Learning Outcomes based Curriculum Framework (LOCF)

for

Bachelor of Technology

Under Self Finance Mode

(Civil Engineering)

B.Tech. (CE)

(Duration 4 Years)

(w.e.f. 2025-26)

Department of Civil Engineering

School of Technology

MAULANA AZAD NATIONAL URDU UNIVERSITY

1. Vision and Mission

1.1 Vision

The goal is to advance the knowledge of civil engineering and research with a global perspective, instilling ethics and moral values in students, and contributing to societal needs and economic growth through innovative, sustainable developments.

1.2 Mission

- Provide quality education and advanced skills in civil engineering with a focus on ethical values and balanced curriculum.
- Promote novelty, innovative thinking, and state-of-the-art research to address societal challenges and sustainable infrastructure.
- Serve as a knowledge base and create professional expertise to benefit the community and inspire future leaders.
- Nurture ethically responsible and technically sound civil engineers through industry interaction and exposure to the latest technologies.

1.3 Strategies for Attaining the Vision and Fulfilling the Mission

Following strategies will be used to ensure the accomplishment of the stated vision and mission:

- *Curriculum Enhancement*: Regularly updating the curriculum to include the latest advancements in civil engineering, ethical considerations, and practical skills to ensure students are well-prepared for global challenges.
- *Industry Partnerships*: Establish strong collaborations with industry leaders and organizations to provide students with internships, workshops, and real-world project opportunities, ensuring practical exposure and industry-ready skills.
- *Research and Innovation Centers*: Develop state-of-the-art research facilities and innovation centers that focus on addressing societal challenges, sustainable infrastructure, and emerging technologies.
- *Ethics and Professional Development*: Integrate courses and workshops on ethics, leadership, and professional development to instill strong moral values and prepare students for responsible citizenship and leadership roles.
- *Community Engagement*: Actively involve students and faculty in community service projects and outreach programs to address local and global societal needs, fostering a sense of social responsibility and civic engagement.
- *Continuous Learning and Development*: Encourage lifelong learning through continuing education programs, seminars, and conferences, ensuring that students and professionals stay updated with the latest trends and advancements in civil engineering.

These strategies can help create a robust foundation for achieving the stated vision and mission of the civil engineering department.

2. Program Educational Objectives

Program Educational Objectives (PEOs) are broad statements that describe the career and professional accomplishments that Civil Engineering Department is preparing its graduates to achieve during the graduation. Following four PEOs are defined as:

PEO 1. Developing graduates having knowledge, competence and skill that transform them into globally competent and locally relevant professionals and having enthusiasm to enhance their professional competence through training and experiential learning throughout their professional career.

PEO 2. Graduates will pursue knowledge and innovation-based development process to find solutions to problems in real life situation that satisfy technical performance specification.

PEO 3. Graduates will play adaptive leadership role in industry, government, education and R&D sectors to boost productivity and contribute economic development.

PEO 4. Graduates will be active members ready to serve the society locally and internationally apart from cultural needs, social awareness and responsibility.

3. Program Outcomes (POs)

Program outcomes are the narrower statements that describe what students are expected to know and be able to do upon graduation. POs represent the knowledge, skills and attitudes the students should have at the end of a program. Following are the statements for POs for Civil Engineering program. At the time of completing their degree requirements, students will be able to:

PO_1: Apply the knowledge of Mathematics, Science, and Engineering fundamentals, and an engineering specialization to solution of complex engineering problems **(Engineering Knowledge)**.

PO_2: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (**Problem analysis**).

PO_3: Design solutions for complex engineering problems and system components or processes that meet the specified needs with appropriate considerations of public health and safety, and cultural, societal, and environmental considerations (**Design/development of solutions**).

PO_4: Use research-based methods including design of experiments, analysis and interpretation of data and synthesis of information leading to logical conclusions (**Conduct investigations of complex problems**).

PO_5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling complex engineering activities with an understanding of limitations (**Modern tool usage**).

PO_6: Apply reasoning within the contextual knowledge to access societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice (**The engineer and society**).

PO_7: Understand the impact of the professional engineering solutions in the societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable developments (**Environment and sustainability**).

PO_8: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice (**Ethics**).

PO_9: Function effectively as an individual independently and as a member or leader in diverse teams, and in multidisciplinary settings (**Individual and team work**).

PO_{10}: 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 oral presentations, and give and receive clear instructions (**Communication**).

PO_{11}: Demonstrate knowledge and understanding of engineering management principles and apply those to one's own work as a member and leader of a team to manage projects in multidisciplinary environments (**Project management and finance**).

PO_{12}: 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 (**Life-long Learning**).

4. Program Specific Outcomes (PSOs)

Program Specific Outcomes (PSOs) are the statements that define outcomes of a program which make students realize the fact that knowledge and techniques learnt in a specific course has direct implication for the betterment of society and its sustainability.

PSO 1: Develop the ability to plan, analyze, design, prepare cost estimates and construction of various civil engineering projects also protecting, restoring the natural environment.

PSO 2: Implement various codal provisions/guidelines as applicable to design in civil engineering profession.

PSO 3: Apply computer aided skill and tools, execute various civil engineering projects.

PSO 4: Apply modern techniques, advanced materials, equipment and management tools so as to complete the civil engineering project within specified time and funds.

PSOs have to be attained by the students in due course of the four years program either as part of their Core, Basic Sciences, Engineering Sciences or as part of their various levels of projects, compulsory courses of Humanities & Social Sciences areas.

5. Mapping between PEOs, POs and PSOs

The following Table lists the relationships between the PEOs, POs. and PSOs. The attainment of POs can be viewed as a strategy for attaining the PEOs. Each PEO is supported by multiple POs to ensure strength in compliance. Also, the relationship between individual PO and PEOs can vary between **Reasonable (1)** and **Strong (3)**.

PEOs	POs												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
PEO1	2	2	1	2	3	2	2	2	2	2	1	2	3	2	3	3
PEO2	2	1	2	1	2	1	1	3	1	1	2	1	3	3	2	2
PEO3	1	2	2	3	3	2	2	1	2	3	1	2	2	2	3	3
PEO4	3	3	1	2	1	1	1	2	1	2	3	2	2	2	1	3

1 - Reasonable

2 - Significant

3 - Strong

6. Course Outcomes (COs)

Course Outcomes are narrower statements that describe what students are expected to know and be able to do at the end of the course. Course outcomes are defined for all courses as part of the syllabus for the course and are measured through performance on assignments, written and oral presentation reports related to individual and team projects and through the mid-term and semester end examinations. Detailed syllabi for each course associated with Course Objectives and Course Outcomes has been for specific outcomes associated with the course. Attaining the COs is at the heart of the educational activity. If COs of individual courses are successfully attained and the curriculum has been designed to achieve the Program Outcomes, then attainment of the POs is also ensured. An effective Assessment Plan has been devised to meet the objective, quantitative and independent measures to demonstrate that all POs and PEOs are being attained by the program.

7. Continuous Quality Improvement and Assessment Plan

The purpose of the Assessment Plan is to ensure attainment of all Program Outcomes (POs) and also the attainment of the Program Educational Objectives (PEOs) and to independently confirm that the POs and PEOs are being attained. Periodic monitoring of progress allows faculty members and the leadership to take corrective actions where the POs and PEOs are not meeting established targets. The process consists of assessing and evaluating the

extent to which the student outcomes are being attained. The results of these assessments and evaluations are subsequently used as the primary inputs for making improvements to the program.

Curriculum for

Undergraduate Degree Courses in Engineering & Technology

CIVIL ENGINEERING

4-year Curriculum structure

Maulana Azad National Urdu University

GENERAL COURSE STRUCTURE & THEME

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

B. Range of Credits: In the light of the fact that a typical Model Four-year Under Graduate degree program in Engineering has about 164 credits, the total number of credits proposed for the four-year B.Tech/B.E. in Civil Engineering and Engineering (Engineering & Technology) is kept as 164 as per AICTE Norms.

C. Structure of UG Program in CEE: The structure of UG program in Civil Engineering shall have essentially the following categories of courses with the breakup of credits as given:

S. No.	Category	Credit Breakup for CEE students
1.	Humanities and Social Sciences including Management courses	10
2.	Basic Science courses	21
3.	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	31
4.	Professional core courses	61
5.	Professional Elective courses relevant to chosen specialization/branch	12
6.	Open Electives from other technical and /or emerging subjects	6
7.	Project work, seminar and internship in industry or elsewhere	19
8.	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition]	(non-credit)
9.	Internship(s)	4
	Total	**164**

Note: If student earns 20 more credits through Swayam he/she will be awarded honours degree

D. Course code and definition:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
C	Credits
HSMC	Humanities and Social Sciences including Management courses
BSC	Basic Science Courses
ESC	Engineering Science Courses
PCC-CE	Professional Core Courses
PEC-CE	Professional Elective Courses
OEC-CE	Open Elective Courses
LC	Laboratory Course
MC	Mandatory Courses
INT	Internship

- **Course level coding scheme:** Three-digit number (odd numbers are for the odd

semester courses and even numbers are for even semester courses) used as suffix with the Course Code for identifying the level of the course. Digit at hundred's place signifies the semester in which course is offered. e.g.

101, 102 … Etc. for first semester.

201, 202 Etc. for second semester.

301, 302 … Etc. for third semester.

- **Category-wise Courses**

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES [HSMC]

Sl. No	**Code No.**	**Course Title**	**Semester**	**Hours per week**			**Total Credits**
				Lecture	Tutorial	Practical	
1.	BTCE111HST	Universal Human Values-II: Understanding Harmony And Ethical Human Conduct	I	2	0	0	2
2.	BTCE211HST	English Communication	II	2	0	0	2
3.	BTCE260HSP	English Communication Lab	II	0	0	2	1
4.	BTCE301HST	Humanities – 1 (Technology & Society)	IV	1	0	0	1
5.	BTCE511HST	Management-I (Organizational Behavior)/ Finance & Accounting	V	2	0	0	2
6.	BTCE512HST	Humanities – II (History of Science and Technology)	V	2	0	0	2
Total Credits							**10**

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BASIC SCIENCE COURSES [BSC]

Sl. No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	BTCE101BST	Linear Algebra and Calculus	I	3	1	0	4
2.	BTCE102BST	Engineering Chemistry	I	3	0	0	3
3.	BTCE150BSP	Engineering Chemistry Lab	I	0	0	4	2
4.	BTCE201BST	Probability and Statistics	II	3	1	0	4
5.	BTCE212BST	Engineering Physics	II	2	0	0	2
6.	BTCE260BSP	Engineering Physics Lab	II	0	0	4	2
7.	BTCE311BST	Differential Calculus and Numerical Analysis	III	3	1	0	4
Total Credits							**21**

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ENGINEERING SCIENCE COURSES [ESC]

Sl. No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	BTCE111EST	Engineering Graphics & Design	I	2	2	0	4
2.	BTCE102EST	Engineering Mechanics	I	3	0	0	3
3.	BTCE150ESP	Engineering Workshop	I	0	0	6	3
4.	BTCE211EST	Programming for Problem Solving	II	3	0	0	3
5.	BTCE260ESP	Programming for Problem Solving Lab	II	0	0	4	2
6.	BTCE212EST	Basic Electrical Engineering	II	3	0	0	3
7.	BTCE261ESP	Basic Electrical Engineering Lab	II	0	0	4	2
8.	BTCE301EST	Strength of Materials-I	III	3	0	0	3
9.	BTCE301ESP	Strength of Materials lab	III	0	0	4	2
10.	BTCE401PCT	Strength of Materials-II	IV	3	0	0	3
11.	BTCE402EST	Civil Engineering Materials, Testing & Evaluation	IV	3	0	0	3
Total Credits							**31**

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PROFESSIONAL CORE COURSES [PCC]

S No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	BTCE301PCT	Surveying and Geomatics	III	3	0	0	3
2.	BTCE302PCT	Fluid Mechanics	III	3	0	0	3
3.	BTCE301PCP	Surveying and Geomatics lab	III	0	0	4	2
4.	BTCE302PCP	Fluid Mechanics lab	III	0	0	4	2
5.	BTCE401PCT	Hydraulic Engineering	IV	3	0	0	3
6.	BTCE402PCT	Environmental Engineering	IV	3	1	0	3
7.	BTCE403PCT	Structural design-1	IV	2	0	0	2
8.	BTCE401PCP	Hydraulic Engineering lab	IV	0	0	4	2
9.	BTCE402PCP	Environmental Engineering lab	IV	0	0	4	2
10.	BTCE405PCT	Quantitative Skill	IV	1	1	0	2
11.	BTCE501PCT	Geotechnical Engineering	V	3	0	0	3
12.	BTCE502PCT	Structural design -II	V	3	0	0	3
13.	BTCE503PCT	Concrete Technology	V	2	0	0	2
14.	BTCE504PCT	Structural Analysis	V	3	0	0	3
15.	BTCE501PCP	Geotechnical Engineering lab	V	0	0	4	2
16.	BTCE601PCT	Transportation Engineering	VI	3	0	0	3
17.	BTCE602PCT	Water Rresource Engineering	VI	3	0	0	3
18.	BTCE603PCT	Design of Steel Structures	VI	3	0	0	3
20.	BTCE601PCP	Transportation Engineering Lab	VI	0	0	4	2
21.	BTCE602PCP	Concrete Technology & Testing lab	VI	0	0	4	2
22	BTCE701PCT	Estimating and Costing	VII	3	0	0	3
23	BTCE702PCT	Building planning and computer aided Civil Engineering Drawing	VII	3	0	0	3
24	BTCE703PCT	Foundation Engineering	VII	3	0	0	3
25	BTCE701PCP	Structural Design Lab	VII	0	0	2	2
Total Credits							**61**

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PROFESSIONAL ELECTIVE COURSES [PEC]

S.No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	PEC	Elective-I	V	3	0	0	3
2.	PEC	Elective-II	VI	3	0	0	3
3.	PEC	Elective-III	VII	3	0	0	3
4.	PEC	Elective-IV	VIII	3	0	0	3
Total Credits							**12**

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OPEN ELECTIVE COURSES [OEC]

S.No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	OET	Open Elective – I	VI	3	0	0	3
2.	OET	Open-Elective-II	VIII	3	0	0	3
Total Credits							**6**

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MANDATORY COURSES (MC)

Non Credit Theory (NCT)

S.No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	BTCE111NCT	Civil Engineering - Societal and Global Impact	I	2	0	0	-
2.	BTCE211NCT	Sports and Yoga or NSS/NCC	II	2	0	0	-
3.	BTCE311NCT	Water and Environmental Sciences	III	2	0	0	-
4.	BTCE411NCT	Essence of Indian Knowledge Tradition	IV	2	0	0	-
5.	BTCE511NCT	Constitution of India	V	2	0	0	-
6.	BTCE611NCT	Instrumentation and Sensor Technologies for Civil Engineering Applications	VI	2	0	0	-
7.	BTCE711NCT	Disaster Preparedness and Planning	VII	2	0	0	-
Total Credits							**-**

PROJECT WORK AND SEMINAR

S.No	Course Code	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	BTCE611PCP	Project-I	VI	0	0	6	3
2.	BTCE711PCP	Project-II	VII	0	0	12	6
3.	BTCE811PCP	Project-III	VIII	0	0	20	10
Total Credits							**19**

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INTERNSHIP (INT)

S.No	Course Code	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	BTCE511INT	Internship-I	V				2
2.	BTCE711INT	Internship-II	VII				2
Total Credits							**4**

II. SEMESTER WISE STRUCTURE OF CURRICULM
[L=Lecture, T=Tutorials, P=Practical, C=Credits]

PROGRAM		YEAR				SEMESTER			
B.Tech. (CE)		I				I			
Course Code	Description	Course Title	Hours/Week			Credits	Score		End Exam Duration
			L	T	P		Internal	External	
BTCE101BST	Basic Science	Linear Algebra and Calculus	3	1	0	4	30	70	3 Hrs
BTCE102BST	Basic Science	Engineering Chemistry	2	0	0	2	15	35	2 Hrs
BTCE111EST	Engineering Science	Engineering Graphics & Design	2	2	0	4	30	70	3 Hrs
BTCE102EST	Engineering Science	Engineering Mechanics	3	0	0	3	30	70	3 Hrs
BTCE150BSP	Basic Science	Engineering Chemistry Lab	0	0	4	2	50	50	3 Hrs
BTCE150ESP	Engineering Science	Engineering Workshop	0	0	6	3	50	50	3 Hrs
BTCE111HST	HSMC	Universal Human Value	2	0	0	2	15	35	2 Hrs
BTCE111NCT	Mandatory Non Credit Course	Civil Engineering - Societal and Global Impact	2	0	0	0	15	35	2 Hrs
		Total				**20**	**650**		
Mandatory Induction Program- 3 Weeks Duration Note: End Semester Examinations of the subject(s) weighted more than 2 credits will be for three Hrs. duration with maximum 100 marks score (30+70)									
***HSMC** - Humanities & Social Sciences including Management									

PROGRAM		YEAR				SEMESTER			
B.Tech. (CE)		I				II			
ourse Code	Description	Course Title	Hours/Week			Credits	Score		End Exam Duration
			L	T	P		Internal	External	
BTCE201BST	Basic Science	Probability and Statistics	3	1	0	4	30	70	3 Hrs
BTCE212BST	Basic Science	Engineering Physics	3	0	0	3	30	70	3 Hrs
BTCE211EST	Engineering Science	Programming for Problem Solving	3	0	0	3	30	70	3 Hrs
BTCE211HST	HSMC	English Communication	2	0	0	2	15	35	2 Hrs
BTCE212EST	Engineering Science	Basic Electrical Engineering	3	0	0	3	30	70	3 Hrs
BTCE260BSP	Basic Science	Engineering Physics Lab	0	0	4	2	50	50	3 Hrs
BTCE260ESP	Engineering Science	Programming for Problem Solving Lab	0	0	4	2	50	50	3 Hrs
BTCE261ESP	Engineering Science	Basic Electrical Engineering lab	0	0	4	2	50	50	3 Hrs
BTCE260HSP	HSMC	English Communication Lab	0	0	2	1	50	50	2 Hrs
BTCE211NCT	Mandatory Non-Credit Audit Course	Sports and Yoga or NSS/NCC	2	0	0	0	15	35	2 Hrs
		Total	**22**				**900**		
***HSMC** - Humanities & Social Sciences including Management									

PROGRAM		YEAR				SEMESTER			
B.Tech. (CE)		II				III			
Course Code	**Description**	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
			L	T	P		Internal	External	
BTCE301PCT	Professional Core Course	Surveying and Geomatics	3	0	0	3	30	70	3 Hrs
BTCE302PCT	Professional Core Courses	Fluid Mechanics	3	0	0	3	30	70	3 Hrs
BTCE301EST	Engineering Science Course	Strength of Materials -I	3	0	0	3	30	70	3 Hrs
BTCE311BST	Basic Science course	Differential Calculus and Numerical Analysis	3	1	0	4	30	70	3 Hrs
BTCE301PCP	Professional Core Courses	Surveying and Geomatics lab	0	0	4	2	50	50	3 Hrs
BTCE302PCP	Professional Core Courses	Fluid Mechanics lab	0	0	4	2	50	50	3 Hrs
BTCE301ESP	Engineering Science Course	Strength of Materials lab	0	0	4	2	50	50	3 Hrs
BTCE311HST	HSMC	Technology & Society	1	0	0	1	15	35	1 Hrs
BTCE311NCT	Mandatory Courses	Water and Environmental Sciences	2	0	0	-	15	35	2 Hrs
		Total	**20**				**800**		

PROGRAM		YEAR				SEMESTER			
B.Tech. (CE)		II				IV			
Course Code	**Description**	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
			L	T	P		Internal	External	
BTCE401PCT	Professional Core Courses	Hydraulic Engineering	3	0	0	3	30	70	3 Hrs
BTCE401EST	Engineering Sciences Courses	Strength of Materials - II	3	0	0	3	30	70	3 Hrs
BTCE402PCT	Professional Core Courses	Environmental Engineering	3	1	0	3	30	70	3 Hrs
BTCE402EST	Engineering Sciences Courses	Civil Engineering Materials, Testing & Evaluation	2	0	0	2	30	70	3 Hrs
BTCE403PCT	Professional Core Courses	Structural design-I	3	0	0	3	30	70	3 Hrs
BTCE401PCP	Professional Core Courses	Hydraulic Engineering lab	0	0	4	2	50	50	3 Hrs
BTCE402PCP	Professional Core Courses	Environmental Engineering lab	0	0	4	2	50	50	3 Hrs
BTCE411NCT	Mandatory Courses	Essence of Indian Knowledge Tradition	2	0	0	-	15	35	2 Hrs
BTCE405PCT	Professional Core Courses	Quantitative Skill	1	1	0	2	15	35	2 Hrs
*** Every Student has to complete Mandatory 6-8 Week Internship during the summer vacations which shall be assess in the beginning of Next Semester/V Semester.**									
		Total	**20**				**800**		

PROGRAM		YEAR				SEMESTER			
B.Tech. (CE)		III				V			
Course Code	**Description**	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
			L	T	P		Internal	External	
BTCE501PCT	Professional Core Courses	Geotechnical Engineering	3	0	0	3	30	70	3 Hrs
BTCE502PCT	Professional Core Courses	Structural design -II	3	0	0	3	30	70	3 Hrs
BTCE503PCT	Professional Core Courses	Concrete Technology	2	0	0	2	50	50	3 Hrs
BTCE504PCT	Professional Core Courses	Structural Analysis	3	0	0	3	30	70	3 Hrs
BTCE511HST	HSMC	Organizational Behavior	2	0	0	2	15	35	2 Hrs
BTCE512HST	HSMC	History of Sciences & Technology in India	2	0	0	2	15	35	2 Hrs
BTCE50XPET	Professional Elective Courses	Elective-I	3	0	0	3	30	70	3 Hrs
BTCE501PCP	Professional Core Courses	Geotechnical Engineering lab	0	0	4	2	50	50	3 Hrs
BTCE511NCT	Mandatory Courses	Constitution of India	2	0	0	-	15	35	2 Hrs
BTCE511INT	Internship	Internship-I	-	-	-	2	50	50	-
		Total	**22**				**850**		

PROGRAM		YEAR				SEMESTER			
B.Tech. (CE)		III				VI			
Course Code	**Description**	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
			L	T	P		Internal	External	
BTCE601PCT	Professional Core Courses	Transportation Engineering	3	0	0	3	30	70	3 Hrs
BTCE602PCT	Professional Core Courses	Water Rresource Engineering	3	0	0	3	30	70	3 Hrs
BTCE603PCT	Professional Core Courses	Design of Steel Structures	3	0	0	3	30	70	3 Hrs
BTCE60XPET	Professional Elective Courses	Elective-II	3	0	0	3	30	70	3 Hrs
BTCE60XOET	Open Elective Courses	Open Elective- I	3	0	0	3	30	70	3 Hrs
BTCE601PCP	Professional Core Courses	Transportation Engineering Lab	0	0	4	2	50	50	3 Hrs
BTCE602PCP	Professional Core Courses	Concrete Technology & Testing lab	0	0	4	2	50	50	3 Hrs
BTCE611PCP	Project	Project-1	0	0	6	3	50	50	Viva-voce
BTCE611NCT	Mandatory Non-Credit Audit Course	Instrumentation and Sensor Technologies for Civil Engineering Applications	2	0	0	0	15	35	2 Hrs
*** Every Student has to complete Mandatory 6-8 Week Internship during the summer vacations which shall be assess in the beginning of Next Semester/VII Semester.**									
		Total	**22**				**850**		

PROGRAM	YEAR	SEMESTER
B.Tech. (CE)	IV	VII

Course Code	Description	Course Title	Hours/Week			Credits	Score		End Exam Duration
			L	T	P		Internal	External	
BTCE701PCT	Professional core course	Estimating and Costing	3	0	0	3	30	70	3 Hrs
BTCE702PCT	Professional core course	Building planning and computer aided Civil Engineering Drawing	3	0	0	3	30	70	3 Hrs
BTCE703PCT	Professional core course	Foundation Engineering	3	0	0	3	30	70	3 Hrs
BTCE701PCP	Professional core course	Structural Design Lab	0	0	4	2	50	50	3 Hrs
BTCE70XPET	Professional Elective Courses	Elective- III	3	0	0	3	30	70	3 Hrs
BTCE711PCP	Project	Project-II	0	0	12	6	100	100	Viva-voce & Demonstration
BTCE711NCT	Mandatory Non-Credit Audit Course	Disaster Preparedness and Planning	2	0	0	0	15	35	2 Hrs
BTCE711INT	Internship	Internship-II	-	-	-	2	50	50	-
Total			**22**				**850**		

PROGRAM	YEAR	SEMESTER
B.Tech. (CE)	IV	VIII

Course Code	Description	Course Title	Hours/Week			Credits	Score		End Exam Duration
			L	T	P		Internal	External	
BTCE80XPET	Professional Elective Courses	Elective-IV	3	0	0	3	30	70	3 Hrs
BTCE80XOET	Open Elective Courses	Open Elective- II	3	0	0	3	30	70	3 Hrs
BTCE811PCP	Project	Project-III	0	0	20	10	100	100	Viva- voce & Demonstration
Total			**16**				**400**		

PROFESSIONAL COURSES –ELECTIVE-I								
Course Code	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
		L	T	P		Internal	External	
BTCE501PET	Open Channel Flow	3	0	0	3	30	70	3 Hrs
BTCE502PET	Building Construction Practice	3	0	0	3	30	70	3 Hrs
BTCE503PET	Environmental Impact Assessment	3	0	0	3	30	70	3 Hrs

PROFESSIONAL COURSES – ELECTIVE-II								
Course Code	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
		L	T	P		Internal	External	
BTCE601PET	Hydrology	3	0	0	3	30	70	3 Hrs
BTCE602PET	Advanced Concrete Technology	3	0	0	3	30	70	3 Hrs
BTCE603PET	Water Resources Systems Planning and Management	3	0	0	3	30	70	3 Hrs
BTCE604PET	Construction Engineering and Management	3	0	0	3	30	70	3 Hrs

PROFESSIONAL COURSES – ELECTIVE-III								
Course Code	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
		L	T	P		Internal	External	
BTCE701PET	Transportation System planning and Management	3	0	0	3	30	70	3 Hrs
BTCE702PET	Advanced Structural Analysis	3	0	0	3	30	70	3 Hrs
BTCE703PET	Remote Sensing	3	0	0	3	30	70	3 Hrs
BTCE704PET	Non Destructive Testing methods	3	0	0	3	30	70	3 Hrs

PROFESSIONAL COURSES – ELECTIVE- IV								
Course Code	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
		L	T	P		Internal	External	
BTCE801PET	Pre fabricated, Precast and Pre stressed structures	3	0	0	3	30	70	3 Hrs
BTCE802PET	Railway Engineering and Airport Engineering	3	0	0	3	30	70	3 Hrs
BTCE803PET	Advanced Design of Steel Structures	3	0	0	3	30	70	3 Hrs
BTCE804PET	Dam Engineering	3	0	0	3	30	70	3 Hrs

OPEN ELECTIVE-I: **A Student need to opt any one subject from the following open electives to be offered by the other Departments**								
Course Code	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
		L	T	P		Internal	External	
BTCE601OET	Water Management	3	0	0	3	30	70	3 Hrs
BTCE602OET	Renewable Energy Sources	3	0	0	3	30	70	3 Hrs
BTCE603OET	Environmental Health and Safety	3	0	0	3	30	70	3 Hrs
BTCE604OET	Energy Efficient buildings	3	0	0	3	30	70	3 Hrs

OPEN ELECTIVE-II: **A Student need to opt any one subject from the following open electives to be offered by the other Departments**								
Course Code	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
		L	T	P		Internal	External	
BTCE801OET	Smart Cities	3	0	0	3	30	70	3 Hrs
BTCE802OET	Sustainable and Green Construction	3	0	0	3	30	70	3 Hrs
BTCE803OET	Engineering Geology	3	0	0	3	30	70	3 Hrs
BTCE804OET	Signal System and traffic Engineering	3	0	0	3	30	70	3 Hrs

Course Code	Course Title	Lecture			Semester: I
BTCS101BST	Linear Algebra and Calculus	L	T	P	
Version: 1.0	Date of Approval:	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic knowledge of Mathematics

Course Objectives:

1. To understand the concept of the matrix and applying to various engineering problems.
2. To provide the concept of Eigen values and eigenvectors.
3. To acquire the concept of mean value theorems and successive differentiation.
4. To impart the concept of partial derivatives of first and higher orders in the field of engineering and technology.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Apply differential and integral calculus to notions of curvature to improper integrals and various engineering problems.	PO_1, PO_2
CO_2	Find the rank of matrices and linear algebra including linear transformations, eigenvalues, diagonalization and orthogonalization.	PO_3, PO_5
CO_3	Evaluate the partial derivatives of first and higher orders.	PO_4
CO_4	Demonstrate various applications with basic understanding of Beta and Gamma functions.	PO_3, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	3										
CO_2			2		2							
CO_3				2								
CO_4			2									2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Matrices:** Matrices, vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination. Cayley-Hamilton's theorem (without proof) and its applications
Unit: 2	**Vector spaces:** Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.
Unit: 3	**Vector spaces:** Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigen bases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.
Unit: 4	**Calculus- I: Mean value theorems:** Rolle's mean value theorem, Lagrange's mean value theorem and Cauchy's mean value theorem (All Theorems without proof); problems on it. **Successive differentiation**: standard results; Leibnitz's theorem; Expansions of functions: , Taylor's and Maclaurin's series with remainders (All Theorems without proof); Maxima and minima for function of one variable.
Unit: 5	**Calculus-II:** **Partial Differentiation:** Partial derivatives of first and higher orders, Homogeneous functions, Euler's Theorem; Total derivative; Change of variables. Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. **Multiple Integrals and Their Applications:** Double integrals and their evaluation; Change of order for integration; Double integrals in polar coordinates; Triple integrals; Application of multiple integrals to find area, volume, surface area

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

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

3	D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4	Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
Reference Books:	
1	H. Anton, C. Rorres, Elementary Linear Algebra with Supplemental Applications, 11th Edition, Wiley Student Edition, New Delhi (2011)
2	N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
3	M. D. Weir, J. Hass, Thomas' Calculus,12th Edition, Pearson India Education Services Pvt Ltd., New Delhi (2016).
4	V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

Course Code	Course Title	Lecture			Semester: I
BTCS102BST	Engineering Chemistry	L	T	P	
Version: 1.0	Date of Approval:	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	2	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): Basic knowledge of Chemistry

Course Objectives:

1. To acquire the knowledge of electrochemistry, corrosion and water treatment which are essential for the Engineers and in industry.
2. To impart the basic knowledge of atomic, molecular and electronic modifications which makes the student to understand the technology based on them.
3. To impart the knowledge of synthetic aspects useful for understanding reaction pathways.
4. To acquire the skills pertaining to spectroscopy and to apply them for medical and other field.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the knowledge of atomic, molecular and electronic changes, band theory related to conductivity.	PO_1, PO_2
CO_2	Apply the required principles and concepts of electrochemistry, corrosion and in understanding the problem of water and its treatments.	PO_3
CO_3	Analyze the knowledge of configurational and conformational analysis of molecules and reaction mechanisms.	PO_2, PO_4
CO_4	Evaluate the required skills to get clear concepts on basic spectroscopy and application to medical and other fields.	PO_4, PO_5

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	1										
CO_2			1									
CO_3		2		1								
CO_4				1	1							

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Molecular structure and Theories of Bonding:** Atomic and Molecular orbitals. Linear Combination of Atomic Orbitals (LCAO), molecular orbitals of diatomic molecules, molecular orbital energy level diagrams of N2, O2 and F2 molecules. π molecular orbitals of butadiene and benzene. Crystal Field Theory (CFT): Salient Features of CFT – Crystal Field Splitting of transition metal ion d- orbitals in Tetrahedral, Octahedral and square planar geometries. Band structure of solids and effect of doping on conductance
Unit: 2	**Water Treatment:** Hardness of water, types of hardness, unites of hardness of water, determination of hardness of water by EDTA method. Boiler troubles - scale and sludge formation in boilers, caustic embrittlement, priming and foaming, Softening of water- Lime soda, permutit and ion exchange process. Problems
Unit: 3	**Electrochemistry and corrosion:** Electro chemical cells – electrode potential, standard electrode potential, types of electrodes – calomel, Quinhydrone and glass electrode. Nernst equation Determination of pH of a solution by using quinhydrone and glass electrode. Electrochemical series and its applications. Numerical problems. Potentiometric titrations. Batteries – Primary (Lithium cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery). Causes and Theories of corrosion – Chemical and electrochemical corrosion, Water line and pitting corrosion; Factors affecting rate of corrosion – Nature of metal and Nature of environment. Corrosion control Methods: using pure metal and alloys, modifying the environment, cathodic protection (sacrificial anodic and impressed current cathodic). Surface coatings: Metallic coatings & methods of application of metallic coatings – hot dipping (galvanization & tinning), electroplating
Unit: 4	**Reactivity of Organic Molecules & Types of Reaction and Mechanism :** Inductive effect, Resonance or Mesomeric effect, Electromeric effect, Hyper conjugation, Carbocation, Carbanion

	& Free radical. Substitution, Addition and Elimination reaction.;Mechanism of the following reactions Aldol condensation, Cannizzaro reaction, Hoffmann reaction & Diels-Alder reaction
Unit: 5	**Spectroscopic techniques and applications**: Principles of spectroscopy, selection rules and applications of electronic spectroscopy. vibrational and rotational spectroscopy. Basic concepts of Nuclear magnetic resonance Spectroscopy, chemical shift. Introduction to Magnetic resonance imaging.
Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.	
Text Books:	
1	Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane.
2	Engineering Chemistry by P.C Jain & Monica Jain, Dhanpatrai Publishing Company (2008)
Reference Books:	
1	Fundamentals of Molecular Spectroscopy, by C. N. Banwell
2	Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.
3	Engineering Chemistry by S.S. Dara & Mukkati S. Chand & Co,New Delhi(2006)
4	Engineering Chemistry – Shasi Chawla, Dhantpat Rai publishing Company, NewDelhi (2008).
5	Engineering Chemistry – R. Gopalan, D. Venkatappayya, D.V. Sulochana Nagarajan – Vikas Publishers (2008)
6	Engineering Chemistry J.C. Kuriacase & J. Rajaram, Tata McGraw Hills co., New Delhi (2004).

Course Code	Course Title	Lecture			
BTCE111EST	Engineering Graphics & Design	L	T	P	**Semester:** I
Version: 1.0	**Date of Approval:**	2	2	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	6	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Theory & Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic knowledge of Mathematics and Physics

Course Objectives:

1. To understand the concept of imagination skills.
2. To acquire the knowledge of developing basic graphic skills.
3. To develop skills in reading and interpretation of engineering Drawings.
4. To impart the knowledge of principles of Isometric Projection, Isometric scale, Isometric Views-Conventions Plane Figures, Simple and Compound Solids.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Get acquainted with the knowledge of various lines, geometrical constructions and construction of various kinds of scales, and Ellipse.	**PO_1, PO_3, PO_9**
CO_2	Improve their imagination skills by gaining knowledge about points, lines and planes.	**PO_2, PO_3, PO_5, PO_9**
CO_3	Become proficient in drawing the projections of various solids	**PO_2, PO_5, PO_6, PO_9**
CO_4	Gain knowledge about orthographic and isometric projections.	**PO_2, PO_4, PO_5, PO_9**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2		2						1			
CO_2		1	1		2				1			
CO_3		2			2	3			1			
CO_4		2		1	2				1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction to Engineering Drawing** covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.
Unit: 2	**Projections of Points and Straight Line**: Point placed in different quadrants. Projections of straight lines - Parallel, perpendicular, inclined to one plan and inclined to planes. True lengths and true angle of a line. Traces of a line. **Projections of Planes:** Projections of regular planes parallel, perpendicular and inclined to one reference plane. Plane inclined to both the reference plane.
Unit: 3	**Projections of Solids**: Projections of regular solids, cube, prism, pyramids, cylinder and cone, axis inclined to one and both the references plane
Unit: 4	**Sections and Sectional Views:** True shape of section, Right Regular Solids- Prism, Cylinder, Pyramid, Cone.
Unit: 5	**Isometric Projections**: Principles of Isometric Projection, Isometric scale, Isometric views-Conventions Plane Figures, Simple and Compound Solids. **Customisation & CAD Drawing** consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House.
2	Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.

Reference Books:

1	Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
2	Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

3	(Corresponding set of) CAD Software Theory and User Manuals

Course Code	Course Title	Lecture			Semester: I
BTCE102EST	Engineering Mechanics	L	T	P	
Version: 1.3	Date of Approval:	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Engineering Mathematics & Engineering Physics

Course Objectives:

1. To understand distributed force systems, centroid/ center of gravity and method of finding centroids of composite figures and bodies
2. To acquire the moment of inertia and method of finding moment of inertia of areas and bodies.
3. To interpret the simple given dynamic problems and solve them for positions, velocities and accelerations, etc.
4. To learn the kinetics of the rigid bodies and solve simple problems using work-energy method.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Identify the significance of centroid/ centre of gravity and find centroids of composite figures and bodies.	PO_1, PO_2, PO_9
CO_2	Understand the moment of inertia and method of finding moment of inertia of areas and bodies	PO_3, PO_6
CO_3	Interpret the simple given dynamic problems and solve them for positions, velocities and accelerations, etc.,	PO_6
CO_4	Understand the kinetics of the rigid bodies and solve simple problems using work-energy method.	PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2							1			
CO_2			2			2						
CO_3						2						
CO_4									1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction to Engineering Mechanics covering-** Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems.
Unit: 2	**Friction covering-** Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction & screw jack .
Unit: 3	**Centroid and Centre of Gravity Covering-**Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia-Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone.
Unit: 4	**Review of Particle Dynamics-** Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular).
Unit: 5	**Introduction to Kinetics of Rigid Bodies Covering-**Basic terms, general principles in dynamics; Types of motion, Instantaneous center of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill.

2	R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
Reference Books:	
1	Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications.
2	Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.

Course Code	Course Title	Lecture			Semester: I
BTCS150BSP	Engineering Chemistry Lab.	L	T	P	
Version: 1.0	Date of Approval:	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Engineering Chemistry

Course Objectives:

1. To acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
2. To impart practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.
3. To develop the experimental skills both manually and by instrumentation of "qualitative and quantitative analysis" of solutions.
4. To impart with basic titration set up and methodologies for determining strength, hardness and alkalinity of various unknown solutions and water samples.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.	PO_1, PO_3, PO_4
CO_2	Conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.	PO_3
CO_3	Gain acquaintance in the determination the amount of hardness and chloride in the various samples of water for general purpose and their use its industries involving boilers.	PO_4, PO_6, PO_7
CO_4	Skills in estimating acidity/alkalinity in given water samples.	PO_7, PO_9

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2		2	1								
CO_2			2									
CO_3				1		1	2					
CO_4							2		1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

List of experiments/demonstrations:

1. Determination of carbonate and bicarbonate in a given mixture
2. Determination of temporary and permanent hardness in water sample using EDTA as standard solution
3. Determination of copper using standard sodium thiosulphate
4. Determination of chloride content in bleaching powder
5. Determination of iron content in the given water sample by Mohr's methods
6. pH- metric titration of acid and base
7. Conductometric titration of acid and base
8. Titration of acid and base by Potentiometry
9. Recording of Cu +2 Spectrum, absorptivity (demo only) determination of λmax and molar concentration by Spectrophotometer
10. Preparation of organic compound benzoic acid
11. Determination of surface tension and viscosity
12. Ion exchange column for removal of hardness of water
13. Synthesis of a polymer/drug
14. adsorption of acetic acid by charcoal

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Practical Engineering Chemistry by K. Mukkanti, etal, B.S. Publications, Hyderabad.
2	Inorganic quantitative analysis, Vogel.

Reference Books:

1	Text Book of engineering chemistry by R. N. Goyal and Harrmendra Goel.

2	A text book on experiments and calculation Engg. S.S. Dara.
3	Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

Course Code	Course Title	Lecture			Semester: I
BTCE150ESP	Engineering Workshop	L	T	P	
Version: 1.3	Date of Approval:	0	0	6	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	6	Internal Evaluation	:	50
Credits	:	3	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Engineering Mechanics

Course Objectives:

1. To provide hands on experience about use of different engineering materials, tools, equipment.
2. To develop a skill of carpentry, fitting and plumbing with safety at work place and team work.
3. To explains the construction, function, use and application of different working tools, equipment and machines.
4. To Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiselling.	PO_1, PO_3, PO_5
CO_2	Apply to fabricate components with their own hands	PO_3, PO_6, PO_9
CO_3	Analyze practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.	PO_1, PO_3, PO_6
CO_4	Ability to design and model different prototypes in the carpentry trade such as Cross lap joint, Dove tail joint.	PO_3, PO_5, PO_6, PO_9

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2		2		2							
CO_2			2			2			1			
CO_3	2		2			2						
CO_4			2		2	2			1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

1. **Carpentry:** Study of hand tools like hacksaws, jack planes, chisels and gauges for construction of various joints. Practice in planning, chiselling, marking and sawing. Joints –Cross joint, T joint, Dove tail joint.
2. **Fitting:** Study of different fitting tools. Use and setting of fitting tools for marking, center punching, chipping, cutting, filing, drilling, their use, different measuring tools, Files – Material and Classification. Practice in filing, cutting, drilling and tapping. Male and female joints, Stepped joints.
3. **Plumbing:** Study of different plumbing tools. Details of plumbing work in domestic and industrial applications. Study of pipe joints, cutting, threading and laying of pipes different fittings using PVC pipes. Use of special tools in plumbing work. Practice of a domestic line involving fixing of a water tap and use of coupling, elbow, tee, and union etc.

TRADES FOR DEMONSTRATION & EXPOSURE:

1. **House Wiring:** Study of wiring tools, industrial wiring, accessories, earthling, and safety precaution. Practice to make parallel and series connection of three bulbs, stair case wiring, florescent lamp fitting.
2. **Machine Tools:** Study and demonstration on working of machine tools. Specification and block diagram of lathe, Drilling machine and grinder. Common lathe operations such as turning, parting, chamfering and facing. Difference between drilling and boring.
3. **Casting:** Study of Moulding Sands, Pattern, Core Prints, Role of Gate runner, riser, core, casting defects like blow holes & cavities. Practical Work: Mould of any pattern Casting of simple pattern, Solid pattern, Split pattern, multi-piece pattern.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Work shop Manual - P.Kannaiah/ K.L.Narayana/ Scitech Publishers.
2	Elements of Workshop Technology (Volume - 1): Hajra Choudhury.
3	Workshop Manual / Venkat Reddy/ BS Publications/Sixth Edition.

Reference Books:

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

2	Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3	Gowri P. Hariharan and A. Suresh Babu,”Manufacturing Technology – I” Pearson Education, 2008.
4	Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

Course Code	Course Title	Lecture			Semester: I
BTCE111HST	Universal Human Values	L	T	P	
Version: 1.0	Date of Approval:	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	2	End Semester	:	35
Instruction Mode	:	Theory & Practical	Exam Duration	:	2 Hrs.

Prerequisite(s): No Prerequisite

Course Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To understand the meaning of happiness and prosperity for a human being.
3. To learn to initiate a process of dialogue within themselves to know what they 'really want to be' in their life and profession.
4. To understand the harmony at all levels of human living and applying understanding of harmony in existence in their profession and lead an ethical life.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	To become more responsible in life and in handling problems with sustainable solutions while keeping human relationships and human nature in mind.	PO_7 , PO_{12}
CO_2	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.	PO_8 , PO_{12}
CO_3	To become more aware of themselves and their surroundings(Family, Society, Nature).	PO_9 , PO_{12}
CO_4	Understand the significance of value inputs in a classroom and start applying them in their life and profession.	PO_{10} , PO_{12}

PO_1-Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1							1					2
CO_2								2				3
CO_3									3			1
CO_4										3		2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction to Value Education** Right Understanding, Relationship and Physical Facility(Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.
Unit: 2	**Harmony in the Human Being** Understanding Human Being as the Co-existence of the self and the body, Distinguishing between the needs of the Self ('I') and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Program to ensure Self-Regulation and Health.
Unit: 3	**Harmony in the Family and Society** Harmony in the Family– the Basic Unit of Human Interaction, 'Trust' –the Foundational Value in Relationship, 'Respect'–as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.
Unit: 4	**Harmony in the Nature/Existence:** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.
Unit: 5	**Implications of the Holistic Understanding – a Look at Professional Ethics** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in

	Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.
Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.	
Text Books:	
1	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019.
2	The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G
Reference Books:	
1	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999
2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

Course Code	Course Title	Lecture			
BTCE111NCT	Civil Engineering – Societal and Global Impact	L	T	P	**Semester:** I
Version: 1.0	**Date of Approval:** --	2	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	0	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): None

Course Objectives:

1. To provide a better understanding of the impact which Civil Engineering has on the Society at large and on the global arena.
2. To enable them realise the impact which civil engineering has on life and take appropriate precautions to ensure that the impact is not adverse but beneficial.
3. To think innovatively to ensure Sustainability.

Course Outcomes (CO):

COs No.	**Statement**	**Mapped Program Outcomes (POs)**
CO_1	Understand the impact which Civil Engineering projects have on the Society at large and on the global arena of using resources efficiently and effectively.	**PO_1, PO_6, PO_8, PO_{11}, PO_{12}**
CO_2	Understand the extent of Infrastructure, its requirements for energy and how they are met: past, present and future	**PO_5, PO_7, PO_9, PO_{11}**
CO_3	The sustainability of the Environment, including its Aesthetics	**PO_7, PO_{11}**
CO_4	The potentials of Civil Engineering for Employment creation and its contribution to the GDP	**PO_6, PO_9, PO_{11}, PO_{12}**

PO1- Engineering Knowledge, **PO2**- Problem analysis, **PO3**- Design/development of solutions, **PO4**- Conduct investigations of complex problems, **PO5**- Modern tool usage, **PO6**- The engineer and society, **PO7**- Environment and sustainability, **PO8**- Ethics, **PO9**- Individual or team work, **PO10**- Communication, **PO11**- Project management and finance, **PO12**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**	**PO_9**	**PO_{10}**	**PO_{11}**	**PO_{12}**
CO_1	2					2		1			1	1
CO_2							3				2	
CO_3							2				2	
CO_4						3			1		3	2

1 - Reasonable; 2 - Significant; 3 - Strong

Detailed Contents:

Unit: 1	Introduction to Course and Overview; Understanding the past to look into the future: Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis; Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering
Unit: 2	Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads,

	Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability
Unit: 3	Environment- Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non- stationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.
Unit: 4	Built environment – Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability.
Unit: 5	Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment(projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development
Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.	
Text Books:	
1	Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition
Reference Books:	
1	NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.
2	Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio

Course Code	Course Title	Lecture			
BTCE201BST	Probability and Statistics	L	T	P	**Semester:** II
Version: 1.0	**Date of Approval:**	3	1	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic knowledge of Mathematics

Course Objectives:

1. To familiarize the students with statistical techniques.
2. To equip the students with standard concepts and tools.
3. To impart the concept of Measures of Central tendency.
4. To acquire the knowledge of Chi-square test for goodness of fit and independence of attributes.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the ideas of probability and random variables and various discrete	**PO_1**
CO_2	Apply continuous probability distributions and their properties.	**PO_2, PO_3**
CO_3	Analyze the basic ideas of statistics including measures of central tendency, correlation and regression.	**PO_3, PO_4**
CO_4	Evaluate the statistical methods of studying data samples.	**PO_5, PO_6, PO_{12}**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2											
CO_2		2	2									
CO_3			2	2								
CO_4					1	1						2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Basic Probability:** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.
Unit: 2	**Continuous Probability Distributions:** Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. **Bivariate Distributions:** Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.
Unit: 3	**Basic Statistics:** Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.
Unit: 4	**Applied Statistics:** Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.
Unit: 5	**Small samples:** Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2	P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003.
3	S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4	W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

Reference Books:

1	N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
2	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
3	Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

Course Code	Course Title	Lecture			Semester: II
BTCE212BST	Engineering Physics	L	T	P	
Version: 1.3	Date of Approval:	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic knowledge of Physics

Course Objectives:

1. To acquire competency in the field of engineering with adaptability to new development in science and technology.
2. To demonstrate various scientific principles, engineering methods and technological development.
3. To learning basic properties and characteristics of light, double slit and triple slit interference, Newton's rings, interference in thin films.
4. To understand the concept of elementary particles and conservation laws.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the Bragg's Law and the principles of lasers, types of lasers and applications.	PO_1
CO_2	Apply various terms related to properties of materials such as, permeability, polarization, etc.	PO_1, PO_2
CO_3	Analyze some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.	PO_2, PO_3, PO_4
CO_4	Analyze and evaluate and simple quantum mechanics calculations.	PO_2, PO_3

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3											
CO_2	2	1										
CO_3		1	2	2								
CO_4		2	2									

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Diffraction: Introduction to interference and example; concept of diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits; diffraction grating, characteristics of diffraction grating and its applications. Polarisation: Introduction, polarisation by reflection, polarisation by double refraction, scattering of light, circular and elliptical polarisation, optical activity.
Unit: 2	Fibre Optics: Introduction, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, application of optical fibres. Lasers: Introduction to interaction of radiation with matter, principles and working of laser: population inversion, pumping, various modes, threshold population inversion, types of laser: solid state, semiconductor, gas; application of lasers.
Unit: 3	Electromagnetism : Laws of electrostatics, electric current and the continuity equation, laws of magnetism. Ampere's Faraday's laws. Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius-Mossotti equation, applications of dielectrics.
Unit: 4	Magnetic Properties of Materials :Magnetisation, permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications. Introduction to quantum physics, black body radiation, explanation using the photon concept, photoelectric effect, Compton effect.
Unit: 5	Quantum Mechanics: de Broglie hypothesis, wave-particle duality, Born's interpretation of the wave function, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Beiser : Modern Physics

2	Mani and Damask : Modern Physics
Reference Books:	
1	Resnick and Halliday : Physics
2	M. Ratner & D. Ratner (Pearson Ed.): Nanotechnology
3	A.J. Decker (Macmillan): Solid State Physics

Course Code	Course Title	Lecture			
BTCE211EST	Programming for Problem Solving	L	T	P	**Semester:** II
Version: 1.0	**Date of Approval:**	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): No specific requisites

Course Objectives:

1. To understand the various steps in program development.
2. To impart the basic concepts in C programming language.
3. To acquire how to write modular and readable C programs.
4. To learn to write programs (using structured programming approach) in C to solve problems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand various problem-solving techniques and implement them in 'C' language.	**PO_1, PO_2**
CO_2	Apply the basic terminology used in computer programming and write, compile and debug programs in C language.	**PO_3,**
CO_3	Develop programs involving decision structures, loops and functions using different data types and data structures.	**PO_3, PO_4**
CO_4	Apply and analyze logical skills to program in C language.	**PO_4, PO_5**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2										
CO_2			2									
CO_3			2	1								
CO_4				1	1							

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction to Programming, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Introduction to programming – definitions and developing Algorithms and flowcharts for simple programs. Introduction to C Programming: Origin and history of c programming character set, Identifiers and keywords data types, constants, variables operators, symbolic constants, Expressions, compound statements, structure of C program, Input and output function.
Unit: 2	C Statements – selection statements – if nested if's, the if-else –if ladder the conditional expressions, switch statement nested switch statements, iteration statements – the for loop, for loop variations, the while loop, the do-while loop, declaring variable with in selection and iteration statements, jump statement, the return statement, the go to submit, break statement, exit( ) function, the continue statement, expression statement. Block statements.
Unit: 3	Arrays – Array what is an array? – Array Declaration, Array Initialization – Accessing individual elements of an array – Two Dimensional Arrays – Passing an array element to a function – Rules of using an array. What are strings? String I/O, string Manipulation Functions – The General Form of a Function, elements of function, function categories, types of functions, Function Arguments Call by value, Call by Reference, return statement. Uses of functions. C pre – processor, storage classes – Automatic – Register, Static and external.
Unit: 4	Pointers – definition, pointer variables, pointer expressions, arithmetic pointers, pointers and arrays, initializing pointers and functions and problems with pointers. Structures – definition, accessing structure members, structure assignments, array of structures, passing structures, structure pointers, uses of structures Unions – definitions, difference between structure and union, type def. Files – introduction to streams and files, basics of files – file pointer, opening and closing files, writing and reading character, file functions.
Unit: 5	Principles of OOP: Programming paradigms, basic concepts, benefits of OOP, applications of OOP Introduction to C++: History of C++, structure of C++, basic data types, type casting, type modifiers, operators and control structures, input and output statements in C++. Classes and objects: class specification, member function specification, scope resolution operator, access qualifiers, instance creation.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Let Us C by Yashwanth Kanethar.
2	E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
Reference Books:	
1	Object Oriented Programming with C++ By E.Balaguruswamy.
2	Programming in C, 2nd Edition, Oxford by Pradip Dey, Mannas Ghosh.

Course Code	Course Title	Lecture			Semester: II
BTCE211HST	English Communication	L	T	P	
Version: 1.0	Date of Approval:	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	2	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): No specific prerequisites.

Course Objectives:

1. To understand the concept of enhancement of the soft and communication skills.
2. To acquire the phonetics & developing vocabulary.
3. To impart the writing applications, letters formal and non-formal, technical writing.
4. To learn the concept of portfolio writing and resume writing.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Read and write paragraphs in English confidently	PO_6, PO_{10}
CO_2	Differentiate among homonyms, homophones, synonyms and antonyms.	PO_6, PO_{10}
CO_3	Read and write the specific details and information such as writing applications, formal letters, CVs, technical reports and project reports.	PO_{12}
CO_4	Communicate with more confident among students, teachers & other stakeholders of the society.	PO_8, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						2				3		
CO_2						2				3		
CO_3												3
CO_4								1				3

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Oral Communication: 1.1. Communication: Verbal and Non-Verbal 1.2. Conversations and Dialogues 1.3. JAM Sessions and Group Discussions 1.4. Presentation Skills and Interview Skills
Unit: 2	Writing Communication: 2.1. Subject-verb agreement 2.2. Précis Writing and Essay Writing 2.3. Letter Writing and Cover Letters 2.4. Portfolio Writing and Resume Writing

Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.

Text Books:

1	Habeeb,G. (2013) *English for Speakers of Urdu: A Proficiency Course*: Orient Black swan
2	Koneru, A. (2015) *Professional Speaking Skills.*OUP.
3	Kumar, S. & P. Lata (2015). *Communication Skills*. New Delhi: OUP.

Reference Books:

1	O'Brien, T. (2011). *Modern Writing Skills*. New Delhi: Rupa
2	Raymond, M. (2013). *English Grammar in Use*. Cambridge: CUP.
3	Taylor, G. (2009). *English Conversation Practice.* Tata McGraw-Hill.

Course Code	Course Title	Lecture			
BTCE212EST	Basic Electrical Engineering	L	T	P	**Semester:** II
Version: 1.0	**Date of Approval:**	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic knowledge of Mathematics and Physics

Course Objectives:

1. To introduce fundamental concepts and analysis techniques in electrical engineering.
2. To provide knowledge about the basic DC and AC electric circuits and magnetic circuits.
3. To impart the concepts of generators, motors, transformers and their applications.
4. To gain knowledge about the fundamentals of wiring and earthling.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understanding of the basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global.	**PO_1, PO_2, PO_3**
CO_2	Illustrate an understanding of basic concepts of analysis of simple DC and AC circuits used in electrical and electronic devices	**PO_2, PO_3, PO_6**
CO_3	Demonstrate an understanding of selection skill to identify the type of motors required for particular application.	**PO_2, PO_3**
CO_4	Analyze and evaluate the effects of electric shock and precautionary measures.	**PO_1, PO_4, PO_7**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2	1									
CO_2		2	2			1						
CO_3		2	2									
CO_4	3			1			2					

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**DC Circuits:** Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.
Unit: 2	**AC Circuits:** Representation of sinusoidal waveforms, peak and rms values, phasor , real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three-phase balanced circuits, voltage and current relations in star and delta connections.
Unit: 3	**Transformers:** Magnetic materials, ideal and practical transformer, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.
Unit: 4	**Electrical Machines:** Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, . Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, and speed control of separately excited dc motor. Construction and working of synchronous generators.
Unit: 5	**Electrical Installations:** Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text 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.

Reference Books:

1	L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
2	E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
3	V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Course Code	Course Title	Lecture			Semester: II
BTCS260BSP	Engineering Physics Lab.	L	T	P	
Version: 1.0	Date of Approval:	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Engineering Physics

Course Objectives:

1. To acquire competency in the field of engineering.
2. To demonstrate to new development in physics laboratory by successfully completing the experiments.
3. To understand and learn basic theory and principles of science.
4. To experiment Thermo electric effect – Seebeck effect and Peltier effect.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Learn basic properties and characteristics of light, Double slit and triple slit interference, Newton's rings, interference in thin films.	PO_1, PO_6
CO_2	Apply the working principle of LASER, laser action, population inversion, Einstein coefficients, elementary laser types and applications of LASER.	PO_3, PO_5
CO_3	Analyze magnetic field and forces, electric field and usage of quantum theory.	PO_2, PO_4
CO_4	Evaluate Thermo electric effect – Seebeck effect and Peltier effect	PO_3, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2					2						
CO_2			2		1							
CO_3		1		1								
CO_4			2						1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

1. Determine the radius of Curvature of Plano convex lens by forming Newton's rings.
2. Determine the Numerical aperture of the given optical fibre by using Laser diode.
3. Draw the current Voltage (V-I) Characteristics of the given P-N-Junction diode.
4. Determine the plank's constant using photocell (Frequency of Blue- 7.406x1014 Hz, Green- 6x1014, Orange 5.26x1014 , Red- 4.68x 1014).
5. Determine the Physical Characteristics of the given Thermistor.
6. Determine the specific rotation of liquid by using polarimeter.
7. Determine the Energy gap of given semiconductor.
8. Determine the wavelength of a given laser source using diffraction grating

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Beiser : Modern Physics
2	Mani and Damask : Modern Physics

Reference Books:

1	Resnick and Halliday : Physics
2	C. Kittel (Wiley Eastern): Introduction to Solid Stat

Course Code	Course Title	Lecture			Semester: II
BTCE260ESP	Programming for Problem Solving Lab	L	T	P	
Version: 1.0	Date of Approval:	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Programming for Problem Solving

Course Objectives:

1. To provide the basic knowledge of programming languages.
2. To learn the syntax and semantics of 'C' language with the help of control structures, iterative control structures.
3. To develop programs using 'C' language with the help of functions, array, pointer and structures.
4. To impart the basic terminology used in computer programming for writing and debugging programs for problem solving.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand various problem-solving techniques and will be able to implement them in 'C' language.	PO_1, PO_2
CO_2	Apply the basic terminology used in computer programming and write, compile and debug programs in C language.	PO_3, PO_5
CO_3	Develop programs involving decision structures, loops and functions using different data types and data structures.	PO_4, PO_9
CO_4	Analyze and evaluate difference between call by value and call by reference.	PO_4

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	3										
CO_2			2		2							
CO_3				1					1			
CO_4				1								

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

List of Experiments:

1. Write C program to input and output the text message.
2. Write C Program to perform all arithmetic operations.
3. Write C Program to utilize the math function.
4. Write C Program to perform the mathematical expressions.
5. Write C Program for Local and Global Variables.
6. Write C Program for internal static and external static variables.
7. Write C Program to find the roots of a Quadratic equation.
8. Write C Programs for all the Operators. (Arithmetical, Logical, Relational, Bitwise).
9. Write C Programs for Increment and Decrement Operators.
10. Write C Programs to implement the Ternary Operator.
11. Write C Programs for special Operators.
12. Write C Programs for all the Control Structures. (Sequential Control Structures, Conditional Control Structures, Iterative Control Structures).
13. Write C Programs to display the different types of patterns using nested for loop.
14. Write C Program for Statements. (Switch, break, goto, continue etc.,).
15. Write C Program to print biggest number from n numbers.
16. Write a C Program to find the given integer number is even or odd number.
17. Write a C Program to calculate the factorial of a given number.
18. Write a C Program to swap the two numbers using temp variable and without using temp variable.
19. Reading and printing a single dimensional array of elements.
20. Ascending and descending of an array.
21. Sum of all odd numbers and sum of all even numbers in a single dimensional array.
22. Mathematical operations on single dimensional arrays.
23. Reading and Printing a multi-dimensional array of elements.
24. Mathematical operations on multi-dimensional array of elements.
25. Passing an array element to a function.
26. Reading and Printing a string.
27. C Programs on String functions.

28. Write a C program to calculate string length by writing the user-define function.
29. Function declaration and initialization.
30. C Program to differentiate the parameters and arguments in functions.
31. Programs for different types of inbuilt functions.
32. Call by value and Call by reference programs in functions.
33. Write a program to swap the given 2 number using passing by reference.
34. Write C Programs to perform all valid arithmetic operations using pointers.
35. C programs on Structures and accessing of members of the structures.
36. Write a C program to print a book information (Book name, Book no, author name) by writing a structure.
37. Write a C program by passing structure elements to a function and display employee Information (emp no, emp name, emp salary, and emp address).
38. C Programs on Reading a file from the secondary storage device.
39. C Program on writing and appending a file on the secondary storage device.
40. C Program on Opening and closing a file.
41. Programs on Classes using C++.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
2	Object Oriented Programming with C++ By E.Balaguruswamy

Reference Books:

1	Programming in C, 2nd Edition, Oxford by Pradip Dey, Mannas Ghosh
2	Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Code	Course Title	Lecture			Semester: II
BTCS261ESP	Basic Electrical Engineering Lab	L	T	P	
Version: 1.0	Date of Approval:	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic Electrical Engineering

Course Objectives:

1. To experiment the basics of Single and Three Phase transformers.
2. To acquire the concepts of D.C. Machines, construction, armature reaction and characteristics.
3. To understand the basic concept of a Three-phase induction motor and its torque slip characteristics.
4. To evaluate the efficiency of the different machines by analyzing their test results.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Explain the concept of circuit laws and network theorems and apply them to laboratory measurements.	PO_1, PO_2, PO_6
CO_2	Understand to systematically obtain the equations that characterize the performance of an electric circuit as well as solving both DC Machines and single-phase transformer.	PO_3, PO_6
CO_3	Analyze the principles of operation and the main features of electric machines and their applications	PO_9
CO_4	Evaluate the skills in using electrical measuring devices.	PO_4

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	1	1				1						
CO_2			1			1						
CO_3									1			
CO_4				1								

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

List of experiments/demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Verification of Thevenin's and Norton Theorems.
3. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
4. Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
5. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
6. To Determine the Performance Characteristics of a Series Motor.
7. To Determine the Performance Characteristics of a Shunt Motor.
8. To Determine the Performance Characteristics of a Compound Motor.
9. Speed Control of DC Shunt Motor.
10. To Determine the Load Characteristics of a Shunt Generator.
11. To Determine the Load Characteristics of a Single Phase Induction Motor.
12. To Determine the Performance Characteristics of a Three Phase Induction Motor.
13. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement).
14. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed.
15. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.

16. 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	
Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.	
Text Books:	
1	Basic Electrical Engineering, S.N. Singh, PHI, Learning Private Limited.
2	Electrical Machines M. N. Bandyopadhya, PHI, Learning Private Limited.
Reference Books:	
1	Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
2	Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
3	(Corresponding set of) CAD Software Theory and User Manuals

Course Code	Course Title	Lecture			Semester: II
BTCS260HSP	English Communication Lab	L	T	P	
Version: 1.0	Date of Approval:	0	0	2	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	100
Periods/ Week	:	2	Internal Evaluation	:	50
Credits	:	1	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	2 Hrs.

Prerequisite(s): English Communication

Course Objectives:

1. To communicate and achieve the perfection of understanding in English language.
2. To understand the spoken English.
3. To understand the written English.
4. To learn business communications in professional English language.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Student will be able to understand, comprehend.	PO_6, PO_{10}
CO_2	Analyze the professional and soft communication skills	PO_2
CO_3	Learn the perfection of understanding in English language.	PO_9, PO_{10}
CO_4	Can read, write and communicate effectively in English.	PO_{10}, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						1				3		
CO_2		2										
CO_3									1	3		
CO_4										3		2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction to Phonetics – Speech Sounds – Vowels & Consonants
Unit: 2	Structure of Syllables – weak forms & strong forms
Unit: 3	Minimal pairs – word accent and stress shifts
Unit: 4	Intonation and common errors in pronunciation
Unit: 5	Conversation practice – oral presentation skills a. Greeting and leave taking, introducing oneself and others b. Apologizing, interrupting, requesting and making polite conversation c. Giving instructions and directions: speaking of hypothetical situations d. Narrating, expressing opinions and telephone interactions

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	"Enjoying Every day English", Published by Sangam Books, Hyderabad
2	Innovate with English: A Course in English for Engineering Students, edited by T Samson, Foundation Books.

Reference Books:

1	English Grammar Practice, Raj N Bakshi, Orient Longman
2	Technical Communication by Daniel Riordan. 2011. Cengage Publications. New Delhi
3	Effective English, edited by E Suresh Kumar, A RamaKrishna Rao, P Sreehari, Published by Pearson
4	Handbook of English Grammar& Usage, Mark Lester and Larry Beason, Tata Mc Graw –Hill.
5	Spoken English, R.K. Bansal & JB Harrison, Orient Longman
6	Technical Communication, Meenakshi Raman, Oxford University Press
7	Objective English Edgar Thorpe & Showick Thorpe, Pearson Education

Course Code	Course Title	Lecture			
BTCE211NCT	Sports & Yoga	L	T	P	Semester: II
Version: 1.0	Date of Approval: --	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	0	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): None

Course Objectives:

1. To make the students understand the importance of physical activities and sports.
2. To make the students understand the importance of sound health and fitness principles as they relate to better health.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	To practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.	PO_6, PO_9, PO_{12}
CO_2	To learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.	PO_6, PO_7, PO_8, PO_{12}
CO_3	To learn breathing exercises and healthy fitness activities	PO_6, PO_{11}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						2			1			2
CO_2						1	2	1			2	2
CO_3						1					2	3

1 - Reasonable; 2 - Significant; 3 - Strong

Detailed Contents:

Unit: 1	Meaning & definition of Physical Education Aim & Objectives of Physical Education Changing trends in Physical Education. Ancient & Modern Olympics (Summer & Winter) o Olympic Symbols, Ideals, Objectives & Values Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award, Dhayanchand Award, Rajiv Gandhi Khel Ratna Award etc.)
Unit: 2	Physical Fitness, Wellness & Lifestyle: Meaning & Importance of Physical Fitness & Wellness Components of Physical fitness Components of Health related fitness o Components of wellness Preventing Health Threats through Lifestyle Change, Concept of Positive Lifestyle Define Anatomy, Physiology & Its Importance. Effect of exercise on various Body Systems. (Circulatory System, Respiratory System, Neuro-Muscular System etc.)
Unit: 3	Kinesiology, Biomechanics & Sports: Meaning & Importance of Kinesiology & Biomechanics in Physical Edu. & Sports Newton's Law of Motion & its application in sports. Friction and its effects in Sports. Postures Meaning and Concept of Postures. Causes of Bad Posture. Advantages & disadvantages of weight training. Concept & advantages of Correct Posture. Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis. Corrective Measures for Postural Deformities
Unit: 4	Yoga Meaning & Importance of Yoga Elements of Yoga Introduction - Asanas, Pranayama,

	Meditation & Yogic Kriyas Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Shashankasana) Relaxation Techniques for improving concentration - Yog-nidra Asanas as preventive measures. Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana. Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana. Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana. Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana. Asthema: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana,
Unit: 5	Training and Planning in Sports Meaning of Training, Warming up and limbering down, Skill, Technique & Style, Meaning and Objectives of Planning. Tournament – Knock-Out, League/Round Robin & Combination. Definition & Importance of Psychology in Physical Edu. & Sports Define & Differentiate between Growth & Development Adolescent Problems & their Management Emotion: Concept, Type & Controlling of emotions Meaning, Concept & Types of Aggressions in Sports. Psychological benefits of exercise. Anxiety & Fear and its effects on Sports Performance. Motivation, its type & techniques. Understanding Stress & Coping Strategies. Doping Meaning and Concept of Doping Prohibited Substances & Methods Side Effects of Prohibited Substances Sports Medicine First Aid – Definition, Aims & Objectives. Sports injuries: Classification, Causes & Prevention. Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries Sports Personalities. Proper Sports Gear and its Importance.
Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.	
Text Books:	
1	Light On Yoga By B.K.S. Iyengar.
2	Health and Physical Education – NCERT (11th and 12th Classes)
Reference Books:	
1	Modern Trends and Physical Education by Prof. Ajmer Singh.

Course Code	Course Title	Lecture			
BTCE301PCT	Surveying and Geomatics	L	T	P	Semester: III
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Engineering Physics, Engineering Mathematics and Engineering Graphics

Course Objectives:

1. Introduce fundamental principles, instruments, and techniques of surveying and levelling.
2. Impart knowledge of angular, linear, and graphical surveying methods including levelling and contouring.
3. Equip students with the skills to perform triangulation, trilateration, and curve setting in various terrains.
4. Familiarize students with modern surveying instruments like Total Station and GPS, including their application and data handling.
5. Provide an understanding of photogrammetry, aerial photography, and mapping techniques using modern tools.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Describe the principles of surveying and levelling, and apply linear, angular, and graphical methods in the field.	PO_1, PO_2, PO_4
CO_2	Conduct triangulation and trilateration using theodolites and related instruments; interpret angular and distance measurements with corrections.	PO_1, PO_2, PO_4
CO_3	Design and set out simple, compound, reverse, transition, and vertical curves for roadway and railway alignment.	PO_1, PO_2, PO_3
CO_4	Operate modern field instruments such as Total Station and GPS for precise surveying and positioning, and manage associated errors.	PO_1, PO_2, PO_4, PO_5
CO_5	Explain the basics of photogrammetry, plan aerial surveys, and interpret aerial photographs for mapping and analysis.	$PO_1, PO_2, PO_5, PO_{12}$

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	3		2								
CO_2	3	3		2								
CO_3	3	2	3									
CO_4	3	2		2	3							
CO_5	3	2			3							2

1 - Reasonable; 2 - Significant; 3 - Strong

Detailed Contents:

Unit: 1	**Introduction to Surveying :** Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, Levelling: Plane table surveying, Principles of levelling- booking and reducing levels; differential, reciprocal leveling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring.
Unit: 2	**Triangulation and Trilateration:** Theodolite survey: Instruments, Measurement of horizontal and

	vertical angle; Horizontal and vertical control - methods -triangulation - network- Signals. Baseline - choices - instruments and accessories - Trigonometric leveling - Axis single corrections.
Unit: 3	**Elements of simple and compound curves** – Method of setting out– Elements of Reverse curve, Transition curve length of curve – Elements of transition curve - Vertical curves
Unit: 4	**Modern Field Survey Systems:** Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.
Unit: 5	**Photogrammetry Surveying:** Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping, photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 20104Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
2	Punmia, B. C. Surveying –Vol. I and II, Laxmi Publication, 2005
3	Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
Reference Books:	
1	Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011

Course Code	Course Title	Lecture			
BTCE302PCT	Fluid Mechanics	L	T	P	Semester: III
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Water resources Engineering

Course Objectives:

1. Understand the basic concepts of fluid properties
2. Provide a first level exposure to the students to fluid statics, kinematics and dynamics.
3. Understanding the measurement of pressure, computations of hydrostatic forces on structural components and the concepts of Buoyancy all find useful applications in many engineering problems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the broad principles of fluid statics, kinematics and dynamics	PO_1, PO_2, PO_3
CO_2	Be able to apply the continuity, momentum and energy principles to mathematical problems	PO_3, PO_4, PO_9
CO_3	Understand flow properties for pipe flow	PO_4, PO_8, PO_9

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	3	1									
CO_2			1	2					1			
CO_3						1		2	3			

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.
Unit: 2	Fluid Statics - Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.
Unit: 3	Fluid Kinematics- Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates.
Unit: 4	Fluid Dynamics- Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation : venturimeter, orifice meter and pitot tube

Unit: 5	Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House
2	Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
Reference Books:	
1	Open channel Flow, K. Subramanya, Tata McGraw Hill.
2	Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill

Course Code	Course Title	Lecture			
BTCE301EST	Strength of Materials - I	L	T	P	**Semester:** III
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Engineering Mechanics and Mathematics

Course Objectives:

1. Understand the basic concept of the stress and strain for different materials.
2. Know the mechanism of development of shear force and bending moments in beams.
3. Understand and analyse the stresses for the combined action of direct load and Bending Moment.
4. Know the concept of unsymmetrical bending and shear centre for different members.
5. Understand the concepts of pure torsion, thick and thin cylinder and their practical applications.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Apply the fundamental concepts of stress and strain in the design of various structural components.	**PO_1, PO_3, PO_{12}**
CO_2	Analyse determinate beams to determine shear forces, bending moments and design forces in trusses.	**PO_1, PO_2, PO_3, PO_5, PO_{12}**
CO_3	Determine the bending stresses and shear stresses produced in a beam subjected to system of loads.	**PO_1, PO_2, PO_3, PO_{12}**
CO_4	Define pure torsion and derive torsional equation and know the advantage of hollow shafts in communicating power.	**PO_1, PO_3, PO_{12}**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3		2									1
CO_2	3	3	3		2							1
CO_3	3	2	3									1
CO_4	3		2									2

1 - Reasonable; 2 - Significant; 3 - Strong

Detailed Contents:

Unit: 1	**Simple Stresses and Strains-** Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience– Gradual, sudden, impact and shock loadings – simple applications.
Unit: 2	**Compound Stresses and Strains-** Two-dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two-dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain.
Unit: 3	**Bending moment and Shear Force Diagrams-** Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without over hangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated

	loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.
Unit: 4	**Flexural Stresses-**Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections. **Shear Stresses-** Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.
Unit: 5	**Direct and Bending:** Basic concept, Eccentric loading, limit of eccentricity-Core of sections-rectangular and circular, solid and hollow sections-wind pressure on chimneys and water pressure on dams. **Thin Cylinders -** Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder. **Thick Cylinders:** Lame's equations, stresses under internal and external fluid pressures- Compound cylinders- Shrink fit pressure.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.
2	Timoshenko, S. and Young, D. H., ―Elements of Strength of Materials‖, DVNC, New York, USA.
Reference Books:	
1	Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson, Prentice Hall, 2004.
2	Kazmi, S. M. A., ―Solid Mechanics‖ TMH, Delhi, India.
3	Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd edn. New York, NY: McGraw Hill, 1979
4	Laboratory Manual of Testing Materials - William Kendrick Hall
5	Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DE wolf – TMH 2002.

Course Code	Course Title	Lecture			Semester: III
BTCE311BST	Differential Calculus and Numerical Analysis	L	T	P	
Version: 1.2	Date of Approval:	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Probability And Statistics

Course Objectives:

1. To introduce the basic concepts of differential equations, partial differential equations, Laplace transformation and numerical analysis.
2. To explore a variety of various mathematical structures by focusing on mathematical objects, operations, and resulting properties.
3. To understand and learn uses and applications of Ordinary and Partial differential equations, Laplace transformation and Numerical analysis in the field of engineering and technology.
4. To impart the knowledge of numerical integration and Euler's method.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Demonstrate the ability to solve problems using Ordinary and Partial differential equations, Laplace transformation and Numerical analysis	PO_1, PO_2
CO_2	Learn the overview of differential equations.	PO_1, PO_{12}
CO_3	Use of equations reducible to exact form using Integrating factors - Linear, Bernoulli 's equations.	PO_3
CO_4	Learn the applications to Newton's Law of Cooling – Law of natural growth and decay.	PO_4, PO_9

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2	2											2
CO_3			2									
CO_4				2					2			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Differential Equations I**- Differential Equations an overview –Exact Differential Equations, Equations reducible to Exact Differential Equations using Integrating factors, Linear, Bernoulli`s Equations, Applications to Newton's Law of Cooling Law of Natural Growth and Decay, Orthogonal Trajectories in Cartesian and Polar form
Unit: 2	**Differential Equations II**- Linear Differential Equations of Higher Order with Constant Coefficients, Complementary Function and Particular Integral, General form of Particular Integral and Special types such as e^{ax} , *cos (ax), sin(ax),* x^m , e^{ax}. *V, x.V*, Method of Variation of Parameters for a Second Order Differential Equation, Applications to Bending of Beams, Electrical Circuits and Simple Harmonic Motion
Unit: 3	**Partial Differential Equations-** Formation of Partial Differential Equations by eliminating the arbitrary constants and arbitrary functions, Solution of Partial Differential Equations (Lagrange's method), Nonlinear Differential Equations of order one (Special forms), Method of Separation of Variables for Solving One Dimensional Wave Equation and Heat Equation and Problems.
Unit: 4	**Laplace Transforms-** Laplace Transform of Standard Functions, Inverse Transform, First Shifting Theorem, Transform of Derivatives and Integrals, Unit Step Function, Second Shifting Theorem, Dirac-delta Function, Convolution Theorem, Periodic Function, Differentiation and Integration of Transforms, Application of Laplace Transform to Ordinary Differential Equations.
Unit: 5	**Numerical Analysis-** Numerical Integration, Trapezoidal rule, Simpson's One-Third rule, Simpson's Three-Eighth rule and Weddle's rule, Numerical Differentiation, Numerical Solution of Ordinary Differential Equations by Euler's Method, Euler's Modified Method and Runge-Kutta Method.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Differential Calculus by shantinarayana
2	Partial Differential Equation by Sneddon
3	Laplace Transform by Schaum's series
Reference Books:	
1	Numerical Analysis by Shastry
2	Engineering Mathematics by B.V Ramana

Course Code	Course Title	Lecture			
BTCE301PCP	Surveying and Geomatics Lab	L	T	P	Semester: III
Version: 1.0	Date of Approval: --	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Engineering Physics, Engineering Mathematics and Engineering Graphics

Course Objectives:

1. To impart knowledge and hands-on experience in basic distance and area measurement techniques using traditional surveying tools.
2. To develop the ability to carry out leveling operations using dumpy level, auto level, and levelling staff.
3. To train students in compass surveying and traversing using prismatic compass and theodolite.
4. To introduce advanced surveying equipment such as total station and electronic theodolite and their field applications.
5. To provide exposure to modern surveying technologies such as GPS and photogrammetry for data acquisition and analysis.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Perform reciprocal ranging, measure distances, and calculate areas using chain and cross-staff surveying methods.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_9, PO_{10}
CO_2	Conduct compass surveys, calculate fore and back bearings, and analyze traverse data.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_9, PO_{10}
CO_3	Carry out differential and fly levelling to determine Reduced Levels using both Height of Instrument and Rise & Fall methods.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_9, PO_{10}
CO_4	Use theodolite and total station for tacheometry, traversing, and measurement of angles, distances, and elevation differences.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_9, PO_{10}, PO_{11}, PO_{12}
CO_5	Demonstrate practical knowledge of GPS and photogrammetry for determining station coordinates and understanding relief and tilt displacement.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_9, PO_{10}, PO_{11}, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2	2	1	1				2	1		
CO_2	3	3	2	2	2				2	1		
CO_3	3	3	3	2	1				2	1		
CO_4	3	3	3	3	2				2	2	1	1
CO_5	2	3	2	3	3				2	2	2	2

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

List of Experiments:

1. Undertake reciprocal ranging and measure the distance between two stations.
2. Determine area of open field using chain and cross staff survey.
3. Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic

Compass.

4. Undertake differential levelling and determine Reduced Levels by Height of instrument method and Rise/fall method using dumpy level/Auto Level and levelling staff.
5. Undertake fly levelling with double check using dumpy level/ Auto level and levelling staff.
6. Use Theodolite as a Tacheometer to compute reduced levels.
7. Use Theodolite as a Tacheometer to compute horizontal distances.
8. Use Electronic Theodolite to Measure Vertical angle by Direct Method.
9. Use Total station instrument to measure horizontal distances and Slope Distance.
10. Use Total station instrument to measure area, traversing and difference of height between Two Points.
11. Use Total station instrument to carry out Survey Project for closed traverse for minimum five sides.
12. Demonstration of GPS and uses to locate the coordinates of a station.
13. Determine the relief and tilt displacement with the help of photogrammetry.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
2	Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011

Reference Books:

1	Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 20104Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.

Course Code	Course Title	Lecture			
BTCE302PCP	Fluid Mechanics Lab	L	T	P	Semester: III
Version: 1.0	Date of Approval: --	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic Theory of flow and fluid properties.

Course Objectives:

1. To understand and enhance the practical knowledge of Fluid mechanics and Hydraulic machines.
2. Students shall be able to carry out the experiments and are designed to demonstrate the applications of the basic fluid mechanics principles and to provide a more intuitive and physical understanding of the theory.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the broad principles of fluid statics, kinematics and dynamics	PO_1, PO_2, PO_3
CO_2	Be able to apply the continuity, momentum and energy principles	PO_3, PO_4, PO_9
CO_3	Determine flow properties for pipe flow	PO_4, PO_8, PO_9

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	3	1									
CO_2			1	2					1			
CO_3						1		2	3			

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

List of experiments/demonstrations:

1. Measurement of velocity and discharge in pipe.
2. Pressure Measuring Devices in pipes
3. Hydraulic Coefficients of Orifice
4. Verification of Bernoulli's Theorem
5. Hydraulic Coefficients of Venturimeter
6. Hydraulic Coefficients of Orifice meter
7. Velocity distribution in pipes
8. Efficiency of Submersible Pump
9. Efficiency of Centrifugal Pump
10. Efficiency of Reciprocating Pump

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
2	Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
Reference Books:	
1	Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
2	Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J.

Course Code	Course Title	Lecture			
BTCE301ESP	Strength of Materials Lab	L	T	P	Semester: III
Version: 1.0	Date of Approval: --	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Engineering Mechanics and Mathematics

Course Objectives:

1. Understand the experiments on various materials to assess their behavior and limitations
2. Learn the brittle and ductile material failure patterns
3. Understand the deflection for different types of beams

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Evaluate Young's modulus, rigidity modulus, hardness number, flexural rigidity and impact strength of given specimens.	PO_1, PO_2, PO_4, PO_5, PO_{12}
CO_2	Find the cracking stress and compressive strength of bricks.	PO_1, PO_2, PO_4, PO_5,
CO_3	Find the deflection of a beam	PO_1, PO_2, PO_4, PO_5, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO1	3	2		3	2							1
CO2	3	2		2	1							
CO3	3	2		3	2							1

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

List of Experiments:

1. Tension –I uni-Axial tension test on a specimen of ductile material
2. Tension II Stress-Strain characteristics of a ductile material
3. Brinell's hardness test
4. Compressive strength test on bricks, cement and concrete
5. Bending test on simply supported beam of timber
6. Torsion test on a specimen of ductile material
7. Bending test on simply supported beam of steel
8. Shear Test
9. Beam Deflection Test
10. Izod Impact Test

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	IS 1608:2005, "Metallic Materials-Tensile testing at ambient temperature", Bureau of Indian Standards, New Delhi.
2	IS 1500:2005, "Method for Brinell Hardness test for metallic materials", Bureau of Indian Standards, New Delhi.
3	IS 1597-1977," Method for Izod impact test of metals", Bureau of Indian Standards, New Delhi.

Reference Books:	
1	Laboratory Manual of Testing Materials - William Kendrick Hall.
2	Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DE wolf – TMH 2002.

Course Code	Course Title	Lecture			Semester:
BTCS311HST	Technology and Society	L	T	P	III
Version: 1.0	**Date of Approval:**				

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	15 Hrs.	Maximum Score	:	50
Periods/ Week	:	1	Internal Evaluation	:	15
Credits	:	1	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): No specific requisite.

Course Objectives:

1. To impart the scientific and technological developments affect society and the environment.
2. To understand the applications of science and technology in societal context.
3. To address science and technology to real-world problems.
4. To learn contributions, governance and ethical issues in the context of emerging technologies.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO1	Understand the scientific debates and ethical concerns of such issues as global warming, biotechnology, GMO foods, healthcare, innovation, and economic competitiveness.	**PO1, PO2**
CO2	Articulate ways in which society is transformed by science and technology.	**PO3, PO6**
CO3	Able to integrate, synthesize, and apply knowledge of the relationship between science and technology and societal issues in both focused and broad interdisciplinary contexts.	**PO1, PO2, PO3,**
CO4	Apply science and technology to real-world problems	**PO7, PO8, PO9, PO12**

PO1- Engineering Knowledge, **PO2**- Problem analysis, **PO3**- Design/development of solutions, **PO4**- Conduct investigations of complex problems, **PO5**- Modern tool usage, **PO6**- The engineer and society, **PO7**- Environment and sustainability, **PO8**- Ethics, **PO9**- Individual or team work, **PO10**- Communication, **PO11**- Project management and finance, **PO12**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2			2			2						
CO3	2	2										
CO4							2	2	2			2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction and Thinking about Technology and Society**: Technological determinism and Techno social System, Technologies all around you, Relationship between technology and society, Role of Technology in Society, Role of society in development and use of Technology, technologies impact on society.
Unit: 2	**Social media and civic engagement:** Social structure and practice, Internet and cause of social isolation, Social Construction of Technology (SCOT),War and Social Technologies Critics, Actor-Network theory
Unit: 3	**Risk and Disasters** Automation in the workplace, Socially constructing automation in the workplace, Technology and inequality, Technological Disasters and Normal Accidents **The Future of Technology-**The directions for future work
Unit: 4	**The Environment, and Waste** The Environmental History of Computing, Identify the causes of climate change, Assess the various impacts of climate change including economic, geopolitical, biological, meteorological, etc. the global political economy of waste

Unit: 5	**Gender and Technology**: Gender influences technologies and social organization of scientific and technical workspaces, technologies as both 'liberating' and 'limiting' women.
Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.	
Text Books:	
1	Technology and Society – 2010,by R.V.G Menon, Publisher: Pearson Education India; First edition (2010)
2	Impact of Science and Technology on Society – 2012,by Ishwar Singh , Publisher: S.K. Kataria & Sons; Reprint 2012 edition
3	Berger, Peter L. and Thomas Luckmann 1966. The Social Construction of Reality: A Treatise in the Sociology of Knowledge, New York: Anchor Books.
4	Latour, B. 2005. Reassembling the Social: An Introduction to Actor–Network Theory, Oxford, New York: Oxford University Press
Reference Books:	
1	Science Technology And Society – 2014,By K Siddhartha, Publisher: Kisalaya Publication; 1 Edition
2	Book: "The Future: Six Drivers of Global Change"
3	Jasanoff, Sheila et al. (eds.). 1995. Handbook of Science and Technology Studies. Thousand Oaks, CA: Sage Publications
4	Weinberg, Alvin. 1966. "Can Technology Replace Social Engineering?" TATF 23-30.

Course Code	Course Title	Lecture			
BTCE311NCT	Water and Environmental sciences	L	T	P	**Semester:** III
Version: 1.0	**Date of Approval:** --	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	0	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): Basic knowledge of Environmental Sciences

Course Objectives:

1. To learn the fundamentals of water and environment.
2. To understand the various steps in water treatment and distribution.
3. To learn how to reduce environmental degradation.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Describe how water should be used judiciously	PO_1, PO_6, PO_7, PO_8
CO_2	Convey the importance of maintain good environment	PO_8, PO_9, PO_{10}
CO_3	Induce environmental awareness among stakeholders	PO_{10}, PO_{11}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2					1	1	2				
CO_2								2	2	3		
CO_3										2	2	

1 - Reasonable; 2 - Significant; 3 - Strong

Detailed Contents:

Unit: 1	Introduction Atmosphere and its composition. Environment and Environmental Pollution. Sources of water, Hydrologic cycle, components of hydrologic cycle (precipitation, infiltration, Interception, runoff etc) Climate change. Flowsheet for surface and groundwater sources.
Unit: 2	Water quality parameters, Drinking water quality standards, Irrigation water quality standards, physicochemical properties of water. Water treatment plants, Point and Non-point source of pollution, Determination of water quality parameters.
Unit: 3	Population forecasting methods, Water demand for various purposes, factors affecting water demand, Water distribution Layout water Treatment. Numerical Problems.
Unit: 4	Air pollution and causes, Air Quality Index and its measurement, Impact of air pollution, factors affecting air pollution, remedial measures for air pollution. Photochemical smog, fog, and PM 10, PM 2.5 acid rain, Greenhouse effect, Global Warming.
Unit: 5	Basics of Solid Waste, Sources and generation of solid waste, their classification and chemical composition; characterization of municipal solid waste; hazardous waste and biomedical waste; impact of solid, waste on environment, human and plant health; different techniques used in collection, storage, transportation and disposal of solid waste (municipal, hazardous and biomedical waste).

	4R- reduce, reuse, recycle and recover; biological processing - composting, anaerobic digestion, aerobic treatment; reductive dehalogenation; mechanical biological treatment; green techniques for waste treatment.
Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.	
Text Books:	
1	Bansil, P.C. 2004. Water Management in India. Concept Publishing Company, India.
2	Manahan, S.E. 2010. Environmental Chemistry. CRC Press, Taylor and Francis Group.
Reference Books:	
1	McDougall, F. R., White, P. R., Franke, M., & Hindle, P. 2008. Integrated Solid Waste Management: A Life Cycle Inventory. John Wiley & Sons

Course Code	Course Title	Lecture			
BTCE401PCT	**Hydraulic Engineering**	L	T	P	**Semester:** IV
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Water resources Engineering

Course Objectives:

1. Introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines.
2. Enable the student to relate the theory and practice of problems in hydraulic engineering.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO1	Understand the concept of flow through pipes	PO_1, PO_4
CO2	Understand the boundary layer theory	PO_1, PO_2, PO_6, PO_7
CO3	Understand basic concept of Open channel flow	PO_1, PO_2, PO_7

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	1			2								
CO_2	1	2		2								
CO_3	1	1				2	2					

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Laminar Flow- Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity. Turbulent Flow- Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram.
Unit: 2	Boundary Layer Analysis-Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control. Flow through Pipes: Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles. Analysis of pipe networks: Hardy Cross method, water hammer in pipes and control measures, branching of pipes, three reservoir problem.
Unit: 3	Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity, Rayleigh method, Buckingham's Pi method and other methods. Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problem.
Unit: 4	Introduction to Open Channel Flow-Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section. Uniform Flow-Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's

	formula. Factors affecting Manning's Roughness Coefficient " n .Most economical section of channel. Computation of Uniform flow, Normal depth.
Unit: 5	**Non**-Uniform Flow- Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Hydraulic Jump- Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House
2	Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
Reference Books:	
1	Open channel Flow, K. Subramanya, Tata McGraw Hill.
2	Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill

Course Code	Course Title	Lecture			
BTCE401EST	**Strength of Materials – II**	L	T	P	**Semester:** IV
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Engineering Mechanics and Strength of Materials – I

Course Objectives:

1. Evaluating deflections of beams due to transverse loads by various methods.
2. Analysis of indeterminate beams by applying the principles of equilibrium and compatibility equations Concept of strain energy principle and its application to evaluate the displacements and redundant forces
3. Phenomenon of buckling of columns using Euler's formula, Rankine's and secant formulae. Pure torsion theory and application to different types of springs.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Interpret the deflections of determinate beams due to transverse loads by various methods.	PO_1, PO_2, PO_3, PO_5, PO_{12}
CO_2	Analyse statically indeterminate beams such as propped cantilever, fixed beams and continuous beams and draw shear force and bending moment diagrams.	PO_1, PO_2, PO_3, PO_5, PO_{12}
CO_3	Analyse the beams and frames and to find deflections by energy principle.	PO_1, PO_2, PO_3, PO_5, PO_{12}
CO_4	Evaluate the crippling load of columns for various end conditions using different formulae.	PO_1, PO_2, PO_5, PO_{12}
CO_5	Evaluate the stresses and strains of circular members subjected to torsion and calculate the power required for torsional revolutions of shafts.	PO_1, PO_2, PO_5, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	3	2		1							1
CO_2	3	3	3		1							1
CO_3	3	3	2		2							1
CO_4	3	2			1							1
CO_5	3	2			2							1

1 - Reasonable; 2 - Significant; 3 - Strong

Detailed Contents:

Unit: 1	**Deflection of beams:** Slope and deflection by double integration method for cantilever, simply supported and overhanging beams carrying point loads, uniformly distributed and varying load over entire span. Moment area and conjugate beam method for simple cases.
Unit: 2	**Propped cantilevers:** Shear Force & Bending Moment diagrams and deflections for elastic and rigid propped cantilever beams subjected to point loads and uniformly distributed loads. **Fixed Beams:** Shear Force & Bending Moment diagrams and deflections in fixed beams with and without sinking of supports subjected to point loads, uniformly distributed and uniformly varying loads. **Continuous Beam**s: Shear Force & Bending Moment diagrams and elastic curve using theorem of

	three moments with and without sinking of supports.
Unit: 3	**Torsion of Shafts:** Assumptions, Tortional Equation for circular sections, strength and stiffness of shafts, Transmission of Power, combined bending and torsion: Principal Stresses. **Springs:** Types of springs and significance, close and open coiled helical springs under axial load and axial twist.
Unit: 4	**Strain energy:** Definitions: Resilience, Proof Resilience and Modulus of Resilience. Strain energy in bars subjected to gradually applied, suddenly applied and impact loads. Strain energy due to shear, bending and torsion.
Unit: 5	**Columns an Struts:** Euler's theory for different end conditions of columns, effective length and limitations of Euler's formula, slenderness ratio. Rankine's Formula, Secant & Perry formula for eccentrically loaded columns.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Strength of Materials and Theory of Structures, Laxmi Publishers, B.C. Punmia, 2000.
2	Strength of Materials, Dhanpat Rai Publishing Company, S. Ramamrutham, R. Narayanan, 2011.
3	A text book of Strength of Materials, Laxmi Publications, Bansal R.K, 2010.
4	Strength of Materials, -A Practical Approach, Universities Press, D.S. Prakash Rao, 1999.

Reference Books:

1	Mechanics of Materials, Tata McGraw-Hill, Ferdinand P Beer, Johnston and DeWolf., 2004.
2	Strength of Materials, Oxford University Press, New Delhi, R. Subramanian, 2005.

Course Code	Course Title	Lecture			
BTCE402PCT	Environmental Engineering	L	T	P	**Semester:** IV
Version: 1.0	**Date of Approval:** -	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic knowledge of Environmental Science

Course Objectives:

1. Provide an expanded view of the difficulties and potential of waste management from both a national and global view point.
2. Discuss both wastewater and municipal solid waste issues.
3. To explain the design concept of sewer lines and waste treatment plants.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the impact of humans on environment and environment on humans	PO_1, PO_6, PO_7, PO_8
CO_2	Be able to plan strategies to control, reduce and monitor pollution	PO_3, PO_{11}
CO_3	Be able to select the most appropriate technique for the treatment of water, wastewater solid waste and contaminated air	PO_{10}, PO_9, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2					2	2	1				
CO_2			3								2	
CO_3		2							1	2		1

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Water: -Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, intake structures. Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes
Unit: 2	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. Storm Water- Quantification and design of Storm water; Sewage and Sullage, disposal and treatment of sewage as per Indian standards, National River cleaning plans.
Unit: 3	Introduction to Air and noise pollution, particulates and gaseous contaminants, working principles of control devices, noise pollution, definition, fundamentals, sources and effect of noise pollution. - Urban air pollution automobile pollution, Air quality standards, Control measures for Air pollution, construction and limitations.

Unit: 4	Solid waste management-Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Disposal of solid waste-segregation, reduction at source, recovery and recycle. Disposal methods-Integrated solid waste management. Hazardous waste: Types and nature of hazardous waste as per the HW Schedules of regulating authorities. landfill; thermal treatment (pyrolysis and incineration) of waste material.
Unit: 5	Government authorities and their roles in water supply, sewerage disposal. Solid waste management and monitoring/control of environmental pollution.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York 1985.
2	Manahan, S.E. 2010. Environmental Chemistry. CRC Press, Taylor and Francis Group.
Reference Books:	
1	Met Calf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, New Delhi.

Course Code	Course Title	Lecture			
BTCE402EST	Civil Engineering Materials Testing and Evaluation	L	T	P	**Semester:** IV
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Engineering Chemistry & Engineering Mathematics.

Course Objectives:

1. Study about the basic building materials, properties and their applications
2. Know the smart building materials, external paints and their uses
3. Understand different types of masonries and their applications
4. Study about standard dimensions of doors, windows, ventilators and other components of buildings

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Differentiate between various building materials i.e., both conventional and smart building materials.	**PO_1, PO_2, PO_7**
CO_2	Know the importance of energy conservation, damp proof course and fire protection in buildings.	**PO_1, PO_6, PO_7**
CO_3	Understand different materials used and construction of various form works and scaffoldings.	**PO_1, PO_3, PO_5, PO_9**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2					2					
CO_2	2					3	3					
CO_3	3		2		2				2			

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction:** Uses of stones as building materials, classification, characteristics, dressing and polishing of stones, methods of quarrying and construction. Bricks: Methods of manufacturing bricks. Classification and methods of construction. **Timber:** Timber as a building material and its uses. Methods of seasoning and preservation laminates and their uses, defects in Timber. Cement: Introduction to cement, different grades, IS specifications and OPC and PPC Cements (blended cements). **Mortar and Sand:** Characteristics of good mortar making sand, availability of sand and its classification, bulking of sand, manufacturing methods of mortar. Different types of mortars-preparation, setting and curing.
Unit: 2	**Coarse and fine Aggregate:** Characteristics of good coarse and fine aggregates for manufacture of concrete. Significance and application of coarse and fine aggregate for the production of good quality concrete. **Concrete:** Introduction to Nominal mix and Design mix.
Unit: 3	**Type of joints in Concrete** - Construction, expansion, contraction, and isolation joints. **Cracks in Buildings**- Type of cracks in buildings, principal causes-moisture movement, thermal variations, elastic deformation, creep, chemical reaction. **Smart building Materials:** Energy conservation in buildings- use of recycled materials, regional

	materials and industrial waste products as means of sustainable development. Green Building Materials.
Unit: 4	**Plastering and Pointing:** Different types of plasters and plastering process, defects in plastering. **Paints, Varnish and Distemper:** Constituents, characteristics of good paints, bases, vehicles, thinners and coloring pigments. Painting of different types of surfaces varnish and its types, application. Distemper, dry and oil bound, and application of distemper.
Unit: 5	**Form work**- Types of Form work, types of materials used in form work. **Scaffoldings**- Types of Scaffoldings, Scaffolding Erection & dismantling, Scaffolding Inspection. **Fire protection in structures**- Classification of fire, general causes of fire, detection of fire, methods for fire control, Analysis for structural components for fire resistance (wood, steel, concrete and masonry). **Damp Proof Course**-Causes of dampness, effects of dampness, methods of damp proofing
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Sushil Kumar, Building Construction, Standard Publishers 1992.
2	M.S. Shetty, Concrete Technology, S. Chand Publishers,2012.
Reference Books:	
1	VN. Vazirani, and S.P. Chandola, Engineering Materials, Khanna Publishers 1993.
2	S.P. Arora and S.P. Bindra, Text book on Building Construction, Dhanpath Raj Publications, 1999.
3	Gurucharan Singh, Building materials and construction, Standard book house.

Course Code	Course Title	Lecture			
BTCE403PCT	**Structural Design - I**	L	T	P	**Semester:** IV
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Engineering Mechanics, Civil Engineering Materials and Strength of Materials

Course Objectives:

1. Design of Reinforced Concrete Members using working stress method and limit state method
2. Indian standard code of practice for reinforced concrete members
3. Identifying the responsibility of engineer in detailing of reinforcement of various RCC members.
4. Developing an understanding of real-world design problems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Adopt the design philosophies of working stress method and Limit state method and design a singly and doubly reinforced sections using working stress method.	**PO_1, PO_2, PO_3, PO_5, PO_{12}**
CO_2	Design singly, doubly and flanged reinforced sections using limit state method and check for limit state of serviceability.	**PO_1, PO_2, PO_3, PO_5, PO_{12}**
CO_3	Design Reinforced concrete beam for shear, torsion and bond.	**PO_1, PO_2, PO_3, PO_5, PO_{12}**
CO_4	Design Reinforced concrete one way, two-way and continuous slabs and design of slab type stair case.	**PO_1, PO_2, PO_3, PO_5, PO_{11}, PO_{12}**
CO_5	Design of footings	**PO_1, PO_2, PO_3, PO_5, PO_{11}, PO_{12}**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2	3		2							1
CO_2	3	3	3		2							1
CO_3	3	3	3		2							1
CO_4	3	2	3		2						1	1
CO_5	3	2	3		2						1	1

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Reinforced Cement Concrete:** Need for Reinforcement in Concrete, Stress - Strain curve for Concrete and steel, Concept of balanced, under-reinforced and over reinforced sections. Design philosophies: Working stress method and limit state method. Classification of limit states, characteristic strength of materials, characteristic loads, partial safety factors, stress block parameters. Analysis and design of singly and doubly reinforced rectangular sections using working stress method.
Unit: 2	**Limit state of Collapse – Flexure:** Assumption, Analysis and design of singly reinforced, doubly reinforced rectangular beams and singly reinforced flanged beams. Limit states of serviceability: Short term, long term, total deflection, Check for deflection, cracking and IS code provisions.

Unit: 3	**Limit State of Collapse in Shear and Torsion:** Design of RC members for Shear and Torsion. Bond, development length and curtailment of reinforcement in beams and detailing of bars: IS code provision.
Unit: 4	**Design of Slabs:** Types of Slabs: Design of one-way, two-way slabs, Simply supported and continuous solid rectangular slabs subjected to uniformly distributed loads. Detailing of reinforcement and check for serviceability of slabs, design and detailing of dog-legged slab type stair case.
Unit: 5	**Limit state of Collapse in Compression:** Design and detailing of axially loaded rectangular and circular short columns with helical reinforcement. Uni-axial and bi-axial bending - interaction diagrams. **Design of footings:** Design of isolated square and rectangular footings, design & Detailing of axially loaded isolated rectangular footing as per IS code provisions.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Design of Concrete Structures, McGraw Hill, David Darwin, Charles W. Dolan, Arthur H. Nilson, 15 Edition, 2016.
2	Reinforced Concrete- Limit State Design, NemChand and Bros publications, A.K Jain, 7th edition 2012.
3	Reinforced concrete structures, Laxmi Publications, B.C. Punmia, 7th Edition, 1992
4	Reinforced Cement concrete Design, S.K. Kataria and Sons publications, Neelam Sharma, 2017
Reference Books:	
1	Reinforced Concrete Design, New Age International Pvt. Ltd., Krishna Raju N. and Pranesh R.N 2003.
2	Reinforced Concrete (Elementary reinforced concrete), Charotar Publications, H. J. Shah, 11th Edition, Volume I, 2016.
Relevant IS Codes:	
1	IS: 456-2000, “Code of Practice for Plain and Reinforced concrete”, Bureau of Indian Standards, New Delhi, India.
2	SP 16, “Design Aids for Reinforced Concrete to IS 456:1978”, Bureau of Indian standards, New Delhi, India.
3	SP 24, “Explanatory Handbook on Indian Standard Code of Practice for Plain and Reinforced Concrete to IS 456:1978”, Bureau of Indian Standards, New Delhi, India.
4	SP 34, “Handbook on Concrete Reinforcement and Detailing (With Amendment I)”, Bureau of Indian Standards, New Delhi, India.
5	IS: 875-1987, “Code of Practice for Design Loads (Other Than Earthquake) for buildings And Structures Parts (1, 2, 3, 4 &5)”, Bureau of Indian Standards, New Delhi, India.

Course Code	Course Title	Lecture			
BTCE401PCP	Hydraulic Engineering Lab	L	T	P	Semester: IV
Version: 1.0	Date of Approval: --	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic Theory of flow and fluid properties.

Course Objectives:

1. To reinforce and enhance understanding of the fundamentals of Fluid mechanics and Hydraulic machines.
2. To demonstrate the experiments related to the applications of the basic fluid mechanics principles and to provide a more intuitive and physical understanding of the theory.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the procedure to estimate discharge in open channels	PO_1, PO_2, PO_3, PO_8
CO_2	Use various open channel devices.	PO_3, PO_4, PO_9
CO_3	Understand the concept of reaction and impulse turbine	PO_9, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	3	1					1				
CO_2			1	2					1			
CO_3									2			1

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

List of experiments/demonstrations:

1. Determination of Reynolds Number for Laminar Flow
2. Determination of Reynolds Number for Laminar Flow
3. Velocity distribution in pipes
4. Major losses in pipe
5. Minor losses in pipe
6. Flow Visualization in open Channel Flow
7. Coefficient of discharge of Broad Crested weir
8. Determination of Froude Number in Open Channel
9. Coefficient of discharge of triangular notch.
10. Coefficient of Discharge of rectangular notch.
11. Coefficient of Discharge of trapezoidal notch.
12. Demonstration of Kaplan/ Francis/ Pelton Turbine

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
2	Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
Reference Books:	
1	Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
2	Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill.

Course Code	Course Title	Lecture			
BTCE402PCP	Environmental Engineering Lab	L	T	P	Semester: IV
Version: 1.0	Date of Approval: --	0	0	2	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic Knowledge of water and Waste water Treatment.

Course Objectives:

1. To learn the tests for measuring quality of drinking water.
2. To learn determination of BOD and COD requirement in sewage.
3. To understand the plotting of water supply scheme highlighting different features.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Perform various tests to assess quality of water.	PO_1, PO_2, PO_{10}, PO_{12}
CO_2	Estimate dissolved solids as per BIS codes.	PO_1, PO_2, PO_6, PO_9, PO_{10}, PO_{12}
CO_3	Measure BOD and COD of sewage sample.	PO_1, PO_2, PO_4, PO_8

PO1- Engineering Knowledge, **PO2**- Problem analysis, **PO3**- Design/development of solutions, **PO4**-Conduct investigations of complex problems, **PO5**- Modern tool usage, **PO6**- The engineer and society, **PO7**- Environment and sustainability, **PO8**- Ethics, **PO9**- Individual or team work, **PO10**- Communication, **PO11**- Project management and finance, **PO12**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO1	2	1								1		1
CO2	2	3				1			2	1		1
CO3	2	2		1				1				

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

List of experiments/demonstrations:

1. Determination of pH and Turbidity
2. Determination of Conductivity and Total dissolved solids.
3. Determination of Alkalinity/Acidity.
4. Determination of Chlorides.
5. Determination and Estimation of total solids, organic solids and inorganic solids.
6. Determination of iron.
7. Determination of Dissolved Oxygen.
8. Determination of Nitrogen.
9. Determination of total Phosphorous.
10. Determination of B.O.D
11. Determination of C.O.D
12. Determination of Optimum coagulant dose.
13. Determination of Chlorine demand.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Chemistry for Environmental Engineering by Sawyer and Mc. Carty
Reference Books:	
1	Standard Methods for Analysis of water and Waste Water – APHA

Course Code	Course Title	Lecture			Semester-IV
BTCE411NCT	**Essence of Indian Knowledge Tradition**	L	T	P	
Version: 1.0	**Date of Approval:**	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	0	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): No specific requisites.

Course Objectives:

1. To understand the foundations of Indian philosophical, scientific, and cultural knowledge systems.
2. To explore the relevance of Indian traditions in the context of sustainability, ethics, and modern life.
3. To gain insights into ancient contributions to mathematics, medicine, architecture, and logic.
4. To develop awareness of Indian value systems and their integration into education and leadership.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Recall the foundations of Indian philosophical and scientific traditions	**PO1, PO12**
CO_2	Explain the Indian epistemological framework and logic systems	**PO1, PO8**
CO_3	Compare ancient Indian sciences with modern scientific approaches	**PO1, PO7**
CO_4	Discuss relevance of traditional values and ethics in contemporary contexts	**PO6, PO7, PO8**
CO5	Reflect on Indian wisdom to propose applications in technology or management	**PO6, PO7, PO8, PO11, PO12**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2											1
CO_2	2							1				
CO_3	3					1	1					
CO_4						2	1	3				
CO5						2	1	1			1	2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction to Indian Knowledge Systems**: Overview of Indian intellectual traditions, Vedas, Upanishads, Darshanas (philosophical systems), Importance of Sanskrit in knowledge transmission.
Unit: 2	**Epistemology and Logic:** Means of knowledge (Pramāṇas): perception, inference, verbal testimony, Nyāya system and Indian logic, Indian approaches to knowledge classification.
Unit: 3	**Science and Technology in Ancient India:** Contributions to mathematics, astronomy, metallurgy, medicine (Ayurveda), Architecture and town planning (e.g., Vāstu Shāstra, Harappa), Water management, sustainable agriculture.
Unit: 4	**Values, Ethics, and Social Systems:** Concepts of Dharma, Artha, Kāma, Mokṣa, Gurukul system and educational values, Role of family, community, and women in ancient society.
Unit: 5	**Relevance in Modern Times:** Integration of Indian knowledge in NEP 2020, Environmental ethics and sustainable living, Applications in management, leadership, holistic health

Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.

Text Books:

1	Mathematical Foundation of Computer Science – Shahnaz Bathul, PHI.
2	Elements of Discrete Mathematics- A Computer Oriented Approach,C.L.Liu, D.P. Mohapatra,3edition,TMH.
3	Discrete Mathematics for Computer Scientists & Mathematicians, second edition, J.L.Mott, A. Kandel, T.P. Baker, PHI
4	Discrete and Combinatorial Mathematics- An Applied Introduction-5th Edition– Ralph. P.Grimaldi, Pearson Education

Reference Books:

1	Discrete Mathematics and its applications, 6th edition, K.H. Rosen, TMH.
2	Discrete Mathematical Structures, Mallik and Sen, Cengage Learning
3	Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby, Sharon Cutler Ross, PHI/ Pearson Education
4	Discrete Mathematics with Applications, Thomas Koshy, Elsevier.
5	Logic and Discrete Mathematics, Grass Man and Tremblay, Pearson Education

Course Code	Course Title	Lecture			Semester: IV
BTCE405PCT	Quantitative Skill	L	T	P	
Version: 1.0	Date of Approval:	1	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	2	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): No specific requisites.

Course Objectives:

1. Develop effective business and professional etiquette
2. Enhance time and task management capabilities
3. Build impactful presentation and communication skills
4. Strengthen logical and analytical reasoning
5. Apply quantitative aptitude for problem-solving.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Demonstrate professional etiquette and communication in diverse settings.	PO_2,PO_6, PO_8, PO_{10}, PO_{11},PO_{12}
CO_2	Present ideas effectively using verbal, non-verbal, and visual communication.	PO_3,PO_9,PO_{10},PO_{11},
CO_3	Apply quantitative and reasoning skills to solve analytical and real-life problems.	PO_3,PO_2,PO_4,PO_5,PO_{10},PO_{12}
CO_4	Integrate soft skills and analytical reasoning for better professional performance.	PO_2,$P0_3$,PO_6,PO_8,PO_9 ,PO_{10},PO_{11}
CO_1	Demonstrate professional etiquette and communication in diverse settings.	PO_2,PO_6, PO_8, PO_{10}, PO_{11},PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1		1				2		2	2	3	2	2
CO_2			2						2	3	2	
CO_3		3	2	3	2					2		2
CO_4		2	2			1		2	3	3	2	

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Business Etiquette: Self-Assessment, consistency, strategic management, networking skills, interview and post interview etiquette, Workplace Etiquette, E-Mail Etiquette, Cultural etiquette **Social etiquette**: social and interpersonal communication
Unit: 2	**Time Management Skill:** Importance of time management, effective Time Management, Create Plan, goal Setting, Fix deadlines, Project Scheduling, Communication, Procrastination **Presentation Skill:** Storytelling, Verbal Communication, Body language, Stage presence, Active Listening, Posture, Voice Projection.
Unit: 3	**Quantitative Ability:** Number system, Percentages, Profit & loss, Ratio & Proportion, time & Work, Time speed distance, Blood Relations, Ages related problems, Mixtures and Allegations, Boats and streams, problems on Trains, Partnership, Data Interpretation
Unit: 4	**Verbal Reasoning:** Syllogism, Coding Decoding, Blood Relation, Logical Venn Diagram, Problems on Calendar, Direction Sense Test, Odd one Out, Statement and Arguments, Analogy.
Unit: 5	**Non-Verbal Reasoning:** Seating Arrangement, Data sufficiency, Alphanumeric series, Logical Based Puzzle, Mirror Image, Cube and Cuboid

Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.

Text Books:

1	Quantitative Techniques for Management, N.D. Vohra, McGraw Hill Education.
2	Quantitative Techniques, C.R. Kothari, Vikas Publishing House.

Reference Books:

1	Dale Carnegie,(2016).How to win Friends and Influence People. Gallery Books, New York
2	Scott Peck. M. (2003). Road Less Travelled Bantam Press, New York City.
3	SMART,(2018). Place Mentor, 1st edition Oxford University Press,Chennai.

Course Code	Course Title	Lecture			Semester: V
BTCE501PCT	Geotechnical Engineering	L	T	P	
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): NIL

Course Objectives:

1. To enable the students to apply the knowledge to various foundations and stability problems of soil structures.
2. To understand the concepts of soil classification, characterises of flow nets and effective stress principle.
3. To impart the knowledge about the shear strength and various methods of measurement of shear strength.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Classify the soil based on index properties.	PO_1, PO_2, PO_3
CO_2	Calculate bearing capacity and settlement of soil	PO_3, PO_4
CO_3	Analyse stability of slope	PO_4, PO_6, PO_8, PO_9, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2									
CO2			2	2								
CO3				3		2		1	1			1

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction–Types of soils, their formation and deposition, Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering. Comparison and difference between soil and rock. Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio- moisture content, unit weight- percent air voids, saturation-moisture content, moisture content- specific gravity etc. Determination of various parameters such as: Moisture content by oven dry method, pycnometer, sand bath method, torsional balance method, nuclear method, alcohol method and sensors. Specific gravity by density bottle method, pycnometer method, measuring flask method. Unit weight by water displacement method, submerged weight method, core-cutter method, sand-replacement method. Methods of site exploration and soil investigation, methods of boring, soil samplers, sampling procedures, analysis of borehole logs, geophysical and advance soil exploration methods.
Unit: 2	Plasticity Characteristics of Soil - Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit and shrinkage limit. Use of consistency limits. Classification of Soils-Introduction of soil

	classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups.
Unit: 3	Permeability of Soil - Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping- out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets. Effective Stress Principle - Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.
Unit: 4	Compaction of Soil-Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control. Stresses in soils – Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart. Contact pressure under rigid and flexible area, computation of displacements from elastic theory.
Unit: 5	Consolidation of Soil - Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation. Shear Strength - Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses,Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behaviour of UU, CU and CD tests, pore-pressure measurement, computation of effective shear strength parameters. Unconfined compression test, vane shear test. Stability of Slopes - Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publication, Delhi.
2	Murthy, V.N.S., A text book of soil mechanics and foundation Engineering, CBS Publishers Distributors Pvt. Ltd., New Delhi.
Reference Books:	
1	Geotechnical engineering. Lancellotta, R. CRC Press.

Course Code	Course Title	Lecture			Semester: V
BTCE502PCT	Structural Design – II	L	T	P	
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Structural Design – I

Course Objectives:

1. Design procedure for combined rectangular footing.
2. Design and detailing of retaining walls.
3. Design procedures and detailing of flat slabs.
4. Design different types of water tanks.
5. IRC loadings for design of R.C. slab bridges.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Design the combined rectangular footing as per IS code.	PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{11}, PO_{12}
CO_2	Check the stability and Design of cantilever and counter fort retaining walls.	PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{11}, PO_{12}
CO_3	Design and detailing of flat slab for given loads.	PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{11}, PO_{12}
CO_4	Design Rectangular and Circular water tanks situated at ground level and design of Intze tank.	PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{11}, PO_{12}
CO_5	Determine loading analysis and design of bridges based on IRC codes.	PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{11}, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2	3		2					1	1	1
CO_2	3	2	3		2					1	1	1
CO_3	3	2	3		2					1	1	1
CO_4	3	2	3		2					1	1	1
CO_5	3	2	3		3					1	2	1

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Combined Footing:** Introduction, Types of footings, Design and Detailing of Combined Rectangular Footing.
Unit: 2	**Retaining Walls** - Different types of Retaining Walls. Proportioning the retaining walls, lateral earth pressure on retaining walls. Stability checks: overturning, sliding, bearing capacity, and settlement. Elastic design and detailing of retaining walls-cantilever and counter fort types.
Unit: 3	**Flat slabs:** IS specifications, Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs - Check for one way and two-way shears – Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip.
Unit: 4	**Water Tanks:** Introduction, Types of Water Tanks, Elastic Design and Detailing of R.C.C Rectangular & Circular Water tanks at ground level and underground rectangular water tanks, design

	of Intze tanks using I.S Code Method.
Unit: 5	**Bridges:** Introduction to Bridges, Classification of Bridges, Recent advances in Bridge Engineering, IRC loading – impact factor – effective width method and Pigeaud's method, Elastic design and detailing of R.C. Slab bridges using IRC codes.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Krishna Raju. N. "Structural Design and Drawing", third Edition, Universities press. 2009.
2	Punmia., B.C. Jain A.K. "RCC designs" (Reinforced concrete structures)" 10th edition, Laxmi publications, 2006.
3	Phatak, "Bridge Engineering." Satya Prakashan Publishers. 1990.
4	Johnson D. Victor. "Essentials of Bridge Engineering." Oxford & IBH Publishers, Pvt.Ltd., New Delhi. (2006).
Relevant IS Codes:	
1	IS: 456: 2000, Code of Practice for Plain and Reinforced Concrete.
2	IS 3370 Part I to Part IV.
3	IRC 112: Code of practice for concrete road bridges.

Course Code	Course Title	Lecture			
BTCE503PCT	Concrete Technology	L	T	P	Semester: V
Version: 1.0	Date of Approval: --	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	2	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): Knowledge of Engineering Chemistry, Civil Engineering Materials, Testing & Evaluation

Course Objectives:

1. The properties of ingredients of concrete.
2. The behaviour of fresh and hardened concrete.
3. Different types of admixtures and their uses.
4. Mix design of concrete for IS method.
5. Different special concretes and their uses.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Identify the properties of different constituents of concrete.	PO_1, PO_2, PO_5, PO_{12}
CO_2	Identify the properties of fresh and Hardened Concrete.	PO_1, PO_2, PO_4, PO_5, PO_{12}
CO_3	Distinguish different chemical and mineral admixtures as per their applications.	PO_1, PO_2, PO_5, PO_{12}
CO_4	Design the concrete mix as per the IS Code and design steps for ACI and British Standard Codes.	PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{11}, PO_{12}
CO_5	Differentiate special concretes depending on their constituents and specific application.	PO_1, PO_2, PO_3, PO_5, PO_7, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2			2							1
CO_2	3	2		2	2							1
CO_3	3	2			2							1
CO_4	3	3	3		3					1	1	1
CO_5	3	2	2		2		2					1

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Cement:** Portland cement- chemical composition- Hydration of cement and hydration products- Structure of hydrate cement- Heat of Hydration and Rate of hydration -Test on physical properties- Different grades of cement- Types of cements. **Aggregates:** Classification of aggregate- Particle shape & texture- Bond, Strength & other mechanical properties of aggregate- Specific gravity, Bulk density, Porosity & moisture content of aggregate- Bulking of sand- Soundness of aggregate- Alkali Aggregate reaction- Sieve analysis- Fineness modulus- Grading of fine & coarse Aggregates- Gap graded aggregate.
Unit: 2	**Properties of Fresh Concrete and Hardened Concrete:** Review of the physical properties of Concrete. Fresh Concrete: Workability- Factors affecting workability- workability tests- Setting times of concrete- Effect of time and temperature on workability- Segregation & bleeding- Mixing and vibration of concrete- Steps in manufacture of concrete- vibration-curing –types of curing -

	water. **Hardened Concrete:** Water/Cement ratio- Abram's Law- Gel space ratio- stress strain curves of concrete. Testing of Hardened Concrete: Destructive testing methods-Compression tests- Split cylinder test- Flexure test - Nondestructive testing methods-Rebound hammer test-ultrasonic pulse velocity test- Pull out Test.
Unit: 3	**Admixtures:** Types of admixtures-mineral and chemical admixtures-properties- dosages - applications and its effect on concrete, water reducing agents. **Durability of concrete** – Factors affecting durability. Shrinkage- types of shrinkage. Creep of concrete- Factors influencing creep- Relation between creep & time- Nature of creep-Effects of creep.
Unit: 4	**Mix Design:** Factors in the choice of mix proportions- Quality Control of concrete-methods of concrete mix design– Mix design by IS method (IS 10262) – design steps for British method and ACI method.
Unit: 5	**Special Concretes:** High strength concrete, Ferro cement mass concrete, light weight concrete, high density concrete, polymer concrete self-compacting concrete, nano concrete, recycled aggregate concrete, geopolymer concrete, fiber reinforced concrete, shotcrete, reactive powder concrete.
Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.	
Text Books:	
1	M. S. Shetty. "Concrete Technology" - S.Chand & Co., Revised Edition, 2006.
2	Gambir. M. L., "Concrete Technology" Tata Mc.Graw Hill Publishers, New Delhi, 5th Edition, 2017.
Reference Books:	
1	Naville. A.M., "Properties of Concrete" Pearson Education India, 5th edition, 2012 2. Santha Kumar. A. R., "Concrete Technology", Oxford University, Standard Edition (23 October 2006).
2	Metha. P. K and Monteiro. J. M. "Concrete: Micro structure, Properties and Materials "-, Tata Mc-Graw Hill Education, 4th edition, 2014.
3	IS 10262: 2019, Concrete Mix Proportioning Guidelines (Second Revision).
4	IS 456 (2000): Plain and Reinforced Concrete - Code of Practice".
5	IS 269:1989, Specification for Ordinary Portland cement.
6	IS 516:1959 Method of test for Strength of Concrete.
7	IS 2386(Part 1):1963 Methods of Test for Aggregates for Concrete: Part 1 Particle Size and Shape.
8	IS 2386(Part 2):1963 Methods of Test for Aggregates for Concrete: Part 2 Estimation of Deleterious Materials and Organic Impurities.

Course Code	Course Title	Lecture			
BTCE504PCT	Structural Analysis	L	T	P	**Semester:** V
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Strength of Materials-II

Course Objectives:

1. Analysis of continuous beams and portal frames using slope deflection method.
2. Application of moment distribution method to continuous beams and portal frames.
3. Analysis of indeterminate beams and portal frames using Kani's method.
4. Determination of displacements in statically determinate structures using strain energy methods and analysis of redundant pin jointed trusses.
5. Use of influence line diagrams in the analysis of simply supported beams and trusses subjected to moving loads.

Course Outcomes (CO):

COs No.	**Statement**	**Mapped Program Outcomes (POs)**
CO_1	Perform analysis of continuous beams and rigid jointed frames subjected to external loads using slope deflection method.	**PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{12}**
CO_2	Analyse continuous beams and rigid jointed frames subjected to external loads using moment distribution method.	**PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{12}**
CO_3	Apply Kani's method to analyse continuous beams and rigid jointed frames subjected to external loads.	**PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{12}**
CO_4	Determine displacements in statically determinate structures using strain energy methods and analyse redundant pin jointed trusses.	**PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{12}**
CO_5	Perform analysis of simply supported beams and trusses subjected to moving loads using influence line diagrams.	**PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{12}**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**	**PO_9**	**PO_{10}**	**PO_{11}**	**PO_{12}**
CO_1	3	3	2		2					1		1
CO_2	3	3	2		2					1		1
CO_3	3	3	2		2					1		1
CO_4	3	3	2		2					1		1
CO_5	3	3	2		2					1		1

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Slope deflection method:** Analysis of continuous beams with and without sinking of supports, single bay single storey portal frames with and without side sway - loading on beam/ portal frame – point load(s) and uniformly distributed load - shear force and bending moment diagrams.
Unit: 2	**Moment distribution method:** Analysis of continuous beams with and without sinking of supports, single bay single storey portal frames with and without side sway - loading on beam/portal frame - point load(s) and uniformly distributed load- shear force and bending moment diagrams.

Unit: 3	**Kani's Method:** Analysis of continuous beams with and without sinking of supports, single bay single storey portal frames with and without side sway – loading on beam/ portal frame point load(s) and uniformly distributed load – shear force and bending moment diagrams.
Unit: 4	**Strain energy methods:** Determination of displacements using unit load method for statically determinate structures such as beams, pin jointed trusses. **Redundant pin jointed trusses:** Analysis of plane trusses with one degree of redundancy (internal / external), lack of fit and temperature effects.
Unit: 5	**Moving loads and influence line diagrams:** Influence lines for reaction, bending moment and shear force. Determination of maximum bending moment and shear force for moving load systems on simply supported girders, Curves of maximum bending moment and shear force for simply supported girders traversed, by (i) single point load, (ii) two-point loads, (iii) uniformly distributed load longer than span, and (iv) uniformly distributed load shorter than span, enveloping parabola and EUDLL. **Moving loads on trusses:** Influence lines for forces in members of statically determinate trusses under moving loads (Warren truss and Pratt truss).

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Punmia. B.C "Strength of Materials and Theory of Structures", Laxmi Publishers, Delhi, 2000.
2	Prakash Rao. D.S. "Strength of Materials- A Practical Approach", Universities Press, 1999.
3	Devdas Menon, "Structural Analysis", 1st Edition, Narosa Book Distributors Pvt Ltd,2014
4	Thandavamoorthy T.S., "Structural Analysis", Oxford Higher Education, Second Edition, 2012.

Reference Books:

1	Ferdinand P Beer, Johnston and De Wolf., "Mechanics of Materials", Tata McGraw-Hill, 2004.
2	Subramanian.R. "Strength of Materials", Oxford University Press, New Delhi 2005.
3	Hibbeler R.C., "Structural Analysis", 8/E, Prentice Hall, Higher Education, 2012.
4	Stephen P. Timoshenko and Donovan H. Young, "Theory of Structures", McGraw Hill International Edition, 1968.

Course Code	Course Title	Lecture			Semester: V
BTCS511HST	Organizational Behavior	L	T	P	
Version: 1.0	Date of Approval:	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	2	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): No specific requisites.

Course Objectives:

1. To develop cognizance of the importance of human behaviour.
2. To describe how people behave under different conditions.
3. To analyses specific strategic human resources demands for future action.
4. To synthesize related information and evaluate options for the most logical and optimal solution such that they would be able to predict and control human behaviour and improve results.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the applicability of the concept of organizational behaviour	PO_1, PO_2, PO_6
CO_2	Demonstrate the applicability of analyzing the complexities associated with management of individual behaviour in the organization.	PO_9, PO_{10}, PO_{11}
CO_3	Analyze the complexities associated with management of the group behaviour in the organization.	PO_8, PO_9
CO_4	Evaluate how the organizational behaviour can integrate in understanding the motivation (why) behind behaviour of people in the organization.	PO_8, PO_9, PO_{10}, PO_{11}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2				1						
CO_2									2	3	3	
CO_3								2	2			
CO_4								2	2	3	3	

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction:** Meaning, Fundamental concepts, Definition, Approaches to OB, Characteristics and limitations of OB, Challenges and Opportunities of OB, Models of OB.
Unit: 2	**Personality:** Definition, Features, Big five model, MBTI, Johari Window, Managerial Implications of Personality. Perceptions and Attributions: Definition, Features, factors affecting perception, Process. Attribution, perceptual and attribution errors, Managerial Implications of Perception.
Unit: 3	Learning: Definition, Features, Classical and operant conditioning, social learning theory, Behavioural modification. Attitude: Definition, Features, ABC model of Attitude, Managerial Implications of Attitude.
Unit: 4	**Motivation:** Concept, Definition, Features, Types of Motivation, Process, Managerial Implications of Motivation. Leadership: Concept, Definition, Leadership Styles, Transactional and Transformational Leadership, Leadership development.
Unit: 5	**Groups and Teams:** Definition, Features, Group development stages, Group vs. Teams, Managing and developing effective teams. Conflict Management: Definition, Features, Types of Conflict, Conflict Resolution Strategies, Relationship between Conflict and Performance. Organizational Culture: Elements and dimensions of organizational culture, Importance of organizational culture in shaping the behaviour of people.

Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.

Text Books:

1	Robbins, S. P., & Judge, T. (2013). Organizational behavior (15th ed.). Boston: Pearson.
2	Newstrom J. W., & Davis, K. (2011). Human behavior at work (12th ed.). Tata McGraw Hill
3	Nelson, D , Quick, J.C., & Khandelwal, P., (2011). ORGB . Cengage Learning.
4	Udai Pareek, Understanding Organizational Behavior, 2nd Edition, Oxford Higher Education, 2004.

Reference Books:

1	Pareek. U. (2010). Understanding Organizational Behavior (2nd ed.). Oxford University Press

2	Schermerhorn, J. R., Osborn, R.N., Hunt, M.U.J (2016). Organizational Behavior (12th ed.). Wiley

Course Code	Course Title	Lecture			Semester: V
BTCE512HST	History of Sciences & Technology in India	L	T	P	
Version: 1.0	Date of Approval:	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	2	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): Basic knowledge of science

Course Objectives:

1. To acquire the knowledge the origin and development of astronomy in ancient India.
2. To understand the origin and growth of mathematics in ancient India.
3. To identify the origin and development of copper, gold, Iron and other metal in ancient India.
4. To know the prominent scientist of India since beginning and their achievement.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Recognize the development of Science Beginning and their achievement	PO_6, PO_7, PO_8
CO_2	Assess the growth of engineering in ancient India.	PO_9
CO_3	Find the significance of metallurgy in ancient India.	PO_7, PO_9
CO_4	Gain the knowledge of history from ancient India to modern India	PO_8, PO_{10}, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						2	2					
CO_2									2			
CO_3							2		2			
CO_4								2		2		2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Science and Technology- The Beginning Development in different branches of Science in Ancient India: Astronomy, Mathematics, Engineering and Medicine. Developments in metallurgy: Use of Copper, Bronze and Iron in Ancient India. Development of Geography: Geography in Ancient Indian Literature.
Unit: 2	Developments in Science and Technology in Medieval India Scientific and Technological Developments in Medieval India; Influence of the Islamic world and Europe; The role of maktabs, madrasas and karkhanas set up. Developments in the fields of Mathematics, Chemistry, Astronomy and Medicine. Innovations in the field of agriculture - new crops introduced new techniques of irrigation etc.
Unit: 3	Developments in Science and Technology in Colonial India Early European Scientists in Colonial India- Surveyors, Botanists, Doctors, under the Company‘s Service.
Unit: 4	Indian Response to new Scientific Knowledge, Science and Technology in Modern India: Development of research organizations like CSIR and DRDO; Establishment of Atomic Energy Commission; Launching of the space satellites
Unit: 5	Prominent scientist of India since beginning and their achievement Mathematics and Astronomy: Baudhayan, Aryabhtatta, Brahmgupta, Bhaskaracharya, Varahamihira, Nagarjuna. Medical Science of Ancient India (Ayurveda & Yoga): Susruta, Charak, Yoga & Patanjali. Scientists of Modern India: Srinivas Ramanujan, C.V. Raman, Jagdish Chandra Bose, Homi Jehangir Bhabha and Dr. Vikram Sarabhai.

Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.

Text Books:

1	George G Joseph, Crest of the Peacock, Non-European roots of mathematics, Third edition, Princeton University Press, Princeton, NJ, 2011.
2	Agrawal, D.P., Ancient Metal Technology and Archaeology of South Asia (A Pan-Asian Perspective), Aryan Books International, New Delhi, 2000

Reference Books:

1	Cunningham , Alexander , The Ancient Geography of India. Indological Book House, Varanasi, 1963.
2	Dey, N. L., The Geographical Dictionary of Ancient and Medieval India. Luzac and Co., London, 1927.

Course Code	Course Title	Lecture			
BTCE501PET	Open Channel Flow	L	T	P	Semester: V
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Water resources Engineering

Course Objectives:

1. Understanding the concept of Open Channel Flow principles, analysis, and design related to the flow of water in open channels.
2. To develop a basic knowledge of open channel flow relationships by applying fluid properties, hydrostatics, and the conservation equations for mass, momentum, and energy..

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO1	Describe the concepts of Open Channel Flow	PO_1, PO_2
CO2	Estimate the flow conditions and flow energy	PO_3, PO_4, PO_5
CO3	Estimate Discharge in open channels	PO_3, PO_4, PO_9, PO_{11}
CO4	Understand the concept of Energy dissipation	PO_7, PO_8

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3										
CO2		2	1	2	2							
CO3			2	3					1		2	
CO4							2	1				

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction: classification of open channel flow. Geometric properties of channel section, Velocity and Pressure distribution in Channel Flow, Kinetic energy and momentum correction factors. Uniform flow, Application of Manning's and Chezy's formulae.
Unit: 2	Energy and momentum principles: Specific energy, critical flow, section factor for critical flow computation, first hydraulic exponent, computation of critical flow, specific force, specific force. Transitions in channels, channel with a hump, transition with change in width, choking flow. Channel conveyance, section factor for critical flow and uniform flow computations. Most economical section of a channel.
Unit: 3	Gradually varied flow: Gradually varied flow equation, assumptions and different forms of the equation, characteristics and classification of flow profiles. Analysis of flow profiles on mild, steep, horizontal and adverse slopes. Solution of the gradually varied flow equation, Graphical integration method, Direct step method.
Unit: 4	Rapidly varied Flow**:** Hydraulic Jump, its definition and types. Momentum equation for the jump, characteristics of jump in horizontal rectangular channel, computation of energy loss and length, location of jump, and pressure distribution, energy dissipaters.
Unit: 5	Measuring devices in open channel: Flow in channels with sharp & broad crested weir. Flow measurement with non-rectangular weirs; Triangular, circular and parabolic weir. Discharge using

	linear proportional weir, Sutro weirs, Quadratic weir, Ogee spillway and sluice gate. Measurement of Discharge and Velocity – Venturi Flume, Standing Wave Flume, Parshall Flume, Broad Crested Weir. Measurement of Velocity- Current meter, Floats, Hot-wire anemometer.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Open channel flow by V.T Chow. McGraw Hill.
2	Flow in Open channels by K Subramanya.Tata McGraw- Hill.
Reference Books:	
1	Flow in Open channels by RangaRaju.Tata McGraw- Hill.

Course Code	Course Title	Lecture			
BTCE502PET	Building Construction and Practice	L	T	P	Semester: V
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Basics of construction materials and their properties

Course Objectives:

1. To learn about the properties of commonly used natural civil engineering materials..
2. To understand basic principles of planning of building, building laws and types of different components of buildings.
3. To develop understanding of different construction techniques.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Will have understanding of basic properties of commonly used construction material.	PO_1, PO_7, PO_{12}
CO_2	Will Gain knowledge of Building by laws, basic principles of planning of building and purpose & geometry and shape of different components as per need including effect of environment on the buildings.	PO_2, PO_3, PO_6
CO_3	Will have basic ideas of different construction techniques used in Civil Engineering projects.	PO_7, PO_8 PO9, PO_{10}, PO_{11}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO1	2						2					1
CO2		1	1			2						
CO3							2	1	2	2	3	

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Sequence of construction of a building, different parts of building, Stonemasonry (Terms, use and classification), Principle of construction, composite masonry, Strength of walls, Strength of masonry, Brick masonry – principles of construction of bonds, Tools and equipment's used.
Unit: 2	Foundation: -Purpose of foundation, causes of failure of foundation, bearing capacity of soils, Dead and live loads, Examination of ground, Types of foundation, drawing of footing foundation setting out of building on ground excavation, Simple machine foundation.
Unit: 3	Flooring: General Considerations, Different types of Floorings, Flat-Floor and Flat-Roof Construction, Different types of Upper Floors.
Unit: 4	Building bye laws: Planning, Site selection, Orientation, Set-back limits, Component of buildings and their purposes and types: Foundations, walls, columns, roofs, doors, windows; Bands and openings in masonry buildings. Damp proofing - Materials and methods used. Termite proofing: pre and post construction treatments. Thermal insulation and its methods, Fire protection of buildings. Routine maintenance of civil engineering structures.

Unit: 5	Construction Techniques: Excavation, dewatering, shoring, underpinning and scaffolding, drilling, blasting, well sinking and pile driving, cofferdams, form work-fabrication and use. Construction techniques for special structures such as high-rise buildings, road construction, dam's bridges, offshore platforms.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Gambhir, M.L., "Concrete Technology", TMH, New Delhi, India
Reference Sources:	
1	Naville, A.M., "Properties of Concrete", Longman
2	Singh, S., Engineering Materials", Konark, Delhi, India.

Course Code	Course Title	Lecture			Semester: VIII
DPCE503PET	Environmental Impact Assessment	L	T	P	
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Basic Science and Environmental Engineering.

Course Objectives:

1. To introduce the fundamental principles and objectives of Environmental Impact Assessment (EIA) and environmental auditing.
2. To understand various sources of environmental hazards and frameworks for environmental risk assessment.
3. To explore different EIA methodologies and criteria for their selection.
4. To analyze risk characterization, vulnerability assessment, and uncertainty analysis through relevant case studies.
5. To familiarize students with environmental laws, acts, and the roles of government bodies in environmental protection.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Define EIA, its objectives, classifications, and key parameters influencing environmental impact analysis.	PO_1, PO_2, PO_6, PO_7, PO_8, PO_{12}
CO_2	Identify sources of environmental hazards and apply appropriate frameworks for ecological and risk assessments.	PO_1, PO_2, PO_4, PO_6, PO_7, PO_8, PO_{12}
CO_3	Select and apply suitable EIA methodologies such as Checklists, Matrices, and Overlays for specific scenarios.	PO_2, PO_3, PO_4, PO_6, PO_7, PO_8, PO_{12}
CO_4	Evaluate risk characterization and uncertainty through case studies of various industries and accident histories.	PO_2, PO_3, PO_4, PO_5, PO_6, PO_7, PO_8, PO_{12}
CO_5	Demonstrate awareness of key environmental legislations and understand the responsibilities of stakeholders in environmental protection.	PO_2, PO_4, PO_6, PO_7, PO_8, PO_9, PO_{10}, PO_{11}, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2				2	3	2				2
CO_2	2	3		2		3	3	2				2
CO_3		3	3	3		3	3	2				3
CO_4		3	3	3	3	3	2	2				3
CO_5		2		2		2	3	3	2	2	2	3

1 - Reasonable; 2 - Significant; 3 - Strong

Detailed Contents:

Unit: 1	Definition of environmental impact assessment and environmental auditing, objectives of EIA. Types of environmental impacts, Basic concept of environmental impact assessment, classification of environmental impact assessment, parameters, impact, evaluation and

	analysis of environmental impact assessment, factors affecting environmental impact assessment, preparation of environmental base map.
Unit: 2	Sources of Environmental hazards, Environmental and ecological risks, Environmental risk assessment framework, Regulatory perspectives, and requirements.
Unit: 3	Introduction to methodologies, criteria for selection of environmental impact assessment methodology, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods.
Unit: 4	Risk Characterization and consequence determination – Vulnerability assessment – Uncertainty analysis. Case studies on risk assessment and management for Chemical industries, Tanneries, Textile industries, Mineral processing and Petrochemical plants, Hazardous waste disposal facilities and nuclear power plants. Case history on Bhopal.
Unit: 5	Legislations; Impact Assessment, Powers, and functions of Central government; State pollution control boards, Duties, and responsibilities of citizens for environmental protection, Important legislations related with environment: Wildlife Protection Act 1972, The Water (Prevention and Control of Pollution) Act 1974. Prevention and Control of Air Pollution Act 1981, Forest Conservation Act 1981, Environment (protection) Act 1986, Hazardous waste (Management and Handling) Rules, 1989, Bio-Medical Waste (Management and Handling).
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Cutter, S.L., Environmental Risk and Hazards,Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
2	Kolluru Rao, Bartell Steven, Pitblado R and Stricoff Risk Assessment and Management
3	Handbook, McGraw Hill Inc., New York,1996.
Reference Books:	
1	Petts, J., "Handbook of Environmental Impact Assessment", Vol., I and II, Conwell Science London.2009.
2	Canter, L.W., "Environmental Risk Assessment", McGraw-Hill, New York. 2006.

Course Code	Course Title	Lecture			Semester: V
BTCE501PCP	Geotechnical Engineering Lab	L	T	P	
Version: 1.0	Date of Approval: --	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic of soil properties.

Course Objectives:

1. To make the students capable of determining soil properties practically.
2. To make the students capable of testing various types of soils and aggregates for the suitability of field applications.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Describe and estimate various soil properties	PO_1, PO_2, PO_3, PO_6
CO_2	Determine the quality of Aggregate	PO_3, PO_7, PO_{11}
CO_3	Understand the bearing capacity concept	PO_2, PO_6, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO1	2	2	3			1						
CO2			1				2				1	
CO3		2				2						3

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

List of experiments/demonstrations:

1. Field Density using Core Cutter method.
2. Field Density using Sand replacement method.
3. Natural moisture content using Oven Drying method.
4. Field identification of Fine-Grained soils.
5. Specific gravity of Soils.
6. Grain size distribution by Sieve Analysis.
7. Determination of Liquid limit
8. Determination of Plastic limit
9. Determination of Shrinkage limit.
10. Aggregates Crushing Value test
11. Abrasion test on Aggregates.
12. Determination of elongation index and flakiness of aggregates.
13. Compaction test Standard Proctor test.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publication, Delhi.

2	Murthy, V.N.S., A text book of soil mechanics and foundation Engineering, CBS Publishers Distributors Pvt. Ltd., New Delhi.
Reference Books:	
1	Geotechnical engineering. Lancellotta, R. CRC Press.

Course Code	Course Title	Lecture			Semester: V
BTCE511NCT	Constitution of India	L	T	P	
Version: 1.0	Date of Approval: 19th BoS 24-07-2025	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	-	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): No specific pre-requisite.

Course Objectives:

1. To understand the salient features of the Indian Constitution.
2. To learn different ways of acquiring Indian Citizenship.
3. To impart the knowledge of the fundamental rights and fundamental duties of Indian citizens.
4. TO describe the directive principles of state policy and their significance.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Practice the moral values that ought to guide the Engineering profession.	PO_6, PO_8
CO_2	Know the definitions of risk and safety also discover different factors that affect the perception of risk.	PO_6, PO_8
CO_3	Appreciate the Ethical issues and know the code of ethics adopted in various professional bodies and industries.	PO_6, PO_7, PO_8
CO_4	Justify the need for protection of human rights and to know about concept of women empowerment.	PO_6, PO_8, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						2		2				
CO_2						2		2				
CO_3						2	2	2				
CO_4						2		2				2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction: Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy
Unit: 2	Union Government and its Administration: Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha
Unit: 3	State Government and its Administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions
Unit: 4	Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy
Unit: 5	Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women

Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.

Text Books:

1	'Indian Polity' by Laxmikanth
2	'Indian Administration' by Subhash Kashyap

Reference Books:

1	'Indian Constitution' by D.D. Basu
2	Indian Administration' by Avasti and Ava

Course Code	Course Title	Lecture			Semester: VI
BTCE601PCT	Transportation Engineering	L	T	P	
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): NIL

Course Objectives:

1. Understand of the fundamentals of Urban transportation planning
2. Understand of contemporary transportation planning issues.
3. Understand of various methods of analysis

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Carry out surveys involved in planning and highway alignment	PO1, PO2
CO_2	Design the geometric elements of highways and expressways	PO3, PO2
CO_3	Carry out traffic studies and implement traffic regulation and intersection design	PO2, PO3, PO9
CO_4	Design flexible and rigid pavements as per IRC	PO3

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2		2	1									
CO3		2	3						2			
CO4			2									
CO5	2	1										

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Highway development and planning-Classification of roads, road development in India, Current Road projects in India; highway alignment.
Unit: 2	Geometric design of highways-: Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment.
Unit: 3	Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; types of intersections, design and principles, design of parking facilities; highway lighting; problem
Unit: 4	Pavement materials- Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests (CBR, Proctor compaction), requirements for different types of pavements, WBM roads.
Unit: 5	Design of pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements-components and functions; factors affecting design and performance of CC pavements; stresses in

	rigid pavements; design of concrete pavements as per IRC; problems, Highway maintenance and drainage system.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017
2	Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.
Reference Books:	
1	Partha Chakraborty, ' Principles Of Transportation Engineering, PHI Learning

Course Code	Course Title	Lecture			
BTCE602PCT	Water Resource Engineering	L	T	P	Semester: VI
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): NIL

Course Objectives:

1. Impart the knowledge regarding the fixation of different levels of reservoirs.
2. Provide understanding of the description regarding planning and design aspects of different types of Dams.
3. Provide understanding of design aspects of different types of weirs and regulatory systems.
4. Impart knowledge regarding the different types of cross drainage structures

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the concept of water requirement of crop	PO_1, PO_7
CO_2	Estimate the duty and delta of crop	PO_3, PO_2
CO_3	Understand the need and basic concept of hydraulic structures	PO_1, PO_6, PO_9
CO_4	Perform the calculations required for design of Hydraulic Structures	PO_2, PO_3, PO_{10}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO_1	2						1					
CO_2		2	1									
CO_3	1					2			2			
CO_4		3	3							1		
CO_5	2						1					

1 - Reasonable; 2 - Significant; 3 - Strong

Detailed Contents:

Unit: 1	Introduction to Irrigation**:** Define Irrigation**,** types and technique of irrigation**.** Cropping seasons, Crop period, base period, Duty, Delta, CCA, GCA, intensity of irrigation, factors affecting duty, Problems on water requirement of crop. Lift irrigation Scheme-Components and their functions, Layout
Unit: 2	Dams and Spillways: Dams and its classification: Earthen dams and Gravity dams (masonry and concrete). Earthen Dams– Components with function, typical cross section, seepage through embankment and foundation and its control. • Methods of construction of earthen dam, types of failure of earthen dam and preventive measures**.** Gravity Dams: Forces acting on gravity dam, failures of gravity dam, Stability of gravity dams, principal and shear stresses, elementary and practical profiles of a gravity dam, economical height of dam, high and low gravity dams, functions, and types of galleries in gravity dams Spillways-Definition, function, location, types and components, Energy dissipaters.

Unit: 3	Diversion Head Works**:** Weirs – components, parts, types, K.T. weir – components and construction. Diversion head works – Layout, components and their function. • Barrages – components and their functions. Difference between weir and Barrage.
Unit: 4	Distribution systems -Canals – Classification according to alignment and position in the canal network, Cross section of canal in embankment and cutting, partial embankment and cutting, balancing depth, Design of most economical canal section. Design of channels- rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi-modular and modular outlets. Lining of canals, types of lining.
Unit: 5	Cross Drainage works- Aqueduct, siphon aqueduct, super passage, level crossing. Canal regulators- Head regulator, Cross regulator, Escape, Falls and Outlets
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	K Subramanya, Engineering Hydrology, Mc
2	K N Muthreja, Applied Hydrology, Tata Mc
Reference Books:	
1	K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc- Graw Hill.
2	.G L Asawa, Irrigation Engineering, Wiley Eastern

Course Code	Course Title	Lecture			
BTCE603PCT	Design of Steel Structures	L	T	P	**Semester:** VI
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Engineering Mechanics, Civil Engineering Materials and Strength of Materials

Course Objectives:

1. Know the IS codal provisions as applicable for the designs.
2. Understand the material behavior and basics of design of steel structures.
3. Learn the design of various members along with the connections.
4. Know the design principles of roof trusses.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Acquire knowledge of IS codal provisions and design of different types of connections. Able to design any type of tension members.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_8, PO_{10}, PO_{12}
CO_2	Competent to design various kinds of compression members and column bases.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_8, PO_{10}, PO_{12}
CO_3	Capable to design different types of beams	PO_1, PO_2, PO_3, PO_4, PO_5, PO_8, PO_{10}, PO_{12}
CO_4	Proficient to design any type of roof trusses	PO_1, PO_2, PO_3, PO_4, PO_5, PO_6, PO_7, PO_8, PO_9, PO_{10}, PO_{11}, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	3	3	2	2			2		2		2
CO_2	3	3	3	2	2			2		2		2
CO_3	3	3	3	2	2			2		2		2
CO_4	3	3	3	2	2	1	1	2	2	2	1	2

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Materials and Specifications:** Chemical composition of steel, types of Structural Steel, Residual stresses, Stress Concentration. Basis of Structural Design: Codes and Specifications, Design Philosophies, working Stress Method, Limit State Method. **Loading and Load Combinations:** Characteristic Loads, Dead Loads, Imposed Loads, Earthquake Loads, Wind Loads and Load Combinations. Partial safety factors for materials and loads. **Bolted Connections (Limit state method):** Bolted Connections, Behavior of Bolted Joints, Design Strength of Ordinary Black Bolts, Design Strength of High Strength Friction Grip Bolts, Pin Connections, Simple Connections and Eccentric Connections. Welded Connections (Limit State Method): Advantages of Welding, Types of Welds and Joints, Simple Connections and Eccentric Connections.
Unit: 2	**Design of Tension Members (Limit State Method):** Types of Tension Members, Design of Strands, Slenderness Ratio, Modes of Failure, Factors Effecting Strength of Tension Members,

	Design of Tension Members (Angles, Other sections and Rods), Lug Angles, Tension Member Splice.
Unit: 3	**Design of Compression Members (Limit state method):** Introduction, Possible Failure Modes, Behavior of Compression Members, Elastic Buckling of Slender Compression Members, Behavior of Real Compression Members, Sections of Compression Members, Effective Length, Design of Compression Members with Single Section and Built-up Sections (Symmetric in both directions), Lacing and Battening, Column Splices. Design of Column Bases (Limit state method): Design of Slab Base and Gusseted Base for Columns.
Unit: 4	**Design of Beams (Limit state method):** Types of Beams, Section Classification, Lateral Stability of Beams, Buckling of Real Beams, Behavior of Beams in Bending, Design of Laterally Supported and Unsupported Beams, Design of Compound Beams, Shear Strength of Beams, Maximum Deflection, Web Buckling and Web Crippling, Biaxial Bending and Unsymmetrical Bending.
Unit: 5	**Design of Roof Trusses (Limit state method):** Types of Trusses, End Bearings, Spacing of Trusses and Purlins, Estimation of Loads with different Roof Coverings, Self-weight of Truss, Wind Effects, Design of Purlins for Dead Load, Imposed Load and Wind Loads. Detailed Design of Roof Trusses including Joints and Supports (only Angular Trusses).
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Subramanian. N, Design of Steel Structures, Oxford University Press, 2008
2	Duggal S.K., Design of Steel Structures, Tata McGraw Hill Publishing, 2009.
3	Shiyekar M.R., Limit State Design in Structural Steel, PHI Learning Pvt. Ltd., 2010.
4	Bhavikatti, S.S., Design of Steel Structures, I.K. International Publishing House Pvt. Ltd. 2010.
5	Gambhir M.L., Fundamentals of Structural Steel Design, McGraw Hill Education, 2013.
Reference Codes:	
1	IS: 800 - 2007, General Construction In Steel - Code of Practice, Bureau of Indian Standards, New Delhi.
2	IS: 875 (Part 1) – 1987, Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Part 1 Dead Loads - Unit Weights of Building Materials and Stored Materials, Bureau of Indian Standards, New Delhi.
3	IS: 875 (Part 2) – 1987, Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Part 2 Imposed Loads, Bureau of Indian Standards, New Delhi.
4	IS: 875 (Part 3) – 2015, Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Part 3 Wind Loads, Bureau of Indian Standards, New Delhi.
5	IS: 875 (Part 4) – 1987, Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Part 4 Snow Loads, Bureau of Indian Standards, New Delhi.
6	IS: 875 (Part 5) – 1987, Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Part 5 Special Loads and Combinations, Bureau of Indian Standards, New Delhi.
7	IS: 1893 (Part 1) – 2016, Criteria for Earthquake Resistant Design of Structures, Part 1 General Provisions and Buildings, Bureau of Indian Standards, New Delhi.

Course Code	Course Title	Lecture			Semester: VI
BTCE601PET	Hydrology	L	T	P	
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Water resources Engineering

Course Objectives:

1. Understand various components of the hydrologic cycle.
2. Understand evapotranspiration, infiltration, analysis of surface runoff process
3. Understand ground water movement & recharge.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand various components of the hydrological cycle.	PO_1, PO_2
CO_2	Estimate various abstractions from precipitation such as evapotranspiration and infiltration.	PO_3, PO_2
CO_3	Derive relationship between rainfall and runoff using statistical techniques and plot stage-discharge relationship.	PO_2, PO_3, PO_{11}
CO_4	Derive unit hydrographs of different durations, and develop synthetic unit hydrographs.	PO_2

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	3										
CO_2		2	1									
CO_3		1	1								2	
CO_4		2										
CO_5	2	3										

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction - hydrologic cycle, water-budget equation, history of hydrology, world water balance, applications in engineering, sources of data
Unit: 2	Precipitation - forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth- area-duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India.
Unit: 3	Abstractions from precipitation - evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, evapotranspiration equations, potential evapotranspiration over India, actual evapotranspiration, interception, depression storage, infiltration, infiltration capacity,

	measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.
Unit: 4	Runoff - runoff volume, SCS-CN method of estimating runoff volume, flow- duration curve, flow-mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph, synthetic hydrograph and problems. Flood: Flood flow formulae, Flood Frequency analysis. Flood Routing: Basic equation, Hydrologic storage routing in reservoirs and channels, Muskingum equation.
Unit: 5	Ground water and well hydrology - forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Engineering Hydrology by K Subramanya
2	Elementary Hydrology by V. P. Singh
Reference Books:	
1	Hydrology for Engineers by Linsely R. k. Tata McGraw
2	Hand book of Applied Hydrology by V.T. Chow. Tata McGraw

Course Code	Course Title	Lecture			Semester: V
BTCE602PET	Advanced Concrete Technology	L	T	P	
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Engineering Chemistry, Civil Engineering Materials, Testing & Evaluation

Course Objectives:

1. The properties of ingredients of concrete.
2. The behavior of fresh and hardened concrete.
3. Different types of admixtures and their uses.
4. Mix design of concrete for IS method.
5. Different special concretes and their uses.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Discuss the concrete ingredients and its influence at gaining strength.	PO_1, PO_2, PO_4, PO_5, PO_7, PO_{10}, PO_{12}
CO_2	Design of concrete mix and grade as per IS codes.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_7, PO_{10}, PO_{11}, PO_{12}
CO_3	Summarizes the concepts of conventional concrete and its differences with other concretes like no fines, light weight etc.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_6, PO_7, PO_{10}, PO_{12}
CO_4	Describe the application and use of fiber reinforced concrete.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_6, PO_7, PO_8, PO_9, PO_{10}, PO_{11}, PO_{12}
CO_5	Design and develop the self-compacting and high-performance concrete.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_6, PO_7, PO_8, PO_9, PO_{10}, PO_{11}, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2	1	2	2	1	2	1	1	2	1	2
CO_2	3	3	3	3	3	1	2	1	1	2	2	2
CO_3	3	2	2	2	2	2	3	1	1	2	1	2
CO_4	2	2	3	2	3	2	3	2	2	3	2	2
CO_5	3	2	3	3	3	2	3	2	2	3	2	3

1 - Reasonable; 2 - Significant; 3 - Strong

Detailed Contents:

Unit: 1	**Fundamentals Of Concrete:** Materials- Cement, Aggregates, mixing water soundness of aggregate- Fresh and hardened concrete: Admixtures- types of admixtures- purposes of using admixtures- chemical composition- effect of admixtures on fresh and hardened concretes- Natural admixtures. Rheology of Concrete.
Unit: 2	Properties of Fresh and hardened concrete and quality control in concrete construction
Unit: 3	**Durability of concrete:** Alkali aggregate reaction, reinforcement corrosion, creep, shrinkage, freezing and thawing, etc. Micro structure of concrete – significance- complexities- Aggregate phase – Hydrated cement phase – Interfacial transition zone – Dimensional stability

Unit: 4	**Fiber-reinforced concrete**- Properties of constituent materials- Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes. Polymer concrete – Fly ash concrete- Lightweight concrete- Introduction- properties of light weight concrete- No fines concrete- design of light weight concrete
Unit: 5	High strength concrete, Mass concrete, Roller compacted concrete, high early strength, Self-compacting concrete. Ready Mix Concrete (RMC) introduction and its advantages, Non-destructive Testing Evaluation.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	M. S. Shetty. "Concrete Technology" - S. Chand & Co., Revised Edition, 2006.
2	Gambir. M. L., "Concrete Technology" Tata McGraw Hill Publishers, New Delhi, 5th Edition, 2017.
Reference Books:	
1	Neville. A.M., "Properties of Concrete" Pearson Education India, 5th edition, 2012 2. Santha Kumar. A. R., "Concrete Technology", Oxford University, Standard Edition (23 October 2006).
2	Metha. P. K and Monteiro. J. M. "Concrete: Micro structure, Properties and Materials "-, Tata Mc-Graw Hill Education, 4th edition, 2014.
3	IS 10262: 2019, Concrete Mix Proportioning Guidelines (Second Revision).
4	IS 456 (2000): Plain and Reinforced Concrete - Code of Practice".
5	IS 269:1989, Specification for Ordinary Portland cement.
6	IS 516:1959 Method of test for Strength of Concrete.
7	IS 2386(Part 1):1963 Methods of Test for Aggregates for Concrete: Part 1 Particle Size and Shape.
8	IS 2386(Part 2):1963 Methods of Test for Aggregates for Concrete: Part 2 Estimation of Deleterious Materials and Organic Impurities.

Course Code	Course Title	Lecture			
BTCE603PET	Water Resources Systems Planning and Management	L	T	P	**Semester:** VI
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Hydrology and Water Resource Engineering

Course Objectives:

1. Understanding of system analysis in the planning, design, and operation of water resources
2. Understanding the formulation of mathematical optimization methods
3. Understanding various programming models.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Describe the concepts of optimization	**PO_1, PO_2, PO_{12}**
CO_2	Understand the concepts of Linear programming	**PO_2, PO_3, PO_6, PO_{12}**
CO_3	Implement the concept of river training	**PO_6, PO_8, PO_9**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										1
CO_2		2	2			1						1
CO_3						2		1	2			

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	General Principles of Systems Analysis to Problems in Water Resources Engineering, Water Resources Planning and Development, Nature of Water Resources Systems, Socio Economic Characteristics.
Unit: 2	Application of Optimization Techniques in water resource management. Objective function and constrains, types of optimization techniques. Single and Multi-objective optimization.
Unit: 3	Formulation of linear programming methods, graphical method, simplex method. Application of linear programming in water resource.
Unit: 4	Planning of reservoir system, optimal operation of single reservoir system, allocation of water resources, optimal cropping pattern, and conjunctive use of surface and sub-surface water resources.
Unit: 5	Classification of rivers and river training works, methods of river training works, marginal embankments, guide bunds, groynes, cutoffs, bank pitching and launching aprons, Simplified river-basin system, Conventional planning process.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Rao, S.S. "Engineering Optimization, Theory and Applications", 3rd Edition, New Age International publication, New Delhi, 2010

2	Vedula, S., and Majumdar, P.P. “Water Resources Systems”–Modeling Techniques and Analysis Tata McGraw Hill, 5th reprint, New Delhi, 2010
Reference Books:	
1	Taha H.A., “Operation Research”, McMillan Publication Co., New York, 1995

Course Code	Course Title	Lecture			
BTCE604PET	**Construction Engineering and Management**	L	T	P	**Semester:** VI
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of construction materials, building Construction and Concrete Technology

Course Objectives:

1. The course aims to provide students with a comprehensive understanding of the fundamentals of construction engineering and management.
2. It introduces the unique features of construction projects, various planning techniques, construction methods, resource management, project monitoring, control mechanisms, and contract management practices.
3. The course equips students with knowledge and skills to plan, organize, execute, and monitor construction projects effectively while ensuring quality, safety, and cost optimization.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO1	The course aims to provide students with a comprehensive understanding of the fundamentals of construction engineering and management.	PO_1, PO_2
CO2	It introduces the unique features of construction projects, various planning techniques, construction methods, resource management, project monitoring, control mechanisms, and contract management practices.	PO_5
CO3	The course equips students with knowledge and skills to plan, organize, execute, and monitor construction projects effectively while ensuring quality, safety, and cost optimization	PO_9
CO4	The course aims to provide students with a comprehensive understanding of the fundamentals of construction engineering and management.	PO_{11}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	3										
CO_2		2	1	2	2							
CO_3			2	3					1		2	
CO_4							2	1				

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	*Basics of* Construction- Unique features of construction, construction projects- types and features, phases of a project, agencies involved and their methods of execution;Construction project planning- Stages of project planning: pre-tender planning, preconstruction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring

	networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion
Unit: 2	Construction Methods basics: Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls; Modular construction methods for repetitive works; Precast concrete construction methods.
Unit: 3	Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction
Unit: 4	*Project Monitoring & Control*- Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health
Unit: 5	*Contracts Management basics:* Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods. *Construction Costs: Make-up of construction costs;* Classification of costs, time- cost trade-off in construction projects, compression and decompression.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Varghese, P.C., "Building Construction", Prentice Hall India, 2007.
2	National Building Code, Bureau of Indian Standards, New Delhi, 2017.
3	Chudley, R., Construction Technology, ELBS Publishers, 2007.
Reference Books:	
1	Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
2	Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006 6. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015

Course Code	Course Title	Lecture			
BTCE601OET	Water Management	L	T	P	Semester: VI
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Basics of Water Resource and Open Channel Flow

Course Objectives:

1. Understand the water demand
2. Understand various rainwater harvesting techniques
3. Understand judicious use of water.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the importance of rainwater harvesting	PO_1, PO_2
CO_2	Implementation of rainwater harvesting techniques.	PO_3, PO_2, PO_6
CO_3	Estimate the Runoff and storage capacity	PO_2, PO_8, PO_9
CO_4	Create awareness about judicious use of water in society	PO_6, PO_8, PO_{10}, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO_1	2	3										
CO_2		2	1			2						
CO_3		3						2	2			
CO_4						3		3		1		2

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Nature and scope of water resources management, Historical Profile on world water resources development, Water resources and human interaction, Concept of sustainable water resources development, need for water resources development in India.
Unit: 2	Integrated approach of water shed management, Role of GIS and remote sensing in water shed management, need of soil and water conservation, Soil erosion causes, effects and remedial measures. Integrated water resources management.
Unit: 3	Water management policy during floods and droughts. Flood damage mitigation, Design floods formulae, Flood mitigation reservoirs, Levees and flood walls, Flood ways, Channel improvement, Evacuation and flood proofing.
Unit: 4	Water conservation methods and measures. Introduction to Rainwater Harvesting, Need for Rainwater Harvesting. Water year, advancement of monsoon in India. Rainfall distribution across India.
Unit: 5	Methods of Rainwater Harvesting and their advantages, Best practices of rainwater harvesting from across India. Technological innovation in rainwater harvesting.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class

sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Lancaster, B. (2019). Rainwater Harvesting for Drylands and Beyond, Volume 1: Guiding Principles to Welcome Rain Into Your Life and Landscape (Vol. 1). Rainsource Press.
2	Avis, R., & Avis, M. (2018). Essential rainwater harvesting: A guide to home-scale system design. New society publishers.
Reference Sources:	
1	Lenton, R., & Muller, M. (2012). Integrated water resources management in practice: Better water management for development. Routledge.

Course Code	Course Title	Lecture			
BTCE602OET	**Renewable Energy Sources**	L	T	P	**Semester:** VI
Version: 1.0	**Date of Approval: --**	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): NIL

Course Objectives:

1. To explain concept of various forms of Non-renewable and renewable energy.
2. Explore society's present needs and future energy demands.
3. Study the principles of renewable energy conversion systems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Describe the environmental aspects of renewable energy resources.	PO_1, PO_2, PO_3
CO_2	Present comparison of renewable energy sources with various conventional energy systems, their prospects and limitations.	PO_6, PO_7, PO_9, PO_{10}
CO_3	Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation.	PO_6, PO_7, PO_{11}, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	1	2	2									
CO_2						2	3		1	3		
CO_3						2	3				2	2

1 - Reasonable; 2 - Significant; 3 - Strong

Detailed Contents:

Unit: 1	Principles of renewable energy; energy and sustainable development, fundamentals and social implications. worldwide renewable energy availability, renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oil shale. Introduction to Internet of energy (IOE).
Unit: 2	Solar Energy: Solar constant, solar radiation geometry, local solar time, day length, solar radiation measurement, radiation on inclined surface, solar radiation data, & solar charts.
Unit: 3	Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics. Bio-Mass: Principles of Bio-Conversion, Anaerobic /aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, l.C. Engine operation, and economic aspects.
Unit: 4	Geothermal Energy: Status & estimates, geothermal resources, geothermal systems & their characteristics. Hydrogen energy. Fuel Cells: Principle & classification, types, conversion, efficiency, polarization, & advantages. Magneto HydroDynamic (MHD) power conversion: Principle, types, closed & open cycle system, materials. Ocean Thermal Energy Conversion (OTEC). Tidal energy. Wave energy.

Unit: 5	Direct Energy Conversion: Need for DEC. Carnot cycle, limitations, Principles of DEC.Thermo-electric generators, See beck, Peltier and Joule Thompson effects, figure of merit, materials, applications, MHD.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Nonconventional Energy sources, G D Rai, Khanna Publication, Fourth Edition.
Reference Books:	
1	Energy Technology, S. Rao and Dr. B.B. Parulekar, Khanna Publication Solar energy, Subhas P Sukhatme, Tata McGraw Hill, 2nd Edition, 1996.

Course Code	Course Title	Lecture			
BTCE603OET	Environmental Health and Safety	L	T	P	Semester: VI
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Basics of construction materials and their properties

Course Objectives:

1. Understand the fire, safety, health and environment challenges in built and industrial environment.
2. To create awareness regarding loss of life & property and damage to environment citing past incidents causing major losses, and their impact with respect to safety legislation and environment.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the fire challenges faced in the built and industrial environment	PO_1, PO_2, PO_7, PO_{12}
CO_2	Understand risks in industrial scenarios	PO_2, PO_3, PO_6
CO_3	Assess the Building construction based on Building Laws	PO_4, PO_5, PO_6, PO_7, PO_8, PO_{10}, PO_{11}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO 10	PO_{11}	PO_{12}
CO_1	2	1					2					1
CO_2		1	1			2						
CO_3				2	1	3	3	1		2	3	

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction: Challenges to safety in built environment, types of hazards likely to cause harm (fire, burns, electric shock, falls), natural disasters, fatalities involving hazardous environments.
Unit: 2	Industrial Safety: concept of industrial safety, health and environment - need, nature and importance. Focus on Human resource, and concept of importance of 'man' as central theme in safety. Concept of accident prevention, occupational health and environmental protection.
Unit: 3	Air Pollution: introduction to Air Pollution Sources and effects of air pollution, Basic principles of air pollution control devices, Global effects of air pollution, Air Pollution due to automobiles, photochemical smog.
Unit: 4	Water Pollution, Sources and effects, Effluent standards Domestic and Industrial wastewater and basic concept of wastewater treatment.
Unit: 5	Solid waste, solid waste management by land filling, composting, sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management and rehabilitation of people.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class

sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Heinrich, H.W. Industrial Accident Prevention by, McGraw Hill Book Co. 1980
2	Purandare D.D. Handbook on Industrial Fire Safety, P&A Publications 1971
Reference Sources:	
1	Fawcett H.H. and W.S. WOOD, Safety and Accident Prevention in chemical operations, 2nd Edition John Wiley and Sons Inc (1982)

Course Code	Course Title	Lecture			
BTCE604OET	**Energy Efficient Buildings**	L	T	P	**Semester:** VI
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): NIL

Course Objectives:

1. Introduce the concepts of energy efficiency, energy conservation and thermal comfort in the built environment.
2. Familiarize participants with the modes of heat transfer and heat losses in building materials. Explain the concepts of heat energy storage, cooling and ventilation in buildings.
3. Obtain knowledge on the various properties of conventional and advanced building materials, used for thermal insulation and moisture control.
4. Provide fundamental knowledge for the calculation of heat losses, moisture conditions and ventilation needs for typical buildings.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Explain the fundamental concepts of energy-efficient buildings, building physics, heat gains, and weather analysis.	PO_1,PO_2
CO_2	Analyze energy use and energy supply systems in buildings, and evaluate heating, ventilating, and air-conditioning (HVAC) systems for optimizing heating and cooling loads.	PO_3, PO_4
CO_3	Applications of daylighting principles, passive heating and cooling strategies, and environmental simulation tools to design sustainable, energy-efficient, and comfortable indoor environments.	PO_4
CO_4	Integrate theoretical knowledge and analytical tools to recommend sustainable and green building solutions considering environmental, functional, and human-centric aspects.	PO_7

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2										
CO2			3	2								
CO3				2								
CO4							3					

1 - Reasonable; 2 - Significant; 3 - Strong

Detailed Contents:

Unit: 1	Introduction to energy efficient buildings; Building physics; heat gains in the building; Weather analysis.
Unit: 2	Energy use in buildings; Energy Supply in Buildings: Heating, Ventilating, and Air Conditioning (HVAC) Systems; Heating and cooling loads.
Unit: 3	Daylighting and artificial lighting, relationship between daylight and human health and benefits of daylighting). Sky condition models and their characteristics. Parameters for daylighting

	design (critical indoor illuminance, critical outdoor illuminance level, daylight factor distribution and glare). Parameters affecting daylighting factor (room depth, height of the window head, shading devices, glazing type, reflectance of room surfaces). Daylighting components (intermediate light spaces, interior light spaces, lateral pass-through components, zenithal pass-through components, global pass-through components)
Unit: 4	Principle of passive heating, Types of passive heating system. Building design strategies to reduce cooling demand, Types of passive cooling systems (evaporative cooling, indirect evaporative cooling and earth cooling systems).
Unit: 5	Daylight analysis, Thermal modelling, ventilation modelling, heat flow analysis, Weather simulation and analysis tool (Climate Analysis, Solar Exposure analysis, Passive strategies through psychometric chart
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Guzowski, M. (2000). *Daylighting for Sustainable Design.* McGraw-Hill, New York.
Reference Books:	
1	Nayak, J. K., & Prajapati, J. A. (2006). *Handbook on Energy Conscious Buildings.* Prepared under the Interactive R&D Project No. 5(03)99-SEC between Indian Institute of Technology, Bombay and Solar Energy Centre, Ministry of New and Renewable Energy, India.

Course Code	Course Title	Lecture			
BTCE601PCP	Transportation Engineering Lab	L	T	P	Semester: VI
Version: 1.0	Date of Approval: --	0	0	2	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic of soil properties.

Course Objectives:

1. To carry out tests on construction materials for their suitability and economic utilization.
2. To identify and classify the pavement materials into different groups according to their characteristics.
3. To make the students aware about the classification, suitability, strength and stability of pavement materials.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO1	Understand and analyse the quality of various pavement materials	PO_1, PO_2, PO_4, PO_8
CO2	Understand suitability in highway construction.	PO_3, PO_7, PO_9, PO_{11}
CO3	Understand the bearing capacity concept	PO_2, PO_6, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2		3				1				
CO_2			2				2		1		1	
CO_3		2				2						3

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

List of experiments/demonstrations:

1. California bearing ratio test on sub grade soil sample.
2. Determination of hardness of stone aggregates by Los Angeles abrasion test.
3. Determination of toughness of stone aggregates by Impact test.
4. Specific gravity and water absorption of stone aggregate.
5. Flakiness and Elongation indices tests on stone aggregate.
6. Soundness test on stone aggregates.
7. Deval attrition test on stone aggregates.
8. Crushing strength test on stone aggregates.
9. Ductility test on bitumen.
10. Softening point test on bitumen.
11. Flash and Fire point test on bitumen.
12. Penetration needle test on bitumen.
13. Viscosity test on bitumen

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	L .R. Kadiyali, Principles and Practices of Highway Engineering, Khanna Publishers, 2009.
2	S. K. Khanna, C. E. G. Justo, A Veeraragavan, Highway Engineering, Khanna Publishers, 10e.
Reference Books:	
1	MoRTH (2013) Specification for Road and bridge works (5th revision)

Course Code	Course Title	Lecture			
BTCE602PCP	Concrete Technology & Testing Lab	L	T	P	**Semester:** VI
Version: 1.0	**Date of Approval:** --	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Civil Engineering Materials, Testing & Evaluation and Strength of Materials-I

Course Objectives:

1. Behaviour of cement and aggregates through laboratory tests
2. Suitability of materials in construction.
3. Preparation of concrete according to BIS.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Assess the suitability of cement, water and aggregates in concrete by conducting various tests prescribed by relevant IS codes.	PO_1, PO_2, PO_4, PO_5, PO_{12}
CO_2	Assess the work ability of concrete and recommend its suitability for structural works.	PO_1, PO_2, PO_4, PO_5, PO_{12}
CO_3	Determine the strengths of hardened concrete in compression, flexure and split tensile tests.	PO_1, PO_2, PO_4, PO_5, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2		3	2							1
CO_2	3	2		3	2							1
CO_3	3	2		3	2							1

1 - Reasonable; 2 - Significant; 3 - Strong

Detailed Contents:

List of Experiments:

Test on Cement

1. Normal Consistency and fineness of cement.
2. Initial setting time and final setting time of cement.
3. Specific gravity of cement.
4. Soundness of cement.
5. Compressive strength of cement.

Test on Aggregate

6. Sieve Analysis and grading of aggregates.
7. Specific gravity of aggregates.
8. Bulking of sand.
9. Bulk and compact densities of fine and coarse aggregates.
10. Water Absorption of Aggregates.

Test on Fresh & Hardened Concrete

11. Slump Cone Test.
12. Compaction Factor Test.
13. Compressive strength of concrete.
14. Split tensile strength of concrete.
15. Flexural strength of concrete.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.	
Text Books:	
1	Santha Kumar. A.R., "Concrete Technology", Oxford university, 2nd Edition, 2006.
2	Shetty. M. S. and Jain. A.K, "Concrete Technology", S.Chand & Co, 2018.
3	Gambhir. M.L., "Concrete Manual", Dhanpat Rai & Sons, 1st edition 2012.
Code Books:	
1	IS 10262:2019, Concrete Mix Proportioning — Guidelines (Second Revision).
2	IS 456:2000, Plain and Reinforced Concrete - Code of Practice (Fourth Revision).
3	IS 269:1989, Specification for Ordinary Portland Cement.
4	IS 516:1959 Methods of test for Strength of Concrete.
5	IS 2386(Part 1):1963 Methods of test for Aggregates for Concrete: Part 1 Particle Size and Shape.
6	IS 2386(Part 2):1963 Methods of test for Aggregates for Concrete: Part 2 Estimation of Deleterious Materials and Organic Impurities.

Course Code	Course Title	Lecture			Semester: VI
BTCE611AUT	Instrumentation & Sensor Technologies for Civil Engineering Applications	L	T	P	
Version: 1.0	Date of Approval: --	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	0	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): Knowledge of Strength of Materials-II

Course Objectives:

1. Understand the fundamentals of instrumentation, sensors, and transducer principles.
2. Learn data acquisition methods and digital signal processing techniques.
3. Analyze sensor system design considering environmental limitations.
4. Ensure signal integrity through proper conditioning and filtering.
5. Apply standards related to noise, sensitivity, and sampling in sensor applications.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the fundamentals of measurement systems, sensor technologies, and transducer operations used in instrumentation.	PO_1, PO_2, PO_5, PO_{10}, PO_{12}
CO_2	Analyze and design appropriate sensor selection, siting, and installation procedures for various engineering monitoring applications.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_6, PO_7, PO_9, PO_{10}, PO_{11}, PO_{12}
CO_3	Develop and plan an instrumentation and monitoring program considering sensor behavior, environmental conditions, and system configuration.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_6, PO_7, PO_9, PO_{10}, PO_{11}, PO_{12}
CO_4	Interpret sensor data using fundamental statistical tools and techniques for signal reduction and analysis in the time domain.	PO_1, PO_2, PO_4, PO_5, PO_{10}, PO_{12}
CO_5	Apply principles of frequency domain signal processing to analyze and extract meaningful physical insights from sensor signals	PO_1, PO_2, PO_4, PO_5, PO_{10}, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2			2					1		2
CO_2	2	3	3	2	3	1	1		1	2	1	2
CO_3	2	2	3	3	3	1	1		2	2	2	3
CO_4	2	3		3	2					2		2
CO_5	2	2		3	3					2		2

1 - Reasonable; 2 - Significant; 3 - Strong

Detailed Contents:

Unit: 1	**Fundamentals of Measurement, Sensing and Instrumentation covering:** definition of measurement and instrumentation, physical variables, common types of sensors; Describe the function of these sensors; Use appropriate terminology to discuss sensor applications; and qualitatively interpret signals from a known sensor type, types of instrumentation, Sensor Specifics, Permanent installations, Temporary installations.
Unit: 2	**Sensor Installation and Operation covering to:** i) Predict the response of sensors to various inputs; ii) Construct a conceptual instrumentation and monitoring program; iii) Describe the order and methodology for sensor installation; and iv) Differentiate between types of sensors

	and their modes of operation and measurement and v) Approach to Planning Monitoring Programs, Define target, Sensor selection, Sensor siting, Sensor Installation & Configuration, Advanced topic, Sensor design, Measurement uncertainty.
Unit: 3	**Data Analysis and Interpretation covering:** a) Fundamental statistical concepts, b) Data reduction and interpretation, c) Piezometer, Inclinometer, Strain gauge, etc. d) Time domain signal processing, e) Discrete signals, Signals and noise and f) a few examples of statistical information to calculate are: Average value (mean), On average, how much each measurement deviates from the mean (standard deviation), Midpoint between the lowest and highest value of the set (median), Most frequently occurring value (mode), Span of values over which your data set occurs (range).
Unit: 4	**Frequency Domain Signal Processing and Analysis covering:** Explain the need for frequency domain analysis and its principles; Draw conclusions about physical processes based on analysis of sensor data; Combine signals in a meaningful way to gain deeper insight into physical phenomena, Basic concepts in frequency domain signal processing and analysis.
Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.	
Text Books:	
1	Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e.
2	Butterworth Hienemann David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press.
3	S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis.
4	J.G. Joshi (2021), Electronic Measurement and Instrumentation, Khanna Publishing House.
5	Ilya Gertsbakh (2010), Measurement Theory for Engineers, Springer.
Reference Books:	
1	Ernest O. Doebelin and Dhanesh N. Manik (2011), Measurement Systems: Application and Design, 5th/e, McGraw-Hill Education.
2	G. Geoffrey Vining (2010), Statistical Methods for Engineers, 3rd/e, Brooks/Cole (Cengage Learning).
3	John P. Bentley (2005), Principles of Measurement Systems, 4th/e, Pearson Education.
4	Ian R. Sinclair and John Dunton (2001), Sensors and Transducers, 3rd/e, Newnes (Elsevier).
5	Pavel Ripka and Alois Tipek (2007), Modern Sensors Handbook, 1st/e, CRC Press.
6	David G. Alciatore and Michael B. Histand (2011), Introduction to Mechatronics and Measurement Systems, 4th/e, McGraw-Hill Education.
7	John G. Proakis and Dimitris G. Manolakis (2006), Digital Signal Processing: Principles, Algorithms, and Applications, 4th/e, Pearson Education.

Course Code	Course Title	Lecture			Semester: VII
BTCE701PCT	Estimation and Costing	L	T	P	
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Civil Engineering Materials, Building Planning & Computer Aided Civil Engineering Drawing.

Course Objectives:

1. Various types of specifications used in construction.
2. The quantities of materials of Civil Engineering Structures.
3. Rate analysis for various item of works in construction.
4. Valuation of land and buildings.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Prepare detailed specifications for major items of buildings.	PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{11}, PO_{12}
CO_2	Estimate the quantity of material for building, road works, culvert, retaining walls and overhead water tank.	PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{11}, PO_{12}
CO_3	Compute and prepare bar bending schedules for slabs, Beams & Columns, footings, stair case, overhead rectangular water tanks and retaining walls.	PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{11}, PO_{12}
CO_4	Prepare rate analysis for major items of works of buildings.	PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{11}, PO_{12}
CO_5	Assess the valuation of land and buildings using different methods.	PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{11}, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2	3		2					2	2	1
CO_2	3	2	3		2					2	2	1
CO_3	3	2	3		3					2	2	1
CO_4	3	2	2		2					2	3	1
CO_5	3	3	2		2					2	3	1

1 - Reasonable; 2 - Significant; 3 - Strong

Detailed Contents:

Unit: 1	**Fundamental of Estimating and Costing:** Estimating and Costing-Meaning, purpose, Roles and responsibility of quantity surveyor, Administrative Approval and Technical Sanction. **Specification writing:** Definition, purpose and importance of specifications, Types of specification, General and detailed specifications for major items of buildings as per Delhi Analysis of Rates and Delhi Schedule of Rates, modes of measurements, general rules for the measurements and its units of different item of Civil engineering work as per I.S:1200.
Unit: 2	**Types of Estimates:** Approximate and Detailed estimate, Standard formats of Measurement sheet, Abstract sheet and face sheet. **Approximate Estimates:** Approximate Estimate-Definition, Purpose. Methods of approximate estimate-Service unit method, Plinth area rate method, Cubical content method,

	Approximate quantity method (simple numerical) **Detailed estimation:** Definition, Purpose and Data required for detailed estimate, factors influencing estimation, Civil cost, GST, Contingencies, Supervision charges, Agency charges, work charged establishment, percentage charges, water supply and sanitary Charges and electrification charges etc. Procedure for preparation of detailed estimate- Taking out quantities and Abstracting. Detailed estimate for Flat roof building (load bearing and RCC framed) - long and short wall method - centre line method.
Unit: 3	**Estimate for Civil Engineering Works:** Earthwork – Detailed estimate of road works for WBM roads, Bituminous and CC road (including earth work), single cell rectangular box culvert, retaining walls, overhead water tank and earth work of irrigation canals (cutting and banking) by – Mid sectional area method, mean sectional area method, Prismoidal and trapezoidal formula method. Capacity of Reservoirs. Detailed estimate for septic tank, Community well. Use of computer /software's / programmes for detailed estimate Preparation of Civil Engineering Works.
Unit: 4	**Estimation of reinforcement quantities:** Estimation of steel quantities and preparation of bar bending schedule (BBS) - RCC framed works for Slabs, Beams and Columns, Footings (Rectangular, Isolated), Stair Case, Overhead rectangular water tank and Retaining wall. Introduction to estimates using excel sheets/ available software's.
Unit: 5	**Rate analysis of civil work:** Definition, purpose and importance. Lead (Standard and Extra), lift, overhead charges, water charges and contractors' profit. Procedure for rate analysis. Task work- Definition, types. Task work of different skilled labour for different items. Categories of labours, their daily wages, types and number of labours for different items of work. Transportation charges of materials– Lead and Lift, Hire charges of machineries and equipment's. Preparing rate analysis of different items of work pertaining to buildings as per the Delhi Analysis of Rates and Delhi Schedule of Rates. **Valuation of Buildings:** Introduction, Basic elements - Market Value. Book Value. Salvage Value, Scrap value, sinking fund, Calculation of depreciation by different methods, Methods of valuation- Land and Building Method, A Typical Example for Valuation by Land and Building Method. Introduction to MS Project.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016.
2	Chakraborthi, M. "Estimating, Costing, Specification and Valuation in Civil Engineering, 24th Edition M. C. Chakraborthi, Kolkata. (2010).
3	Jagjit Singh "Estimating and Costing in Civil Engineering." Galgotia publications, New Delhi. (1996).
Reference Books:	
1	B.S. Patil, "Civil Engineering Contracts and Estimation", Orient Black swan Private Ltd; Fourth edition 2015.
2	Gurcharan Singh & Jagdish Singh, "Estimating Costing and Valuation", Standard Publishers Distributors, 2012.
3	Standard Scheduled Rates and Relevant BIS Codes (SP:27 & BIS:1200).

Course Code	Course Title	Lecture			Semester: VII
BTCE702PCT	Building Planning and Computer Aided Civil Engineering Drawings	L	T	P	
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Theory	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic knowledge of Engineering Drawing

Course Objectives:

1. Understand the concept of built environment, green building principles, and planning for inclusive accessibility in site design.
2. Develop building plans, elevations, sections, and constructional details for residential, educational, health, and recreational structures.
3. Design water supply, sanitation, and solid waste management systems for various types of buildings including accessibility features.
4. Analyze and plan fire protection systems, elevator and escalator provisions in compliance with safety and accessibility norms.
5. Understand and plan HVAC (Heating, Ventilation, and Air Conditioning) systems and integrate building services using CAD tools.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the concept of built environment, green building principles, and planning for inclusive accessibility in site design.	PO_1, PO_3, PO_6, PO_7, PO_8, PO_9, PO_{10}, PO_{11}, PO_{12}
CO_2	Develop building plans, elevations, sections, and constructional details for residential, educational, health, and recreational structures.	PO_1, PO_2, PO_3, PO_9, PO_{10}, PO_{11}
CO_3	Design water supply, sanitation, and solid waste management systems for various types of buildings including accessibility features.	PO_1, PO_3, PO_4, PO_6, PO_7, PO_{10}, PO_{12}
CO_4	Analyze and plan fire protection systems, elevator and escalator provisions in compliance with safety and accessibility norms.	PO_1, PO_3, PO_6, PO_7, PO_8, PO_{10}, PO_{12}
CO_5	Understand and plan HVAC (Heating, Ventilation, and Air Conditioning) systems and integrate building services using CAD tools.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_9, PO_{10}, PO_{11}, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2		2			3	2	2	1	2	1	2
CO_2	3	2	2						1	2	1	
CO_3	3		3	2		2	2			1		2
CO_4	2		3			2	1	1		2		2
CO_5	3	2	2	2	2				1	3	1	2

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:	
Unit: 1	Concept of built environment and its application in planning. Recommendation of National building code., Green building, Introduction-Benefits, National priorities, rating system, check list, Site selection and planning. **Principle of Planning for differently abled publics:** Standardization and Contextualization of accessibility in built environment, Overview of accessibility codes (National and International Perspectives), Accessibility Elements of Built Environment in urban and rural Contexts (Kerb, Ramps, Levels, Ramps, Gradients and other relevant elements) Principle of site planning and approaches for accessibility, Accessibility in public Sanitation System.
Unit: 2	**Planning of Building: -** Preparation of constructional details and drawings-plan, elevation, section, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window. **Planning of building such as:** Residential building –Load bearing structure, RCC framed structure. Building for Education – school, college, Library. Building for health –Dispensary, Hospital Industrial structure Building for entertainment-Theatre, club house, sports club. Other structure-Office, Hostel, Guest house.
Unit: 3	**Building's Water Supply, Sanitary and Solid waste management: -** Design of water supply, layout, distribution system. Sanitation System, waste water and storm water collection system for various types of buildings. Accessibility in public Sanitation Systems. Wet and dry solid waste collection, segregation and disposal, Vermi-composting etc. Provision of Chutes. **Electrical Services: -** Domestic Supply, Distribution Circuits, basic wiring systems. Design and planning: - Lighting of staircase, corridors, Use of Solar Panels as source of power, Lightening Conductor for High-rise Buildings.
Unit: 4	**Fire Protection System: -** Introduction, Fire protection, Systems of firefighting external and internal, smoke alarm. Safety corridors in Highrise structures. Introduction, types of elevators. Operation and maintenance, Safety norms. Control systems, electrical requirement, and generator back-up, Escalators in Industry and in malls-multiplex. Accessible Circulation System for differently abled publics.
Unit: 5	**Heating Ventilation and Air Conditioning-** Ventilation, functional requirement, Heat balance system of ventilation, General rules and regulations in artificial ventilation system, Central air conditioning: - ducting and glass claddings. Operation and maintenance.

Building Planning and Computer Aided Civil Engineering Drawings Content:

1. Preparation of detailed constructional plan of a residential building.
2. Preparation of front elevation, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window.
3. Preparation of line plans of various public buildings like:
4. Building for Education – School, College, Library.
5. Building for health –Dispensary, Hospital.
6. Prepare layout for water supply and drainage for a residential building and for multi-storeyed buildings.
7. Building's Solid Waste Collection and disposal system: landfills
8. Fire Protection System: Design of emergency exits and emergency vehicle routes with fire protection symbols

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	M.G.Shah, Kale, Patki, Building Drawing with an Integrated Approach to Built Environment, Tata McGraw-Hill Education India, 5th edition, 2011, (ISBN: 9780071077873, 0071077871).
2	Building Services Environmental And Electro Mechanical Services, Second Revised, 2014, (ISBN:

	9788175259805)
3	Bindu Madhavi Reddy – Building Services in Civil Engineering, IK International Publishing.
4	National Building Code of India, Bureau of Indian Standards.
5	S. V. Deodhar – Building Services, Khanna Publishers.
6	Green Building Guidelines, TERI, New Delhi.
Reference Books:	
1	Joseph DeChiara, Michael J. Crosbie – Time Saver Standards for Building Types, McGraw-Hill.
2	Francis D.K. Ching – Building Construction Illustrated, Wiley.
3	David Littlefield – Metric Handbook: Planning and Design Data, Routledge.
4	Steinfeld & Maisel – Universal Design: Creating Inclusive Environments, Wiley.

Course Code	Course Title	Lecture			
BTCE703PCT	**Foundation Engineering**	L	T	P	**Semester:** VII
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Geotechnical Engineering

Course Objectives:

1. To enable the students to apply the knowledge to various foundations and stability problems of soil structures.
2. To understand the concepts of soil classification, characterises of flow nets and effective stress principle.
3. To impart the knowledge about the shear strength and various methods of measurement of shear strength.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Describe the concepts of Earth Pressure and estimate the earth pressure	PO_1, PO_4
CO_2	Understand the need for deep and shallow foundation	PO_1, PO_{11}
CO_3	Calculate the Bearing Capacity of soil	PO_2, PO_4, PO_7, PO_{12}
CO_4	Understand the concept of vibration in machine foundation	PO_6, PO_8, PO_9

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2			3								
CO_2	1		2	2							2	
CO_3		1		2			1					1
CO_4						1		2	1			

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Earth Pressures and Retaining Walls: Active, passive and pressure at rest, Rankine's and Coulomb's theories; influence of surcharge, layers and water table. Rebhann's and Culmann's graphical method of active pressure for cohesionless soil.
Unit: 2	Simplified procedure for design of cantilever and anchored sheet pile walls. Classification of earth retaining structures (Rigid and Flexible). Analysis of Retaining Walls: Cantilever, Counterfort and Buttress.
Unit: 3	Shallow Foundations: Types and general requirements of shallow foundation; Bearing capacity consideration, Terzaghi, Mayerhof and Skempton's analyses, Effect of water table on bearing capacity. Permissible, total and differential settlements as per IS Codes. Plate load test; standard and cone penetration tests. Design of shallow foundations.
Unit: 4	Deep Foundations: Types, purpose and classification of pile foundations: Construction of piles, pile load test, load capacity and settlement of piles; Design of Pile foundations, use of relevant I.S. Code (I.S. 2911: Part I-IV); Effective Stress Principle - Introduction, effective stress principle, nature of

	effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.Well foundation: Types, element and construction well foundation, principles of design.
Unit: 5	Soil Dynamics & Machine Foundations: Introduction to soil dynamic, definitions, spring mass system, single degree of freedom system, free and forced vibration of damped and undamped systems; Types & criteria for design of machine foundations. Analysis and design of block foundation; Vibration isolation (active and passive method).
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publication, Delhi.
2	Murthy, V.N.S., A text book of soil mechanics and foundation Engineering, CBS Publishers Distributors Pvt. Ltd., New Delhi.
Reference Books:	
1	Design of foundation and Retaining Structures by S. Prakash, G Ranjan& S Saran; Sarita Pracashan, Meerut.

Course Code	Course Title	Lecture			Semester: VII
BTCE701PCP	Structural Design Lab	L	T	P	
Version: 1.0	Date of Approval: --	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Civil Engineering Materials, Testing & Evaluation and Strength of Materials-I

Course Objectives:

1. To understand the fundamental principles and codal provisions for the design of reinforced concrete structural elements.
2. To develop the ability to analyze and design beams, slabs, columns, staircases, foundations, and retaining walls.
3. To apply design methodologies to various structural systems including continuous and simply supported elements.
4. To prepare detailed structural drawings for different reinforced concrete components.
5. To enhance practical skills in structural design and drafting for real-world civil engineering applications.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Analyze structural behavior and apply codal provisions in the design of reinforced concrete elements.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_{12}
CO_2	Design singly and doubly reinforced beams, T-beams, and continuous beams for various loading conditions.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_{12}
CO_3	Design different slab systems, staircases, columns, and foundations using appropriate structural principles.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_{12}
CO_4	Design and detail cantilever and counterfort retaining walls for stability against earth pressure.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_6, PO_7, PO_{12}
CO_5	Prepare accurate and comprehensive structural drawings for all designed components as per IS codes	PO_1, PO_2, PO_3, PO_4, PO_5, PO_9, PO_{10}, PO_{11}, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	3	2	2	2							2
CO_2	3	3	3	2	2							1
CO_3	3	2	3	2	2							1
CO_4	3	2	3	2	2	1	2					1
CO_5	2	1	2	1	3				2	3	2	2

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

List of Experiments:

1. Design and drawing of singly reinforced simply supported beam.
2. Design and drawing of doubly reinforced rectangular simply supported beam.
3. Design and drawing of doubly reinforced rectangular continuous beam.
4. Design and drawing of T-section simply supported beam.

5. Design and drawing of T-section continuous beam.
6. Design and drawing of one-way simply supported slab.
7. Design and drawing of one-way continuous slab system.
8. Design and drawing of two-way simply supported slab.
9. Design and drawing of two-way continuous slab system.
10. Design and drawing of Dog-legged staircase.
11. Design and drawing of open wall type staircase.
12. Design and drawing of columns.
13. Design and drawing of foundation.
14. Design and drawing of Cantilever Retaining wall.
15. Design and drawing of counterfort Retaining wall.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

	Text Books:
1	Jain and Jaikrishna, Plain and Reinforced Concrete, Vol. I, Nemchand Brothers. (ISBN-8185240086/978-8185240084).
2	Shrikhant Vanakudre, Prestressed Concrete (Materials, Analysis and Design), Khanna Publishing House, (ISBN: 9789386173317)
3	V. L. Shah and Karve, Limit State Design - Reinforced Concrete Structures Publications. (ISBN-9788190371711/8190371711).
4	N. Krishna Raju, Pre-stressed Concrete, Tata McGraw Hill. (ISBN- 9789387886209/9387886204).
	Reference Books:
1	P. Dayaratnam, Design of Reinforced Concrete Structures, Oxford & IBH. (ISBN-9789386479785/9386479788).
2	T.Y. Lin, Design of Prestressed Concrete Structures, John Wiley and Sons Inc., 2010. (ISBN-9788126528035/8126528036).
3	P.D.Arthur and V.Ramkrishnan, Ultimate Strength Design for Structural Concrete, Wheeler & Co. Pvt Ltd. (ISBN- 0273403230/978-0273403234).
4	B.P. Hughes, Limit State Theory for Reinforced Concrete Design, Pitman. (ISBN-0273010239/978-0273010234).

Course Code	Course Title	Lecture			
DPCE701PET	Transportation System Planning And Management	L	T	P	Semester: VII
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Transportation Engineering

Course Objectives:

1. To understand of the various techniques of transportation management
2. To understand the performance of various transportation systems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the concept of conflicts and intersection	PO_1, PO_2
CO_2	Understand the concept of transportation management	PO_2, PO_3
CO_3	Assess the performance of various transportation engineering	PO_6, PO_8, PO_9, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO_1	2	2										
CO_2		1	2									
CO_3						1		2	2			2

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	General Importance of transportation, transportation planning methodology, hierarchical levels of planning and its relation to rural, urban areas. Long range planning, Passenger and goods transportation, General concept and process of transport planning, Land-use transport interactions, Socio-economic characteristics of Land use.
Unit: 2	Transportation Systems Multi modal transportation system; Characteristics of Mass Transit systems including technical, demand operational and economic problems, fixed Track Facility, Mass Rapid Transit System Elevated, Surface and Underground construction , Express Bus System, integrated Operating Characteristics of Terminal and Transfer facilities.
Unit: 3	Urban Transportation Planning Studies Urban Travel Characteristics, Private and Public Behavior analysis, Transportation demand Surveys, Delineation of the urban area, zoning, Origin-Destination Studies, Home Interviews, trip Classification and Socio- Economic variables in trip making projections.
Unit: 4	Planning Methodology and Systems analysis Study of existing network-trip generation techniques, Category analysis, multiple regression techniques, Modal split analysis.
Unit: 5	Trip distribution techniques, Growth Factor model, Gravity models, Opportunity models and multiple regression models, Traffic assignment methods, Minimum Path tree-All or nothing assignment and capacity restraint techniques, analysis and evaluation techniques.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:	
1	Kadiyali, L. R., Traffic Engineering and Transport Planning.
2	Khanna S.K. and Justo C. E. G. Highway Engg.- New Chand Publication 2008.
Reference Books:	
1	Goulias, K. G. (2002). Transportation systems planning: methods and applications. CRC press.

Course Code	Course Title	Lecture			
BTCE702PET	Advanced Structural Analysis	L	T	P	**Semester:** VII
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Structural Analysis

Course Objectives:

1. Analysis of portal frames using Approximate methods.
2. Analysis of Three hinged and two hinged arches.
3. Analysis of continuous beams and frames using matrix methods.
4. Analysis of beams and frames using column analogy method.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Analyse the portal frames using approximate methods.	PO_1, PO_2, PO_4, PO_5, PO_{12}
CO_2	Analyse the three hinged and two hinged circular and parabolic arches.	PO_1, PO_2, PO_4, PO_5, PO_{12}
CO_3	Analyse the continuous beams and frames using flexibility method.	PO_1, PO_2, PO_4, PO_5, PO_{12}
CO_4	Analyse the continuous beams and frames using Stiffness method.	PO_1, PO_2, PO_4, PO_5, PO_{12}
CO_5	Analyse the beams and frames using column analogy method.	PO_1, PO_2, PO_4, PO_5, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	3		2	2							1
CO_2	3	3		2	2							1
CO_3	3	3		3	3							1
CO_4	3	3		3	3							1
CO_5	3	3		2	3							1

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Approximate Method of Analysis:** Approximate methods of analysis of multi storied multi bay 2D rigid jointed frames by portal frame method, cantilever method.
Unit: 2	**Three Hinged Arches:** Introduction, Types, Analysis of three hinged circular and parabolic arches, Bending Moment, Horizontal Thrust, Radial shear for static loading. **Two Hinged Arches:** Introduction, Types, Analysis of two hinged circular and parabolic arches, Bending Moment, Horizontal Thrust, Radial shear for static loading. Effect of yielding of supports.
Unit: 3	**Flexibility Method:** Determination of Static indeterminacy - Equilibrium and compatibility conditions-Principle of superposition, Application of Flexibility Method to continuous beams and portal frames.
Unit: 4	**Stiffness Matrix Method:** Determination of kinematic indeterminacy. Application of Stiffness Method to continuous beam and portal frames.

Unit: 5	**Column Analogy Method:** Introduction to column analogy, sign conventions, stresses in a column, Application to Beams and symmetric Frames, Stiffnesses and carry over factors of beams with uniform cross sections.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Parekar. S.R., Somayya. H.M. "Structural Analysis – II", Nirali Prakashan Publishers, 1st edition. 2017.
2	Pandit. G. S., Gupta. S.P., "Structural Analysis – A Matrix Approach" Tata McGraw Hill, New Delhi, 1st edition, 2008.
3	Bhavikatti. S. S., "Structural Analysis Vol- I & II," Vikas Publishing, 4th Edition, 2011.
Reference Books:	
1	Punmia. B.C. and Jain. A.K. "Theory of structures", Laxmi Publications, New Delhi, 2004.
2	Gere. J.M. & William Weaver, "Matrix Analysis of Framed Structures", 2nd Ed., D Van Nostand, New Jersey, 1980.
3	Junarkar. S. B. and Shah, "Mechanics of structures", Charotar Pub, House, 2001.
4	Prakash Rao. D. S., "Structural Analysis - a Unified Approach", University Press, 1991.

Course Code	Course Title	Lecture			
BTCE703PET	**Remote Sensing**	L	T	P	**Semester:** VII
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): NIL

Course Objectives:

1. To understand the basic fundamental principles of remote sensing, data acquisition and image interpretation techniques.
2. To provide concepts and applications of electromagnetic spectrum, energy balance, principles of radiation mechanism, energy interactions with atmosphere and earth features, platforms.
3. To understand the applications of remote sensing for real world problems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand physical principles and sensing process involved in remote sensing.	PO_1, PO_2
CO_2	Describe the various satellites used in the collection of remotely sensed data.	PO_3, PO_2
CO_3	Perform visual interpretation analysis on remotely sensed data.	PO_6, PO_8, PO_9
CO_4	Apply the knowledge of remote sensing in various thematic studies	PO_5

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	1	2										
CO_2		2	3									
CO_3						2		3	3			
CO_4					3							
CO_5	1	2										

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Remote Sensing: Basic concept of remote sensing, Overview of Remote Sensing and Remote Sensing Systems, Electromagnetic Radiation, Terms and Definitions, Laws of Radiation, EM Spectrum, Sources of EMR, Interactions between EM Radiation and Atmosphere and matter, Atmospheric windows, Reflection, Absorption and Transmission. Data and Information, Remote sensing data Collection, Remote sensing advantages & Limitations, Remote Sensing process. Historical Components of Remote Sensing Principles & methods of remote sensing – Active and Passive remote sensing.
Unit: 2	Energy use in buildings; Energy Supply in Buildings: Heating, Ventilating, and Air Conditioning (HVAC) Systems; Heating and cooling loads.
Unit: 3	Image Acquisition: Platforms & Sensors, Sensor types and characteristics, Remote Sensing Systems - Active and Passive Systems, Imaging and Non-Imaging Systems, characteristics of optical sensors;

	FOV, IFOV, Resolutions in RS - Spatial, Spectral, Radiometric and Temporal, Orbits for Earth Observation, Sensors and their characteristics on board IRS, LANDSAT, IKONOS, Quickbird satellites
Unit: 4	Geographic Information Systems: Introduction, History of GIS, GIS Components, GIS Applications in Real life. The Nature of geographic data, Maps, Types of maps, Map scale, Types of scale, Map and Globe, Coordinate systems, Map projections, Map transformation, Geo-referencing. Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS. Storage of GIS data, Introduction to QGIS, Georeferencing an Image, Creating vector features, Vector functions and Querying.
Unit: 5	Land use/Land cover in water resources, Surface water mapping and inventory, Rainfall – Runoff relations and runoff potential indices of watersheds, Flood and Drought impact assessment and monitoring, Watershed management for sustainable development and Watershed characteristics and concept of watershed.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Lillesand, Thomas M. and Kiefer, Ralph, W., "Remote Sensing and Image Interpretation", 4th Edition, John Wiley and Sons, New York, 2000
2	Sabins, F.F. Jr., 'Remote Sensing – Principles and Interpretation", W.H. Freeman & Co., 2002 Edition
Reference Books:	
1	Campbell John B.: Introduction to Remote Sensing Taylor & Francis.
2	. S. Kumar, Basics of Remote sensing & GIS, Laxmi Publicatio

Course Code	Course Title	Lecture			
BTCE704PET	Non Destructive Testing Methods	L	T	P	**Semester:** VII
Version: 1.0	**Date of Approval:** --	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Engineering Mechanics, Civil Engineering Materials & Structural Analysis

Course Objectives:

1. To introduce the basic principles, techniques, equipment, applications and limitations of NDT methods such as Visual, Electro Magnetic Testing and Ultrasonic Testing.
2. To enable selection of appropriate NDT methods.
3. To identify advantages and limitations of non-destructive testing methods.
4. To make aware the developments and future trends in NDT.
5. Exposure to various non-destructive testing methods which is essential in advanced manufacturing applications, the course aims at giving an insight into various Non-Destructive Testing methods used in practice.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Differentiate various defect types in concrete and identify suitable NDT methods for assessment.	PO_1, PO_2, PO_4, PO_5, PO_{10}, PO_{12}
CO_2	Evaluate the suitability and limitations of different NDT methods for specific industrial applications.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_{10}, PO_{12}
CO_3	Interpret results obtained through common NDT techniques like rebound hammer and ultrasonic pulse velocity test.	PO_1, PO_2, PO_4, PO_5, PO_{10}, PO_{12}
CO_4	Understand and apply codes and standards related to NDT of concrete structures.	PO_1, PO_2, PO_5, PO_6, PO_7, PO_8, PO_{10}, PO_{12}
CO_5	Demonstrate familiarity with modern NDT techniques such as acoustic emission and tomography.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_{10}, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	3		2	2					1		1
CO_2	2	3	2	2	3					1		1
CO_3	2	2		3	3					2		1
CO_4	2	2			2	1	1	2		2		1
CO_5	2	2	1	2	3					2		2

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction** • Importance and need of non-destructive testing. Basic methods for NDT of concrete structures. Qualification and certification. • **Basic manufacturing processes and defects of concrete structures**: Types of concrete

	structures, Composition of concrete, Process of concrete manufacture, Discontinuities and defects in concrete structures, Situations where NDT is an option to consider for investigation of in-situ concrete.
Unit: 2	**Testing and Visual Inspection** • **Testing of concrete:** Quality control tests, Partial destructive tests. • Comparison of NDT methods. • Introduction, Tools and equipment for visual inspection, General procedure of visual inspection, Applications of visual inspection, Sketches of typical defects found by visual inspection.
Unit: 3	**NDT Methods** • **Schmidt Rebound Hammer Test:** Fundamental principle, Equipment for Schmidt/rebound hammer test, General procedure for Schmidt rebound hammer test, Applications of Schmidt rebound hammer test, Range and limitations of Schmidt rebound hammer test. • **Electromagnetic Methods of Testing Concrete:** Fundamental principles, Equipment for electromagnetic inspection, General procedure for electromagnetic testing, Applications of electromagnetic testing method, Range and limitations of electromagnetic testing method, Work or site calibration. • **Ultrasonic Testing -Pulse velocity test:** Fundamental principle, Equipment for pulse velocity test, Applications, Determination of pulse velocity, Factors influencing pulse velocity measurements, Detection of defects, Developments in ultrasonic tomography.
Unit: 4	**Other Methods of NDT:** • Acoustic emission, Computer tomography. • **Strain sensing:** Mechanical gauges, Electrical resistance gauges, Acoustic gauges, Electrical displacement transducers, other types of strain measuring devices, Choice of strain measuring method. • Corrosion rate measurement.
Unit: 5	**Codes, Standards & Specifications:** • **General considerations:** The need for standards, Different categories of standards. • **Standardization organizations:** American Society for Testing and Materials (ASTM), International Organization for Standardization (ISO), American Concrete Institute.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Baldev Raj, Practical Non – Destructive Testing, Narosa Publishing House ,1997.
2	Hull B. and V. John, Non-Destructive Testing, Macmillan,1988.
3	Kraut kramer, Josef and Hebert Kraut kramer, Ultrasonic Testing of Materials, Springer- Verlag, 1990.
Reference Books:	
1	The Testing Instruction of Engineering Materials – Davis H.E Troxel G.E wiskovil C.T – McGraw hill.
2	Non-Destructive Testing – Mc Gonnagle JJ – Garden and reach New York.
3	Non-Destructive Evolution and Quality Control – volume 17 of metals hand book 9 edition Asia internal 1989.
Code Books:	
1	**IS 13311 (Part 1)-1992**: Method of Non-Destructive Testing of Concrete – Ultrasonic Pulse Velocity
2	**IS 13311 (Part 2)-1992**: Method of Non-Destructive Testing of Concrete – Rebound Hammer
3	**IS 456-2000**: Plain and Reinforced Concrete – Code of Practice
4	**IS 4926-2021**: Ready-Mixed Concrete – Code of Practice
5	**IS 516 (Part 5/Sec 1)-2018**: Hardened Concrete – Non-Destructive Testing – Rebound Hammer
6	**IS 516 (Part 5/Sec 2)-2018**: Hardened Concrete – Non-Destructive Testing – Ultrasonic Pulse Velocity
7	**IS 13111-1991**: Guidelines for Inspection and Maintenance of Concrete Structures
8	**IS 2810-1979**: Glossary of Terms Relating to Non-Destructive Testing
9	**IS 13827-1993**: Improving Earthquake Resistance of Earthen Buildings – Guidelines (includes

	NDT relevance)
10	**IS 14858-2000**: Requirements for Accreditation of Testing and Calibration Laboratories
11	**IS 15498-2004**: Guidelines for Improving the Durability of Concrete Structures
12	**IS 1786-2008**: High Strength Deformed Steel Bars and Wires for Concrete Reinforcement– Specification

Course Code	Course Title	Lecture			
DPCE711NCT	Disaster Preparedness & Planning Management	L	T	P	Semester: VII
Version: 1.0	Date of Approval: --	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	0	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): NIL

Course Objectives:

1. To provide broad understanding about the basic concepts of Disaster Management with preparedness as a Civil Engineer.
2. To introduce engineers various natural hazards that can pose risk to property, lives, and livestock, etc.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understanding the concept of Disaster Management	PO_1, PO_6, PO_{12}
CO_2	Understand the relationship between Development and Disasters.	PO_2, PO_6, PO_7
CO_3	Understand Categories of Disasters and prioritise suitable preparedness.	PO_7, PO_9, PO_{10}, PO_{11}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2					3						1
CO_2		1				2	3					
CO_3							2		3	2	2	

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks- severity, frequency and details, capacity, impact, prevention, mitigation).
Unit: 2	Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.
Unit: 3	Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.
Unit: 4	Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post- disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders;

	Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority
Unit: 5	Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land- use changes, urbanization etc.), sustainable and environmentally friendly recovery; reconstruction and development methods. Accessibility in Disaster Contexts and Emergency Services for differently abled publics (Accessibility in context of Disaster Preparedness, Response, Mitigation and reconstruction).
Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.	
Text Books:	
1	Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
Reference Sources:	
1	http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2	http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)

Course Code	Course Title	Lecture			Semester: VIII
BTCE801PET	Prefabricated, Pre-cast and Pre-stressed structures	L	T	P	
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Engineering Mechanics, Concrete Technology & Reinforced Concrete Design

Course Objectives:

1. To introduce various types of precast and prefabricated concrete elements.
2. To know advantages and disadvantages of precast and prefabricated concrete elements.
3. To understand prestressing methods, systems for Reinforced Concrete members.
4. To learn issues involved in loss of prestressing.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Select the relevant precast concrete element for a given type of construction.	PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{12}
CO_2	Use relevant components for prefabricated structures.	PO_1, PO_2, PO_3, PO_5, PO_{10}, PO_{12}
CO_3	Justify the relevance of prestressed element in a given situation.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_8, PO_{10}, PO_{12}
CO_4	Select relevant methods / systems for given construction work.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_9, PO_{10}, PO_{12}
CO_5	Propose suitable cable profile for the given prestressed concrete members	PO_1, PO_2, PO_3, PO_4, PO_5, PO_{10}, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2	3		2					2		1
CO_2	3	2	2		3					1		1
CO_3	3	3	2	2	2			1		2		1
CO_4	2	3	3	2	3				1	2		1
CO_5	3	3	2	2	3					2		1

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Precast concrete Elements** • Introduction to precast concrete members – Advantages and disadvantages of precast concrete members – various materials used such as plain cement concrete, reinforced cement concrete, prestressed concrete, self-compacting concrete, ferro-cement, aerated and foam concrete. • Non-structural Precast elements – Fencing Poles, Man- hole Covers, Hollow and Solid Blocks, Transmission Poles, etc. • Structural Precast elements – Canal lining, Box culvert, Bridge panels. • Fabricating systems, storage, transportation and equipment's used.
Unit: 2	**Prefabricated building** • Introduction to Prefabricated Structures: Need for prefabrication –Principles –Materials –

	Modular coordination – Standardization –Systems –Production- storage-curing – Transportation –Erection. • Prefabricates classification, foundation, columns, beams, roof and floor panels, wall panels, erection and assembly. • Ecological aspect of use of prefabricated building.
Unit: 3	**Introduction to Prestressed Concrete** • Basic terminology, Principles of pre-stressed concrete and basic terminology. • Applications, advantages and disadvantages of prestressed concrete. • Materials used and their properties, Necessity of high-grade materials. • Types of Pre-stressing steel -Wire, Cable, tendon, Merits-demerits and applications.
Unit: 4	**Methods, Systems of Prestressing and Losses of Prestress** • Methods of prestressing – Internal and External pre-stressing, Pre tensioning and Post tensioning- applications, merits and demerits. • Systems for pre-tensioning – process, applications, merits and demerits – Hoyer system. • Systems for post-tensioning-process, applications, merits and demerits – Freyssinet system. **Loss of prestress:** • Understanding of loss of prestress, Losses of prestress in pre-tensioned and post-tensioned members, prestressing force in cable – Loss of prestress during the tensioning process due to friction, length effect and curvature effect (Simple numerical problems to determine loss of prestress) – Loss of prestress at the anchorage stage.
Unit: 5	**Analysis of Prestress:** Basic assumptions, analysis of prestress, resultant stress, pressure line, kern points, cable profiles, load balancing concept, stress diagrams for prestress, dead load and live load. **Design of Sections:** Flexural strength design of rectangular, I and T sections using IS code.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Krishna Raju, N., Pre-stressed Concrete, Tata McGraw Hill, New Delhi.
2	A.H. Nilson, "Design of Prestressed Concrete", John Wiley and Sons, 1982.
3	Shrikant B. Vanakudre, Prestressed Concrete, Khanna Publishing House, New Delhi
4	Marzuki, Nor Ashikin, Pre-Cast and Pre-Stress Technology: Process, Method and Future Technology, Create space Independent Publication.
5	Indian Concrete Institute., Handbook on Precast Concrete buildings.
6	Elliott, Kim S., Precast Concrete Structures, CRC Press, New York.
7	Lin, T.Y., Design of Pre-Stressed Concrete Structures, John Wiley and Sons, New York Nagarajan, Pravin., Pre-stressed Concrete Structures, Pearson Education India.
8	Ganesan. R and Latha. A, "Prefabricated Structures", Sree Kalamani Publication, 2020.
Code Books:	
1	IS 12592 Precast Concrete Manhole Cover and Frame, BIS, New Delhi.
2	IS 15658 Precast concrete blocks for paving – Code of Practice, BIS, New Delhi.
3	IS 15916 Building Design and Erection Using Prefabricated Concrete – Code of Practice, BIS, New Delhi.
4	IS 15917 Building Design and Erection Using Mixed/Composite Construction – Code of Practice, BIS, New Delhi.
5	IS 458 Precast Concrete Pipes (with and without reinforcement) – Specification, BIS, New Delhi.
6	IS:1343 – 1980, "Code of practice for prestressed concrete".

Course Code	Course Title	Lecture			Semester: VIII
BTCE802PET	Railway and Airport Engineering	L	T	P	
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Transportation and Geotechnical Engineering

Course Objectives:

1. Understand the design of railways
2. Understand the concept of Wind rose Diagram and runways.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Identify different railway crossings and components.	PO_1, PO_2, PO_{12}
CO_2	Prepare wind rose diagram	PO_1, PO_2, PO_6, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										1
CO_2	2	2				1						1

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Railway Engineering Development of railways in India, Permanent way and railway track components, different gauges in India, conning of wheels, Functions of various Components - Rails, Sleepers and Ballast, Rails - types of rails, rail sections, defects in rails, creep of rails, rail fixtures and fastenings, rail joints and welding of rails, sleepers – types, spacing and density, Ballast – types, advantages and disadvantages, Subgrade – Requirement, embankment.
Unit: 2	Geometric design of railway track: gradients, grade compensation, speed of trains on curves, super elevation, cant deficiency, negative super elevation, curves, widening on curves. Track layouts, Switches, Tongue Rails, Crossings, Layout of Turnout – Double Turnout, Diamond crossing, Scissors crossing
Unit: 3	Railway Station and Yard Railway traction and track resistance, stresses in railway track – rails, sleepers, ballast. Points and crossings – turnouts, switches, crossings. Track junctions – types, splits, diamond, gauntlet, scissor crossovers. Railway stations - requirements, facilities, classifications, platforms, loops, sidings. Railway yards – types, required equipment in yards. Signaling and control system – objectives, classification, Interlocking of signals and points.
Unit: 4	Airport Engineering Development, policy of air transport, aircrafts, aerodromes, air transport authorities, air transport activities, air crafts and its characteristics, airport classifications as per ICAO. Regional planning-concepts and advantages, location and planning of airport as per ICAO and FAA. Airport Master plan, Airport site selection, Zoning laws, Airport Elements - airfield, terminal area, zoning laws, classification of obstructions, approach zone, turning zone, airport capacity, runway capacity, estimation of future air traffic, development of new airport, requirements of an ideal airport
Unit: 5	Runway and Taxiway Design, Wind rose and orientation of runway, wind coverage and crosswind component, factors affecting runway length, basic runway length and corrections to runway length, runway geometrics and runway patterns (configurations), Runway

	marking, threshold limits cross section of runway. Taxiway Design: Controlling factors, taxiway geometric elements, layout, exit taxiway, location and geometrics, holding apron, turnaround facility. Aprons -locations, size, gate positions, aircraft parking configurations and parking systems, hanger-site selection, planning and design considerations, Fuel storage area, blast pads. Wind direction indicator. LCN system of Pavement Design, Airfield Pavement – Failures, Maintenance and Rehabilitation.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	K.F. Antia, "Railway Engineering", New Book Company, Bombay, India.
2	S. K. Khanna & M. G. Arora, " Airport Planning and Design" , Nem Chand & Bros. Roorkee, India
Reference Books:	
1	Collis, Hugh. Transport, engineering and architecture. Gulf Professional Publishing, 2003.

Course Code	Course Title	Lecture			Semester: VIII
BTCE803PET	Advanced Design of Steel Structures	L	T	P	
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Engineering Mechanics, Concrete Technology & Reinforced Concrete Design

Course Objectives:

1. To familiarize students with codal provisions (IS:800-2007, IRS Bridge Rules) and drawing details.
2. To enable students to design advanced steel structures such as plate girders, gantry girders, and railway bridges using the limit state method.
3. To develop ability to carry out detailed design, including connections, stiffeners, bearings, and framing for steel bridges.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Design welded plate girders with proper stiffeners and connections using IS:800-2007.	PO_1, PO_2, PO_3, PO_4, PO_5
CO_2	Analyze and design gantry girders for industrial applications.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_{11}, PO_{12}
CO_3	Design steel railway plate girder bridges with detailed structural elements and connections.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_6, PO_{11}, PO_{12}
CO_4	Design appropriate end bearings for steel railway bridges.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_{12}
CO_5	Evaluate wind effects and incorporate lateral stability through cross frames and bracings.	PO_1, PO_2, PO_3, PO_4, PO_5, PO_6, PO_7, PO_{11}, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	3	3	2	2							
CO_2	3	3	3	2	2						1	1
CO_3	3	3	3	2	2	1					1	1
CO_4	3	2	2	2	1							1
CO_5	3	3	3	2	2	1	2				1	1

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Design of Plate Girders (Limit state design):** Design of welded Plate girder for static loads as per IS:800-2007-Economical depth, design of cross section, Flange curtailment, Intermediate and bearing stiffeners, design of connections. Sketch showing the details of longitudinal section and cross section.
Unit: 2	**Design of Gantry girders (Limit state method):** Basic principles, loads, codal provisions, design of cross section and design of welded connection as per IS: 800-2007.Sketch showing general layout and cross section of Gantry girder.
Unit: 3	**Design of steel railway Plate Girder Bridge:** Types of steel bridges, Economical span, Indian standard railway broad gauge train loading-permissible stresses. Design of Deck type riveted

	plate girder railway bridges for broad gauge main line loading –Design of cross section, riveted connections, intermediate and bearing stiffeners. Sketch showing the longitudinal section & cross section.
Unit: 4	**End bearings:** Types of bearings for steel railway bridges. Design of rocker and roller bearings for steel railway bridges.
Unit: 5	**Design of Deck type riveted plate girder railway bridges:** Economical depth, detailed design of Cross section, connections, intermediate and bearing stiffeners, Wind effects-Design of Cross frames.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Duggal S.K., "Design of Steel Structures", 2nd Edition, Tata McGraw Hill Publishing, 2019.
2	N. Subramanian "Design of Steel Structures: Limit state method" 3rd Edition, Oxford University Press, 2018
3	Gambhir M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2013
4	Bhavikatti S.S., "Limits state Design of Steel Structures", 5th Edition, Dream Technology Press 2019.
Reference Books:	
1	A.S. Arya and J.L Ajmani "Design of Steel Structures", Nem Chand & Bros. 2014.
2	M.R. Shiyekar, "Design of Steel Structures, (Limit State Method)", Second Edition, PHI Learning Pvt Ltd. 2013.
3	Ramachandra and Virendra Gehlot, "Design of Steel Structures", Volume – 2, Scientific Publishers, 2008.
Code Books:	
1	IS: 800-2007: Code of Practice for General Construction in Steel, Bureau of Indian Standards, New Delhi.
2	IS: 875-1987: Code of Practice for Design loads for buildings and structures, Bureau of Indian Standards, New Delhi.
3	ISI Handbook No.1 Bureau of Indian standards, New Delhi.
4	Bridge Rules-1982, specifications for Indian railway loadings.
5	IS: 1915-1961- The Indian standard code of practice for design of steel bridges Bureau of Indian standards, New Delhi.

Course Code	Course Title	Lecture			Semester: VIII
BTCE804PET	**Dam Engineering**	L	T	P	
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Water resources Engineering

Course Objectives:

1. Understanding the concept and need of dam Engineering
2. Understanding basic principles of forces acting on the dam
3. Understanding the Analysis and Safe design of Dams and Spillways.

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Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the fundamental concepts of dam engineering and, select proper materials, suitable site, appropriate type of dam in a given field condition	PO_1, PO_2
CO_2	Assess the various forces acting on gravity dams under various design conditions and check the stability of a dam.	PO_3, PO_4, PO_5
CO_3	Estimate forces acting on arch and buttress dams under various design conditions and design the required elements of the dams.	PO_3, PO_4, PO_9, PO_{11}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	1	2									1	
CO_2			3	2		2	2					
CO_3			3	2					2			

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Types of Dam, merits and demerits, dam site selection, selection of dam, Forces acting on gravity Dam, Methods of analysis of gravity Dam, Modes of failure and stability requirements, Design criteria and factor of safety.
Unit: 2	Elementary profile of a gravity dam, Low and high gravity dams, Zoning of dams, Galleries in dams, Temperature control in mass concrete; gravity dams subjected to earthquakes.
Unit: 3	Buttress and Arch dams, Types, selection, merits and demerits, Elementary design Principles of Arch and Buttress dams
Unit: 4	Earth Dam their component and functions, causes of failure. Factors influencing the design of an earth dam. Design criteria for Earth Dam.
Unit: 5	Elementary idea of design for spillway and energy dissipaters.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly

end semester examination.	
Text Books:	
1	R.S. Varshney “Concrete Dams”, by 1982, NCB, Roorkee
2	IS: 6512-1984, Is Code for criteria for Design of solid Gravity Dams.
Reference Books:	
1	W.P. Creager, J. Justin,.Daud Hinds, “Engineering for Dams” vol.I-III, Wiley, N.Y., USA.

Course Code	Course Title	Lecture			Semester: VIII
BTCE801OET	Smart Cities	L	T	P	
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Knowledge of Basic knowledge of urban planning and infrastructure systems, Familiarity with environmental and sustainability concepts, Understanding of government policies and urban governance frameworks.

Course Objectives:

1. To introduce the concept and evolution of smart cities and their significance in modern urban planning.
2. To understand the core features, components, and challenges in smart city development.
3. To examine national and international smart city initiatives and policies.
4. To explore infrastructure management practices and services applicable to smart cities.
5. To understand sustainable practices, smart construction methods, and green building rating systems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Define the need, concept, and evolution of smart cities.	PO_1, PO_6, PO_7
CO_2	Identify features, components, and challenges involved in the development of smart cities.	PO_1, PO_2, PO_6, PO_7
CO_3	Evaluate the role of policies and mission plans like India's "100 Smart Cities" initiative.	PO_1, PO_3, PO_6, PO_8
CO_4	Analyze the types and management of infrastructure services in smart cities.	$PO_2, PO_3, PO_5, PO_6, PO_9$
CO_5	Apply principles of sustainable construction and smart technologies for smart urban development.	$PO_3, PO_4, PO_5, PO_6, PO_7, PO_{10}, PO_{12}$

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2					2	1					
CO_2	3	2				3	2					
CO_3	2		2			2		1				
CO_4		2	3		2	2			1			
CO_5			2	2	2	3	3			1		2

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Definition, Concept, Need and importance, Benefits of smart cities, History of Smart city in India.
Unit: 2	Features & components of a smart city, Characteristics and factors of smart cities, Smart structures, Classification of smart structures, Challenges faced in developing smart cities, Scope of smart cities, Worldwide Policies for Smart City.

Unit: 3	Government of India: India "100 Smart Cities" Policy and Mission, Smart Cities in India, Case Studies of Smart City.
Unit: 4	Infrastructure Management in India, Challenges, Objectives, Various types of infrastructure Services, Applications for Existing Smart City.
Unit: 5	Dimension of Smart Cities, Smart Construction, Planning & Design, Theory and principles, Sustainable Building- Housing, Introduction to Green Buildings, Features of green building rating systems in India: LEED, GRIHA, Energy Saving System, Solar Energy for Smart City, Project Management. Storage and Conveyance System of Water, Sustainable Water and Sanitation, Sewerage System, Flood Management, Conservation System Methods etc.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Arup Mitra; "Insights into inclusive growth, employment and wellbeing in India"; Springer (2013), New Delhi (ISBN: 978-81-322-0655-2).
2	William J. V. Neill (2004); "Urban Planning and cultural identity"; Routledge, London (ISBN:0- 415-19747-3)
Reference Books:	
1	Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia, Anthony M. Townsend
2	Publisher: W. W. Norton & Company
3	Smart Cities: Foundations, Principles, and Applications, Houbing Song, Ravi Srinivasan, Tamim Sookoor, Sabina Jeschke, Publisher: Wiley
4	Building Smart Cities: Analytics, ICT, and Design Thinking, Carol L. Stimmel, Publisher: CRC Press
5	Smart Cities in India: Governance, Sustainability and Development, T.M. Vinod Kumar, Publisher: Springer
6	Smart Cities and Infrastructure: Challenges and Opportunities, Mohammad S. Obaidat, Petros Nicopolitidis, Publisher: Elsevier

Course Code	Course Title	Lecture			
BTCE802OET	**Sustainable and Green Construction**	L	T	P	**Semester:** VIII
Version: 1.0	**Date of Approval: --**	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): NIL

Course Objectives:

1. The objective is to understand students with comprehensive knowledge and practical skills in sustainable and green construction including its connection to current energy conservation policies and regulations.
2. This involves identifying and utilizing different materials suitable for green building practices.
3. Additionally, it is important to familiarize oneself with different rating systems and their specific criteria to effectively evaluate green building projects.

Course Outcomes (CO):

COs No.	**Statement**	**Mapped Program Outcomes (POs)**
CO_1	Explain the principles of sustainability and green construction, and their relevance to the built environment.	PO_1, PO_2
CO_2	Analyze green building rating systems (e.g., LEED, GRIHA, IGBC) and incorporate their guidelines in project development.	PO_{11}
CO_3	Develop sustainable construction strategies that reduce environmental impact while ensuring cost-effectiveness and durability.	PO_6
CO_4	Demonstrate the ability to integrate sustainable practices into real-life construction projects through case studies or design proposals.	PO_7

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**	**PO_9**	**PO_{10}**	**PO_{11}**	**PO_{12}**
CO_1	1	2										
CO_2											2	
CO_3						2						
CO_4							3					

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction to sustainable Development: Definition and principles of sustainable development, Historical context and evolution of sustainability, Global and local challenges related to sustainability. Sustainable construction Material and Technology: Green building materials and technologies, Life cycle assessment of materials, Resource efficiency and waste reduction in construction, Low-impact construction methods
Unit: 2	Sustainable Site Planning: Site selection and evaluation for sustainable construction, green space planning and landscaping, Sustainable storm water management-,

Unit: 3	Sustainable Building Design: Principles of green building design, Passive design strategies for energy efficiency, Daylighting and natural ventilation, Integration of sustainable technologies in design Construction and Demolition Waste Management: Waste reduction and recycling in construction, Responsible demolition practices, Circular economy concepts in construction. Building Certifications and Standards: LEED (Leadership in Energy and Environmental Design) certification, BREEAM (Building Research Establishment Environmental Assessment Method), Other regional and international green building certifications Environmental Regulations and Policy: - Building codes and regulations for sustainable construction - Environmental impact assessments - Government policies promoting green construction
Unit: 4	Economics of Sustainable Construction: - Cost-benefit analysis for green building projects - Financial incentives for sustainable construction - Business models for green technologies in construction
Unit: 5	Project Management for Sustainable Construction: - Sustainable project planning and execution - Stakeholder engagement and communication - Monitoring and evaluating sustainability performance.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Kibert, C.J., Sustainable construction: Green Building design and Delivery, John Wiley Hobouken, New Jersey.
2	Chauhan, DS Sreevasthava, SK., Non-conventional Energy Resources, New Age International Publishers, New Delhi
Reference Books:	
1	O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi.
2	Jagadeesh, K S, Reddy Venkatta Rama & Nanjunda Rao, K S., Alternative Building Materials and Technologies, New Age International Publishers, Delhi.

Course Code	Course Title	Lecture			Semester: VIII
BTCE803OET	Engineering Geology	L	T	P	
Version: 1.0	Date of Approval: --	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic Knowledge of Soil and Rock Formation

Course Objectives:

1. Understanding of Earth System Science
2. Understanding exogenous and endogenous environments and forces in context to and with application in Civil Engineering.
3. Understanding basic knowledge about natural earth material i.e. minerals and rocks with their inherent properties as well as deformation features as building material.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Get the knowledge of earth and its mineral matter	PO_1, PO_2, PO_7 PO_{12}
CO_2	Get the knowledge of rock and its physical and engineering properties.	PO_1, PO_2, PO_6, PO_{12}
CO_3	Get the knowledge of tectonic activity with details of earthquake.	PO_6 PO_7 PO_{10}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2					1					1
CO_2	2	2				1						2
CO_3						2	2			2		

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	General Geology: Introduction to the Earth Sciences, Elementary idea about the internal structure of the earth. Elementary knowledge of the physical properties of the common rock forming minerals. Introduction to the major group of rocks, mode of origin classification and properties. Study of the internal structures such as crust, mantle and core of the earth.
Unit: 2	Structural Geology and Geomorphology: Study of rocks, mode of formation and Classification of Igneous rocks. Physical and Engineering properties of igneous rocks. Relevance of Igneous rocks in civil engineering practices. Mode of formation and classification of Sedimentary Rocks. Physical and Engineering properties of Sedimentary rocks. Relevance of sedimentary rocks in Civil Engineering practices. Mode of formation and classification of metamorphic rocks. Physical and Engineering properties of metamorphic rocks. Relevance of metamorphic rocks in civil engineering practices.
Unit: 3	Deformation of the rocks. Dip, strike and structural features including fold, fault, joint and unconformity and their engineering significance. Fundamental concepts of study of landforms. Elementary idea of the geological work of glacier, river, sea waves and wind and their engineering significance. Study of Tectonic activity of the earth.
Unit: 4	Weathering and erosion. Natural agencies of Weathering and Erosion. Types of Weathering.

	Formations of various types of landforms. Glacial land forms, wind landforms and fluvial landforms. Significance of various landforms in Civil Engineering practices. Formations of various types of soils.
Unit: 5	Site investigation Techniques. Geological Investigation for Dam site and reservoir, bridges, tunnels and building. Landslide and land subsidence. Study of earthquake, classification of earthquake, earthquake zoning in India. Rocks as engineering material. Hydrologic cycle and study of ground water.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Geology for Engineers By Dr. D.S. Arora
2	Engineering Geology By Prabin Singh
Reference Books:	
1	Geology for Engineers by Krenin & Judd

Course Code	Course Title	Lecture			
BTCE804OET	**Signal System and Traffic Engineering**	L	T	P	**Semester:** VIII
Version: 1.0	**Date of Approval: --**	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	40 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): NIL

Course Objectives:

1. To understand traffic and its components, factors affecting road traffic for intersection design.
2. Explain sampling of data, analysis and interpretation of data in conducting various surveys

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand basic concepts of traffic flow and traffic system.	PO_1, PO_2
CO_2	Understand analysis and design of traffic Signal system.	PO_3, PO_4, PO_6, PO_8, PO_{11}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2										
CO_2			3	1		1		1			3	

1 - Reasonable; 2 - Significant; 3 – Strong

Detailed Contents:

Unit: 1	Components of road traffic - the vehicle, driver and road. Objectives and scope of traffic engineering. Road user characteristics; human and vehicle characteristics, factors affecting road traffic. Concepts of passenger car units for mixed traffic flow.
Unit: 2	Volume studies, Speed studies, Origin and destination studies and parking studies, Accidents, Lighting, Capacity and Level-of-service analysis.
Unit: 3	Regulations and control of traffic and method of control. General regulations; Regulations on Vehicles, drivers and Traffic management. Traffic signs, markings, islands and signals. Different methods of signal design; redesign of existing signal including case studies. Signal system and co-ordination. Introduction of pedestrian actuated and traffic adoptive signals.
Unit: 4	Traffic signal definition, types of traffic signal, advantages and disadvantage of signal, types of traffic signals system, element used in the design of traffic signal, method of signal design.
Unit: 5	Measurement at a Point (Volume data collection and analysis, PCU, PHF etc.), Measurement over a Short Section (Speed data collection and analysis), Measurement along a Length of Road (Density and travel time measurement and analysis), Moving Observer Method, Traffic forecasting and growth studies.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Kadiyali, L.R., 'Traffic Engineering and Transport Planning', Khanna Publications.

Reference Books:

1	Drew, D.R., 'Traffic Flow Theory and Control', McGraw Hill Book Co. 3. IRC Third Highway Safety Workshop, Lecture Notes 1978 and other IRC publications.