow, flood frequency method, catchment

area formulae, Flood-hydrograph, Rainfall analysis, Infiltration, Run off, Unit hydrograph and its determination, Estimation of runoff.

Unit-V: **Ground Water**: Aquifers and its types, Confined and unconfined aquifer, Darcy's Law, hydraulic conductivity, transmissivity, well hydraulics.

Canal Hydraulics: Types of canals, parts of canal irrigation system, channel alignment, assessment of water requirements, estimation of channel losses, design of channels, regime and semi theoretical approaches (Kennedy's Theory, Lacey's Theory), cross section of channels, Silt control in canals.

Recommended Books

1. Chow, V.T., Open channel Hydraulics, McGraw Hill International
2. Henderson, F.M., Open Channel Flow, McGraw Hill International
3. Subramanya, K., Flow in Open Channels, Tata McGraw Hill
4. Ranga Raju, K.G., Flow through open channels, T.M.H.
5. French, R.H., Open Channel Hydraulics, McGraw Hill International
6. Graf, W.H., Hydraulics of Sediment Transport, McGraw Hill International

Course Outcome:-

At the end of the course, the student will be able to:

CO1	Discuss the behavior of the water supply system in Melbourne & Identify properties of fluids
CO2	Define pressure in static and flowing fluids & the control volume approach and continuity equation
CO3	Calculate velocity and pressure by applying Euler's and Bernoulli's equations
CO4	Find the forces exerted on objects by applying momentum equation & Discuss the behaviour of real fluid
CO5	Define the energy grade line and estimate energy losses in pipe flow & Calculate the magnitudes of hydrostatic forces on surfaces

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	M	L	L	M	-	M	L	L	L	H	H
CO2	L1	H	M	L	M	-	M	L	-	L	M	L	M	M	M
CO3	L2	M	L	L	H	-	L	M	-	L	L	-	-	M	L
CO4	L3, L4	M	M	M	M	L	M	L	-	-	M	L	L	L	M
CO5	L1	H	L	M	M	-	M	M	-	M	L	L	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC406: Building Planning

Course Objectives:

- To understand the fundamental principles and concepts of planning and architecture for buildings.
- To study about different views of layout.
- To learn the development controls covered by building bye laws and national building code for buildings

Course Content:

Unit-I: **Introduction**: Types of buildings, criteria for location and site selection, site plan and its detail. **Sun Consideration:** Different methods of drawing sun chart, sunshading devices, design of louvers.

Unit-II: **Climatic and comfort Consideration**: Elements of climate, global climate, climatic zones of India, thermal comfort, biclimatic chart,

Orientation: Meaning, factors affecting orientation, orientation criteriafor tropical climate.

Unit-III: **Building Bye Laws and NBC Regulations:** Objective of by-laws, regulation regarding; means of access, lines of building frontages, covered area, floor area ratio, open spaces around buildings, height & sizes of rooms, plinth regulation.

Principles of Planning: Different factors affecting planning viz-aspect, prospect, furniture requirement,roominess, grouping, circulation, elegance, privacy etc.

Unit-IV: **Vastu Shastra In Modern Building planning:** Factors considered in Vastu, site selection, orientation, planning and design of residential buildings, school/hospital

Unit-V: **Functional Design and Accommodation Requirements of Non Residential Buildings:** viz-school buildings, rest house, primary health centers, post office etc.

Services in Buildings

(A) Lighting and ventilation, doors and windows, lifts.

(B) Acoustics, sound insulation and noise control.

(C) Fire fighting provisions

Course Outcome:-

At the end of the course, the student will be able to:

Students Learning Outcomes After studying this subject students will be able to:

CO1	Comprehend local building bye-laws and provisions of National Building Code in respect of building and town planning.
CO2	Discuss various aspects of principles of planning and architecture in planning building and mass composition.
CO3	Explain the principles of planning and design considerations to construct earthquake resistant building.
CO4	Prepare working drawings, foundation plans and other executable drawings with proper details for residential buildings

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1,L2	H	L	M	M	L	M	M	-	H	L	L	L	H	H
CO2	L2	H	L	L	M	L	H	M	-	M	L	M	L	H	M
CO3	L2	H	M	L	M	-	M	M	-	L	M	M	M	M	L
CO4	L4	M	M	M	M	L	L	M	-	M	L	L	M	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,
CD2	Tutorials/Assignments	CO2, CO3, CO4,
CD3	Seminars / Presentations	CO3, CO4,
CD4	Project Discussions	CO2, CO3, CO4,
CD5	Self- learning advice using internets	CO2, CO4

BTCEPCC407: Concrete Technology

Course Objectives:

- 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.
- To present the foundations of basic Engineering tools and concepts related to Concrete technology and Civil Engineering.
- To give an experience in the implementation of Engineering concepts which are applied in field of Civil Engineering.

Course Content:

Unit-I: **Ingredients of concrete:** Cement: hydration of cement and its basic compounds, structure of hydrated cement, C-S-H gel, heat of hydration, gel-space ratio etc.

Aggregates: types, physical properties and standard methods for their determination, including Grading of aggregates as per IS. Manufactured sand- properties and IS Specifications for use in concrete.

Unit-II: **Concrete:** Grade of concrete, proportioning of ingredients, water content and its quality, water/cement ratio and its role, Properties of fresh concrete including workability, air content, Flow ability, Segregation, Bleeding and Viscosity etc. Factors affecting, methods of determination. Properties of hardened concrete such as strengths, permeability, creep, shrinkage,factors influencing, Standard tests on fresh and hardened concrete as per IS code. Aggregate- cement interface, its effect on properties of concrete. Concrete mix deign (IS method)- with and without water reducing admixtures

Unit-III: **NDT**: Introduction and their importance. Application & use of Rebound Hammer, Ultra-sonic pulse velocity meter, Rebar & Cover meter, half-cell potential meter, corrosion resistivity meter, core sampling. Interpretation of their results,

Unit-IV: **Concrete Handling in Field:** Batching, mixing, placing and transportation of concrete, equipments for material handling, various methods their suitability and precautions. Compaction of concrete: methods &equipments. Curing of concrete: various methods their suitability.

Durability of concrete. Causes of deterioration, Carbonation, Tests for durability assessment **Admixture in concrete:** Chemical and mineral admixtures, their types and uses: accelerator, retarders, water-proofing, plasticisers, super plasticizers-types, their suitability. Fly ash-properties for use in concrete, specifications of flyash as per IS 3812, and effect on properties of concrete. GGBFS, Microsilica and metakaolin-propertie, specifications and utility in concrete.

Unit-V: **Form work:** Requirements, their types. Typical formworks and shuttering/centering for Columns, beams, slabs, walls, etc. Slip and moving formwork.

Special types of concrete: Sulphate resisting concrete, under water concreting, pumpable concrete: methods and issues in making, salient properties and applications.Concretes with tailored properties- including high performance concrete, with specific properties in fresh and hardened states, self-compacting concrete-materials, mix proportioning, test methods, use and applications with case studies.

Course Outcome:

At the end of the course, the student will be able to:

CO1:	Think logically for development Concrete technology application in field of Civil Engineering.
CO2:	Gain an experience in the implementation of Concrete Materials on engineering concepts which are applied in field Construction Field
CO3:	Identify the functional role of ingredients of concrete and apply this knowledge to mix design philosophy
CO4:	Acquire and apply fundamental knowledge in the fresh and hardened properties of concrete
CO5:	Evaluate the effect of the environment on service life performance, properties and failure modes of structural concrete and demonstrate techniques of measuring the Non Destructive Testing of concrete structure

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	L	M	M	L	M	M	-	H	L	L	M	H	H
CO2	L2	H	L	L	M	-	H	M	-	M	L	M	M	M	H
CO3	L2	H	M	L	H	-	M	M	-	L	L	M	L	M	H
CO4	L3	M	M	M	M	L	L	M	-	M	M	L	M	L	M
CO5	L1	M	L	L	M	L	M	H	-	M	L	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 408: Material Testing Lab

Course objectives:

- To apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
- To function on multi-disciplinary teams in the area of materials testing.
- To use the techniques, skills and modern engineering tools necessary for engineering.
- To understand of professional and ethical responsibility in the areas of material testing.
- To communicate effectively the mechanical properties of materials.

List of Experiments:

1. Tests on Mild steel and HYSD Bar –To determine compressive and tensile strength, yield strength, percentage elongation etc.
2. Tests on Cement and concrete cubes/ core to establish their strength
3. Hardness Test – Rockwell Hardness and Brinell Hardness
4. Impact Test – Izod and Charpy
5. Modulus of Rupture of Wooden Beam
6. Fatigue Test
7. Spring Test
8. Torsion Test

Course Outcome:-

At the end of the course, the student will be able to:

CO1:	Extend the knowledge about the characteristics, sources and defects in various materials.
CO2:	Design and test the materials either in the laboratory or in the field before their actual use at the site.
CO3:	Attain the knowledge of different components of building, their classification, materials and methods of construction and causes of their failures.
CO4:	Know the various services to be provided and the defects in the buildings along with the remedial measures for proper maintenance of the buildings

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	H	L	M	M	L	M	L	-	H	M	L	M	H	H
CO2	L6	H	L	L	M	L	H	L	-	M	L	M	M	H	M
CO3	L3	H	M	L	H	-	M	M	-	L	M	M	L	M	M
CO4	L2	M	M	M	M	L	L	M	-	M	L	L	M	L	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO2, CO3, CO4,
CD3	Seminars / Presentations	CO3, CO4 , CO1
CD4	Project Discussions	CO2, CO3
CD5	Self- learning advice using internets	CO2, CO4

BTCEPCC409: Hydraulics Engineering Lab

COURSE OBJECTIVES:

- To provide practical knowledge in verification of principles of fluid flow
- To impart knowledge in measuring pressure, discharge and velocity of fluid +-flow
- To understand Major and Minor Losses
- To gain knowledge in performance testing of Hydraulic Turbines and Hydraulic Pumps at constant speed and Head
- Students will understand and be able to apply fundamental concepts and techniques of hydraulics and hydrology in the analysis, design, and operation of water resources systems.

List of Experiments :-

1. To determine the minor losses.
2. To determine the friction factor.
3. To determine Cd of Broad crested weir.
4. To verify the momentum equation.
5. To determine the discharge of venturimeter.
6. To determine Manning’s & Chezy's coefficient of roughness for the bed of a given Channel.
7. To study and plot characteristics curve of hydraulic jump.
8. To study velocity distribution in open channel flow.

Course Outcome:-

At the end of the course, the student will be able to:

CO1	Become familiar with different water resources terminology like hydrology, ground water, hydraulics of pipelines and open channel.
CO2	Understand and be able to use the energy and momentum equations.
CO3	Analyze flow in closed pipes, and design and selection of pipes including sizes.
CO4	Understand pumps classification and be able to develop a system curve used in pump selection.
CO5	Design and select pumps (single or multiple) for different hydraulic applications.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	H	M	M	M	L	L	M	-	L	L	M	H	H	H
CO2	L2	M	L	M	L	-	M	-	-	-	H	L	M	H	M
CO3	L4	M	H	H	H	-	L	M	-	M	M	M	L	M	M
CO4	L2	M	L	M	M	-	-	L	-	-	L	H	L	L	M
CO5	L1,L2,L6	M	H	H	H	-	L	M	-	-	L	-	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC410: Building Drawing

Course Objectives:

- To study the basic concepts about civil engineering.
- To plan residential and public buildings.

List of Experiments:

1 To plan and draw working drawing of a Residential building with following detail.
   (a) Site plan
   (b) Foundation plan
   (c) Plan
   (d) Two sectional elevations
   (e) Front elevation
   (f) Furniture plan
   (g) Water supply and sanitary plan
   (h) Electric fitting plan
2 To design and draw a Primary Health Center
3 To design and draw a Primary School
4 To design and draw a Rest House
5 To design and draw a Post Office
6 To design and draw a Bank
7 To design and draw a College Library
8 To design and draw a Cinema Theatre

Course Outcome:-

At the end of the course, the student will be able to:

CO1:	Select, Construct and Interpret appropriate drawing scale as per the situation.
CO2:	Draw simple curves like ellipse, cycloid and spiral.
CO3:	Draw Orthographic projections of points, lines and planes.
CO4:	Draw orthographic projection of solids like cylinders, cones, prisms pyramids including sections & Layout development of solids for practical situations.
CO5:	Draw isometric projections of simple objects.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2,L4	H	L	M	M	L	M	M	-	H	L	L	L	H	H
CO2	L3	H	L	L	L	L	H	M	-	M	L	M	L	M	L
CO3	L3	H	M	L	M	-	M	M	-	L	L	M	M	M	H
CO4	L3	M	M	M	M	L	L	M	-	M	M	L	M	L	M
CO5	L3	M	L	L	L	L	M	H	-	M	M	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC411: Sketchup 3D Lab

Course Objectives:

- To boost skills, such as 3D animation, drawing, and drafting.
- Sketchup classes to learn the exciting field of 3D design
- To prepare a map or plan to represent an area on a horizontal plan.
- To develop methods through the knowledge of modern science and the technology and use them in the field.
- To solve measurement problems in an optimal way.

List of Experiments :-

1. Introduction of various tools and axis used to develop 3D structure.
2. Introduction and exercises to develop various 3D geometrical shapes and structure. Like walls, columns, roofs, tilted roofs, etc
3. Understanding and Use of the concept of Groups and Components while development of 3D. Development of various building elements like Door windows, glazing, ventilation etc as individual Group and components.
4. Introduction of Use of colors and textures on the surface.
5. Understanding of Importing of different CAD files in Sketch up and development of detailed 3D structure.

Course Outcome:-

At the end of the course, the student will be able to:

CO1:	Generate clear, visual RFI graphics.
CO2:	Create dimensionally accurate, highly-detailed 3D models.
CO3:	Edit models in development.
CO4:	Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity
CO5:	Use a range of surveying equipment and analyze the accuracy of the equipment and results

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	M	-	L	-	-	L	L	L	H	H	H
CO2	L4	M	L	M	H	L	M	-	-	H	M	-	M	M	H
CO3	L4	M	H	H	H	-	L	-	-	M	M	-	M	M	M
CO4	L3	M	L	M	L	L	M	-	-	L	L	L	L	M	M
CO5	L2	H	H	L	H	L	L	-	-	L	M	L	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC412: Concrete Lab

Course Objectives: -

- To include advanced cement-based composites, emerging materials, and green materials.
- Material properties are evaluated using conventional and innovative non-destructive evaluation methods.
- To Brief course description: Microstructure of hydration products and its effect on properties of concrete.
- To provide Mechanisms and interaction of chemical admixtures and industrial wastes to produce sustainable and high performance concrete.
- To Evaluate of fresh and hardened properties of conventional and cement-based composites

List of Experiments:

1. To determine the fineness of Cement by Blaine's air permeability test.
2. To determine the flexural strength of Concrete.
3. To determine Soundness of cement by Le-chatelier apparatus.
4. To determine the specific gravity of fine aggregate (sand) by Pycnometer.
5. To determine the bulking of fine aggregate and to draw curve between water content and bulking.
6. Sieve analysis of coarse aggregates and fine aggregates.
7. To determine the workability of given concrete mix by slump test.
   To determine the optimum dose of super plastsizers by Flow table test.
8. To design concrete mix of M-20 grade in accordance with I S 10262.
9. To design concrete mix of M-40 grade with super plasticizer in accordance with I S10262.
10. To determine the Permeability of Concrete.
11. Study of Core cutter, UPV & Rebound Hammer equipment.

Course Outcomes:

At the end of the course the student will be able to

CO1:	Outline the importance of testing of cement and its properties
CO2:	Assess the different properties of aggregate
CO3:	Summarize the concept of workability and testing of concrete
CO4:	Describe the preparation of green concrete
CO5:	Describe the properties of hardened concrete

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	L	M	M	L	M	M	-	H	L	L	M	H	H
CO2	L3	H	L	L	M	-	H	M	-	M	M	M	M	M	H
CO3	L2	H	M	L	H	-	M	M	-	L	M	M	L	M	L
CO4	L2	M	M	M	M	L	L	M	-	M	L	L	M	L	M
CO5	L2	M	L	L	L	L	M	H	-	M	L	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4,
CD3	Seminars / Presentations	CO3, CO4
CD4	Project Discussions	CO2, CO3, CO4
CD5	Self- learning advice using internets	CO2, CO4

BTCESODECA 413: Social Outreach, Discipline & Extra Curricular Activities

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Develop their self-confidence, leadership qualities, and their responsibilities towards the commUnity.
CO2:	Have an impact on academic development, personal development, and civic responsibility
CO3:	Understand the value of Social Work.
CO4:	Understand the Significance of Discipline in student's Life
CO5:	Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

BTBSC414: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of CommUnity based motivation videos, CommUnity based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

Semester – V

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCEESC 501	Construction Technology and Equipment	Core	30	70	100	3	-	-	3
BTCEPCC 502	Structure Analysis-I	Core	30	70	100	3	-	-	3
BTCEPCC 503	Design of Concrete Structures	Core	30	70	100	3	-	-	3
BTCEPCC 504	Geotechnical Engineering	Core	30	70	100	3	-	-	3
BTCEPCC 505	Water Resource Engineering	Core	30	70	100	3	-	-	3
BTCEPEC 506A	Air & Noise Pollution and Control	Elective	30	70	100	3	-	-	3
BTCEPEC 506B	Disaster Management	Elective	30	70	100	3	-	-	3
BTCEPEC 506C	Town Planning	Elective	30	70	100	3	-	-	3
BTCEPEC 507A	Repair and Rehabilitation of Structures	Elective	30	70	100	3	-	-	3
BTCEPEC 507B	Ground Improvement Techniques	Elective	30	70	100	3	-	-	3
BTCEPEC 507C	Energy Science and Engineering	Elective	30	70	100	3	-	-	3
BTBSC 508	Professional Skills	SEC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCEPCC 509	Concrete Structures Design Lab	Core	30	20	50	-	-	1	1
BTCEPCC510	Geotechnical Engineering Lab	Core	30	20	50	-	-	1	1
BTCEPCC 511	Water Resources Engineering Design Lab	Core	30	20	50	-	-	1	1
BTCEPCC 512	Python Lab	Core	30	20	50	-	-	1	1
BTCESODECA 513	Social Outreach, Discipline & Extra Curricular Activities		50		50	-	-	1	1
BTBSC 514	ANANDAM	AECC	**50**	**50**	100	**1**	**-**	**1**	**2**
	Total		**460**	**690**	**1150**	**24**	**0**	**6**	**30**

BTCEESC 501: Construction Technology and Equipment

Course Objective:

- To understand the scope and outcome of construction technology.
- To get proper knowledge about Safety in construction and Safety measure
- To explore the Need of construction planning and its Management.

Course Content:

Unit- I: **Introduction:** Objective, scope and outcome of the course.

Engineering Economy: Principle of Engineering Economy, Minimum cost point analysis, Breakeven point analysis, Depreciation and depletion

Unit- II: **Safety in construction:** Causes, classification, cost and measurement of an accident, safety programme for construction, protective equipment, accident report,

Unit- III: **Safety measure:** (a) For storage and handling of building materials.(b) Construction of elements of a building (c) In demolition of buildings; Safety lacuna in Indian scenario. Fire safety provisions as per NBC.

Unit- IV: **Construction Planning**: Need of construction planning, Constructional Resources, construction team, stages in construction, preparation of construction schedule, Job layout, inspection and quality control;

Materials Management: Objective and functions of material management

Unit- V: **Construction Equipment and Management:** Earth Moving Equipment-Bull dozers tractor pulled scrapers Power shovels Draglines clamshells; cranes; Hoes, Trenching machine types Hauling Equipment; Drilling, Blasting and Tunnelling Equipment; Pile Driving Equipment

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of construction technology.
CO2:	Understand the Fire safety provisions as per NBC.
CO3:	Get proper knowledge about Safety in construction and Safety measure.
CO4:	Know the Need of construction planning and its Management.
CO5:	Know the Construction Equipment and their Management.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	M	L	M	M	-	H	M	L	M	H	H
CO2	L2	H	M	L	M	-	H	H	-	M	L	M	H	M	H
CO3	L1	H	L	L	L	L	M	M	-	L	L	M	L	M	M
CO4	L1	M	M	M	M	L	L	M	-	M	M	L	M	L	M
CO5	L1	M	L	L	L	-	M	H	-	M	L	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO4
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 502: Structure Analysis-I

Course Objective:

- To know the structural vibration and Simple Harmonic Motion.
- To understand the scope and outcome of Structure Analysis.
- To analyze Indeterminate Structures.

Course Content:

Unit- I: Introduction: Objective, scope and outcome of the course.

Introduction to Indeterminate structures, Degrees of freedom per node, Static and Kinematic indeterminacy (i.e. for beams, frames & portal with & without sway etc.), Releases in structures, Maxwell's reciprocal theorem and Betti's theorem.

Unit- II: Analysis of prop cantilever structures, Analysis of Indeterminate Structure (fixed and continues beams) using Area moment method.

Unit- III: Analysis of Indeterminate Structure (fixed and continues beams) using Conjugate beam method, Three moments Theorem.

Unit- IV: Analysis of Statically Indeterminate Structures using Slope deflection method and Moment distribution method applied to continuous beams and portal frames with and without inclined members

Unit- V: Vibrations: Elementary concepts of structural vibration, Mathematical models, basic elements of vibratory system. Degree of freedom. Equivalent Spring stiffness of springs in parallel and in series.

Simple Harmonic Motion: vector representation, characteristic, addition of harmonic motions, Angular oscillation.

Undamped free vibration of SDOF system: Newton's law of motion, D Almbert's principle, deriving equation of motions, solution of differential equation of motion, frequency & period of vibration, amplitude of motion; Introduction to damped and forced vibration.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of Structure Analysis.
CO2:	Analyze the Indeterminate Structures.
CO3:	Solve problems by Area moment method.
CO4:	Know the structural vibration and Simple Harmonic Motion.
CO5:	Evaluate solutions for Static and Kinematic indeterminacy.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	M	-	M	L	-	H	L	L	M	H	H
CO2	L4	H	M	M	M	-	H	H	-	M	L	M	H	H	M
CO3	L3	H	M	H	H	L	M	L	-	L	M	M	L	L	M
CO4	L1	M	L	L	L	L	L	L	-	M	L	L	M	L	M
CO5	L4	M	L	L	L	-	M	H	-	M	M	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO4, CO5
CD4	Project Discussions	CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 503: Design of Concrete Structures

Course Objective:

- To understand the scope and outcome of the Concrete Structures.
- To evaluate the role of the Limit state of serviceability for deflection and collapse in shear.
- To assess the structural behavior of concrete structures.

Course Content:

Unit- I: **Introduction:** Objective, scope and outcome of the course.

Fundamental concepts of design of RC members, assumptions. Types and function of reinforcement. Introduction to various related IS codes, Characteristic load and characteristic strength.

Working Stress Method: Working stress design philosophy. Analysis and Design of singly reinforced rectangular beam section for flexure.

Limit State Design: Limit state design philosophy. Assumptions, Analysis and design of singly reinforced, doubly reinforced rectangular beams and flanged beams for flexure using codal provisions for simply supported, cantilever, fixed and continuous beams.

Unit- II: **Limit state of serviceability for deflection:** control of deflection as per codal provisions of empirical coefficients.

Limit state of collapse in shear: Types of shear reinforcement and its detailing, analysis and design of shear reinforcement for prismatic sections.

Limit state of collapse in bond: concept of bond stress, anchorage length and development length. Detailing and curtailment of reinforcement as per codal provisions.

Unit- III: **Slabs:** Analysis and design of one way and two way slabs using LSM, Detailing of reinforcement. Check for shear and deflection.

Unit- IV: **Columns:** Short and long columns, their structural behaviour. Analysis and design of axially loaded short columns, using LSM. Analysis of eccentrically loaded short columns. Introduction to Pu- Mu interaction curves and their use for eccentrically loaded columns.

Unit- V: **Footings:** Analysis and design of Isolated column footing for axial load. Introduction to combined footing for two columns (without central beam) for axial loads using LSM.

Torsion: Analysis and Design of beams for torsion as per codal method.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Concrete Structures.
CO2:	Evaluate the role of the Limit state of serviceability for deflection and collapse in shear.
CO3:	Assess the structural behavior of concrete structures.
CO4:	Solve problems related to Columns and Slabs.
CO5:	Solve problems related to Footing and Torsion.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	M	L	M	L	-	H	L	L	M	H	H
CO2	L5	H	M	M	M	-	H	M	-	M	M	M	H	M	H
CO3	L3	H	M	M	H	L	M	M	-	L	M	M	L	M	M
CO4	L3	M	M	M	M	L	L	M	-	M	L	L	M	L	M
CO5	L3	M	M	M	M	-	M	M	-	M	M	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 504: Geotechnical Engineering

Course Objective:

- To understand the scope and outcome of the Geotechnical Engineering.
- To solve Compressibility and Consolidation of soil.
- To analyze the Bearing Capacity of Soils.

Course Content:

Unit- I: **Introduction:** Objective, scope and outcome of the course.

Soil and soil-mass constituents, water content, specific gravity, void ratio, porosity, degree of saturation, air void and air content, Unit weights, density index etc. Inter-relationships of the above. Determination of index properties of soil: water content, specific gravity, particle size distribution, sieve and sedimentation analysis, consistency limits, void ratio and density index. Mineral structures, structures of Illite Montmorillonites and kaolinite and their characteristics. Darcy's law of permeability of soil and its determination in laboratory.

Stresses in soil mass: total, effective and neutral pressure, calculation of stresses, influence of water table on effective stress, quicksand phenomenon. Classification of soil for general engineering purposes : particle size and I.S. Classification systems.

Unit- II: Mohr's circle of stress, shearing strength of soil, parameters of shear strength, Coulomb's failure envelope, determination of shear parameters by Direct Shear Box. Tri-axial and unconfined compression test apparatuses. Principles of soil compaction, laboratory compaction tests; Proctor's test, Stresses in Soil under surface loading: Bossinesq's and Westergaard's analysis for vertical pressure and its distribution in a soil mass. Vertical stresses due to concentrated loads, Isobar diagram, Vertical stress distribution on a horizontal plane. Influence diagram, Vertical stresses at a point under circular and rectangular loaded area. Approximate methods of obtaining vertical pressure due to surface loading. Newmark's chart,

Unit- III: **Compressibility and Consolidation:** Introduction to consolidation, comparison of compaction and consolidation, Spring Analogy Terzaghis one dimensional consolidation theory, Degree of consolidation, consolidation test, Compressibility parameters, coefficient of consolidation. Pre-consolidation pressure and its determination. Normally, over and under consolidated soils. Methods of predicting Settlement and its rate. Total and differential Settlement.

Unit- IV: **Stability of Slopes:** Classifications of slopes, Stability analysis of infinite slopes. Stability of finite slopes by Swedish and Friction circle method. Stability analysis by Taylor's stability number , Taylor's stability number curves. . Bishop's method of stability analysis. Earth Pressure: Active, passive and earth pressure at rest. Rankine's and Coulomb's theories. Rebhann's and Culman's graphical methods for active earth

pressure for vertical and inclined back retaining walls, horizontal and inclined cohesion less back fill.

Unit- V: **Bearing Capacity of Soils:** Terminology related to bearing capacity, Common types of foundations. Terzaghi and Meyehoff's theory for bearing capacity. Rankine's method for minimum depth of foundation. Skempton's method. Effect of eccentricity and water table on bearing capacity. IS code method, Plate load and penetration tests for determining bearing capacity. Introduction to pile.

Site Investigations: Methods of explorations. Planning of Investigations, Depth of exploration, Number of boreholes, Undisturbed and Disturbed samples. Types of samplers. Brief description of procedures of sampling, Transportation and Storage of samples.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Geotechnical Engineering.
CO2:	Solve Compressibility and Consolidation of soil.
CO3:	Understand the Soil and soil-mass.
CO4:	Analyze the Bearing Capacity of Soils.
CO5:	Know the Planning of Investigations and Depth of exploration.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	L	L	L	L	L	M	-	L	L	-	L	H	H
CO2	L3	L	M	M	M	-	L	-	-	M	M	L	M	M	H
CO3	L2	M	M	L	M	L	-	L	-	H	L	M	L	M	L
CO4	L4	M	M	M	M	-	-	-	-	M	M	-	M	L	M
CO5	L1	M	L	L	L	-	L	L	-	L	M	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTCEPCC 505: Water Resource Engineering

Course Objective:

- To understand the scope and outcome of Water Resource Engineering.
- To study the Canal Irrigation. Embankment Dams and Well Irrigation.
- To evaluate Hydrologic cycle and measurement of rainfall.

Course Content:

Unit- I: **Introduction:** Objective, scope and outcome of the course.

Introduction: Definitions, functions and advantages of irrigation, present status of irrigation in India, classification for agriculture, soil moisture and crop water relations, Irrigation water quality. Consumptive use of water, principal Indian crop seasons and water requirements.

Unit- II: **Canal Irrigation:** Types of canals, design of channels, regime and semi theoretical approaches (Kennedy's Theory, Lacey's Theory) Diversion Head works: Design for surface and subsurface flows, Bligh's and Khosla's methods.

Unit- III: **Embankment Dams:** Suitable sites, causes of failures, stability and seepage analysis, flow net, principles of design of earth dams.

Gravity Dams: Force acting on a gravity dam, stability requirements.

Unit- IV: **Well Irrigation:** Open wells and tube wells, types of tube wells, duty of tube well water. Cross-Drainage Structure: Necessity of Cross drainage structures, their types and selection, comparative merits and demerits.

Unit- V: **Hydrology:** Definition, Hydrologic cycle, measurement of rainfall, Flood hydrograph, Rainfall analysis, Infiltration, Run off, Unit hydrograph and its determination.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of Water Resource Engineering.
CO2:	Study the design of channels.
CO3:	Study the Canal Irrigation. Embankment Dams and Well Irrigation.
CO4:	Evaluate Hydrologic cycle and measurement of rainfall.
CO5:	Evaluate Infiltration, Run off and Unit hydrograph.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	M	L	M	L	L	M	-	L	L	-	L	H	H
CO2	L2	H	M	M	M	-	L	-	-	M	L	L	L	H	M
CO3	L2	M	L	L	M	-	-	L	-	H	M	M	L	M	M
CO4	L4	M	M	M	H	-	-	-	-	M	M	-	M	L	M
CO5	L4	H	M	M	H	L	L	L	-	L	L	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPEC506A: Air & Noise Pollution and Control

Course Objective:

- To understand the scope and outcome of the Air and Noise Pollution and Control.
- To access the problems by Air pollutants and Effects on Health.
- To evaluate solutions for noise on health and noise environments.

Course Content:

Unit- I: Introduction: Objective, scope and outcome of the course.

Air Pollution: Air pollutants, Sources, classification, Combustion Processes and pollutant emission, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects-Smoke, smog and ozone layer disturbance, Greenhouse effect.

Unit- II: Air sampling and pollution measurement methods, principles and instruments, Ambient air quality and emission standards, Air pollution indices, Air Act, legislation and regulations, control principles.

Unit- III: Removal of gaseous pollutants by adsorption, absorption, reaction and other methods. Particulate emission control, settling chambers, cyclone separation, Wet collectors, fabric filters, electrostatic precipitators and other removal methods like absorption, adsorption, precipitation etc. Biological air pollution control technologies, Indoor air quality.

Unit- IV: Noise pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria,

Unit- V: Effects of noise on health, annoyance rating schemes; special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Noise control methods.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Air and Noise Pollution and Control..
CO2:	Access the problems by Air pollutants and Effects on Health.
CO3:	Study Air sampling and pollution measurement methods.
CO4:	Study the Removal of gaseous pollutants by adsorption, absorption.
CO5:	Evaluate solutions for noise on health and noise environments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	M	L	M	L	L	M	-	L	M	-	L	H	H
CO2	L4	M	M	L	M	L	L	-	-	M	L	L	L	M	H
CO3	L2	M	L	M	L	-	-	L	-	M	M	M	M	M	M
CO4	L2	H	M	M	M	-	-	-	-	M	M	-	L	L	M
CO5	L4	M	M	L	M	-	L	L	-	L	L	L	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4
CD4	Project Discussions	CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPEC506B: Disaster Management

Course Objective:

- To understand the scope and outcome of the Disaster Management.
- To understand the Concepts and definitions of Disaster, Hazard.
- To study the Disaster Management and acts.

Course Content:

Unit- I: **Introduction:** Objective, scope and outcome of the course.

Introduction: Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Natural and Manmade Disasters, Disaster and Development, and Climate Change.

Types of Disasters, their occurrence/ causes, impact and preventive measures:

Unit- II: **Geological Disasters:** earthquakes, landslides, tsunami, mining;

Hydro-Meteorological Disasters: floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves.

Unit- III: **Biological Disasters:** epidemics, pest attacks, forest fire.;

Technological Disasters: chemical, industrial, radiological, nuclear.

Unit- IV: **Manmade Disasters:** building collapse, rural and urban fire, road and rail accidents.

Disaster profile of Indian continent, Mega Disasters of India and Lessons Learnt. Risk mapping.

Unit- V: **Disaster Management Cycle:** Disaster Management Cycle and its components: Pre disaster and post disaster, Paradigm Shift in Disaster Management. Safety tips for various types of disasters.

Disaster management system in India: Disaster Management Act 2005, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter- Governmental Agencies.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Disaster Management.
CO2:	Understand the Concepts and definitions of Disaster and Hazard.
CO3:	Understand the Biological Disasters and Technological Disasters.
CO4:	Study Disaster Management and acts.
CO5:	Evaluate solutions for Disaster profile and disaster cycle.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	M	M	M	-	L	M	-	L	M	-	M	H	H
CO2	L2	L	M	M	M	L	L	-	-	M	M	L	M	M	L
CO3	L2	M	L	H	L	M	-	L	-	H	L	M	L	M	M
CO4	L2	M	M	M	M	L	-	-	-	-	M	-	-	L	M
CO5	L4	H	M	M	M	M	L	L	-	-	L	L	-	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4
CD4	Project Discussions	CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

TCEPEC 506C: Town Planning

Course Objective:

- To understand the scope and outcome of the Town Planning.
- To study the Civic Surveys and Zoning.
- To get the knowledge about Public Buildings and Re-planning of existing towns.

Course Content:

Unit- I: Introduction: Objective, scope and outcome of the course.

Introduction: Definition of town planning, Evolution of towns, Objects of town planning, Economic Justification for town planning, Principles of town planning, Necessity of town planning, Origin, Growth and patterns of town development, distribution of land use, site for ideal town, powers required to enforce T.P. scheme

Unit- II: Civic Surveys: Definition, Necessity, collection of data, Types of surveys, methods adopted to collect data, Drawings, reports.

Zoning: Definition, Use of land, Objects of zoning, Principles of zoning, Aspects, Advantages & Importance zoning, Transition zone, Zoning powers, Maps for zoning

Unit- III: Importance and Demand of housing, Classification, requirements and design of residential building, Housing agencies, Housing problems in India.

Slums: Causes, characteristics and effects of slums, Slum clearance.

Unit- IV: Industries: Classification of industry, Concentration of industry, requirements of the industry, Industrial townships.

Public Buildings: Location, classification principle of design, town center, grouping of public buildings. Town Planning, CL-SPP/CL-DDU/Nadiad, Gujarat, INDIA 4

Unit- V: Re-planning of existing towns: Objects of re-planning, defects of existing town, data required for re- planning, Urban Renewal projects, De-centralization and Re-centralized, Garden city concept overview.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Town Planning.
CO2:	Study the Civic Surveys and Zoning.
CO3:	Know the Importance and Demand of housing.
CO4:	Get the knowledge of characteristics and effects of slums.
CO5:	Get the knowledge about Public Buildings and Re-planning of existing towns.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	H	M	H	-	L	M	-	L	L	-	M	H	H
CO2	L2	H	M	L	M	L	L	-	-	M	L	L	M	H	M
CO3	L2	M	L	M	M	-	-	L	-	H	L	M	L	M	M
CO4	L1	L	L	L	L	-	-	-	-	-	M	-	L	L	M
CO5	L1	M	L	L	L	L	L	L	-	-	M	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO4,
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPEC507A: Repair and Rehabilitation of Structures

Course Objective:

- To understand the scope and outcome of the Repair and Rehabilitation of Structures.
- To know the Factors affecting and Preventive measures and Cracks in Concrete and Masonry Structures
- To know the Materials for Repair and Under Water Repair.

Course Content:

Unit- I: **Introduction:** Objective, scope and outcome of the course.

Deterioration of Concrete Structures: Penetrability of concrete permeability, sorptivity, diffusion. Physical processes- abrasion, erosion. Chemical- carbonation, chloride and sulfate attack. Alkali – Aggregate Reaction. Corrosion- mechanism.

Unit- II: **Factors affecting and Preventive measures:** for all the above, including water – proofing techniques for various conditions, sacrificial anode, corrosion resistant steel, corrosion inhibitors, protective coatings etc.

Cracks in Concrete and Masonry Structures- Types, patterns, measurement and preventive measures

Unit- III: **Assessment of Risk/Damage in Structures:** Preliminary investigation- visual, history collection etc. Detailed Investigation: core cutting, rebar locator, corrosion meter, penetration resistance, pull out tests, half–cell potential, concrete resistivity etc. Interpretation of non destructive test data from all the above tests as well as rebound hammer number and ultra sonic pulse velocity. Destructive and chemical tests- on material samples from site.

Unit- IV: **Materials for Repair:** polymers and resins, self curing compounds, FRP, ferro-cement- properties, selection criterion, cement based and polymer modified mortars etc

Repair Techniques: Grouting, Jacketing, External bonded plates processes, limitations, design computations etc. including numerical problems.

Unit- V: **Under Water Repair:** Processes

Case Studies: related to rehabilitation of bridge piers, heritage structures, masonry structures etc.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Repair and Rehabilitation of Structures.
CO2:	Know the factors affecting and Preventive measures for Cracks in Concrete and Masonry Structures.
CO3:	Get the Assessment of Risk/Damage in Structures.
CO4:	Study the Materials for Repair and Repair Techniques.
CO5:	Know the Materials for Repair and Under Water Repair.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	M	L	M	-	M	M	-	L	L	L	-	H	H
CO2	L2	M	H	M	H	L	H	-	-	M	M	M	-	M	H
CO3	L1	M	M	L	M	-	M	L	-	H	L	H	L	M	M
CO4	L1	H	M	L	M	L	H	-	-	M	M	M	M	L	M
CO5	L1	M	M	M	M	-	M	L	-	L	M	-	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPEC507B: Ground Improvement Techniques

Course Objective:

- To understand the scope and outcome of the Ground Improvement Techniques.
- To Study Densification by Compaction Near Surface.
- To analyze the Design methods of reinforced earth wall.

Course Content:

Unit- I: **Introduction:** Objective, scope and outcome of the course.

Introduction: Formation of soil- Mechanical Weathering, Chemical weathering, types of soil-Residual soil, Transported soil, Regional soil Deposit in India, Difficult soils- Expansive soil, Collapsible soil, organic soil etc. Purpose and Principles of Ground Improvements.

Unit- II: **Densification by Compaction Near Surface:** Theory of compaction, Laboratory compaction tests; compaction in field, Effect of compaction on different soil properties, Factor affecting compaction in field, Measurement of density in field.

Densification by Deep Compaction:

(a) Vibration methods- Vibro compaction, Vibro floatation, Vibratory probes method, Blasting.

(b) Displacement methods- Sand compaction piles; Dynamic compaction.

Unit- III: **Modification Using Stone Columns:**

Introduction- Failure mechanism, load carrying capacity, settlement analysis, installation technique, Geo-synthetic -encased stone columns, Mechanism of encasement, field control of stone columns

Pre-Compression and Vertical Drain: Applicability and types of pre compression. Purpose and mechanism of pre-compression by pre loading. Design procedure of pre-compression by preloading.

Pre-compression by preloading with vertical drains- Principles, Advantages, and disadvantages of Vertical drains, Type of Vertical drains, Installation, Monitoring and Instrumentation of Vertical drains.

Unit- IV: **Modification by Grouting:** Purpose, principles and classification of grouts and their properties. Desirable characteristics of grout, Grouting methods, Planning and operation of grouting, control of grouting operations and monitoring.

Unit- V: **Modification by Soil Reinforcement:** Purpose of reinforced earth, Mechanism of reinforced soil, Failure mechanism of reinforced earth, Advantages of reinforced earth. Application of Reinforced Earth,

Design methods of reinforced earth wall-

(a) Check for External stability.

(b) Check for Internal stability.

Miscellaneous Methods of Soil stabilization: Lime stabilization, cement stabilization, bituminous stabilization, chemical stabilization.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Ground Improvement Techniques.
CO2:	Study of Densification by Compaction near Surface.
CO3:	Understand the Pre-compression.
CO4:	Know the Modification by Grouting and Soil Reinforcement.
CO5:	Analyze the Design methods of reinforced earth wall.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	M	L	M	L	L	M	-	L	L	-	M	H	H
CO2	L2	H	M	M	M	L	M	-	-	M	M	L	-	M	H
CO3	L2	M	M	M	H	-	H	L	-	H	L	M	-	M	M
CO4	L1	H	L	L	L	L	M	-	-	M	L	-	M	L	M
CO5	L4	M	M	M	M	-	L	L	-	L	M	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO4, CO5
CD4	Project Discussions	CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPEC 507C: Energy Science and Engineering

Course Objective:

- To understand the scope and outcome of the Energy Science and Engineering.
- To study the Energy & Environment and Engineering for Energy conservation.
- To know the Civil Engineering Projects connected with the Energy Sources.

Course Content:

Unit- I: **Introduction:** Objective, scope and outcome of the course.

Introduction to Energy Science: Scientific principles and historical interpretation to place energy use in the context of pressing societal, environmental and climate issues; Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment

Unit- II: **Energy Sources:** Overview of energy systems, sources, transformations, efficiency, and storage. Fossil fuels (coal, oil, oil bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems

Unit- III: **Energy & Environment:** Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability

Unit- IV: **Civil Engineering Projects connected with the Energy Sources:** Coal mining technologies, Oil exploration offshore platforms, Underground and under-sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers; hydro power stations above-ground and underground along with associated dams, tunnels, penstocks, etc.

Unit- V: **Engineering for Energy conservation:** Concept of Green Building and Green Architecture; Green building concepts; LEED ratings; Identification of energy related enterprises

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Energy Science and Engineering.
CO2:	Study the Energy & Environment and Engineering for Energy conservation.
CO3:	Know the Scientific principles and historical interpretation.
CO4:	Get the Remedies & alternatives for fossil fuels.
CO5:	Know the Civil Engineering Projects connected with the Energy Sources.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	M	L	M	-	L	M	-	L	L	-	M	H	H
CO2	L2	H	M	M	M	L	L	-	-	M	L	L	M	H	M
CO3	L1	M	L	L	L	-	-	L	-	-	L	M	L	M	M
CO4	L1	H	L	L	L	L	-	-	-	-	L	-	-	L	M
CO5	L1	H	L	L	L	-	L	L	-	L	M	L	-	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTBSC508: Professional Skills

Objectives:

1. To acquire career skills and fully pursue to partake in a successful career path
2. To prepare good resume, prepare for interviews and group discussions
3. To explore desired career opportUnities in the employment market in consideration of an individual SWOT.
4. Understand the significance of Team Skills and help them in acquiring them
5. To help them design, develop and adapt to situations as an individual and as a team.

Course Contents:

Unit I: Resume Skills & Interview Skills

Resume Skills : Preparation and Presentation, Introduction of resume and its importance, Difference between a CV, Resume and Bio data, Essential components of a good resume, Resume skills : common errors, Common errors people generally make in preparing their resume, Prepare a good resume of her/his considering all essential components

Interview Skills : Preparation and Presentation, Meaning and types of interview (F2F, telephonic, video, etc.), Dress Code, Background Research, Do's and Don'ts, Situation, Task, Approach and Response (STAR Approach) for facing an interview, Interview procedure (opening, listening skills, closure, etc.), Important questions generally asked in a job interview (open and closed ended questions), Interview Skills : Simulation, Observation of exemplary interviews, Comment critically on simulated interviews, Interview Skills : Common Errors, Discuss the common errors generally candidates make in interview, Demonstrate an ideal interview

Unit II: Group Discussion Skills & Exploring career opportUnities

Meaning and methods of Group Discussion, Procedure of Group Discussion, Group Discussion- Simulation, Group Discussion - Common Errors, Knowing yourself – personal characteristics. Knowledge about the world of work, requirements of jobs including self-employment, Sources of career information, Preparing for a career based on their potentials and availability of opportUnities

Unit III: Presentation Skills, Trust and Collaboration

Types of presentations, Internal and external presentation, Knowing the purpose, Knowing the audience, Opening and closing a presentation, Using presentation tools, Handling questions, Presentation to heterogenic group, Ways to improve presentation skills over time, Explain the importance of trust in creating a collaborative team, Agree to Disagree and Disagree to Agree – Spirit of Team work, Understanding fear of being judged and strategies to overcome fear

Unit IV: Listening as a Team Skill & Brainstorming

Advantages of Effective Listening, Listening as a team member and team leader. Use of active listening strategies to encourage sharing of ideas (full and undivided attention, no interruptions, no prethink, use empathy, listen to tone and voice modulation, recapitulate points, etc.)., Use of group and individual brainstorming techniques to promote idea generation., Learning and showcasing the principles of documentation of team session outcomes

Unit V: Social and Cultural Etiquette & Internal Communication

Need for etiquette (impression, image, earn respect, appreciation, etc), Aspects of social and cultural/corporate etiquette in promoting teamwork, Importance of time, place, propriety and adaptability to diverse cultures, Use of various channels of transmitting information including digital and physical, to team members.

Course Outcomes:

CO	Statement
	After the completion of this course, students will be able to:
CO1	Prepare their resume in an appropriate template without grammatical and other errors and using proper syntax and Participate in a simulated interview
CO2	Actively participate in group discussions towards gainful employment, Capture a self - interview simulation video regarding the job role concerned and Enlist the common errors generally made by candidates in an interview.
CO3	Perform appropriately and effectively in group discussions and Explore sources (online/offline) of career opportUnities
CO4	Use common technology messaging tools that are used in enterprises for flow of information and transition from command and control to informal communication during an online/offline team session & Actively use and operate online team communication tools: Webinar, Skype, Zoom, Google hangout etc
CO5	Appreciate and demonstrate Team Skills & Generate, share and maximise new ideas with the concept of brainstorming and the documentation of key critical ideas/thoughts articulated and action points to be implemented with timelines in a team discussion (as MOM) in identified applicable templates

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Levels	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L6	**L**	**H**	**L**	**M**	**L**	**H**	**H**	**M**	**-**	**H**	**M**	**-**	**L**	**L**
CO2	L3	**L**	**H**	**L**	**M**	**L**	**H**	**H**	**M**	**-**	**H**	**M**	**-**	**L**	**L**
CO3	L3	**L**	**H**	**L**	**M**	**L**	**H**	**H**	**M**	**-**	**H**	**M**	**-**	**L**	**M**
CO4	L3	**L**	**H**	**L**	**M**	**L**	**H**	**H**	**M**	**-**	**H**	**M**	**-**	**L**	**M**
CO5	L3	**L**	**H**	**L**	**M**	**L**	**H**	**H**	**M**	**-**	**H**	**M**	**-**	**L**	**M**

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTCEPCC 509: Concrete Structures Design Lab

Course Objective:

- To understand the design procedures of Concrete Structures.
- To Analyze and Design different beams, slabs and footings.

List of Experiments

1. Revision of Typical problems of BMD and SFD
2. Analysis and Design of singly reinforced rectangular beam section for flexure, based on Working stress design philosophy.
3. Analysis and Design of singly reinforced rectangular beam section for flexure, based on Limit State design philosophy.
4. Analysis and Design of doubly reinforced rectangular beam section for flexure, based on Limit State design philosophy.
5. Analysis and Design of flanged beam section for flexure, based on Limit State design philosophy
6. Problems on Limit state of serviceability for deflection as per codal provisions of empirical coefficients.
7. Analysis and design of prismatic sections for shear using LSD.
8. Problems on limit state of collapse in bond.
9. Analysis and design of one way slabs using LSM.
10. Analysis and design of two way slabs using LSM.
11. Analysis and design of short axially loaded columns.
12. Analysis and design of footing.
13. Analysis and Design of beams for torsion as per codal method.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the design procedures of Concrete Structures.
CO2:	Understand Working stress design philosophy and Limit State design philosophy.
CO3:	Work on Limit state of serviceability and codal method.
CO4:	Solve Problems on limit state of collapse in bond.
CO5:	Evaluate solutions for prismatic sections for shear.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	M	L	L	L	M	M	-	L	L	-	M	H	H
CO2	L2	H	M	M	L	L	L	-	-	M	L	L	M	M	M
CO3	L3	M	L	L	M	-	-	L	-	L	M	M	L	L	M
CO4	L3	L	-	M	L	-	-	-	-	-	M	-	-	M	M
CO5	L3	M	M	M	L	L	L	L	-	-	L	L	-	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO1, CO3, CO4, CO5
CD4	Project Discussions	CO1, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC510: Geotechnical Engineering Lab

Course Objective:

- To study the soil and its engineering properties.
- To determine different tests on soil.

List of Experiments

1. Grain size distribution by sieve Analysis and Hydrometer
2. Determination of specific Gravity by Pycnometer.
3. Determination of liquid limit by Casagrande's apparatus and cone penetrometer.
4. Determination of plastic limit and shrinkage limit
5. Determination of field density by core-cutter and sand replacement method
6. Determination of compaction properties by standard Proctor Test Apparatus
7. Determination of C-Ø values by unconfined compression Test Apparatus, Direct Shear Test Apparatus and Triaxial Test.
8. To determine the differential free swell index of soil and swelling pressure of soil.
9. To determine the CBR of soil.
10. To determine the compressibility parameters of soil by consolidation test.
11. To determine the permeability of soil by constant and falling head methods. Design as per syllabus of theory.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Study the soil and its engineering propertirs.
CO2:	Determine plastic, liquid and shrinkage limits.
CO3:	Solve problems relatesd to compressibility parameters of soil.
CO4:	Determine different tests on soil.
CO5:	Determine the permeability of soil.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	M	L	M	-	L	M	-	L	M	-	M	H	H
CO2	L5	H	H	M	H	L	L	-	-	M	L	L	L	M	H
CO3	L3	M	M	M	M	-	-	L	-	H	M	M	L	M	M
CO4	L5	H	H	H	H	-	-	-	-	M	L	-	M	L	M
CO5	L5	M	M	M	M	-	L	L	-	L	M	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 511: Water Resources Engineering Design Lab

Course Objective:

- To understand the scope and outcome of Water Resource Engineering.
- To study the Canal Irrigation. Embankment Dams and Well Irrigation.
- To evaluate Hydrologic cycle and measurement of rainfall.

List of Experiments

1. To establish steady uniform flow conditions in the Laboratory flume and to determine Chezy's coefficient "C" and Manning's Coefficient "n".
2. To investigate the relationship between E & Y in a rectangular channel.
3. To study the flow characteristics over a hump/weir.
4. To study the characteristics of hydraulic jump developed in the laboratory flume.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of Water Resource Engineering.
CO2:	Study the design of channels.
CO3:	Study the Canal Irrigation. Embankment Dams and Well Irrigation.
CO4:	Evaluate Hydrologic cycle and measurement of rainfall.
CO5:	Evaluate Infiltration, Run off and Unit hydrograph.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	M	L	M	-	L	M	-	L	L	-	L	H	H
CO2	L2	L	M	M	M	L	L	-	-	M	M	L	L	M	H
CO3	L2	M	L	L	M	-	-	L	-	H	L	M	L	M	M
CO4	L3	M	M	M	H	-	-	-	-	M	M	-	M	L	M
CO5	L3	H	M	M	M	L	L	L	-	L	M	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 512: Python Lab

Course Objective:

- To describe the need for Object-oriented programming concepts in Python.
- To infer the supported data structures like lists, dictionaries and tuples in Python.
- To illustrate the application of matrices and regular expressions in building the Python programs.
- To discover the use of external modules in creating excel files and navigating the file systems.

List of Experiments

1. Write a program to demonstrate basic data type in python.
2. Write a program to compute distance between two points taking input from the user
3. Write a program add.py that takes 2 numbers as command line arguments and prints its sum.
4. Write a Program for checking whether the given number is an even number or not.
5. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . . , 1/10
6. Write a Program to demonstrate list and tuple in python.
7. Write a program using for loop that loops over a sequence.
8. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.
9. Find the sum of all the primes below two million.
10. By considering the terms in the Fibonacci sequence whose values do not exceed four million, WAP to find the sum of the even-valued terms.
11. Write a program to count the numbers of characters in the string and store them in a dictionary data structure.
12. Write a program to use split and join methods in the string and trace a birthday of a person with a dictionary data structure
13. Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?
14. Write a program to print each line of a file in reverse order.
15. Write a program to compute the number of characters, words and lines in a file.
16. Write a function nearly equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on.
17. Write function to compute gcd, lcm of two numbers. Each function shouldn’t exceed one line.
18. Write a program to implement Merge sort.
19. Write a program to implement Selection sort, Insertion sort.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Create, Test and Debug Python Programs
CO2:	Implement Conditionals and Loops for Python Programs
CO3:	Use functions and represent Compound data using Lists, Tuples and Dictionaries
CO4:	Read and write data from & to files in Python and develop Application using Python.
CO5:	Illustrate sort methods in Python Programs.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L6	H	M	M	M	M	-	-	-	L	M	L	L	M	M
CO2	L3	M	M	M	M	L	-	-	-	M	M	L	M	H	M
CO3	L2	H	L	H	L	M	-	-	-	L	L	L	M	H	H
CO4	L6	H	M	H	M	M	-	-	-	M	M	M	L	H	H
CO5	L3	M	M	M	M	L	-	-	-	M	M	L	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,CO5
CD2	Tutorials/Assignments	CO2, CO3
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit	-

TCESODECA 513: Social Outreach, Discipline & Extra Curricular Activities

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Develop their self-confidence, leadership qualities, and their responsibilities towards the commUnity.
CO2:	Have an impact on academic development, personal development, and civic responsibility
CO3:	Understand the value of Social Work.
CO4:	Understand the Significance of Discipline in student's Life
CO5:	Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

BTBSC514: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of CommUnity based motivation videos, CommUnity based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

Semester –VI

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCEESC 601	Wind & Seismic Analysis	Core	30	70	100	3	-	-	3
BTCEPCC 602	Structural Analysis-II	Core	30	70	100	3	-	-	3
BTCEPCC 603	Environmental Engineering	Core	30	70	100	3	-	-	3
BTCEPCC 604	Design of Steel Structures	Core	30	70	100	3	-	-	3
BTCEPCC 605	Estimating & Costing	Core	30	70	100	3	-	-	3
BTCEPEC 606A	Pre-Stressed Concrete	Elective	30	70	100	3	-	-	3
BTCEPEC 606B	Solid and Hazardous Waste Management	Elective	30	70	100	3	-	-	3
BTCEPEC 606C	Traffic Engineering and Management	Elective	30	70	100	3	-	-	3
BTCEPEC 607A	Machine Learning	Elective	30	70	100	3	-	-	3
BTCEPEC 607B	Rock Engineering	Elective	30	70	100	3	-	-	3
BTCEPEC 607C	Geographic Information System & Remote Sensing	Elective	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCEPCC 608	Environmental Engineering Design and Lab	Core	30	20	50	-	-	1	1
BTCEPCC 609	Steel Structure Design Lab	Core	30	20	50	-	-	1	1
BTCEPCC 610	Quantity Surveying and Valuation Lab	Core	30	20	50	-	-	1	1
BTCEPCC 611	Water and Earth Retaining Structures Design Lab	Core	30	20	50	-	-	1	1
BTCEPCC 612	Machine Learning Lab	Core	30	20	50	-	-	1	1
BTCESODECA 613	Social Outreach, Discipline & Extra Curricular Activities		50		50	-	-	-	1
BTBSC 614	ANANDAM	AECC	**50**	**50**	100	**1**	**-**	**1**	**2**
	Total		**460**	**640**	**1100**	**22**	**0**	**6**	**29**

BTCEESC 601: Wind and Seismic Analysis

Course Objective:

- To understand the scope and outcome of the Wind And Seismic Pressures.
- To design structures for wind and seismic loads.

Course Contents:

Unit-I: **Introduction:** Objective, scope and outcome of the course.

Structural Systems: Types of structures and Structure's forms, Symmetry and Asymmetry in building forms, Vertical and lateral load resting elements, shear walls, framed tubes and various multistory configurations.

Unit-II: **Design Loads:** various types of loads and relevant codes. Design loads for different types of buildings. (IS-875 part 1 & 2) & Load Flow Concept

Unit-III: **Wind Loads Analysis:** Wind loads & calculation of wind load on flat roof, pitched roof and single sloped roof buildings (IS: 875-Part 3).

Unit-IV: **Earthquake Load Analysis:** Earthquake loads & calculations of earthquake loads on framed structures. (IS: 1893 – Part 1).

Unit-V: **Earthquake Resistant Construction:** Typical seismic failure of masonry and RCC structures. Earthquake resistant construction of buildings, and various provisions as per IS codes; IS 4326,IS-13827, IS-13828, IS-13920, IS-13935.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Wind And Seismic Pressures.
CO2:	Know the Symmetry and Asymmetry in building forms.
CO3:	Design Loads for wind and seismic loads.
CO4:	Solve problems using provisions as per IS codes.
CO5:	Know Earthquake Resistant Construction.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	M	M	M	L	L	M	-	L	L	-	M	H	H
CO2	L1	M	L	L	L	L	M	-	-	M	M	L	M	H	H
CO3	L5	L	M	M	M	-	H	L	-	H	L	M	L	M	M
CO4	L3	L	L	L	L	-	M	-	-	M	M	-	L	L	M
CO5	L1	M	M	M	M	L	L	L	-	L	L	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4
CD4	Project Discussions	CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTCEPCC 602: Structural Analysis-II

Course Objective:

- To understand the scope and outcome of the Structural Analysis.
- To solve problems using different methods like Unit load method and Energy Methods.
- To analyze of multistory frames and space trusses.

Course Contents:

Unit-I: **Introduction:** Objective, scope and outcome of the course.

Unit load method & their applications: deflection of determinate beams and frames, analysis of determinate and redundant frames up to two degree of redundancy, lack of fit in redundant frames.

Introduction to Energy Methods: Strain energy for gradually applied, suddenly applied and impact loads, Strain energy due to axial loads, bending, shear and torsion;. Castiglione's theorems & their applications in analysis of determinate and redundant frames up to two degree of redundancy and trussed beams; Stresses due to temperature & lack of fit in redundant frames; deflection of determinate beams, frames using energy methods.

Unit-II: **Influence line diagram & Rolling load:** ILD for beams & frames, Muller-Breslau principle and its application for drawing ILD, Rolling load, maximum stress resultants in a member/section, absolute maximum stress resultant in a structure.

Unit-III: **Arches:** analysis of three hinged two hinged and fixed type parabolic arches with supports at the same level and at different levels.

Unit-IV: **Unsymmetrical bending:** Definition, location of NA, computation of stresses and deflection, shear centre and its location,

Unit-V: **Approximate methods for lateral loads:** Analysis of multistory frames by portal method, cantilever method & factor method. Analysis of determinate space trusses by tension coefficient method

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Structural Analysis.
CO2:	Solve problems using different methods like Unit load method and Energy Methods.
CO3:	Solve problems of two hinged and fixed type parabolic arches.
CO4:	Solve problems related to Unsymmetrical bending.
CO5:	Analyze multistory frames and space trusses.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	M	M	M	-	L	M	-	L	L	-	-	H	H
CO2	L2	H	M	H	H	L	L	-	-	M	L	L	-	M	M
CO3	L2	M	L	M	M	-	-	L	-	H	L	M	L	M	L
CO4	L2	M	M	H	H	L	-	-	-	M	M	-	M	L	M
CO5	L4	H	M	M	M	-	L	L	-	L	L	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3
CD4	Project Discussions	CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 603: Environmental Engineering

Course Objective:

- To understand the scope and outcome of Environmental Engineering.
- To analyze Water Treatment and Sewage.
- To evaluate the composition and properties of air and noise.

Course Contents:

Unit-I: **Introduction:** Objective, scope and outcome of the course.

Water: -Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices. 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.

Unit-II: Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes.

Unit-III: **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 characteristics: Quality parameters: BOD, COD, TOC, Solids, DO, Nitrogen, Phosphorus, Standards of disposal into natural watercourses and on land, Indian standards.

Unit-IV: Sewage and Sullage, Pollution due to improper disposal of sewage, Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes.

Wastewater Disposal and Refuse: Disposal of sewage by dilution, Self purification of streams, sewage disposal by irrigation sewage farming, waste water reuse.

Unit-V: **Air -**Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air quality standards, Control measures for Air pollution

Noise-Basic concept, measurement and various control methods

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of Environmental Engineering.
CO2:	Know the sources of Water and water quality issues.
CO3:	Understand analyzing Water Treatment and Sewage.
CO4:	Get knowledge about the Pollution due to improper disposal of sewage.
CO5:	Evaluate the composition and properties of air and noise.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	M	L	M	-	L	M	-	L	L	-	M	H	H
CO2	L1	M	L	L	L	L	L	M	-	M	M	L	H	H	L
CO3	L2	L	H	M	M	-	-	H	-	H	L	M	M	M	M
CO4	L1	M	L	L	L	L	M	M	-	-	L	-	L	M	L
CO5	L4	H	M	M	M	-	L	H	-	-	M	L	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4
CD4	Project Discussions	CO3, CO4
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 604: Design of Steel Structures

Course Objective:

- To understand the scope and outcome of the Steel Structures.
- To solve problems related to Connections, Tension Members, Compression Members, etc.
- To evaluate solutions for different type of steel structures.

Course Contents:

Unit-I: **Introduction:** Objective, scope and outcome of the course.

Types of Steels and their broad specifications. Structural steel forms- hot rolled, tubular, light gauge etc and their applicability. Classification of cross sections as per IS 800-2007- Plastic, compact, semi compact and slender- characteristics

Plastic analysis of steel structures, fundamentals, shape factor, static and mechanism method of analysis, bending of beams of uniform cross sections (any shape)

Connections: Types of bolts, load transfer mechanism, prying action. Design of bolted and welded connections under axial and eccentric loadings with IS provisions

Unit-II: **Tension Members:** Design strength in gross section yielding, net section rupture and block shear. Design of axially loaded members.

Compression Members: Types of buckling, Imperfection factor, Buckling curves for different cross sections as per IS. Design of compression members: Axially loaded members including made up of angle section: single and in pair; built up columns including design of lacings and battens as per IS.

Unit-III: **Beams:** Design of beams: simple and compound sections. Design of laterally supported and unsupported beams including for web buckling, web crippling, lateral torsional buckling.

Member design under combined forces: Compressive load and uniaxial moment. tension and uniaxial moment

Column Bases: Design of column bases for axial and eccentric compressive loads: Slab and gusseted base.

Unit-IV: **Design of plate girder**: Design of welded and bolted sections including web and flange splicing, horizontal, intermediate and bearing stiffeners. Shear strength determination by post critical and tension field action methods. End panel design options and procedure as per IS 800. Curtailment of flange plates. Connections for flange plate to flange angles and flange angles to web, etc. Design of welded connections.

Unit-V: **Design of gantry girder:** Design of roof trusses members for combined forces, wind loading etc. Purlin design. Introduction to Pre Engineered Buildings , characteristics and their applications.

Introduction of truss girder bridges-its members including portal and sway bracings etc. Design aspects of foot over bridges.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Steel Structures.
CO2:	Study design of Beams, plate girder, gantry girder and Column Bases.
CO3:	Solve problems related to Connections, Tension Members, Compression Members, etc.
CO4:	Evaluate solutions for different type of steel structures.
CO5:	Study Member design under combined forces.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	M	L	M	-	L	-	-	L	L	-	-	H	H
CO2	L2	H	M	M	M	-	L	-	-	M	M	L	-	M	L
CO3	L3	L	L	L	L	-	-	-	-	H	L	M	L	M	M
CO4	L4	H	M	L	M	L	-	-	-	M	M	-	M	M	M
CO5	L2	H	M	M	M	L	L	-	-	L	M	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO4, CO5
CD4	Project Discussions	CO3, CO4
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 605: Estimating & Costing

Course Objective:

- Impart the knowledge of estimating, costing and valuation for civil engineering structures.
- Prepare and evaluate contract documents.
- Identify and differentiate between the two types of estimate.

Course Contents:

Unit-I: Introduction: Purpose and importance of estimates, principles of estimating, Methods of taking out quantities of items of work, Mode of measurement, measurement sheet and abstract sheet; bill of quantities, Types of estimate, plinth area rate, cubical content rate, preliminary, original, revised and supplementary estimates for different projects.

Unit-II: Rate Analysis: Task for average artisan, various factors involved in the rate of an item, material and labor requirement for various trades; preparation for rates of important items of work, Current schedule of rates. (C.S.R.)

Unit-III: Estimates: Preparing detailed estimates of various types of buildings, R.C.C. works and earth work calculations for roads and estimating of culverts Services for building such as water supply, drainage and electrification.

Unit-IV: Cost of Works: Factors affecting cost of work, overhead charges, Contingencies and work charge establishment, various percentages for different services in building.

Unit-V: Valuation: Purposes, depreciation, sinking fund, scrap value, year's purchase, gross and net income, dual rate interest, methods of valuation, rent fixation of buildings.

Reference Books Recommended:

(1) "Estimating and Costing" by B. N. Dutta, UBS Publisher.

(2) "Estimating and Costing" by Rangwala, Charotar Publishing House.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Compare different types of estimate, Units of measurements & payments for different item of works in construction and illustrate a relationship to Bill of Quantities and Scheduled rates
CO2 :	Understand the specifications of different Items of works.
CO3:	Estimate the quantities and evaluate the abstract cost for different types of buildings by Long wall-short wall method
CO4:	Estimate the quantities and evaluate the abstract cost for different types of buildings by Centre line method
CO5:	Organize Quantity surveying for any kind of civil structures using modern tools and manage the project problems, formulate and solve in teams, in order to improve future problem solving ability and able to present it.

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	M	M	M	-	L	M	-	L	M	-	M	H	H
CO2	L2	L	M	M	M	L	L	-	-	M	M	L	M	M	L
CO3	L2	M	L	H	L	M	-	L	-	H	L	M	L	M	M
CO4	L2	M	M	M	M	L	-	-	-	-	M	-	-	L	M
CO5	L4	H	M	M	M	M	L	L	-	-	L	L	-	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTCEPEC 606A: Pre-Stressed Concrete

Course Objective:

- To understand the scope and outcome of the Pre-Stressed Concrete.
- To analyze of Pre-stress and Bending Stresses.
- To evaluate losses, deflection and design of Pre-stressed Concrete Members.

Course Contents:

Unit-I: **Introduction:** Objective, scope and outcome of the course.

Introduction: Basic concepts of Pre-stressing and its advantages. Materials for pre-stressed concrete. Tensioning devices. Pretensioning and post tensioning systems.

Unit-II: **Analysis of Pre-stress and Bending Stresses:** Assumptions, Flexural analysis of pre-stressed rectangular and unsymmetrical T section. Concept of load balancing.

Unit-III: **Losses of Pre-stress:** Losses due to - elastic deformation of concrete, successive tensioning of curved cable, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip.

Unit-IV: **Deflection of Pre-stressed Concrete Members:** Effect of tendon profile and associated factors incontinuous members. Computation of deflection in pre-stressed concrete members.

Unit-V: **Design of Pre-stressed Concrete Sections:** Flexural Shear and Torsional strength using simplified code procedure (IS-1343-2012). Design of simply supported Pre-stressed Concrete Sections for flexure.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Pre-Stressed Concrete.
CO2:	Understand the Pre-tensioning and post-tensioning systems.
CO3:	Understand analysis of Pre-stress and Bending Stresses.
CO4:	Evaluate losses, deflection and design of Pre-stressed Concrete Members.
CO5:	Design Simply Supported Pre-stressed Concrete Sections for flexure.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	M	L	M	-	L	-	-	L	L	-	L	H	H
CO2	L2	H	M	M	M	L	M	-	-	L	M	L	L	M	H
CO3	L2	L	L	L	M	-	L	-	-	H	L	M	L	M	L
CO4	L4	H	M	L	M	L	-	-	-	M	M	-	M	L	M
CO5	L6	H	H	M	H	M	L	-	-	L	L	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTCEPEC 606B: Solid and Hazardous Waste Management

Course Objective:

- To understand the scope and outcome of the Solid and Hazardous Waste.
- To study Solid Waste Characterization.
- To understand the Treatment and Disposal of Solid Waste.

Course Contents:

Unit-I: **Introduction:** Objective, scope and outcome of the course.

Introduction to SWM: Definition of waste and solid waste, classification solid waste, sources of solid waste, its composition, factors affecting waste generation, traditional methods of waste collection and disposal

Unit-II: **Waste Collection:** Components of waste collection, waste collection containers, their characteristics, types, waste collection vehicles, collection frequency, collection route, transfer stations

Unit-III: **Solid Waste Characterization:** Physical characteristics, chemical characteristics and biological characteristics of solid wastes

Waste Processing: Size reduction, factors affecting size reduction, size reducing equipment, volume reduction, equipment for volume reduction, waste minimization, waste hierarchy, 3 R principle

Unit-IV: **Hazardous Waste:** Definition, sources, classification, collection, segregation, treatment and disposal methods

Radioactive Waste, E-Waste, Biomedical Waste: Definition, sources, classification, segregation, management and disposal methods

Unit-V: **Treatment and Disposal of Solid Waste:** Composting, vermicomposting, biogas production, thermal treatment, incineration, pyrolysis, gasification, biological treatment, Sanitary land filling, land fill leachate and gas management

Latest Advances and Rules related to SWM, Hazardous Waste, Plastic Waste and E-Waste Management

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Solid and Hazardous Waste.
CO2:	Get to know the Components of waste collection
CO3:	Know the E-Waste, Biomedical Waste.
CO4:	Study Solid Waste Characterization.
CO5:	Understand the Treatment and Disposal of Solid Waste.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	H	L	H	L	L	M	-	L	L	-	L	H	H
CO2	L1	M	M	M	M	-	L	-	-	M	M	L	L	M	H
CO3	L1	L	L	L	L	-	-	L	-	H	L	M	L	M	M
CO4	L2	M	M	L	M	L	-	-	-	-	M	-	M	L	M
CO5	L2	L	H	M	H	L	L	L	-	-	L	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTCEPEC 606C: Traffic Engineering and Management

Course Objective:

- To understand scope and outcome of the Traffic Engineering and Management.
- To study Traffic Planning, its safety and management.

Course Contents:

Unit-I: **Introduction:** Objective, scope and outcome of the course.

Traffic Planning and Characteristics: Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow .

Unit-II: **Traffic Surveys**: Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including non-motorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation –Level of service – Concept, applications and significance

Unit-III: **Traffic Design and Visual Aids:** Intersection Design – channelization, Rotary intersection design – Signal design – Coordination of signals — Grade separation – Traffic signs including VMS and road markings – Significant roles of traffic control personnel – Networking pedestrian facilities & cycle tracks.

Unit-IV: **Traffic Safety and Environment**: Road accidents – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards –

Unit-V: **Traffic Management:** Area Traffic Management System – Traffic System Management (TSM) with IRC standards –- Traffic Regulatory Measures-Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods- Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Traffic Engineering and Management.
CO2:	Understand of Traffic and environment hazards.
CO3:	Get the understanding of Speed, journey time and delay surveys.
CO4:	Study Traffic Planning, its safety and management.
CO5:	Know the Intelligent Transport System for traffic management.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	M	L	M	L	L	M	-	-	M	-	M	H	H
CO2	L2	M	M	M	M	L	L	-	-	-	M	L	M	M	M
CO3	L1	L	L	L	L	-	-	L	-	H	L	M	-	M	L
CO4	L2	L	M	L	M	-	-	-	-	M	L	-	L	L	M
CO5	L1	H	M	M	M	-	L	L	-	L	M	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO4
CD5	Self- learning advice using internets	CO2, CO4

BTCEPEC 607A : Machine Learning

Course Objectives:

- To introduce students to the basic concepts and techniques of **Machine Learning**.
- To develop skills of using recent **machine learning** software for solving practical problems.
- To gain experience of doing independent study and research.

Course Contents:

Unit I: Supervised learning algorithm: Introduction, types of learning, application, Supervised learning: Linear Regression Model, Naïve Bayes classifier Decision Tree, K nearest neighbor, Logistic Regression, Support Vector Machine, Random forest algorithm

Unit II: Unsupervised learning algorithm: Grouping unlabelled item susing k-means clustering, Hierarchical Clustering, Probabilistic clustering, Association rule mining, Apriori Algorithm, f-p growth algorithm, Gaussian mixture model.

Unit III: Introduction to Statistical Learning Theory, Feature extraction-Principal component analysis, Singular value decomposition. Feature selection–feature ranking and subset selection, filter, wrapper and embedded methods, Evaluating Machine Learning algorithms and Model Selection.

Unit IV: Semi supervised learning, Reinforcement learning : Markov decision process (MDP), Bellman equations, policy evaluation using Monte Carlo, Policy iteration and Value iteration, Q-Learning, State-Action-Reward-State-Action (SARSA), Model-based Reinforcement Learning.

Unit V: Recommended system, Collaborative filtering, Content-based filtering Artificial neural network, Perceptron, Multilayer network, Back propagation, Introduction to Deep learning.

Reference/Text Books:

- Tom M Mitchell, Machine Learning, McGraw Hill Education
- Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
- Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000. ISBN: 9780471056690.
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Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Describe intelligent agents for search and games
CO2:	Convert AI problems through programming with Python
CO3:	Learning optimization and inference algorithms for model learning
CO4:	Make programs for an agent to learn and act in a structured environment.
CO5:	Learn recommended system in ML.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	H	M	M	M	M	M	-	-	-	M	-	M	M	M
CO2	L2	M	M	H	M	L	-	-	-	-	M	-	L	M	M
CO3	L1	M	H	M	H	-	-	-	-	-	H	-	L	H	M
CO4	L3	H	M	H	M	M	-	M	-	-	M	-	L	H	M
CO5	L1	M	H	M	H	-	-	-	-	-	H	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO4 ,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3
CD3	Seminars	CO3 ,CO4
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO4,CO5

BTCEPEC 607B: Rock Engineering

Course Objective:

- To understand the scope and outcome of the Rock Engineering.
- To study Engineering Classification, Properties and Laboratory Tests of Rocks
- To get the knowledge of Strength of Rocks in Unconfined and confined condition.

Course Contents:

Unit-I: **Introduction:** Objective, scope and outcome of the course.

Engineering Classification of Rocks: Objectives, Intact rock classification, Rock mass Classification. Terzaghi's, Rock load classification, Austrian classification, Deere's rock quality classification, rock structure rating concept, RMR classification, Q classification. Inter relation between Q and RMR.

Unit-II: **Engineering Properties and Laboratory Tests on Rocks:** Porosity, Density, Moisture content, Degree of saturation, Co-efficient of permeability, Durability, Compressive strength, Tensile strength, Shear strength, elasticity, Plasticity Deformability. Sampling and Samples Preparations, Uniaxial Compressive strength, Tensile Strength – Brazilian test, Shear strength test – Direct Shear test and Punch shear test, Triaxial Test, Flexural strength.

Unit-III: **In-situ Tests on Rocks**: Necessity of In-situ test, Plate load test for deformability, Field Shear test

Jointed Rocks: Rocks Joint properties, Joint properties, Joint Roughness Co-efficient, Scale effects, Dilation, Orientation of Joints, Gouge, Joint Intensity, Uniaxial Compressive strength of Jointed Rocks.

Unit-IV: **Strength of Rocks in Unconfined Condition**: Ramamurthy Strength Criteria, Singh and Rao Strength Criteria, Kulatilake Methodology, Barton Methodology.

Unit-V: **Strength of Rocks in Confined Condition:** History of Hoek and Brown Failure Criterions, Parabolic Strength Criteria.

Bearing Capacity of Rocks: Bearing capacity of intact rocks, jointed rocks,IS Code methodology, Singh and Rao Method and latest methodologies.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Rock Engineering.
CO2:	Study In-situ Tests on Rocks.
CO3:	Study the Engineering Classification, Properties and Laboratory Tests of Rocks
CO4:	Get the knowledge of Strength of Rocks in Unconfined and confined condition.
CO5:	Know the Bearing Capacity of Rocks.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	L	L	L	L	L	M	-	-	L	-	L	H	H
CO2	L2	L	H	M	H	L	L	-	-	-	M	L	H	M	M
CO3	L2	H	M	M	M	-	-	L	-	L	M	M	L	M	L
CO4	L1	M	M	L	M	-	-	-	-	H	M	-	-	L	M
CO5	L1	H	L	L	L	L	L	L	-	M	L	L	-	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTCEPEC 607C: Geographic Information System & Remote Sensing

Course Objective:

- To understand the scope and outcome of the Geographic Information System & Remote Sensing.
- To Study Photogrammetry, Remote Sensing, Image Interpretation and Geographic Information System.

Course Contents:

Unit-I: **Introduction:** Objective, scope and outcome of the course.

Photogrammetry: Definition of Photogrammetric Terms, Geometry of aerial and terrestrial photographs,Aerial camera and phototheodolite, Scale of a Photograph, Tilt and Height displacements, Stereoscopicvision and stereoscopes, Height determination from parallax measurements, Flight planning, Maps and Map substitutes and their uses.

Unit-II: **Remote Sensing:** Introduction and definition of remote sensing terms, Remote Sensing System, Electromagnetic radiation and spectrum, Spectral signature, Atmospheric windows.

Unit-III: Different types of platforms, sensors and their characteristics, Orbital parameters of a satellite, Multi concept in Remote Sensing.

Unit-IV: **Image Interpretation:** Principles of interpretation of aerial and satellite images, equipments and aids required for interpretation, ground truth – collection and verification, advantages of multidate and multiband images. Digital Image Processing concept.

Unit-V: **Geographic Information System (GIS) :** Introduction & applications of GIS in map revision, Land use, Agriculture, Forestry, Archaeology, Municipal, Geology, water resources, Soil Erosion, Land Suitability analysis, change detection.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Geographic Information System & Remote Sensing.
CO2:	Use the Digital Image Processing concept.
CO3:	Study Maps and Map substitutes and their uses.
CO4:	Study Photogrammetry, Remote Sensing, Image Interpretation and Geographic Information System.
CO5:	Understand the concept of Soil Erosion, Land Suitability analysis, etc.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	M	L	M	-	L	M	-	L	M	-	L	H	H
CO2	L3	H	L	L	L	-	L	-	-	-	L	L	L	M	H
CO3	L2	M	L	L	L	-	-	L	-	H	L	M	L	M	M
CO4	L2	L	M	L	M	L	-	-	-	-	M	-	M	L	M
CO5	L2	H	M	M	M	-	L	L	-	-	M	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO4
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 608: Environmental Engineering Design and Lab

Course Objective:

- To understand the Population forecasting and Water Quality parameters.
- To examine Physical, chemical and biological Characterization of water.

LIST OF EXPERIMENTS:

1. Population forecasting and water demand
2. Water Quality parameters
3. Design of Sedimentation tanks, coagulation and flocculation tanks
4. Design of rapid and slow sand filters
5. Design of disinfection Units and transmission systems
6. Design of Sewer lines and storm water systems
7. Design of aerobic and anaerobic treatment Units
8. Design of suspended and attached growth systems

Lab:

1. Physical Characterization of water: Turbidity, Electrical Conductivity, pH
2. Analysis of solids content of water: Dissolved, Settleable, suspended, total, volatile, inorganic etc.
3. Alkalinity and acidity, Hardness: total hardness, calcium and magnesium hardness
4. Optimum coagulant dose
5. Chemical Oxygen Demand (COD)
6. Dissolved Oxygen (D.O) and Biochemical Oxygen Demand (BOD)
7. Break point Chlorination
8. Bacteriological quality measurement: MPN.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the Population forecasting and Water Quality parameters.
CO2:	Study the design of Sedimentation tanks, coagulation and flocculation tanks
CO3:	Design aerobic and anaerobic treatment Units.
CO4:	Examine Physical, chemical and biological characterization of water.
CO5:	Study the design of disinfection Units and transmission systems.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	M	L	M	-	M	M	-	L	M	-	M	H	H
CO2	L4	L	M	M	M	L	L	M	-	M	M	L	L	M	L
CO3	L6	M	H	M	H	-	-	L	-	H	L	M	M	M	M
CO4	L5	M	M	L	M	L	-	M	-	-	L	-	L	L	M
CO5	L2	H	M	M	M	-	L	L	-	-	L	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO1, CO2, CO3, CO4, CO5
CD4	Project Discussions	CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 609: Steel Structures Design Lab

Course Objective:

- To understand the scope and outcome of the Steel Structures.
- To solve problems related to Connections, Tension Members, Compression Members, etc.
- To evaluate solutions for different type of steel structures.

List of Experiments:

Analysis and design Problems as per different topics of syllabus of theory BTCE604, with latest version of IS 800 and other relevant IS codes. In addition to numerical problems, following exercises:

1. Case study of foot over bridges/truss- Girder Bridge in vicinity /home town of the students, preferably in groups of 8-10 students. A report including photographs marked with names and section details of different members in it (maximum limit of words: 1000).
2. Case study of a structure using tubular sections or light gauge sections in vicinity /home town of the students, preferably in groups of 8-10 students. A report including photographs marked with names, size and section details of different members in it (maximum limit of words: 1000).

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Steel Structures.
CO2:	Study design of Beams, plate girder, gantry girder and Column Bases.
CO3:	Solve problems related to Connections, Tension Members, Compression Members, etc.
CO4:	Evaluate solutions for different type of steel structures.
CO5:	Study Member design under combined forces.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	M	L	M	-	L	M	-	L	M	-	L	H	H
CO2	L2	H	M	M	M	L	L	-	-	M	L	L	L	H	M
CO3	L3	L	H	L	H	L	-	L	-	H	L	M	L	M	M
CO4	L5	H	L	L	M	-	-	-	-	M	L	-	M	M	L
CO5	L2	H	H	M	H	L	L	L	-	L	M	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO4, CO5
CD4	Project Discussions	CO3, CO4
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 610: Quantity Surveying and Valuation Lab

Course Objective:

- To understand the scope and outcome of the Quantity Surveying and Valuation.
- To solve problems of Preliminary, Detailed Estimate and Rate Analysis of buildings.
- To evaluate solutions related to Earthwork Calculation and Valuation of Buildings and Properties.

List of Experiments

1. Preliminary Estimate (Plinth Area and Cubic Content).
2. Detailed Estimate of buildings (Long wall-Short wall and Centre line method).
3. Rate Analysis of different Items of Works (Earthwork, Concrete Work, DPC, Stone masonry, Brickwork, RCC, Roofing, Flooring, and Finishing etc.).
4. Earthwork Calculation for Roads, Irrigation Canals and Channels (cutting and filling).
5. Valuation of Buildings and Properties.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Quantity Surveying and Valuation Lab.
CO2:	Evaluate the solutions related to Earthwork Calculation for Roads, Irrigation Canals and Channels.
CO3:	Solve problems of Preliminary, Detailed Estimate and Rate Analysis of buildings.
CO4:	Evaluate the solutions related to Valuation of Buildings and Properties.
CO5:	Understand the Long wall-Short wall and Centre line method.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	M	L	M	-	L	M	-	-	L	-	M	H	H
CO2	L5	L	M	M	M	L	L	-	-	-	L	L	M	M	H
CO3	L3	M	M	M	M	M	-	L	-	H	M	M	L	M	M
CO4	L5	L	L	L	L	L	-	-	-	M	L	-	M	L	M
CO5	L2	H	M	L	M	M	L	L	-	L	M	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC 611: Water and Earth Retaining Structures Design Lab

Course Objective:

- To understand the scope and outcome of the Water and Earth Retaining Structures design.
- To analyze and design continuous beams, Circular domes, etc.

List of Experiments

1. **Continuous Beams:** Analysis and Design of continuous beams using coefficients (IS Code), concept of moment redistribution
2. **Curved Beams:** Analysis and design of beams curved in plan.
3. **Circular Domes:** Analysisand design of Circular domes with u.d.l. & concentrated load at crown.
4. **Water Tanks and Towers:** Water Tanks and Water Towers-design of rectangular, circular and Intze type tanks, column brace type staging.
5. **Retaining walls:** Analysis and design of Cantilever Retaining Walls: Introduction to counter fort and buttress type retaining walls, their structural behaviour and stability analysis.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Water and Earth Retaining Structures Design.
CO2:	Study the design of continuous beams and Circular beam.
CO3:	Study the design of Water Tanks and Water Towers, Circular domes, etc.
CO4:	Know the structural behaviour and stability.
CO5:	Study the design of Cantilever Retaining Walls.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	L	M	-	L	M	-	L	M	-	M	H	H
CO2	L3	M	H	M	H	L	L	-	-	M	L	L	M	M	H
CO3	L3	M	M	L	M	-	-	L	-	H	M	M	L	M	L
CO4	L1	M	L	L	L	L	-	-	-	-	M	-	-	M	M
CO5	L3	H	M	M	M	-	L	L	-	-	M	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTCSPCC 612: Machine Learning Lab

Course Objective:

- To Make use of Data sets in implementing the machine learning algorithms
- To Analyze and evaluate simple algorithms for pattern classification.
- To implement the machine learning concepts and algorithms in any suitable language of choice.

List of Experiments

1. Implement and demonstrate the FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Build intelligent agents for search and games
CO2:	Solve AI problems through programming with Python
CO3:	Learning optimization and inference algorithms for model learning
CO4:	Design and develop programs for an agent to learn and act in a structured environment.
CO5 :	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L6	H	M	H	M	M	-	-	-	L	M	-	L	M	M
CO2	L5	M	M	H	M	L	-	-	-	L	M	-	M	H	M
CO3	L1	H	L	H	L	L	-	-	-	L	L	-	M	H	H
CO4	L6	H	M	H	M	M	-	-	-	M	M	-	L	H	H
CO5	L3	M	M	M	M	L	-	-	-	M	M	L	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO2, CO3,CO5
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit	-

BTCESODECA 613: Social Outreach, Discipline & Extra Curricular Activities

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Develop their self-confidence, leadership qualities, and their responsibilities towards the commUnity.
CO2:	Have an impact on academic development, personal development, and civic responsibility
CO3:	Understand the value of Social Work.
CO4:	Understand the Significance of Discipline in student's Life
CO5:	Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

BTBSC 614: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of CommUnity based motivation videos, CommUnity based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

Semester – VII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCEPCC701	Transportation Engineering	Core	30	70	100	3	-	-	3
BTCEPEC702A	Human Engineering and Safety	Elective	30	70	100	3	-	-	3
BTCEPEC702B	Environmental Engineering and Disaster Management	Elective	30	70	100	3	-	-	3
BTCEPEC702C	Non Destructive Testing	Elective	30	70	100	3	-	-	3
BTCEPCC703	Geographic information system & remote sensing	Core	30	70	100	3	-	-	3
BTCEPCC704	Pre-stressed concrete	Core	30	70	100	3	-	-	3
BTEESEC705	Research and Publication Ethics	Core	30	70	100	3	-	-	3
BTBSC 706	Leadership & Management Skills	SEC	30	70	100	2			2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCEPCC707	Road Material Testing Lab	Core	30	20	50	-	-	1	1
BTCEPCC708	Professional Practices & Field Engineering Lab	Core	30	20	50	-	-	1	1
BTCEPSIT709	Practical Training	Core	60	40	100	2	-	-	2
BTCEPCC710	Seminar	Core	60	40	100	2	-	-	2
BTCESODECA711	Social Outreach, Discipline & Extra Curricular Activities		**50**	**-**	50	**-**	**-**	**-**	**1**
BTBSC 712	ANANDAM	AECC	**50**	**50**	100	**1**		**1**	**2**
	Total		**460**	**590**	**1050**	**22**	**0**	**3**	**26**

BTCEPCC701: Transportation Engineering

Course Objective:

- To understand the applications of Transportation Engineering.
- To study the Statistical Methods for Traffic Engineering.
- To know the Traffic Characteristics, Environment, Management and Road Safety.

Course Contents:

Unit- I: **Introduction:** Objective, scope and outcome of the course Highway planning and alignment: Different modes of transportation– historical Development of road construction- Highway Development in India –Classification of roads- Road pattern– Highway planning in India- Highway alignment- Engineering Surveys for alignment– Highway Project- Important Transport/Highway related agencies in India. PMGSY project. Introduction about IRC, NRRDA

Unit- II: **Geometric Design of highways**: The highway crosses sectional elements- Camber- Sight Distance - Types of sight distances -Design of horizontal alignments - Super elevation, Widening of Pavements on horizontal curves- transition Curves- Design of Vertical alignments – Gradients- summit and Valley Curves- Recommendations of IRC Codes of Practice.

Highway Materials: Desirable Properties, Testing Procedures, Standards and standard values relating to Soil, Stone Aggregates, Bitumen and Tar, fly- ash/pond-ash. Role of filler in bituminous mix, materials of filler. Specifications of DLC and PQC for rigid pavement

Unit- III: **Highway Construction and Equipments**: Methods of constructing different types of roads viz. Earth roads, Stabilized roads, WBM, WMM roads, earthen embankments, DLC and embankments with fly ash. Bituminous roads and Concrete roads. Berms and Shoulders, Features of rural roads including those in PMGSY. Hot mix plant for Bituminous roads-components, layout, control panel, quality assurance. Highway construction of rigid and flexible pavements including types of road rollers, specifications of compaction of different layers of bituminous roads, modern pavers for CC roads. Roller compacted concrete road construction

Unit- IV: **Design of flexible and rigid pavements as per IRC**: IRC provisions including those of IRC 37, IRC 58

Introduction of Railway Engineering: Types and Selection of Gauges, Selection of Alignment, Ideal Permanent Ways and Cross- sections in different conditions,

Drainage, Salient Features and types of Components viz. Rails, Sleepers, Ballast, Rail Fastenings

Unit- V: **Introduction of Airports and Harbours**: **Airport Engineering**: - Introduction: Requirements to Airport Planning, Airport Classifications, Factors in Airport Site Selection, Airport Size. Planning of Airport: Requirements of Airport- Terminal Area, Runway Length etc. Harbours: history of water transportation, modern trends in water transportation, components of harbour, classification of harbours. Ports and docks

Text / Reference Books:

1. Highway Engineering by Khanna SK & CG Justo, Nem Chand & Brothers, Roorkee.
2. Highway Engg. By LR Kadyali, Khanna Tech Publications, Delhi.
3. Railway Engineering by Saxena SC and Arora SP, Dhanpat Rai Publishers, Delhi.
4. S C Rangwala, airport engineering, Charotar publication house. 7 Gautam H. Oza, Dock & Harbour Engineering, Charotar publication House.

Course Outcome

At the end of the course, the student will be able to:

CO1:	Understand the importance & characteristics of road transport for geometric design of various roads with proper alignment based on planning principles, survey data, economics & finance data.
CO2:	Recognize the knowledge of highway materials & construction of various types of roads and identify the problems associated with roads & remedies for same.
CO3:	Understand the traffic characteristics, interpretation of traffic data & its uses, traffic safety & various control measures and traffic environment interaction for safe & healthy environment
CO4:	Apply existing technology to the design, construction, and maintenance of railway physical facilities
CO5:	Analyze major issues and problems of current interest to the Airport Engineering.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	H	M	H	L	M	M	-	H	L	-	M	H	H
CO2	L2	M	M	M	H	-	-	M	-	M	M	L	L	M	H
CO3	L2	M	M	H	H	-	-	L	-	L	L	L	L	M	M
CO4	L3	M	M	M	M	-	-	L	-	-	M	M	L	L	M
CO5	L4	H	H	L	H	L	M	-	-	M	M	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPEC702A: Human Engineering and Safety

Course Objective:

Students would be able to

- To protect the comfort, health, safety and well-being of personnel
- To minimize the risk of design-induced human performance issues, which may lead to major incidents, other adverse events, and reliability issues.

Course Contents:

Unit- I: **Introduction:** Objective, scope and outcome of the course ,Human factors in system development – concept of systemsBasic processes in system development, performance reliability, humanperformance. Information input process

Unit- II: Visual displays, majortypes and use of displays, auditory and factual displays.

Unit- III: Measurement of energy, direct and indirect methods. Energy cost of different activities and Acceptable work load. Noise andvibration, its measurement and control.

Unit- IV: **Anthropometry**: arrangement and utilization of work space,atmospheric conditions, heat exchange process and performance.

Unit- V: Dangerous machine (Regulation) act, Rehabilitation andcompensation to accident victims, Safety gadgets for spraying,threshing, Chaff cutting and tractor & trailer operation etc.

Course Outcome:

At the end of the course, the student will be able to:

CO1:	Understand the exposure of engineering design.
CO2:	Measure energy cost of different activities
CO3:	Use anthropometric parameters in designing of different civil engineering machines
CO4:	Equip with the knowledge of ergonomic assessment of different working environment
CO5:	Describe the professional ethics, holistic systems and implications of value based living

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	H	M	H	L	M	M	L	H	M	M	M	H	H
CO2	L3	H	M	M	H	-	-	M	-	M	L	L	L	M	H
CO3	L3	H	M	L	M	-	-	L	M	L	L	L	L	M	L
CO4	L1	M	L	L	L	-	-	L	-	-	L	M	-	L	M
CO5	L4	M	L	L	M	L	M	-	-	M	M	-	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTCEPEC702B: Environmental Engineering and Disaster Management

Course Objective:

- To achieve the goal of environmental engineering is to ensure that societal development and the use of water, land and air resources are sustainable.
- To understand the management of these resources so that environmental pollution and degradation is minimized.

Course Contents:

Unit- I: **Introduction:** Objective, scope and outcome of the course.Importance of safe water supply system. Domestic water requirements for urban and rural areas

Unit- II: **Sources of Water supply** : Intakes and transportation of water. Drinking water quality. Indian Standards of drinking water.

Unit- III: Introduction to water treatment for safe drinking, Importance ofsanitation. Domestic waste water: quantity, characteristics, disposal in urbanand rural areas.

Unit- IV: **Sewer**: types, design discharge and hydraulic design. Introduction to domestic wastewater treatment. Solid waste: quantity, characteristics and disposal for urban and rural areas.

Unit- V: **Introduction to air pollution**.: Types of pollutants, properties and their effects on living beings. BIS standards for pollutants in air and their abetments. Introduction to variousdisaster, Importance of disaster management**.**

Course Outcome :

At the end of the course, the student will be able to:

CO1:	Understand the various types of natural resources and problems due to over exploitation.
CO2:	Know the components of various types of ecosystem and interrelation between the components.
CO3:	Understand various factors which cause environmental pollution and their control measures.
CO4:	Understand various hazards & disasters, their affects and mitigation measures.
CO5:	Analyze and interpret the Environmental Engg. Systems from chemistry and microbiological point of view.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	H	M	H	L	M	M	M	H	L	M	L	H	H
CO2	L2	H	M	M	H	-	-	M	L	M	M	L	L	M	M
CO3	L2	H	H	L	H	-	-	L	L	L	L	L	L	M	L
CO4	L2	M	M	M	M	-	-	L	-	-	L	M	L	L	M
CO5	L4	M	H	L	H	L	M	-	M	M	M	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPEC702C: Non Destructive Testing

Course Objectives:

Students would be able to

- To introduce the basic principles, techniques, equipment, applications and limitations of NDT methods such as Visual, Penetrant Testing, Magnetic Particle Testing, Ultrasonic Testing, Radiography, Eddy Current.
- To enable selection of appropriate NDT methods.
- To identify advantages and limitations of nondestructive testing methods
- To make aware the developments and future trends in NDT.

Course Contents:

Unit- I: **Introduction**: Objective, scope and outcome of the course.

Overview of NDT: NDT Versus Mechanical testing, Overview of the Non DestructiveTesting Methods for the detection of manufacturing defects as wellas material characterization. Relative merits and limitations,various physical characteristics of materials and their applicationsin NDT, Visual inspection, Unaided and aided.

Unit- II: **Surface Non Destructive Evaluation (NDE) Methods**:Liquid Penetrant Testing, Principles, types and properties of liquidpenetrants, developers, advantages and limitations of variousmethods. Testing Procedure, Magnetic Particle Testing, Theory ofmagnetism, inspection materials. Magnetisation methods,Interpretation and evaluation, Principles and methods ofdemagnetization, Residual magnetism

Unit- III: **Thermography and Eddy Current Testing (ET**):Thermography, Principles, Contact and non contact inspectionmethods, Advantages and limitation, Instrumentations andmethods, applications. Eddy Current Testing, Generation of eddycurrents, Properties of eddy currents, Eddy current sensingelements, Types of arrangement, Applications, advantages,Limitations, Interpretation/Evaluation.

Unit- IV: **Ultrasonic Testing (UT) and Acoustic Emission (AE)**:Ultrasonic Testing, Principle, Transducers, transmission andpulse-echo method, straight beam and angle beam,instrumentation, data representation, A-Scan, B-scan, C-scan.Acoustic Emission Technique, Principle, AE parameters,Applications.

Unit- V: **Radiography (RT):** Principle, Interaction of X-Ray with matter, imaging, film and film less techniques, Types and use of filters and screens, Geometricfactors, Inverse square, law, characteristics of films,Interpretation/ Evaluation, Fluoroscopy, Xero Radiography,Computed Radiography, Computed Tomography.

Special Techniques and Applications: Phased array ultrasonics time of flight diffractions, Automated and remote ultrasonic testing, Acoustic pulse reflectometry, Alternative current field method, Case studies on NDT techniques used in aircrafts.

Course Outcome:

At the end of the course, the student will be able to:

CO1:	Have a basic knowledge of surface NDE techniques which enables to carry out various inspections in accordance with the established procedures.
CO2:	Calibrate the instrument and inspect for in-service damage in the components.
CO3:	Have a basic knowledge of ultrasonic testing which enables them to perform inspection of samples.
CO4:	Calibrate the instrument and evaluate the component for imperfections.
CO5:	Differentiate various defect types and select the appropriate NDT methods for the specimen.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	H	L	L	L	L	M	M	-	H	L	M	-	H	H
CO2	L4	H	L	L	M	L	-	M	-	L	L	L	L	M	H
CO3	L1	H	L	L	L	L	-	L	-	L	M	L	L	M	M
CO4	L4	M	M	M	M	-	-	L	-	-	M	M	M	L	M
CO5	L4	M	M	L	M	-	M	-	-	M	L	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC703 GEOGRAPHIC INFORMATION SYSTEM & REMOTE SENSING

Course Objective:

- To understand the scope and outcome of the Geographic Information System & Remote Sensing.
- Study of Photogrammetry, Remote Sensing, Image Interpretation and Geographic Information System.

Course Contents:

Unit-I **Introduction:** Objective, scope and outcome of the course.

Photogrammetry: Definition of Photogrammetric Terms, Geometry of aerial and terrestrial photographs,Aerial camera and phototheodolite, Scale of a Photograph, Tilt and Height displacements, Stereoscopicvision and stereoscopes, Height determination from parallax measurements, Flight planning, Maps and Map substitutes and their uses.

Unit-II **Remote Sensing:** Introduction and definition of remote sensing terms, Remote Sensing System, Electromagnetic radiation and spectrum, Spectral signature, Atmospheric windows.

Unit-III Different types of platforms, sensors and their characteristics, Orbital parameters of a satellite, Multi concept in Remote Sensing.

Unit-IV **Image Interpretation:** Principles of interpretation of aerial and satellite images, equipments and aids required for interpretation, ground truth – collection and verification, advantages of multidate and multiband images. Digital Image Processing concept.

Unit-V **Geographic Information System (GIS) :** Introduction & applications of GIS in map revision, Land use, Agriculture, Forestry, Archaeology, Municipal, Geology, water resources, Soil Erosion, Land Suitability analysis, change detection.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Students will understand the scope and outcome of the Geographic Information System & Remote Sensing.
CO2:	Use of Digital Image Processing concept.
CO3:	Students will be able to study Maps and Map substitutes and their uses.
CO4:	Students will be able to study Photogrammetric, Remote Sensing, Image Interpretation and Geographic Information System.
CO5:	Understanding the concept of Soil Erosion, Land Suitability analysis, etc.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	L	M	L	H	-	L	M	L	L	L	-	-	H	H
CO2	L3	H	L	M	L	L	L	-	H	M	-	L	-	M	H
CO3	L2	M	L	L	-	M	-	L	-	H	L	M	L	M	M
CO4	L4	-	M	L	L	L	-	-	L	-	H	-	M	L	M
CO5	L4	H	M	M	L	M	L	L	M	-	M	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO4
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPCC704 PRE-STRESSED CONCRETE

Course Objective:

- To understand the scope and outcome of the Pre-Stressed Concrete.
- Analysis of Pre-stress and Bending Stresses.
- To evaluate losses, deflection and design of Pre-stressed Concrete Members.

Course Contents:

Unit-I **Introduction:** Objective, scope and outcome of the course.

Introduction: Basic concepts of Pre-stressing and its advantages. Materials for pre-stressed concrete. Tensioning devices. Pretensioning and post tensioning systems.

Unit-II **Analysis of Pre-stress and Bending Stresses:** Assumptions, Flexural analysis of pre-stressed rectangular and unsymmetrical T section. Concept of load balancing.

Unit-III **Losses of Pre-stress:** Losses due to - elastic deformation of concrete, successive tensioning of curved cable, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip.

Unit-IV **Deflection of Pre-stressed Concrete Members:** Effect of tendon profile and associated factors incontinuous members. Computation of deflection in pre-stressed concrete members.

Unit-V **Design of Pre-stressed Concrete Sections:** Flexural Shear and Torsional strength using simplified code procedure (IS-1343-2012). Design of simply supported Pre-stressed Concrete Sections for flexure.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Students will understand the scope and outcome of the Pre-Stressed Concrete.
CO2:	Understanding the Pre-tensioning and post-tensioning systems.
CO3:	Students will be able to understand analysis of Pre-stress and Bending Stresses.
CO4:	Students will be able to evaluate losses, deflection and design of Pre-stressed Concrete Members.
CO5:	Design of Simply Supported Pre-stressed Concrete Sections for flexure.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	L	L	L	L	-	L	M	L	L	L	-	M	H	H
CO2	L4	L	L	M	L	L	L	-	H	M	-	L	M	M	H
CO3	L1	M	M	L	M	M	-	L	-	-	L	M	L	M	M
CO4	L4	L	H	L	-	L	-	-	L	-	H	-	-	L	M
CO5	L4	L	M	M	-	M	L	L	M	L	M	L	-	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTEESEC705: Research and Publication Ethics (RPE)

Course Objectives:

1. To identify the concept of research.
2. To identify the scientific conduct of research.
3. To understand the publication Ethics.
4. To understand Open access publications and publication misconduct.
5. To understand the Research Data and Research Metrics.

Course Contents:

Unit I: PHILOSOPHY AND ETHICS

1. Introduction to Philosophy : definition, nature and Scope, Concept, Branches
2. Ethics: definition, moral philosophy, nature of moral judgements and reaction

Unit II: SCIENTIFIC CONDUCT

1. Ethics with respect to science and research
2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism(FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentation of data.

Unit II: PUBLICATION ETHICS

1. Publication ethics: definition, introduction and importance
2. Best practices /Standards setting initiatives and guidelines: COPE. WAME, etc.,
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
5. Violation of publication ethics, authorship and contributorship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

Unit IV: OPEN ACCESS PUBLISHING AND PUBLICATION MISCONDUCT

1. Open access publications and initiatives
2. SHEERPA/RoMEO online resource to check publisher copyright & Self – archiving policies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder /Journal suggestion tools viz.JANE., Elsevier journal Finder,

Springer Journal Suggester, etc.

5. Subject specific ethical issues, FFP, authorship
6. Conflicts of interest
7. Complaints and appeals: examples and fraud from India and abroad.
8. Use of plagiarism software like Turnitin, Urkund and other open source software tools

Unit V: DATABASES AND RESEARCH METRICS

A. Databases

1. Indexing databases
2. Citation databases: Web of Science, Scopus, etc

Research Metrics

1. Impact Factor of Journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
2. Metrics: h-index, g index, i10 index, altmetrics

Reference:

1. Bird, A.(2006). Philosophy of Science.Routledge
2. Maclntyre, Alasdair (1967) A Short History of Ethics. London
3. P.Chaddah, (2018) Ethics in Competitive Research: Do not get Scooped; do not get Plagiarized, ISBN:978-9387480865
4. National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). On Being a Scientist: A Guide to responsible conduct in Research: Third Edition, National Academies Press.
5. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019), ISBN:978-81-939482-1-7. htt://www.insaindia.res.in/pdf/Ethics_Book.pdf.

Course Outcomes:

COs	Statement
	After completion of this course, students will be able to:
CO1	Understand the concept of research.
CO2	Understand the scientific conduct of research.
CO3	Understand the publication Ethics.
CO4	Understand Open access publications and publication misconduct. ct.
CO5	Understand the Research Data and Research Metrics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	M	H	L	H	L	H	H	M	L	L	-	-	H	H
CO2	L2	H	H	M	M	M	L	-	L	-	L	-	M	M	M
CO3	L3	M	H	M	M	M	M	H	L	-	L	-	-	H	M
CO4	L4	H	H	M	M	M	-	H	-	L	M	-	M	M	M
CO5	L4	H	H	H	M	M	-	-	-	L	M	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1,CO2,CO3, CO4,CO5
CD3	Seminars	CO2,CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO5

BTBSC 706: Leadership & Management Skills

Course Objectives:

1. To help students to develop essential skills to influence and motivate others
2. To inculcate emotional and social intelligence and integrative thinking for effective leadership
3. To create and maintain an effective and motivated team to work for the society
4. To nurture a creative and entrepreneurial mindset
5. To make students understand the personal values and apply ethical principles in professional and social contexts.

Course Contents:

Unit I: Leadership Skills

Understanding Leadership and its Importance: What is leadership? Why Leadership required? Whom do you consider as an ideal leader? Traits and Models of Leadership: Are leaders born or made? Key characteristics of an effective leader, Leadership styles, Perspectives of different leaders. Basic Leadership Skills: Motivation, Team work, Negotiation, Networking. Innovative Leadership. Concept of emotional and social intelligence, Synthesis of human and artificial intelligence, Why does culture matter for today's global leaders.

Unit II: Managerial Skills

Basic Managerial Skills, Planning for effective management, How to organise teams? Recruiting and retaining talent, Delegation of tasks, Learn to coordinate, Conflict management, Self Management Skills, Understanding self concept, Developing self-awareness, Self-examination, Self-regulation.

Unit III: Entrepreneurial Skills

Basics of Entrepreneurship: Meaning of entrepreneurship, Classification and types of entrepreneurship, Traits and competencies of entrepreneur, Creating Business Plan, Problem identification and idea generation, Idea validation, Pitch making.

Unit IV: Design Thinking

Design Thinking: What is design thinking? Key elements of design thinking: Discovery, Interpretation, Ideation- Experimentation – Evolution, How to transform challenges into pportUnities?

How to develop human-centric solutions for creating social good?

Unit V: Ethics and Integrity

Learning through Biographies: What makes an individual great? Understanding the persona of a leader for deriving holistic inspiration, Drawing insights for leadership, How leaders sail through difficult situations? Ethics and Conduct, Importance of ethics, Ethical decision making, Personal and professional moral codes of conduct, Creating a harmonious life

Text Books:

1. Ashokan, M. S. (2015). Karmayogi: A Bbiography of E. Sreedharan. Penguin, UK.
2. Brown, T. (2012). Change by Design. Harper Business
3. Kalam A. A. (2003). Ignited Minds: Unleashing the Power within India. Penguin Books India
4. Kelly T., Kelly D. (2014). Creative Confidence: Unleashing the Creative Potential Within Us All. William Collins
5. McCormack M. H. (1986).What They Don't Teach You at Harvard Business School: Notes From A Street-Smart Executive. RHUS

Suggested Readings:

- Sternberg R. J., Sternberg R. J., & Baltes P. B. (Eds.). (2004). International Handbook of Intelligence. Cambridge University Press.

E-Resources

- India's Hidden Hot Beds of Invention Ted Talk by Anil Gupta - https://www.ted.com/ talks/anil_gupta_india_s_hidden_hotbeds_of_invention
- Knowledge@Wharton Interviews Former Indian President APJ Abdul Kalam - . "A Leader Should Know How to Manage Failure" https://www.youtube.com/ watch?v=laGZaS4sdeU

NPTEL Course on Leadership - https://nptel.ac.in/courses/122105021/9

Course Outcome:

CO	Statement
	After completion of this course, students will be able to:
CO1	Examine various leadership models and understand/assess their skills, strengths and abilities that affect their own leadership style and can create their leadership vision
CO2	Learn and demonstrate a set of practical skills such as time management, self management, handling conflicts, team leadership, etc.
CO3	Understand the basics of entrepreneurship and develop business plans
CO4	Apply the design thinking approach for leadership
CO5	Discuss the importance of ethics and moral values for making of a balanced personality

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Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Levels	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L4	**M**	**M**	**-**	**-**	**M**	**M**	**M**	**H**	**-**	**L**	**L**	**-**	**M**	**M**
CO2	L3	**M**	**M**	**M**	**M**	**M**	**M**	**L**	**M**	**-**	**M**	**M**	**-**	**M**	**M**
CO3	L2	**M**	**M**	**M**	**H**	**M**	**M**	**M**	**M**	**-**	**L**	**L**	**-**	**M**	**M**
CO4	L3	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**H**	**-**	**L**	**L**	**-**	**M**	**M**
CO5	L1`	**-**	**M**	**L**	**H**	**H**	**H**	**M**	**M**	**-**	**L**	**L**	**-**	**M**	**M**

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1,CO2,CO3, CO4,CO5
CD3	Seminars	CO1,CO2,CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1, CO2,CO3, CO4
CD5	Industrial visit	

BTCEPCC707: Road Material Testing Lab

Course Objective:

- To apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials
- To function on multi-disciplinary teams in the area of materials testing & Ability to use the techniques, skills and modern engineering tools necessary for engineering.
- To understand professional and ethical responsibility in the areas of material testing.
- To communicate effectively the mechanical properties of materials.

Course Contents:

1. Aggregate Impact Test
2. To determine the Angularity Number, Flakiness Index & Elongation Index of aggregates
3. Los Angeles Abrasion Test
4. Aggregate Crushing Value Test
5. Standard Tar Viscometer Test for given bitumen sample
6. Ductility Test for a given bitumen sample
7. To determine the softening point for given sample of bitumen.
8. Marshall Stability Test
9. Float Test
10. Preparation of Dry lean concrete mix and testing of its strength

Course Outcome:

At the end of the course, the student will be able to:

CO1:	Evaluate the strength of sub grade soil by CBR test.
CO2:	Recognize the knowledge about different physical properties of aggregates by performing different test on road aggregates.
CO3:	Outline the various properties of bitumen material and mixes by performing various tests on it.
CO4:	Identify different pavement and functions of different components in pavement.
CO5:	Design pavement and overlays as per need and field condition and Design bituminous mix as per Indian standard

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L4	H	H	M	H	L	M	M	-	H	L	M	L	H	H
CO2	L2	H	M	L	M	L	L	M	-	M	L	L	L	M	H
CO3	L1	M	L	L	L	-	L	L	-	L	M	L	L	M	M
CO4	L2	M	M	M	M	-	L	L	-	-	L	M	L	L	M
CO5	L6	M	M	M	H	L	M	-	-	M	L	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTCEPCC708: Professional Practices & Field Engineering Lab

Course Objectives:

Students would be able to

- To understand the Personal and professional development of a student through activities such as industry expert lectures, industrial visits, group discussions and seminars etc.

Course Contents:

1. Different types of Knots
2. Site plan, index plan, layout plan, plinth area, and floor area of buildings
3. Foundation plan layout infield
4. Bar bending schedule
5. Specifications- For different classes of building and Civil Engineering works
6. Specifications of building components
7. Valuation of buildings and properties
8. Work at heights – scaffolding and ladders use, type of scaffolds, safety requirements, design and load factors, defects and inspection norms, type of ladders, upkeep, defects and good maintenance tips

Course Outcome :

At the end of the course, the student will be able to:

CO1:	Demonstrate the information and data Search in advancements of Electrical and Electronics Engineering.
CO2:	Get the exposure to industry expert lectures and interaction.
CO3:	Demonstrate interpersonal skills by way of Group discussions in a healthy environment
CO4:	Develop confidence and life skills to handle engineering assignments
CO5:	Understand industrial environment and visit industry

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	H	H	M	H	L	M	-	-	H	L	M	M	H	H
CO2	L1	M	H	L	H	-	L	M	M	M	L	L	L	M	H
CO3	L3	L	M	M	H	L	L	L	L	L	L	L	L	M	M
CO4	L6	M	M	M	M	-	M	L	L	-	L	M	M	L	M
CO5	L2	M	H	L	H	L	M	-	M	M	M	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO4, CO5

BTCEPSIT709: Practical Training

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Capability to acquire and apply fundamental principles of engineering.
CO2:	Become master in one's specialized technology
CO3:	Become updated with all the latest changes in technological world.
CO4:	Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	H	L	H	L	-	-	-	-	L	-	L	M	M
CO2	L3	M	L	H	H	L	-	-	-	-	L	-	M	H	M
CO3	L6	M	H	M	M	L	-	-	-	-	L	-	M	M	M
CO4	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

BTCEPSIT 710: Seminar

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Personalize and create a communication style for individual & team building.
CO2:	Use values in improving one's own professionalism
CO3:	Develop the higher cognitive abilities that are analysis, synthesis and evaluation.
CO4:	Ability to identify, formulate and present model problems.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	H	L	H	L	-	-	-	-	L	-	L	M	M
CO2	L3	M	L	H	H	L	-	-	-	-	L	-	M	H	M
CO3	L6	M	H	M	M	L	-	-	-	-	L	-	M	M	M
CO4	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

BTCESODECA 711: Social Outreach, Discipline & Extra Curricular Activities

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Develop their self-confidence, leadership qualities, and their responsibilities towards the commUnity.
CO2:	Have an impact on academic development, personal development, and civic responsibility
CO3:	Understand the value of Social Work.
CO4:	Understand the Significance of Discipline in student's Life
CO5:	Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

BTBSC 712: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of CommUnity based motivation videos, CommUnity based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

Semester – VIII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCEPCC801	Project Planning and Construction Management	Core	30	70	100	3	-	-	3
BTCEPEC802A	Energy Management	Elective	30	70	100	3	-	-	3
BTCEPEC802B	Waste And By Product Utilization	Elective	30	70	100	3	-	-	3
BTCEPEC802C	Disaster Management	Elective	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCEPCC803	Project Planning and Construction Management lab	Core	30	20	50	-	-	1	1
BTCEPCC804	Pavement Design	Core	30	20	50	-	-	1	1
BTCEPSIT805	Project	Core	210	140	350	3	-	4	7
BTCESODECA806	Social Outreach, Discipline & Extra Curricular Activities		50		50	-	-	1	1
BTBSC 807	ANANDAM	AECC	50	50	100	1	-	1	2
	Total		**430**	**370**	**800**	**10**	**-**	**8**	**18**

BTCEPCC801: Project Planning and Construction Management

Course Objective:

- To analyze professional decisions based on ethical principles.
- To analyze construction documents for planning and management of construction processes.
- To analyze methods, materials, and equipment used to construct projects.

Course Contents:

Unit-I: **Introduction:** Objective, scope and outcome of the course

Financial Evaluation of Projects And ProjectPlanning: Capital investment proposals, criterions to judge the worthwhile of capital projects viz. net present value, benefit cost ratio, internal rate of return, Risk cost management, main causes of project failure. Categories of construction projects, objectives, project development process, Functions of project management, Project management organization and staffing, Stages and steps involved in project planning, Plan development process, objectives of construction project management.

Unit-II: **Project Scheduling:** Importance of project scheduling, project work breakdown process – determining activities involved, work breakdown structure, assessing activity duration, duration estimate procedure, Project work scheduling, Sequence of construction activities, Project management techniques – CPM and PERT networks analysis, concept of precedence network analysis.

Unit-III: **Project Cost and Time Control:** Monitoring the time progress and cost controlling measures in a construction project, Time cost trade-off process: direct and indirect project costs, cost slope, Process of crashing of activities, determination of the optimum duration of a project, updating of project networks, resources allocation.

Unit-IV: **Contract Management:** Elements of tender operation, Types oftenders and contracts, Contract document, Legal aspects ofcontracts, Contract negotiation & award of work, breach of contract,determination of a contract, arbitration.

Unit-V: **Safety and Other Aspects of Construction Management:** Safety measures to be followed in various construction works like excavation, demolition of structures, explosive handling, hot bitumen work. Project Management Information System – Concept, frame work, benefits of computerized information system. Environmental and social aspects of various types of construction projects.

Recommended Texts:

1. Construction Planning & management By P S Gahlot& B M Dhir, New AgeInternational Limited Publishers.
2. Construction Project planning & Scheduling by Charles Patrick, Pearson,2012..
3. Construction Project Management Theory & practice --- Kumar NeerajJha, Pearson, 2012
4. Modern construction management--Harris, Wiley India.
5. Construction Management & Planning by Sengupta and Guha-TataMcGraw Hill publication.
6. Project Management – K Nagrajan – New age International Ltd.Professional Construction Institute Edition.
7. Construction Project Management Planning, Scheduling and Controlling-Chitakara- Tata McGraw Hill, New Delhi
8. Construction Planning, Equipment and Methods by R. L. Peurify.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Project Planning and Construction Management.
CO2:	Know the use of Financial Evaluation of Projects and Project Planning.
CO3:	Understand the Importance of project scheduling.
CO4:	Get the idea of Monitoring the time progress and cost controlling measures.
CO5:	Know the concept of Contract Management and Safety.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	M	L	M	M	-	H	M	M	L	H	H
CO2	L1	H	L	L	L	L	-	M	-	M	M	L	-	M	L
CO3	L2	H	M	L	M	-	-	L	-	L	L	-	L	M	-
CO4	L1	M	L	L	L	-	-	L	-	-	M	-	-	-	M
CO5	L1	M	H	L	H	L	M	-	-	M	L	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPEC802A: Energy Management

Course Objective: Student will able to

- To maximize profit and minimize costs by optimizing energy procurement and utilization, throughout the organization.
- To minimize energy costs without affecting production and quality and to minimize environmental effects.

Course Contents:

Unit-I: **Introduction:** Objective, scope and outcome of the course. Houses, Transport, Electric Power. Energy Integration, Energy Matrix.

Unit-II: **Energy Basics;** Energy Demand Management, Conservation & Resource Development, Energy for Sustainable Development.

Unit-III: **Need for Energy Management by Sector-** Industry, Buildings

Unit-IV: **Need for Energy Management by Sector-** Agriculture, Domestic; Energy forecasting techniques;

Unit-V: **Energy Auditing;** Energy management for cleaner production, application of renewable energy, appropriate technologies.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Energy Management.
CO2:	Understand the Need for Energy Management by different Sectors.
CO3:	Study the Sustainable Development and Energy Demand Management,.
CO4:	Analyze the Energy management for cleaner production.
CO5:	Get to know the appropriate technologies for Sustainable Development.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	H	M	M	L	M	M	-	H	M	M	M	H	H
CO2	L2	H	M	L	M	L	-	M	M	M	L	L	L	M	L
CO3	L2	H	M	L	H	-	-	L	M	L	M	-	L	M	-
CO4	L4	M	M	M	M	-	-	L	L	-	L	-	L	-	M
CO5	L1	M	L	L	L	L	M	-	-	M	M	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTCEPEC802B: Waste and By-Product Utilization

Course Objective:

- To protect the environment through effective waste management techniques.
- To protect health, well being and environment.
- To prevent pollution.
- To reduce and reuse of waste.

Course Contents:

Unit-I: **Introduction:** Objective, scope and outcome of the course. Sedimentation, coagulation, flocculation and floatation, Secondary treatments: Biological and chemical oxygen demand for different food plant waste– trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons

Unit-II: **Types and formation of byproducts and waste;** magnitude of waste generation in different agro- processing industries; concept scope and maintenance of waste management and effluent treatment, basics pf Waste Recycling & Resources Recovery System (WRRRS), Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorous and sulphurin waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues.

Unit-III: Waste utilization in various industries, furnaces and boilers run on agricultural wastes and byproducts, briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization.

Unit-IV: Waste treatment and disposal, design, construction, operation and management of institutional commUnity and family size biogas plants, concept of vermi-composting, Pre-treatment of waste:

Unit-V: **Tertiary treatments:** Advanced waste water treatment process-sand, coal and activated carbon filters, phosphorous, sulphur, nitrogenand heavy metals removal, Assessment, treatment and disposal of solid waste.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Waste and By-product Utilization.
CO2:	Understand the formation of byproducts and waste
CO3:	Understand the Waste utilization in various Sectors.
CO4:	Analyze the Waste treatment and its disposal, design, construction, operation and management.
CO5:	Understand the assessment, treatment and disposal of solid waste.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
Co1	L2	H	H	M	H	L	M	M	-	H	L	M	L	H	H
CO2	L2	H	M	M	M	L	-	M	M	M	M	L	M	M	L
CO3	L2	H	H	L	H	-	-	L	M	L	L	-	L	M	-
CO4	L4	M	M	M	M	-	-	L	L	-	M	-	L	-	M
CO5	L2	M	H	L	H	L	M	-	-	M	L	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO4, CO5

BTCEPEC802C: Disaster Management

Course Objective: Student will able to

- To provide basic conceptual understanding of disasters and its relationships with development.
- To gain understand approaches of Disaster Risk Reduction (DRR) and the relationship between vulnerability, disasters, disaster prevention and risk reduction.

Course Contents:

Unit-I: **Introduction:** Objective, scope and outcome of the course. Types of Disasters, their occurrence/ causes, impact and preventive measures.

Unit-II: Understanding Disasters and Hazards and related issues social and environmental. Risk and Vulnerability.

Unit-III: **Natural. Disasters-** Hydro-meteorological Based Disasters like Flood, Flash Flood, Cloud Burst, Drought, Cyclone, Forest Fires; Geological Based Disasters like Earthquake, Tsunami, Landslides, Volcanic Eruptions.

Unit-IV: **Man made Disasters:** Textile Processing Industrial Hazards, Major Power Break Downs, Traffic Accidents, Fire Hazards.

Unit-V: Management roll in mitigating Disaster in Indian Textile Industries. Roll of production people in Disaster Management.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the scope and outcome of the Disaster Management.
CO2:	Understand Disasters and Hazards and related issues.
CO3:	Study the Hydro-meteorological Based and Geological Based Disasters and Man made Disasters.
CO4:	Know the Management roll in mitigating Disaster in Indian Textile Industries.
CO5:	Know the Roll of production people in Disaster Management.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	H	M	H	L	M	M	-	-	M	L	M	H	H
CO2	L2	H	L	L	M	L	-	M	L	-	M	-	L	M	H
CO3	L2	H	L	L	M	-	-	L	M	L	L	L	L	M	M
CO4	L1	M	L	L	L	-	-	L	M	-	L	M	-	M	L
CO5	L1	M	L	L	L	L	M	-	-	M	M	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTCEPCC803: Project Planning and Construction Management Lab

Course Objective: Student will able to

- To Discuss principles of management and its functions in construction organization.
- To get the Knowledge of organization's working procedures and organizational developments and group decision making.
- To Identify quality of team leader and qualities of project leader.

Course Contents:

1. Assignments on net present value, benefit cost ratio, internal rate ofreturn.
2. Types of contracts – Tenders, tender form, submission and opening of tenders, measurement book, muster roll, piecework agreement and workorder.
3. Drafting of tender documents, special terms andconditions.
4. Drafting of tender notices for different types ofworks
5. Different models of PPP like BOT, BOOTetc.
6. Arbitration.
7. Preparation of bardiagram.
8. Network Analysis using PERT andCPM.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the Project Planning and Construction Management, its applications.
CO2:	Study the Types of contracts, arbitration, etc.
CO3:	Study the drafting of tender documents, special terms and conditions.
CO4:	Understand the different models of PPP like BOT, BOOT etc.
CO5:	Study Network Analysis using PERT and CPM.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	H	M	M	L	M	M	-	H	M	M	L	H	H
CO2	L2	H	M	L	M	L	L	M	-	M	L	L	L	M	H
CO3	L2	H	L	L	L	-	-	L	-	L	M	L	L	M	L
CO4	L2	M	M	M	M	-	-	L	-	-	L	-	L	L	M
CO5	L2	M	M	L	M	L	M	-	-	M	M	-	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTCEPCC804: Pavement Design

Course Objective: Student will able to

- To Design geometric elements of Cross Section of various types of roads.
- To Design geometric elements of Horizontal Alignment of Roads
- To Design geometric elements of Vertical Alignment of Roads.
- To design various devices for traffic management.

Course Contents:

1. **Pavement Mix Analysis:** Aggregate blending, bituminous mix design – Marshall Stability approach, concrete mix design for DLC and PQC with IS code provisions.

2. **Pavement Basics:** Types & comparison, vehicular loading pattern, factors affecting design and performance of pavements, sub grade requirements.

3. **Design of Flexible Pavements:** Analytical approach, flexible pavement layers, ESWL, repetitions of load, techniques of design methods, wheel load analysis, traffic analysis, stress distribution in sub-grade soil, Burmister's theories, group index method, CBR approach, IRC 37 and other guidelines.

4. **Design of Concrete Pavements:** Westergaard's approach, temperature & frictional stresses, design of expansion & longitudinal joints, design of dowel & tie bars, IRC 58 and other guidelines.

5. **Specifications for rural roads:** Important aspects of IRC SP 020, Rural Road Manual. NRRDA publications

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Understand the Pavement Mix Analysis with IS code provisions.
CO2:	Study the Pavement Basics, Types & comparison.
CO3:	Study the Design of Flexible Pavements.
CO4:	Know the Specifications for rural roads.
CO5:	Study the Design of Concrete Pavements.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	M	L	M	-	-	H	M	M	M	H	H
CO2	L2	H	M	L	H	L	L	-	-	M	L	L	L	M	H
CO3	L2	H	H	L	H	L	-	L	-	L	L	L	-	M	L
CO4	L1	M	L	L	L	-	-	L	-	-	M	-	-	L	M
CO5	L2	M	M	L	H	-	M	-	-	M	L	-	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTCEPSIT 805: Project

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Capability to acquire and apply fundamental principles of engineering.
CO2:	Be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills.
CO3:	Identify, formulate and model problems and find engineering solution based on a systems approach.
CO4:	Capability and enthusiasm for self-improvement through continuous professional development and life-long learning.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO2	L3	M	L	H	L	M	-	-	-	-	L	-	L	M	M
CO3	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO4	L4	M	M	H	L	M	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTCESODECA 806: Social Outreach, Discipline & Extra Curricular Activities

Course Outcomes:

At the end of the course, the student will be able to:

CO1:	Develop their self-confidence, leadership qualities, and their responsibilities towards the commUnity.
CO2:	Have an impact on academic development, personal development, and civic responsibility
CO3:	Understand the value of Social Work.
CO4:	Understand the Significance of Discipline in student's Life
CO5:	Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

BTBSC 807: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of CommUnity based motivation videos, CommUnity based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

11. Teaching-Learning Process/ Methodology (TLM):

The teaching-learning process should be aimed at systematic exposition of basic concepts so as to acquire knowledge of technical program in a canonical manner. In this context, applications of technical program and linkage with the theory constitute a vital aspect of the teaching-learning process. The course offers many modes of learning and assessment methods. Students have great freedom of choice of course which they can study. The various components of teaching learning process are summarized in the following heads.

1. **Class room Lectures:** The most common method of imparting knowledge is through lectures. There are diverse modes of delivering lectures such as through blackboard, power point presentation and other technology aided means. A judicious mix of these means is a key aspect of teaching-learning process.
2. **Tutorials:** To reinforce learning, to monitor progress, and to provide a regular pattern of study, tutorials are essential requirements. During these tutorials, difficulties faced by the students in understanding the lectures, are dealt with. Tutorials are also aimed at solving problems associated with the concepts discussed during the lectures.
3. **Practical:** To provide scientific visualization and obtaining results of Technical program in practical sessions. These sessions provide vital insights into scientific concepts and drawlearner's attention towards limitations of scientific computations. During practical, scientific models arising in real life problems can also be simulated.
4. **Choice based learning/Open elective:** LOCF in this undergraduate program provides great flexibility both in terms of variety of courses and range of references in each course.
5. **Field based learning:** Students may enhance their knowledge through field based learning while understanding the practical importance.
6. **Textbooks learning:** A large number of books are included in the list of references of each course for enrichment and enhancement of knowledge.
7. **E-learning:** Learner may also access electronic resources and educational websites for better understanding and updating the concepts.
8. **Self-study materials:** Self-study material provided by the teachers is an integral part of learning. It helps in bridging the gaps in the classroom teaching. It also provides scope for teachers to give additional information beyond classroom learning.
9. **Assignment/Problem solving:** Assignments at regular intervals involving applications of theory are necessary to assimilate basic concepts of courses. Hence, it is incumbent on the part of a learner to complete open-ended projects assigned by the teacher.
10. **Internships:** The teaching-learning process needs to be further supported by other activities devoted to subject-specific and interdisciplinary skills, summer and winter internships. During these internships it is expected that a learner will interact with experts and write a report on a topic provided to the learner.
11. **Institute visits:** Institute visit by a learner is also a part of learning process. During such visits a learner has access to knowledge by attending academic activities such as seminars, colloquia, library consultation and discussion with faculty members. These activities provide guidance and direction for further study.

12. **Industrial visits:** Industrial visits offer an opportUnity to observe applications of scientific concepts. These visits also give an opportUnity to realize the power of mathematical ideas and their translation in problem solving.
13. **Training programs:** Training programs organized by various agencies/institutes provide an opportUnity to learn various dimensions of courses.

12. ASSESSMENT AND OUTCOME MESUAREMENT METHODS (AOMM):

A range of assessment methods which are appropriate to test the understanding of various concepts of courses will be used. Various learning outcomes will be assessed using time-bound examinations, problem solving, assignments and viva-voce examination. For various courses in this program, the following assessment methods shall be adopted:

i. Scheduled/unscheduled tests
ii. Problem solving sessions aligned with classroom lectures
iii. Practical assignments
iv. Regular chamber consultation with faculty members
v. Class Tests and semester end comprehensive examination

Examination and Evaluation:

I. The medium of instructions and examination shall be Bilingual.
II. Candidates shall be examined according to the scheme of examination and syllabus as approved by the BOS and Academic Council from time to time.
III. To pass each semester examination, a candidate must obtain at least 40% marks in each written paper, practical work semester examination.
IV. Each theory paper for the respective semester examination shall be set and evaluation of the answer books shall be done as per the University rules.
V. The assessment of External Evaluation i.e. End Term Semester Examination will be made out of 70 (Seventy) marks in theory Papers and Internal Evaluation of 30 (Thirty) marks.

Criterion for awarding Grading System:

Criterion for Awarding SGPA and CGPA: The criterion for awarding the Semester GradePoint Average (SGPA) and Cumulative Grade Point Average (CGPA) for B.Tech. Program shall be as follows:

a) The criterion for passing in a subject is that a student should secure minimum 40% marks in individual paper.
b) A student obtaining less than pass marks as specified above, in each subject (sum of internal and End-Term examinations) he will be declared fail in that subject and will have to re-appear in a End-Term examination of the course in subsequent odd / even semester end term examination, subject to maximum permissible period of n+4 semesters to complete the course.
c) The University has adopted Absolute Grading System for converting marks into grades. The formula of 10- point grading system for conversion of marks obtained into Letter Grades and converting Letter Grades to Grade Point is given below

Table: Marks, Letter Grades and Grade Points

Marks	Letter Grade	Grade Points
91-100	O (Outstanding)	10
81-90	A+(Excellent)	9
71-80	A(Very Good)	8
61-70	B+(Good)	7
51-60	B(Above Average)	6
46-50	C(Average)	5
40-45	P (Pass)*	4
0-39	F(Fail)	0
-	AB (Absent)	0

***Pass Mark: 40% in individual paper**

d) While converting the marks into Letter Grade, the rounding off marks must be considered.

e) A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

f) For noncredit courses "Satisfactory" or Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

Computation of SGPA and CGPA:

The university has adopted UGC recommended procedure for computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

a) The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the papers/ courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$\textbf{SGPA}\ (Si) = \Sigma\ (Ci \times Gi) / \Sigma Ci$$

Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course. The university shall issue Semester Grade Card to the student.

b) The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$$\textbf{CGPA} = \Sigma\ (Ci \times Si) / \Sigma\ Ci$$

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

c) The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Illustration of Computation of SGPA and CGPA and Format for Transcripts:

a) Computation of SGPA and CGPA

Illustration for SGPA

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course/Paper 1	3	A	8	3x8=24
Course/Paper 2	4	B+	7	4x7=28
Course/Paper 3	3	B	6	3x6=18
Course/Paper 4	3	O	10	3x10=30
Course/Paper 5	3	C	5	3x5=15
Course/Paper 6	4	B	6	4x6=24
	20			**139**

Thus, SGPA= 139/20= 6.95

b) Illustration for CGPA

Semester-1	Semester-2	Semester-3	Semester-4	Semester-5	Semester-6	Semester-7	Semester-8
Credit: 20	Credit: 22	Credit: 25	Credit: 26	Credit: 26	Credit: 25	Credit: 24	Credit: 26
SGPA:6.9	SGPA:7.8	SGPA:5.6	SGPA:6.0	SGPA:6.3	SGPA:8.0	SGPA:8.0	SGPA:8.0

Thus, CGPA= $\frac{20x6.9+22x7.8+25x5.6+26x6.0+26x6.3+25x8.0+24x8.0+26x8.0}{194}$ = **7.06**

13. TEACHERS TRAINING (TT):

Learning Outcomes Based Curriculum Framework (LOCF) Quality initiative of UGC based on Outcome Based Education (OBE) is being implemented by the University Grants Commission to enhance the Quality of Higher Education and that of Higher Education Learners and Teachers. Therefore, university arrange following activities for teachers training:

1. Workshops for LOCF implementation.
2. Seminar for LOCF implementation.
3. FDP on LOCF.
4. Outcome based higher education and understanding the learning objectives, learning outcomes, new approaches in the area of outcome measurement, preparing future ready teachers and students.
5. Developing a battery of quality speakers/educators to become resource persons to play role for Training of Trainers (TO

14. KEY WORDS:

LOCF, CBCS, Course Learning Outcomes, Employability, Graduate Attributes Communication Skills, Critical Thinking, and Descriptors.

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