

# **DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE**

(An Autonomous Institution, Affiliated to Anna University, Chennai)

**PERAMBALUR - 621212**

**REGULATIONS – 2020**

**CHOICE BASED CREDIT SYSTEM**

**CURRICULA AND SYLLABI**



**DEPARTMENT OF CIVIL ENGINEERING**

(Applicable to the students admitted from the Academic year 2020 – 2021)

Discussed in BOS meeting Dated: 29.04.21/ Civil Ratified & Approved in Academic Council on 11.05.21

**DEPARTMENT OF CIVIL ENGINEERING**  
**(Applicable to the students admitted from the Academic year 2020 – 2021)**  
**DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE**  
**(An Autonomous Institution, Affiliated to Anna University, Chennai)**

**BE CIVIL ENGINEERING**  
**REGULATIONS-2020**  
**CHOICE BASED CREDIT SYSTEM**  
**Course Matrix**  
**I-VIII CURRICULA AND SYLLABI**

Semester –I									
S. No.	Subject Code	Name of the subject	Credit	L-T-P	Internal Assessment		End semester Examination		Minimum Passing Marks
					Max. Marks	Min. Marks	Max. Marks	Min. Marks	
1	U20HS101	Communicative English	3	3-0-0	20*		80		
2	U20MA101	Engineering Mathematics	4	3-1-0	20*		80		
3	U20PH101	Engineering Physics - I	3	3-0-0	20*		80		
4	U20CY101	Engineering Chemistry	3	3-0-0	20*		80		
5	U20GE101	C - Programming	3	3-0-0	20*		80		
6	U20GE102	Engineering Graphics	4	2-0-2	20*		80		
7	U20BS101	Physics and Chemistry Laboratory	2	0-0-4	20		80		
8	U20GE103	C - Programming Laboratory	2	0-0-4	20		80		
<b>Mandatory Course</b>									
9									
<b>Total</b>			24						

HS	BS	ES	PC	PE	OE	EEC	MC	Total Credits
3	12	9	-	-	-	-	-	24

\*-> Continuous Assessment (CA)

Semester –II									
S. No.	Subject Code	Name of the subject	Credit	L-T-P	Internal Assessment		End semester Examination		Minimum Passing Marks
					Max. Marks	Min. Marks	Max. Marks	Min. Marks	
1	U20HS201	Functional English	3	3-0-0	20*		80		
2	U20MA201	Advanced Calculus and Ordinary Differential Equations	4	3-1-0	20*		80		
3	U20PH201	Engineering Physics – II	3	3-0-0	20*		80		
4	U20GE201	Python Programming	3	3-0-0	20*		80		
5	U20CE201	Fundamentals of Civil Engineering	3	3-0-0	20*		80		
6	U20GE202	Engineering Mechanics	3	3-0-0	20*		80		
7	U20GE203	Engineering Practices Laboratory	2	0-0-4	20		80		
8	U20GE204	Python Programming Laboratory	2	0-0-4	20		80		
9	U20CE202	Computer Aided Building Drawing	2	0-0-4	20		80		
<b>Mandatory Course</b>									
10									
<b>Total</b>			25						

HS	BS	ES	PC	PE	OE	EEC	MC	Total Credits
3	7	10	5	-	-	-	-	25

\*-> continuous Assessment (CA)

Semester –III									
S. No.	Subject Code	Name of the subject	Credit	L-T-P	Internal Assessment		End semester Examination		Minimum Passing Marks
					Max. Marks	Min. Marks	Max. Marks	Min. Marks	
1	U20MA301	Transforms and Partial Differential Equations	4	3-1-0	20*		80		
2	U20CE306	Applied Geology	3	3-0-0	20*		80		
3	U20CE301	Strength of Materials- I	4	3-1-0	20*		80		
4	U20CE302	Fluids Mechanics	3	3-0-0	20*		80		
5	U20CE303	Engineering Survey	3	3-0-0	20*		80		
6	U20HS202	Environmental Science and Engineering	3	3-0-0	20*		80		
7	U20CE304	Strength of Materials Laboratory	2	0-0-4	20		80		
8	U20CE305	Survey Practical	2	0-0-4	20		80		
<b>Mandatory Course</b>									
9		G4: Technical Expertise Level-1 / G5: Social Course							
<b>Total</b>			24						

HS	BS	ES	PC	PE	OE	EEC	MC	Total Credits
3	4	3	14	-	-	-	-	24

\*-> continuous Assessment (CA)

Semester –IV									
S. No.	Subject Code	Name of the subject	Credit	L-T-P	Internal Assessment		End semester Examination		Minimum Passing Marks
					Max. Marks	Min. Marks	Max. Marks	Min. Marks	
1	U20MA402	Numerical Methods	4	3-1-0	20*		80		
2	U20CE401	Geotechnical Engineering-I	3	3-0-0	20*		80		
3	U20CE402	Strength of Materials-II	3	3-0-0	20*		80		
4	U20CE403	Hydraulics and Hydraulic Machinery	3	3-0-0	20*		80		
5	U20CE404	Transportation Engineering-I	3	3-0-0	20*		80		
6	U20CE405	Concrete Technology	3	3-0-0	20*		80		
7	U20CE406	Geotechnical Engineering Laboratory	2	0-0-4	20		80		
8	U20CE407	Hydraulic Engineering Laboratory	2	0-0-4	20		80		
<b>Mandatory Course</b>									
9		G5: Social Course G6: Employability Course Level-1	-						
<b>Total</b>			23						

\*->

HS	BS	ES	PC	PE	OE	EEC	MC	Total Credits
-	4	-	19	-	-	-	-	23

continuous Assessment (CA)

Semester – V									
S. No.	Subject Code	Name of the subject	Credit	L-T-P	Internal Assessment		End semester Examination		Minimum Passing Marks
					Max. Marks	Min. Marks	Max. Marks	Min. Marks	
1.	U20CE501	Structural Analysis	4	3-0-0	20*		80		
2.	U20CE502	Public Water Supply System & Treatment	3	3-1-0	20*		80		
3.	U20CE503	Design of RC Elements	3	3-1-0	20*		80		
4.	U20CE504	Transportation Engineering-II	3	3-0-0	20*		80		
5.	U20CE505	Geotechnical Engineering-II	3	3-0-0	20*		80		
6.		<b>Open Elective - I</b>	3	3-0-0	20*		80		
7.	U20HS501	Professional Communication	2	0-0-4	20		80		
8	U20CE506	Survey Camp	1	0-0-2	20		80		
9	U20CE507	Concrete and Highway Engineering Laboratory	2	0-0-4					
<b>Mandatory Course</b>									
10		G7: Skill Course Level-2 G8: Service to Society Level-2							
<b>Total</b>			23						

HS	BS	ES	PC	PE	OE	EEC	MC	Total Credits
-	-	-	20	-	3	1	-	24

\*-> continuous Assessment (CA)

Semester – VI									
S. No.	Subject Code	Name of the subject	Credit	L-T-P	Internal Assessment		End semester Examination		Minimum Passing Marks
					Max. Marks	Min. Marks	Max. Marks	Min. Marks	
1	U20CE601	Municipal Waste Water Engineering	4	3-1-0	20 *		80		50
2	U20CE602	Design of Reinforced Concrete & Brick Masonry Structures	3	3-0-0	20 *		80		50
3	U20CE603	Design of Steel Structures	3	3-0-0	20 *		80		50
4		<b>Professional Elective I</b>	3	3-0-0	20 *		80		50
5		<b>Professional Elective II</b>	3	3-0-0	20 *		80		50
6	U20CE604	Computer Aided Design and Drafting Laboratory	2	0-0-4	20		80		50
7	U20CE605	Water and Waste Water analysis Laboratory	2	0-0-4	20		80		50
<b>Mandatory Course</b>									
8		G7: Skill Course Level-2 G9: Employability Course Level-2							
<b>Total</b>			20						

HS	BS	ES	PC	PE	OE	EEC	MC	Total Credits
	-	-	14	6	-	-	-	20

Professional Elective I		Professional Elective II	
U20CE611	Site Investigation Methods and Practices	U20CE621	Remote Sensing and GIS Application
U20CE612	Construction Methods and Equipments	U20CE622	Cadre Surveying
U20CE613	Construction Contracts and Specifications	U20CE623	Intelligent Transportation System
U20CE614	Construction Safety Management	U20CE624	Traffic Planning and Design
U20CE615	Professional Ethics and human Values	U20CE625	Urban planning

\*-> continuous Assessment (CA)

Semester – VII									
S. No.	Subject Code	Name of the subject	Credit	L-T-P	Internal Assessment		End semester Examination		Minimum Passing Marks
					Max. Marks	Min. Marks	Max. Marks	Min. Marks	
1	U20CE701	Estimating, Costing and Valuation Engineering	4	3-0-0	20 *		80		50
2	U20CE702	Water Resources Engineering	3	3-0-0	20 *		80		50
3		Professional Elective III	3	3-0-0	20 *		80		50
4		Professional Elective IV	3	3-0-0	20 *		80		50
5		Open Elective II	3	3-0-0	20 *		80		50
6	U20CE703	Internship / Industrial Training / Academic Attachment	2	0-0-4	20		80		50
7	U20CE704	Design Project	2	0-0-4	20		80		50
<b>Mandatory Course</b>									
8		G10:Proficiency Exam / G12 :Employability Course Level- 3							
<b>Total</b>			20						

HS	BS	ES	PC	PE	OE	EEC	MC	Total Credits
-	-	-	7	6	3	4	-	20

Professional Elective III		Professional Elective IV	
U20CE731	Pre - stressed Concrete Structures	U20CE741	Municipal Solid Waste Management
U20CE732	Industrial Structures	U20CE742	Environmental Impact Assessment
U20CE733	Structural Dynamics	U20CE743	Management of Irrigation System
U20CE734	Soil Dynamics	U20CE744	Ground Water Hydrology
U20CE735	Disaster Management	U20CE745	River Engineering

\*-> continuous Assessment (CA)

Semester - VIII									
S. No.	Subject Code	Name of the subject	Credit	L-T-P	Internal Assessment		End semester Examination		Minimum Passing Marks
					Max. Marks	Min. Marks	Max. Marks	Min. Marks	
1		<b>Professional Elective V</b>	3	3-0-0	20*		80		
2		<b>Professional Elective VI</b>	3	3-0-0	20*		80		
3	U20CE801	Project Work	6	0-0-12	20		80		
<b>Mandatory course</b>									
4		G11: Technical Expertise Level-2 G12 :Employability Course Level-3							
<b>Total</b>			<b>12</b>						

HS	BS	ES	PC	PE	OE	EEC	MC	Total Credits
-	-	-	-	6	-	6	-	12

Professional Elective V		Professional Elective VI	
U20CE851	Repair and Rehabilitation of Structures	U20CE861	Prefabricated Structures
U20CE852	Ground Improvement Techniques	U20CE862	Precast And Modular Construction Practices
U20CE853	Structural Health Monitoring and Retrofitting	U20CE863	Building Services
U20CE854	Green Building Practices	U20CE864	Professional Practices in Civil Engineering
U20CE855	Geo-Environmental and Geo Hazard Engineering	U20CE865	Appropriate Technology in Construction

\*-> continuous Assessment (CA)

## SUMMARY

<b>B. E., Civil Engineering</b>											
<b>S. No</b>	<b>Subject Area</b>	<b>Credits per Semester (DSEC)</b>								<b>Credits Total</b>	<b>Percentage %</b>
		<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	<b>V</b>	<b>VI</b>	<b>VII</b>	<b>VIII</b>		
1	Humanities and social sciences	3	3	3	-	-	-	-	-	9	<b>5.26</b>
2	Basic Sciences	12	7	4	4	-	-	-	-	27	<b>15.79</b>
3	Engineering Sciences	9	10	3	-	-	-	-	-	22	<b>12.86</b>
4	Professional Cores	-	5	14	19	20	12	7	-	77	<b>45.02</b>
5	Professional Electives	-	-	-	-	-	6	6	6	18	<b>10.52</b>
6	Open Electives	-	-	-	-	3	-	3	-	6	<b>3.51</b>
7	Employability Enhancement	-	-	-	-	-	2	4	6	12	<b>7.01</b>
<b>Total</b>		<b>24</b>	<b>25</b>	<b>24</b>	<b>23</b>	<b>23</b>	<b>20</b>	<b>20</b>	<b>12</b>	<b>171</b>	<b>100.00</b>

## SEMESTER I

U20HS101

### COMMUNICATIVE ENGLISH (COMMON TO ALL BRANCHES)

L	T	P	C
3	0	0	3

**Pre-requisite:** Acquiring Basic grammar knowledge.

#### COURSE OBJECTIVES

- To enable the engineering students to develop their basic communication skills in English for academic and social purposes.
- To equip the students with appropriate oral and written communication skills.
- To inculcate the skills of listening, reading and critical thinking.
- To integrate English Language learning with employability skills and training.
- To enhance the students' proficiency in reading skills enabling them meet the academic demands of their course.

#### UNIT I GENERAL INTRODUCTION 9

Listening - Listening to conversations, Welcome Speeches, Lectures and description of equipment. Speaking - introducing one self - family and friends. Reading - Practice in skimming - scanning and predicting - Writing - completing sentences. Grammar - WH - Questions - asking and answering - Yes or No questions and Question Tag - Parts of Speech. Prefixes - Suffixes - Tense- Present, Past and Future Tense. Word formation.

#### UNIT II TECHNIQUES OF READING AND WRITING 9

Reading - Purpose of reading-comprehension - re - reading- post reading - comprehension questions (multiple choice questions or short questions/open-ended questions). Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Autobiographical writing (writing about one's leisure time activities, hometown, etc.) - Listening - Situational Conversation, Telephonic Conversation. Speaking - Sharing information of a personal kind - greeting - Taking leave - Grammar - Adjectives, Prepositions, Conjunctions, Articles, Punctuations - Error correction, editing mistakes in grammar, vocabulary, spelling.

#### UNIT III GRAMMAR AND SKILL DEVELOPMENT 9

Reading - Reading general contexts and interpreting graphical representations. Writing - understanding text structure - Use of reference words and discourse markers - Coherence - Jumbled Sentences Listening - listening to longer texts and filling up the table - Product description - narratives from different sources. Speaking - asking about routine actions and expressing opinions. Grammar-Past Tense - Kinds of noun, verb and adverb, Impersonal Passive voice.

#### UNIT IV READING AND LANGUAGE DEVELOPMENT 9

Reading - Short reading passages for sentence matching exercises, Picking out specific information in a short text. Writing - Letter writing, informal or personal letters - e-mails - conventions of personal e-mail - Listening-listening to dialogues or conversations and completing exercises based on them. Speaking - Group Discussion - Grammar - Future tense, Synonyms - Antonyms - Phrasal verbs.

#### UNIT V WRITING SKILLS 9

Reading - Intensive reading - Writing - Writing short essays - Dialogue Writing - Listening - listening to talks - conversations - Speaking - Presenting welcome speech and vote of thank - Grammar - Modal verbs - Collocations - Single word substitutes.

**COURSE OUTCOMES****Learners are able to**

1. Speak clearly, effortlessly, confidently and appropriately.
2. Write coherently with acceptable accuracy, organizing ideas logically.
3. Listen and comprehend different discourses and genres of texts.
4. Read and comprehend different discourses and genres of texts.
5. Read and infer, analyze, predict, interpret and draw conclusions any printed text.

**TEXT BOOKS**

1. Board of Editors Using English "A Course book for Undergraduate Engineers and Technologists". Orient Black Swan Limited, Hyderabad, 2015.
2. Richards, C. Jack. "Interchange Students'Book-2", New Delhi: CUP, 2015.

**REFERENCES**

1. Bailey, Stephen. "Academic Writing: A practical guide for students". New York: Rutledge, 2011.
2. Raymond Murphy, Murphy's "English Grammar", Cambridge University Press 2004.
3. Meenakshi Raman, Sangeeta Sharma, "Technical Communication: English Skills for Engineers", Oxford University Press, 2009.
4. Dr.S.Sumant, "Technical English" Tata McGraw-Hill, New Delhi, 2001.
5. "Essential English" - E.Suresh Kumar, P. Sreehari, J. Savithri - Orient Blackswan 2011.

**U20MA101****ENGINEERING MATHEMATICS  
(COMMON TO ALL BRANCHES)****L T P C  
3 1 0 4****Prerequisite:** Basic ideas of Matrices, Differentiation and Integration.**COURSE OBJECTIVES**

- To handle practical problems arising in the field of engineering.
- To achieve conceptual understanding and to retain the best traditions of traditional calculus.
- To provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- To deal with topics such as single variable and multivariable Calculus.
- To play an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

**UNIT I EVALUATION AND APPLICATION OF MATRICES****12**

Definition - Basic concepts of Matrices - Eigen values and Eigen vectors of a real matrix -Characteristic equation -Properties of Eigen values and Eigen vectors - Cayley - Hamilton theorem - Diagonalization of matrices - Reduction of a quadratic form to canonical form by Orthogonal transformation - Nature of quadratic forms.

**UNIT II DIFFERENTIAL CALCULUS****12**

Limit of a function - Continuity - Derivatives - Differentiation Rules - Mean Value Theorem - Interval of increasing and decreasing functions - Maxima and Minima - Interval of concavity and convexity.

**UNIT III MULTIVARIABLE CALCULUS****12**

Limits and Continuity - Partial derivatives - Total derivative - Differentiation of implicit functions - Jacobian and properties -Taylor's series for functions of two variables -Maxima, Minima and saddle points -

Method of Lagrange multipliers.

**UNIT IV INTEGRAL CALCULUS 12**

Definite Integrals and its properties - Fundamental theorem of Calculus - Techniques of integration for Indefinite Integrals using basic integration formulas -Integration by parts -Trigonometric Substitutions - Integration of Rational functions by Partial Fractions.

**UNIT V MULTIPLE INTEGRAL AND THEIR APPLICATIONS 12**

Double integrals - Change the order of integration - Polar Coordinates - Area - Change of variables - Triple integrals - Volume - Applications - Areas and Volumes.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

**Learners are able to**

1. Express large amounts of data and functions in an organized and concise form apart from diagonalizing matrices.
2. Solve maxima and minima problems using differentiation.
3. Apply functions of several variables to solve problems in engineering and technology.
4. Evaluate integrals by using Fundamental Theorem of Calculus.
5. Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change the order and change of variables.

**TEXT BOOKS**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Ed., 2014.
2. Veerarajan T, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2011.

**REFERENCES**

1. Bali N. P. and Manish Goyal, "Engineering Mathematics" (For Semester I) Third Edition, University Science Press, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2014
3. Fritz John and Richard Courant, "Introduction to Calculus and Analysis" Springer, 1999.
4. James Stewart, "Calculus: Early Transcendental", Cengage Learning, 7th Edition, New Delhi, 2015.
5. Venkatraman M K, "Engineering Mathematics, Volume-I", Second edition, National Publishing Co, Chennai, 2003.

**U20PH101**

**ENGINEERING PHYSICS - I  
(COMMON TO ALL BRANCHES)**

L	T	P	C
3	0	0	3

**Pre-requisite:** Adequate knowledge in basic and modern physics.

**COURSE OBJECTIVES**

- To impart knowledge in basic concepts of physics relevant to engineering applications.
- Capability to understand advanced topics in engineering.
- To acquire the knowledge of recent trends in LASER, Optical Fiber, and Ultrasonic.
- To understand the physical significance of the wave function

**UNIT I SOLID STATE PHYSICS**

**9**

Lattice -unit cell -seven crystal systems -Bravais lattices -lattice planes -Miller indices –derivation for inter-planar spacing in terms of Miller indices-calculation of number of atoms per unit cell , atomic radius , coordination number and packing factor for SC, BCC, FCC and HCP structures. X-ray diffraction: Bragg's law -diffraction methods: powder and Laue methods. Crystal Growth Techniques: melt growth technique (Bridgman and Czochralski techniques).

**UNIT II ELASTICITY OF MATTER 9**

Introduction- Elasticity - Plasticity–Hooke's law - relationship between three moduli of elasticity (qualitative) -stress –strain diagram -Poisson's ratio - factors affecting elasticity. Beam: Internal Bending moment -Cantilever: theory and experiment-Young's modulus: theory and experiment (uniform and non-uniform bending) -I-shaped girders-advantages and applications -twisting couple of a wire or cylinder - torsion pendulum - determination of moment of inertia of disc and rigidity modulus of cylindrical wire.

**UNIT III ULTRASONICS AND ITS APPLICATIONS 9**

Introduction-classification of sound- properties of infrasonics, audible and ultrasonics -production: magnetostriction and piezoelectric methods–detection of ultrasonic waves–determination of velocity of sound in liquid (Acoustic grating method). Applications: Engineering and medical field- Non-destructive testing: pulse echo system through transmission and reflection modes. Ultrasonic scanning methods- Sonogram.

**UNIT IV MODERN PHYSICS 9**

Black body radiation- Basic Laws -Planck's hypothesis and its radiation law: derivation -deduction of Wien's displacement law and Rayleigh Jean's law from Planck's law -Photons and its properties-Compton Effect –derivation –experimental verification. Photo Electric effect and its Laws -Einstein's Equation - Matter waves–de-Broglie hypothesis - de-Broglie wavelength-Schrodinger's time independent and time dependent wave equations -physical significance of the wave function. Application: particle in one dimensional box-normalization - degenerate and non-degenerate states.

**UNIT V LASER AND OPTICAL FIBER 9**

Laser: properties–population inversion-pumping methods –Einstein's coefficients-derivation. Types: He-Ne and semiconductor lasers (Homo and Hetero junction) –uses of LASER- Hologram -Construction and Reconstruction Process. Optical fiber: Structure-advantages of optical fibre-Principle and propagation of light through optical fiber–expressions for numerical aperture and acceptance angle–fabrication of optical fiber- types of optical fibers-fiber optical communication system -endoscope -Fiber optic sensors (Qualitative Study only).

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

**Learners are able to**

1. Assess the elastic behavior of the materials and bending behavior of beam.
2. Acquire knowledge of NDT and applications of ultrasonics.
3. Know the development of modern physics and its applications.
4. Recognize the uses of laser and fiber optics.
5. Distinguish the different crystal systems, structural determination and synthesis of crystals.

**TEXT BOOKS**

1. Marikani, "Engineering Physics", PHI, New Delhi, 2013.
2. S. Vadivel & A. Pannerselvam, "Engineering Physics", Jaitech Publications, 2015.

**REFERENCES**

1. Selladurai, "Engineering Physics Part-I", PHI learning private limited, New Delhi, 2010.
2. V.Rajendran, "Engineering Physics", Tata McGraw-Hill. New Delhi.2011
3. P. K. Palanisamy "Engineering Physics". Scitech Publications, 2011
4. Raymond A. Serway and John Jewett, Jr. , "Physics for Scientist and Engineer with modern Physics", Mary Finch Publication, 9<sup>th</sup> edition,2014.
5. William T. Silfvast , "Laser Fundamentals", Second Edition, Cambridge University Press, 2008.

**U20CY101**

**ENGINEERING CHEMISTRY  
(COMMON TO ALL BRANCHES)**

**L T P C  
3 0 0 3**

**Pre-requisite:** Basics of Ionisation, adsorption phenomenon kinetics, Light emission components

**COURSE OBJECTIVES**

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photo physical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two Component systems and appreciate the purpose and significance of alloys.

**UNIT I BASICS OF POLYMER 9**

Introduction: Classification of Polymers -Natural and Synthetic: Thermoplastic and Thermosetting  
Functionality -Degree of Polymerization. Types and mechanism of Polymerization:  
Addition, Condensation and Co-polymerization. Properties of Polymer - Techniques of Polymerization:  
Bulk, Emulsion, Solution and Suspension. Preparation, Properties and uses of Nylon6.6, and Epoxy resin.

**UNIT II SURFACE CHEMISTRY AND CATALYSIS 9**

Adsorption: Types of Adsorption -Adsorption of gases on solids -Adsorption of solute from solutions -  
Adsorption isotherms -Freundlich's Adsorption Isotherm -Langmuir's Adsorption Isotherm -Applications of  
Adsorption on pollution abatement. Catalysis: Catalyst -Types of Catalysis -Criteria -Auto Catalysis -  
Catalytic Poisoning and Catalytic Promoters - Acid Base Catalysis -Enzyme Catalysis - Michaelis -  
Menten equation.

**UNIT III CHEMICAL THERMODYNAMICS 9**

Terminology of Thermodynamics - Second Law: Entropy - Entropy change for an ideal gas, Reversible  
and Irreversible Processes; Entropy of Phase Transitions; Clausius inequality. Free Energy and Work  
function: Helmholtz and Gibbs free energy functions - Criteria of Spontaneity: Gibbs - Helmholtz  
equation -Clausius - Clapeyron equation: Maxwell Relations - Van't Hoff Isotherm and Isochore.

**UNIT IV PHOTO CHEMISTRY AND SPECTROSCOPY 9**

Photo Chemistry: Laws of Photo Chemistry - Grotthuss-Draper law, Stark - Einstein Law and  
Lambert - Beer Law. Quantum Efficiency - Determination - Photo Processes - Internal Conversion, Inter  
- system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization.  
Spectroscopy: Electromagnetic Spectrum- Absorption of Radiation - Electronic, Vibrational and  
Rotational transitions. UV - visible and IR Spectroscopy.

**UNIT V PHASE RULE AND ALLOYS 9**



classes - Constants - Keywords - Operators: Precedence and Associativity - Expressions - Input/ Output statements, Assignment statements - Decision making statements - Switch statement - Looping statements - Pre-processor directives - Compilation process

**UNIT II      ARRAYS AND STRINGS      9**

Introduction to Arrays: Declaration, Initialization - One dimensional array - Example Program: Computing Mean, Median and Mode - Two dimensional arrays.- String operations: length, compare, concatenate, copy - Selection sort, linear and binary search.

**UNIT III      FUNCTIONS AND POINTERS      9**

Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) - Recursion - Example Program: Scientific calculator using built-in functions, Binary Search using recursive functions - Pointers - Pointer operators - Pointer arithmetic - Arrays and pointers - Array of pointers.

**UNIT IV      STRUCTURES      9**

Structure - Nested structures - Pointer and Structures - Array of structures - Example Program using structures and pointers - Union- Example Program using unions and pointers.

**UNIT V      FILE PROCESSING      9**

Files - Types of file processing: Sequential access, Random access - Sequential access file - Example Program: Finding average of numbers stored in sequential access file - Random access file - Example Program: Transaction processing using random access files - Command line arguments.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

**Learners are able to**

1. Develop simple applications in C using basic constructs
2. Design and implement applications using arrays and strings
3. Develop and implement applications in C using functions and pointers.
4. Develop applications in C using structures.
5. Design applications using sequential and random access file processing

**TEXT BOOKS**

1. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2006.

**REFERENCES**

1. Paul Deitel and Harvey Deitel, —"C How to Program", Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, "Programming in C", CENGAGE Learning India pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.

**U20GE102**

**ENGINEERING GRAPHICS  
(COMMON TO ALL BRANCHES)**

**L T P C  
2 0 4 4**

**Pre-requisite:** Basic knowledge in practical geometry construction, imagination and mathematics.

### **COURSE OBJECTIVES**

- To Develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.

#### **UNIT I PLANE CURVES AND ORTHOGRAPHIC PROJECTION 6+12**

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimension. Basic Geometrical constructions, Curves used in engineering practices: Conics - Construction of ellipse, parabola and hyperbola by eccentricity method - Construction of cycloid - construction of involutes of square and circle - Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects - Layout of views- Freehand sketching of multiple views from pictorial views of objects.

#### **UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method (polygonal and circular surfaces) inclined to both the planes.

#### **UNIT III PROJECTION OF SOLIDS 6+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

#### **UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other - obtaining true shape of section. Development of lateral surfaces of simple solids - Prisms, pyramids cylinders and cones.

#### **UNIT V ISOMETRIC PROJECTION 6+12**

Principles of Isometric Projection - Isometric scale –Isometric projections of simple solids and truncated solids - Prisms, Pyramids, Cylinders, Cones- combination of two solid objects in simple vertical positions.

**TOTAL: 30+60 = 90 PERIODS**

### **COURSE OUTCOMES:**

#### **Learners are able to**

1. Familiarize with the fundamentals and standards of Engineering graphics.
2. Perform freehand sketching of basic geometrical constructions and multiple views of objects.
3. Project orthographic projections of lines and plane surfaces.
4. Draw projections and solids and development of surfaces.
5. Visualize and to project isometric and perspective sections of simple solids.

### **TEXT BOOKS**

1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

### **REFERENCES**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company

Limited, New Delhi, 2008.

3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

**Publication of Bureau of Indian Standards:**

1. IS 10711 - 2001: Technical products Documentation - Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) - 2001: Technical products Documentation - Lettering.
3. IS 10714 (Part 20) - 2001 & SP 46 - 2003: Lines for technical drawings.
4. IS 11669 - 1986 & SP 46 - 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) - 2001: Technical drawings - Projection Methods.

**Special points applicable to Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**U20BS101**

**PHYSICS AND CHEMISTRY LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-requisite:** Basic knowledge of Physics and chemistry laboratory apparatus.

**PHYSICS LABORATORY**

**COURSE OBJECTIVE**

- To handle different experiments to test the physics concepts applied in optics, thermal physics, electronics, sound, elasticity and etc..

**LIST OF EXPERIMENTS**

1. Find the Young's modulus by non-uniform bending method
2. Verify of band gap energy of a PN junction semiconductor using PN junction kit
3. Determination of wavelength of Laser and particle size using Laser grating method
4. Determination of rigidity modulus of given wire using Torsion pendulum method
5. Determination of thickness of a thin specimen using Air wedge method

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:**

**Young's Modulus: Non-Uniform bending**

- a. Travelling Microscope - 6 Nos.
- b. Pin -Scale Knife edge - 6 Nos.

**Band gap**

- a. PN Junction diode setup - 6 Nos.
- b. Eliminator - 6 Nos.

**Particle Size**

- a. Laser grating - 6 Nos.
- b. Circular disc with particle coated - 6 Nos.
- c. Laser Source - 6 Nos.

<b>Torsional Pendulum</b>	- 6 Nos.
a. Torsional Pendulum	- 6 Nos.
b. Thin wire	- 6 Nos.
c. Cloch	- 6 Nos.
d. Screw gauge	- 6 Nos.
<b>Air wedge</b>	
a. Air wedge	- 6 Nos.
b. Travelling Microscope	- 6 Nos.
c. Mercury vapour lamp	- 6 Nos.

**TOTAL :30 PERIODS**

**COURSE OUTCOMES:**

**Learners are able to**

1. Apply the basic theory for the corresponding experiment
2. Know the procedure to use physics equipment

**CHEMISTRY LABORATORY**

**COURSE OBJECTIVES**

- To make the student to acquire practical skills in the determination of water quality
- Parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by Viscometry.

**LIST OF EXPERIMENTS**

1. Determination of DO content of water sample by Winkler's method.
2. Determination of chloride content of water sample by argentometric method.
3. Determination of strength of given hydrochloric acid using pH meter.
4. Determination of strength of HCL using conductivity meter
5. Determination of molecular weight of polyvinyl alcohol using Ostwald visco meter.

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:**

a. Iodine flask	- 30 Nos.
b. PH meter	- 5 Nos.
c. Conductivity meter	- 5Nos.
d. Spectrophotometer	- 5 Nos.
e. Ostwald Viscometer	- 5 Nos.
f. Common Apparatus:	- 10 Nos.

Pipette, Burette, Conical Flask, Porcelain tile, Dropper

**TOTAL :30 PERIODS**

**COURSE OUTCOMES :**

**Learners are able to**

1. The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.
2. Utilize the fundamental laboratory techniques for analyses such as titrations, separation, purification and spectroscopy.

**Pre-requisite:** Basic computer knowledge to install software.

**COURSE OBJECTIVES**

- To develop programs in C using basic constructs.
- To develop applications in C using strings, pointers, functions, structures.
- To develop applications in C using file processing.

**LIST OF EXPERIMENTS**

1. Programs using I/O statements and expressions.
2. Programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Check whether a given number is Armstrong number or not?
6. Populate an array with height of persons and find how many persons are above the average height.
7. Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.
8. Given a string "a\$bcd./fg" find its reverse without changing the position of special characters.(Example input:a@gh%;j and output:j@hg%;a)
9. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
10. From a given paragraph perform the following using built-in functions:
  - a. Find the total number of words.
  - b. Capitalize the first word of each sentence.
  - c. Replace a given word with another word.
11. Solve towers of Hanoi using recursion.
12. Sort the list of numbers using pass by reference.
13. Generate salary slip of employees using structures and pointers.
14. Compute internal marks of students for five different subjects using structures and functions.
15. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.

**TOTAL: 60 PERIODS**

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:**

**HARDWARE:**

1. Standalone desktops 30 Nos.

**SOFTWARE:**

1. C / Equivalent Compiler 30 Nos.

**COURSE OUTCOMES**

1. Develop C programs for simple applications making use of basic constructs, arrays and strings.
2. Develop C programs involving functions, recursion, pointers, and structures.
3. Design applications using sequential and random access file processing.

## SEMESTER II

U20HS201

### FUNCTIONAL ENGLISH (COMMON TO ALL BRANCHES)

L	T	P	C
3	0	0	3

**Pre-requisite:** Basics skills development of Reading and Writing.

#### COURSE OBJECTIVES

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

#### UNIT I VOCABULARY AND GRAMMAR 9

Listening - Listening to talks mostly of a scientific/technical .Speaking - Asking for and giving directions- Reading - reading short technical texts from journals-newspapers- Writing- purpose statements- extended definitions- issue-writing instructions - recommendations- Language Development-subject verb agreement -compound words. Technical vocabulary.

#### UNIT II TECHNIQUES OF READING AND WRITING 9

Listening: Listening Process; Types of Listening; Intensive vs. Extensive Listening; Barriers to Listening. Speaking - describing a process-Reading - reading longer technical texts- identifying the various transitions in a text- paragraphing- Writing- interpreting charts, graphs- Language Development - vocabulary used in informal letters/emails and reports .Homonyms and Homophones-Common Errors. Numerical adjectives.

#### UNIT III GRAMMAR AND SKILL DEVELOPMENT 9

Listening- Listening to classroom lectures/ talks on engineering/technology -Speaking -introduction to technical presentations- Reading-longer texts both general and technical, practice in speed reading; Writing- checklists- Describing a process, use of sequence words-Language Development -sequence words- Misspelled words.-use of clauses. Verb forms. Direct/Indirect Speech.

#### UNIT IV INTERVIEW SKILL AND LANGUAGE DEVELOPMENT 9

Listening- Listening to documentaries and making notes. Speaking - mechanics of presentations- Reading- Reading for detailed comprehension-Writing-email etiquette -job application-cover letter- Résumé preparation ( via email and hard copy)- analytical essays and issue based essays-- Language Development -finding suitable synonyms-paraphrasing-. -if conditionals.

#### UNIT V TECHNICAL WRITING 9

Listening- TED/Ink talks; Speaking-participating in a group discussion - Reading- reading and understanding technical articles Writing- Writing reports- minutes of a meeting- accident and survey- Language Development- Comparative Adjectives

**TOTAL: 45 PERIODS**

## COURSE OUTCOMES

### Learners are able to:

1. Use academic and technical vocabulary in relevant contexts. Construct meaningful and grammatically correct sentence.
2. Effectively listen and acquire language and content, read fast and understand texts.
3. Use oral presentation skills in all professional contexts.
4. Demonstrate the understanding of the nature and importance of technical communication Draft various types of technical and business documents like, reports, proposals and business letters.
5. Compose documents like job application, book review etc.

### TEXT BOOKS

1. Board of editors. Fluency Using English” A Course book for Undergraduate Engineering Technologists”. Orient Blackswan, Hyderabad, 2015.
2. Sudharshana. N.P and Saveetha.C. “English for Technical Communication”. Cambridge University Press: New Delhi, 2016.

### REFERENCES

1. Barrass, Robert. “Scientists Must Write”. London: Routledge.2003.
2. Faculty of English. “Technical Communication”. SASTRA Publication. 2017.
3. Raman, Meenakshi & Sangeeta Sharma. “Technical Communication: Wren & Martin. High School English Grammar and Composition”. (Revised edn.) New Delhi: Chand & Co. 1995.
4. S.Sumant, “Technical English” Tata McGraw-Hill, New Delhi, 2001.
5. E.Suresh Kumar, P. Sreehari, J. Savithri “Essential English” - Orient Blackswan 2011.

<b>U20MA201</b>	<b>ADVANCED CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS (COMMON TO ALL BRANCHES)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Prerequisite:** Basic concepts of vectors and complex numbers.

### COURSE OBJECTIVES

- To familiarize the prospective engineers with techniques in ordinary differential equations, complex variables and complex integration.
- The Study of Laplace transforms help to solve the differential equations that occur in various branches of engineering disciplines.
- Vector calculus can be widely used for modeling the various laws of physics.
- The various methods of complex analysis can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

### UNIT I APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS 12

Basic concepts - Separable differential equations - Exact differential equations - Integrating factors - Linear differential equations - Second order linear differential equations with constant coefficients - Particular Integral using operator method and Method of variation of parameters - Homogenous equation of Euler's and Legendre's type-Physical Applications-Oscillations of a Spring.

### UNIT II LAPLACE TRANSFORMS 12

Existence conditions - Transforms of elementary functions –Transform of unit step function and unit impulse function - Basic properties - Shifting theorems -Transforms of derivatives and integrals - Transform of periodic functions - Inverse transforms: Convolution theorem (Statement only) and Partial Fractions - Application to solution of linear second order ordinary differential equations with constant coefficients-Unit Step Function-Unit impulse function.



U20PH201

**ENGINEERING PHYSICS - II  
(COMMON TO ALL BRANCHES)**

**L T P C  
3 0 0 3**

**Prerequisite:** Basic knowledge in material property and its uses.

**COURSE OBJECTIVES**

- To understand the basics of electric, thermal, magnetic, super conducting and dielectric properties of materials
- To aware about recent trends in physics

**UNIT I ELECTRON THEORY OF SOLIDS 9**

Introduction: types of materials- classical free electron theory: postulates- derivation of electrical conductivity and thermal conductivity- derivation. Wiedemann-Franz law and its verification-merits and demerits of classical free electron theory. Quantum free electron theory: Fermi energy level and its importance -Fermi-Dirac distribution function and its variation with temperature - density of energy states -carrier concentration in metals -average energy of electrons at 0 K.

**UNIT II FUNDAMENTALS OF SEMICONDUCTORS 9**

Introduction: properties- Types semiconductors- concept of effective mass of an electron and hole. Intrinsic semiconductor: carrier concentration in an intrinsic semiconductor-derivation -variation of Fermi energy level with temperature - Extrinsic semiconductor: carrier concentration derivation (P and N type semiconductor) - Hall effect-theory and experimental determination of Hall coefficient - Applications.

**UNIT III DIELECTRICS AND FERRO ELECTRICS 9**

Introduction: fundamental definitions in dielectrics-expressions for electronic and ionic polarization mechanisms- orientation polarization - space charge polarization - Langevin - Debye equation - frequency and temperature effects on polarization. Capacitor-energy stored in capacitor- Internal field - Clausius Mossotti relation-dielectric loss -dielectric breakdown - various breakdown mechanisms with characteristics - applications of dielectric materials - Ferro electrics -properties and applications.

**UNIT IV MAGNETISM AND SUPER CONDUCTORS 9**

Magnetic Materials: Introduction-basic definitions - origin of magnetic moment -Bohr magneton - magnetic materials: classification of dia, para, ferro magnetic materials. Ferro magnetic domains-energies involved in the growth of magnetic domains-hysteresis-explanation of hysteresis curve based on domain theory-soft and hard magnetic materials. Superconducting Materials: properties - types - BCS theory of super conductivity-Applications: cryotron and Mag-lev.

**UNIT V NANOMATERIALS 9**

Definition of nano system- Quantum confinement - 0D to 3D Quantum confined nanostructures - density of energy states from 3D to 0D- Preparation: top down and bottom up approaches- PLD - PVD - CVD - Electro deposition- Carbon nanotubes-types - SWCNT and MWCNT, Armchair, Zig-zag and Chiral structures-properties-applications

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES :**

**Learners are able to**

1. Select the metals required for specific applications in the area of engineering and technology.
2. Distinguish between different types of semiconductor and determination of Hall co-efficient.



histogram.

## **UNIT V FILES, MODULES AND PACKAGES**

**9**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES :**

#### **Learners are able to**

1. Develop algorithmic solutions to simple computational problems
2. Decompose a Python program into functions.
3. Implement database and GUI applications
4. Represent compound data using Python lists, tuples, dictionaries.
5. Read and write data from/to files in Python Programs.

### **TEXT BOOKS**

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (<http://greenteapress.com/wp/think-python/>)
3. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python ", Revised and updated for Python 3.2, Network Theory Ltd., 2011.

### **REFERENCES**

1. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

<b>U20CE201</b>	<b>FUNDAMENTALS OF CIVIL ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisites:** Basic knowledge of Civil Engineering Area.

### **COURSE OBJECTIVES**

- To provide the students an overview of the profession of Civil Engineering.
- To give the students an illustration of the use and properties of various building materials and explain the building construction aspects.
- To pursue a career in one of the many areas of Civil Engineering with deep interest and keenness

## **UNIT I INTRODUCTION TO CONSTRUCTION ENGINEERING**

**9**

General introduction- History of Civil Engineering- Classical and Modern building material including composites- Construction method- -3D Printing-Automation/Robotic Construction-LEED rating Smart cities- Software's: Auto CADD, STAAD-pro, Ms project, Primavera & BIM.

## **UNIT II INTRODUCTION TO WATER, ENVIRONMENT AND ENERGY ENGINEERING**

**9**

Hydrological cycle-Water distribution network- Water and Waste water treatment Energy systems and Transformation-Wind, Solar & Hydro energy- Foot print concept-Green energy – Software: GIS.

**UNIT III INTRODUCTION TO SURVEYING AND TRANSPORTATION ENGINEERING 9**

Fundamentals of Civil Engineering Survey-Modern surveying equipment: Total Station, GPS- Intelligent Transportation system-Urban Transport-Traffic control Software: MX.

**UNIT IV INTRODUCTION TO GEOTECHNICAL ENGINEERING 9**

Soil types and formation-Types of foundation-Tunnelling- Site investigation method Bore hole logs- Offshore structures.

**UNIT V INTRODUCTION TO DISASTER PREPAREDNESS AND MANAGEMENT 9**

Definition: Disaster, Hazard, Vulnerability, Risk-Natural and manmade disasters Disaster impacts- Principle of disaster management-Sustainable construction.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

Upon completion of the course, the students will be able to

1. Assess the utility of different Building materials and Construction methods in civil engineering applications.
2. Correlate the interconnection between water, environment and energy engineering.
3. Apply basic surveying principles and assess its relationship with advancement in Transportation system.
4. Assess the site investigation methods and bore log.
5. Comment on the risk associated with and its impact on engineering structures

**TEXT BOOKS**

1. Khanna,K., Justo CEG, Highway Engineering,KhannaPublishers,Roorkee,2014
2. Shanmugam, G., and Palanichamy, M.S., Basic Civil and Mechanical Engineering, Tata McGraw Hill Publishing Co., New Delhi,2015.

**REFERENCES**

1. Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, New Delhi 2015.
2. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), "Energy Systems and Sustainability": Power for a Sustainable Future. Oxford University Press
3. Pradeep Sahn, 2004, "Disaster Risk Reduction in South Asia", Prentice Hall.
4. Ghosh G.K., 2006, "Disaster Management", APH Publishing Corporation
5. Ristinen, Robert A. Kraushaar, Jack J "Energy and the Environment", 2nd Edition, John Wiley(2006)

**U20GE202**

**ENGINEERING MECHANICS**

L	T	P	C
3	0	0	3

**Pre-requisite:** Mathematics I and II Applied Physics

**COURSE OBJECTIVE**

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering



2. Hibbeler, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics Statics and Dynamics", 4th Edition, Pearson Education 2006.
4. Meriam J.L. and Kraige L.G., "Engineering Mechanics- Statics and Dynamics - Volume I &II, Third Edition, John Wiley & Sons,1993.
5. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

<b>U20GE203</b>	<b>ENGINEERING PRACTICES LABORATORY (COMMON TO ALL BRANCHES)</b>	<b>L T P C</b>
		<b>0 0 4 2</b>

**Prerequisite:** Basic knowledge of Civil, Mechanical, Electrical and Electronics Engineering Equipments

**COURSE OBJECTIVE**

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)**

**CIVIL ENGINEERING PRACTICES**

**Buildings:**

- a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

- a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- b) Study of pipe connections requirements for pumps and turbines.
- c) Preparation of plumbing line sketches for water supply and sewage works.
- d) Hands-on-exercise:  
Basic pipe connections - Mixed pipe material connection - Pipe connections with different joining components.
- e) Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

- a) Study of the joints in roofs, doors, windows and furniture.
- b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting

**MECHANICAL ENGINEERING PRACTICES**

**Welding:**

- a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
- b) Gas welding practice

**Basic Machining:**

- a) Simple Turning and Taper turning
- b) Drilling Practice

**Sheet Metal Work:**

- a) Forming & Bending:
- b) Model making - Trays and funnels.

c) Different type of joints.

**Machine assembly practice:**

- a) Study of centrifugal pump
- b) Study of air conditioner

**Demonstration on:**

- a) Smithy operations, upsetting, swaging, setting down and bending.  
Example –Exercise - Production of hexagonal headed bolt.
- b) Foundry operations like mould preparation for gear and step cone pulley.
- c) Fitting - Exercises - Preparation of square fitting and V - fitting models.

**GROUP B (ELECTRICAL & ELECTRONICS)**

**ELECTRICAL ENGINEERING PRACTICES**

- 1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- 2. Fluorescent lamp wiring.
- 3. Stair case wiring
- 4. Measurement of electrical quantities - voltage, current, power & power factor in RLC circuit.
- 5. Measurement of energy using single phase energy meter.
- 6. Measurement of resistance to earth of an electrical equipment.

**ELECTRONICS ENGINEERING PRACTICES**

- 1. Study of Electronic components and equipments - Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
- 2. Study of logic gates AND, OR, EX-OR and NOT.
- 3. Generation of Clock Signal.
- 4. Soldering practice - Components Devices and Circuits - Using general purpose PCB.
- 5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 60 PERIODS**

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**CIVIL**

Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.

- |  |         |
|--|---------|
| 1. Carpentry vice (fitted to work bench                        | 15 sets |
| 2. Standard woodworking tools                                  | 15 Nos. |
| 3. Models of industrial trusses, door joints, furniture joints | 15 sets |
| Power Tools:   | 5 each  |
| (a) Rotary Hammer  | 2 Nos   |
| (b) Demolition Hammer  | 2 Nos   |
| (c) Circular Saw   | 2 Nos   |
| (d) Planer   | 2 Nos   |

- (e) Hand Drilling Machine 2 Nos
- (f) Jigsaw 2 Nos

### **MECHANICAL**

- Arc welding transformer with cables and holders** 5 Nos.
- 1. Welding booth with exhaust facility 5 Nos.
- 2. Welding accessories like welding shield, chipping hammer, wire brush, etc.. 5 Sets
- 3. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
- 4. Centre lathe 2 Nos.
- 5. Hearth furnace, anvil and smithy tools 2 Sets
- 6. Moldings table, foundry tools 2 Sets.
- 7. Power Tool: Angle Grinder 2 Nos.
- 8. Study-purpose items: centrifugal pump, air-conditioner One each

### **ELECTRICAL**

- 1. Assorted electrical components for house wiring 15 Sets
- 2. Electrical measuring instruments 10 Sets
- 3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each  
1 No.
- 4. Megger (250V/500V) 2 Nos.
- 5. Power Tools: 2 Nos.
  - a) Range Finder 2 Nos.
  - b) Digital Live-wire detector 2 Nos.

### **ELECTRONICS**

- 1. Soldering guns 10 Nos.
- 2. Assorted electronic components for making circuits  
Small PCBs 50 Nos.
- 3. Multimeters 10 Nos.
- 4. Study purpose items: 10 Nos. (Telephone, FM radio, low-voltage power supply)

### **COURSE OUTCOMES:**

#### **Learners are able to**

- 1. Fabricate carpentry components and pipe connections including plumbing works.
- 2. Use welding equipments to join the structures.
- 3. Carry out the basic machining operations
- 4. Make the models using sheet metal works
- 5. Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundry and fittings
- 6. Carry out basic home electrical works and appliances
- 7. Measure the electrical quantities

8. Elaborate on the components, gates, soldering practices.

**U20GE204**

**PYTHON PROGRAMMING LABORATORY  
(COMMON TO ALL BRANCHES)**

L	T	P	C
0	0	4	2

**Pre-requisite:** Basic knowledge of install programming soft ware

**COURSE OBJECTIVES**

- To read, write and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- To implement functions for structuring Python programs.
- Represent compound data using Python lists, tuples, and dictionaries.
- To get input data from/to files in Python.

**LIST OF PROGRAMS**

1. Write python program to Compute the GCD of two numbers.
2. Write python program to Find the square root of a number (Newton's method).
3. Write python program to Exponentiation (power of a number).
4. Write python program to Find the maximum of a list of numbers.
5. Write python program to Linear search and Binary search.
6. Write python program to Selection sort, Insertion sort.
7. Write python program to Merge sort
8. Write python program to First n prime numbers.
9. Write python program to Multiply matrices.
10. Implement python programs that take command line arguments (word count).
11. Implement python program to Find the most frequent words in a text read from a file .
12. Write python program to Simulate elliptical orbits in Pygame.
13. Write python program to Simulate bouncing ball using Pygame.

**TOTAL :60 PERIODS**

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:**

**HARDWARE:**

Standalone desktops 30 Nos

**SOFTWARE:**

Python 3 interpreter for Windows/Linux

**COURSE OUTCOMES:**

**Learners are able to**

1. Compile and execute simple Python programs.
2. Implement mathematical calculation in programs
3. Develop Python programs step-wise by defining functions and calling them.
4. Use Python lists, tuples, dictionaries for representing compound data.
5. Execute simulation of pygame programs

U20CE202

**COMPUTER AIDED BUILDING DRAWING**

**L T P C**  
**0 0 4 2**

**Pre-requisite:** Basic Building drawing using computer software.

**COURSE OBJECTIVES:**

- To achieve skill sets to prepare computer aided engineering drawings
- To understand the details of construction of different building elements.
- To visualize the completed form of the building and the intricacies of construction based on the engineering drawings.

**UNIT I**

**Drawing Basics:** Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962.

**Simple Engineering Drawings With CAD Drawing Tools :** Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, Working with multiple drawings.

**UNIT II**

Drawings Related to Different Building Elements:

Following drawings are to be prepared for the data given using CAD Software

1. Principles of planning, orientation and complete joinery details (Paneled and Glazed Doors and Windows)
2. Buildings with load bearing walls
3. Buildings with sloping roof
4. R.C.C. framed structures.
5. Industrial buildings – North light roof structures
6. Building Information Modelling

**TOTAL: 60 PERIODS**

**COURSE OUTCOME**

1. The students will be able to draft the plan, elevation and sectional views of the buildings, industrial structures, and framed buildings using computer softwares.

**TEXTBOOKS:**

1. George Omura, "Mastering in AUTOCAD 2002", BPB Publications, 2002
2. Sikka V. B., "A Course in Civil Engineering Drawing", 4<sup>th</sup> Edition, S.K. Kataria and Sons, 1998.

**REFERENCES**

1. Alf Yardwood, "Introduction to Autocad 2008": 2D & 3D Design, Newnes, 2007.
2. Marimuthu V.M., Murugesan R. and Padmini S., "Civil Engineering Drawing-I", Pratheeba Publishers, 2008.
3. Shah.M.G., Kale. C.M. and Patki. S.Y., "Building Drawing with an Integrated Approach to Built Environment", Tata McGraw Hill Publishers Limited, 2004.
4. Sham tickoo, "Autocad 2008: For Engineers & Designers", Dreamtech press, 2007
5. Verma.B.P, "Civil Engineering Drawing and House Planning", Khanna Publishers, 1989.

### SEMESTER III

<b>U20MA301</b>	<b>TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Pre-requisite:** U20MA101, U20MA201

#### **COURSE OBJECTIVES**

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

#### **UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12**

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

#### **UNIT II FOURIER SERIES 12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

#### **UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12**

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

#### **UNIT IV FOURIER TRANSFORMS 12**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

#### **UNIT V Z -TRANSFORM AND DIFFERENCE EQUATIONS 12**

Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

**TOTAL: 60 PERIODS**

#### **COURSE OUTCOMES**

##### **Learners are able to**

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

#### **TEXT BOOKS**

3. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics; Volume III", S. Chand & Co Ltd., 2008.
4. Singaravelu. A, "Transforms and Partial Differential Equations", Meenakshi Agency. Rev. Ed, 2013.

#### REFERENCES

1. Goyal. Manish and Bali, N.P, "A Textbook of Engineering mathematics", 6th ed., Laxmi Publication (P) Ltd. New Delhi, 2012.
2. Grewal, B.S. "Higher Engineering Mathematics", 42nd ed., Khanna publishers, New Delhi, 2012.
3. Kreyszig, Erwin. "Advanced Engineering Mathematics", 9th ed., Wiley Publications, New Delhi, 2006.
4. Ray Wylie. C and Barrett.L.C, Advanced Engineering Mathematics, 6<sup>th</sup> Edition, Tata Mc Graw Hill Education Pvt Ltd, New Delhi, 2012.
5. Veerarajan,T. "Engineering mathematics (for III Semester)", 3rd ed., Tata Mc Graw Hill, New Delhi, 2005

**U20CE306**

**APPLIED GEOLOGY**

L	T	P	C
3	0	0	3

**Prerequisite:**

#### COURSE OBJECTIVES

- To Understand the Earth System, fundamental geomorphic and dynamic processes on the Earth
- To know about the material present i.e. minerals and rocks
- To Understand Structural deformations, impacts Earthquakes zone, effects and causes.
- To Know subsurface exploration methods and consideration for site selection for projects.

#### **UNIT I            PHYSICAL GEOLOGY**

**9**

Geology in civil engineering – branches of geology – structure of earth and its composition weathering of rocks – scale of weathering – soils – landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering. Plate tectonics – Earth quakes – Seismic zones in India.

#### **UNIT II            MINEROLOGY**

**9**

Physical properties of minerals – Quartz group, Feldspar group, Pyroxene – hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals.

#### **UNIT III            PETROLOGY**

**9**

Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

#### **UNIT IV            STRUCTURAL GEOLOGY AND GEOPHYSICAL METHODS**

**9**

Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations.

#### **UNIT V            APPLICATION OF GEOLOGICAL INVESTIGATIONS**

**9**

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings – Hydrogeological investigations and mining – Coastal protection structures. Investigation of Landslides, causes and mitigation.

**TOTAL: 45 PERIODS**

#### **COURSE OUTCOMES:**

**Learners are able to**

1. Generate global vision of Earth process and Identify the subsurface material.
2. Knows reason for phenomena like Earthquakes and zoning.



forces.

- Determine principal stresses and planes for an element in two and three dimensional state of stress.
- Draw the Shearing force and bending moment diagrams for beams subjected to all the types of loading.
- Calculate bending and shearing stresses of beam under flexure and shear.
- Ideas of torsional stresses and how to evaluate it in circular sections and its applications in spring analysis.

#### TEXT BOOKS

- Bansal R.K, "Strength of Materials", Laxmi Publications, New Delhi, 2017.
- Rajput R.K, "Strength of Materials", S.Chand and Co, New Delhi, 2014.

#### REFERENCES

- Chandramouli P.N, "Fundamentals of Strength of Materials", PHI Learning Private Limited, New Delhi, 2013.
- Junnarkar.S.B. and Shah.H.J, "Mechanics of Structures", Vol I, Charotar Publishing House, New Delhi 2016.
- Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, SMTS –I Strength of materials, Laxmi publications. New Delhi, 2015
- Singh. D.K., " Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2016
- Subramanian R, "Strength of Materials", Oxford University Press, New Delhi, 2010.

**U20CE302**

**FLUIDS MECHANICS**

L	T	P	C
3	0	0	3

**Pre-requisite:** U20GE202, U20PH101

#### COURSE OBJECTIVES

- To understand the properties of fluids, fluid statics and kinematic problems such as finding particle paths and stream lines.
- To understand the basic properties of the fluid, fluid kinematics, fluid dynamics and to analyze and appreciate the complexities involved in solving the fluid flow problems.
- to use important concepts of continuity equation, Bernoulli's equation and turbulence, boundary layer and flow through pipes
- To study Dimensional Analysis – Rayleigh's method, Buckingham's Pi-theorem

#### UNIT I DEFINITIONS AND FLUID PROPERTIES

7

Definitions – Fluid and fluid mechanics – Dimensions and units – Fluid properties – Continuum Concept of system and control volume.

#### UNIT II FLUID STATICS AND KINEMATICS

10

Pascal's Law and Hydrostatic equation – Forces on plane and curved surfaces – Buoyancy – Metacentre – Pressure measurement – Fluid Kinematics – Stream, streak and path lines – Classification of flows – Continuity equation (one, two and three dimensional forms) – Stream and potential functions – flow nets – Velocity measurement (Pitot tube, current meter, Hot wire and hot film anemometer, float technique, Laser Doppler velocimetry).

#### UNIT III FLUID DYNAMICS

10

Euler and Bernoulli's equations – Application of Bernoulli's equation – Discharge measurement – Laminar flows through pipes and between plates – Hagen Poiseuille equation – Turbulent flow – Darcy – Weisbach formula – Moody diagram – Momentum Principle.

#### UNIT IV BOUNDARY LAYER AND FLOW THROUGH PIPES

9

Definition of boundary layer – Thickness and classification – Displacement and momentum thickness – Development of laminar and turbulent flows in circular pipes – Major and minor losses of flow in pipes – Pipes in series and in parallel – Pipe network. application of Boundary layer and flow through pipes.

#### UNIT V SIMILITUDE AND MODEL STUDY

9

Dimensional Analysis – Rayleigh’s method, Buckingham’s Pi-theorem – Similitude and models studies – Scale effect and distorted models. Dimensionless parameters- application of dimensionless parameters

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

**Learners able to**

- Understands the basic principles of fluid mechanics.
- Understands the concepts of statics and dynamics of fluid flow.
- Develops skills in analyzing fluid flows through the proper use of modeling and the application of the basic fluid-flow principles.
- Apply boundary layer concepts and flow through pipes major and minor losses
- Analyze the similitude and models

**TEXT BOOKS**

1. Jain.A.K., "Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, 12<sup>th</sup> Editions, 2016.
2. Modi, P.N. & Seth, S.M “Hydraulics and fluid Mechanics”, Standard book house, New Delhi, 2015.

**REFERENCES**

1. Bansal.R.K., “Fluid Mechanics and Hydraulic Machines”, Laxmi Publications Pvt. Ltd., New Delhi, 2013.
2. Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 2013.
3. Streeter, Victor, L. and Wylie, Benjamin E., “Fluid Mechanics”, McGraw-Hill Limited,1998.
4. Subramanya.K "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.
5. White, F.M., Fluid Mechanics, 8/e in SI units, McGraw-Hill, 2017.

**U20CE303**

**ENGINEERING SURVEY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE201

**COURSE OBJECTIVES**

- To measure the land area by chaining, compass and plane table
- To have the ability to apply knowledge of mathematics and engineering.
- To understand the measurement techniques and equipment used in land surveying.
- To know about the application of tacheometric surveying.
- To relate the knowledge on Surveying to the new frontiers like Electronic Distance Measurement, Total Station, Global Positioning System, Photogrammetric surveying and Remote Sensing.

**UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING AND LEVELLING 9**

Classifications and basic principles of surveying - Equipment and accessories for ranging and chaining - Methods of ranging -Compass - Types of Compass - Bearing - Types - True Bearing - Magnetic Bearing - Levelling- Principles and theory of Levelling - Datum- Bench Marks - Temporary and Permanent Adjustments- Methods of Levelling- Booking - Reduction - Sources of errors in Levelling - Curvature and refraction.

**UNIT II THEODOLITE AND TRIGNOMETRIC LEVELLING 9**

Introduction- Classification of theodolite- Temporary and permanent adjustments –Measurements of horizontal and vertical angles- Theodolite traversing-Traversing computation-Balancing of traversing- Introduction to omitted measurements. Levelling: Heights and distances - Base of the object accessible and inaccessible.

**UNIT III TACHEOMETRIC SURVEYING AND CONTOURS 9**

Introduction-Instruments-Different systems of tachometric measurements- Tacheometer -Stadia Constants - Analytic Lens Tangential and Stadia Tacheometry surveying-Substense method: Vertical

and horizontal measurements. Contour - Contouring - Characteristics of contours - Methods of contouring- Direct method-Indirect method- Contour gradient -Uses of contour plan and map- Measurements of area and volume.

**UNIT IV CURVES AND TRIANGULATION 9**

Curves-Classifications-Elements of curves-Designation of curves-Setting out of simple curves: Linear and instrument method.

Triangulation- Classification-Basic systems-Operation-Signals and towers-Satellite station.

**UNIT V ADVANCED SURVEYING 9**

**Total Station** : Advantages - Fundamental quantities measured - Parts and accessories - working principle - On board calculations - Field procedure - Errors and Good practices in using Total Station  
**GPS Surveying** : Different segments - space, control and user segments - satellite configuration - signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - Hand Held and Geodetic receivers - data processing - Traversing and triangulation.

**Hydrographic Surveying** – Tides – MSL – Sounding methods – Three point problem – Strength of fix – Introduction about Drone surveying..

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

**Learners are able to**

1. Conduct linear and angular measurement survey with the help of chain, tape and compass.
2. Determine the horizontal and vertical distance by traversing using theodolite and measure difference in elevation and produce reduced level of the given points.
3. Describe the methods of setting out curves in the field and to determine the area and volume of structures.
4. Handle total station instrument for making the horizontal and vertical measurements
5. Conduct the global positioning system for determining geographical location of the site.

**TEXT BOOKS**

3. Kanetkar T.P, "Surveying and Levelling Vols. I and II", United Book Corporation, Pune, 2014.
4. Punmia B.C, "Surveying, Vol. I and II", Laxmi Publications, 2016.

**REFERENCES**

1. Arora K. R, "Surveying Vol. I and II", Standard Book House, 2015.
2. Basak N.N, "Surveying and Levelling", Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 2014.
3. Duggal S.K, "Surveying Vol. I and II", Tata McGraw Hill, New Delhi, 2013.
4. Kumar S., "Basics of Remote Sensing and GIS", Laxmi Publication (P) Ltd, 2015.
5. Venkatramaiah, Text book of Surveying, University press, New Delhi, 2014.

<b>U20HS202</b>	<b>ENVIRONMENTAL SCIENCE AND ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CY101

**COURSE OBJECTIVES**

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world envisions the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.



2001.

3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan ,R, "Environmental Studies-From Crisis to Cure", Oxford University Press (2005).
5. Kaushik, A & Kaushik, CP, "Environmental Science and engineering", 3rd Edition, New Age International (P) Limited, New Delhi, 2009. ( Module I)

<b>U20CE304</b>	<b>STRENGTH OF MATERIALS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-requisite:** U20CE302

### **COURSE OBJECTIVE**

- To find the Young Modulus, torsional strength, hardness and tensile strength of given specimens
- To find stiffness of open coiled and closed coiled springs.
- To study the deflection of a simply supported beam.
- To verify the torsional formula, compare the torsional stiffness of solid and Hollow shaft

### **LIST OF EXPERIMENTS**

1. Tension test on steel rod
2. Compression test on wood
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring
10. Test on cement( Fineness Consistency, Soundness, Initial and Final)

### **LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:**

<b>Sl.No</b>	<b>Description of Equipment</b>	<b>Quantity</b>
1.	UTM of minimum 400 kN capacity	1
2.	Torsion testing machine	1
3.	Izod impact testing machine	1
	Hardness testing machine	
	Rockwell	
4.	Vicker's (any 2)	1 each
	Brinell	
5.	Beam deflection test apparatus	1
6.	Extensometer	1
7.	Compressometer	1
8.	Dial gauges	Few
9.	Le Chatelier's apparatus	2
10.	Vicat's apparatus	2
11.	Mortar cube moulds	10

**TOTAL :60 PERIODS**

### **COURSE OUTCOMES:**

**Learners are able to**

3. evaluate Young Modulus, torsional strength, hardness and tensile strength of given specimens
4. Stiffness of open coiled and closed coiled springs.

5. Deflection of a simply supported beam.
6. Find torsional formula, compare the torsional stiffness of solid and Hollow shaft
7. Calculate the initial and final setting value of cement.

**REFERENCES:**

1. IS1786-2008 (Fourth Revision, Reaffirmed 2013), 'High strength deformed bars and wires for concrete reinforcement – Specification', 2008.
2. Strength of Materials Laboratory Manual, Anna University, Chennai - 600 025.

**U20CE305**

**SURVEY PRACTICAL**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-requisite:** U20CE201

**COURSE OBJECTIVES**

- Chain Surveying
- Chain Traverse
- Compass Surveying
- Compass surveying Traversing
- Plane Table Surveying – Radiation, intersection, Traverse, Resection Leveling

**LIST OF EXPERIMENTS**

1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset
2. Setting out works – Foundation marking using tapes single Room and Double Room
3. Compass Traversing – Measuring Bearings & arriving included angles
4. Fly levelling using Dumpy level & Tilting level
5. Check levelling
6. Measurements of horizontal angles by reiteration and repetition and vertical angles
7. Determination of elevation of an object using single plane method when base is Accessible/inaccessible.
8. Determination of Tacheometric Constants
9. Heights and distances by stadia Tacheometry
10. Heights and distances by Tangential Tacheometry
11. Traverse using Total station and Area of Traverse (Study)
12. Determination of distance and difference in elevation between two inaccessible points using Total station (Study)

**TOTAL: 60 PERIODS**

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:**

<b>Sl.No</b>	<b>Description of Equipment</b>	<b>Quantity</b>
1.	Total Station	3 Nos
2.	Theodolites	Atleast 1 for every 5 students
3.	Dumpy level / Filling level	Atleast 1 for every 5 students
4.	Pocket stereoscope	1
5.	Ranging rods	
6.	Levelling staff	
7.	Cross staff	1 for a set of 5 student
8.	Chains	

9.	Tapes	
10.	Arrows	
11.	Prismatic Compass	10 nos
12.	Surveyor Compass	2 nos
13.	Survey grade or Hand held GPS	3 nos.

### **COURSE OUTCOMES**

#### **Learners are able to**

1. use conventional surveying tools such as chain/tape, compass, plane table, level in the field of civil engineering applications such as structural plotting and highway profiling
2. apply the procedures involved in field work and to work as a surveying team
3. plan a survey appropriately with the skill to understand the surroundings
4. take accurate measurements, field booking, plotting and adjustment of errors can be understood
5. plot traverses / sides of building and determine the location of points present on field on a piece of paper

#### **REFERENCES:**

1. Arora K. R, "Surveying Vol. I and II", Standard Book House, 2015.
2. Duggal S.K, "Surveying Vol. I and II", Tata McGraw Hill, New Delhi, 2013.
3. Kanetkar T.P, "Surveying and Levelling Vols. I and II", United Book Corporation, Pune, 2014.
4. Punmia B.C. Surveying, Vols. I and II, Laxmi Publications, 16<sup>th</sup> Edition, 2017.

SEMESTER IV					
U20MA402	NUMERICAL METHODS	L	T	P	C
		3	1	0	4
<b>Pre-requisite:</b> U20MA301					
<b>COURSE OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>To introduce the numerical techniques of interpolation in various intervals in real life</li> <li>To introduce the basic concepts of solving algebraic and transcendental equations. To acquaint the student with understanding of numerical techniques of differentiation and situations.</li> <li>To acquaint the knowledge of various techniques and methods of solving ordinary differential</li> <li>Integration which plays an important role in engineering and technology disciplines.</li> <li>To understand the knowledge of various techniques and methods of solving various types of equations. partial differential equations.</li> </ul>					
<b>U N I T I</b>	<b>SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS</b>			<b>9</b>	
Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.					
<b>U N I T II</b>	<b>INTERPOLATION AND APPROXIMATION</b>			<b>9</b>	
Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton's forward and backward difference formulae					
<b>U N I T III</b>	<b>NUMERICAL DIFFERENTIATION AND INTEGRATION</b>			<b>9</b>	
Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.					
<b>U N I T IV</b>	<b>INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS</b>			<b>9</b>	
Single step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order equations - Multi step methods - Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.					
<b>U N I T V</b>	<b>BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS</b>			<b>9</b>	
Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.					
<b>TOTAL: 45+15 =60 PERIODS</b>					
<b>COURSE OUTCOMES</b>					
<b>Learners are able to:</b>					
<ul style="list-style-type: none"> <li>Understand the basic concepts and techniques of solving algebraic and transcendental equations.</li> <li>Appreciate the numerical techniques of interpolation and error approximations in various intervals</li> </ul>					

in real life situations.

- Apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

**TEXT BOOKS**

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

**REFERENCES**

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi
2. Gerald. C. F. and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.
3. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2nd Edition, Prentice Hall, 1992.
4. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi, 2007.
5. Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5th Edition, 2015.

<b>U20CE401</b>	<b>GEOTECHNICAL ENGINEERING-I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Prerequisite:** U20GE202

**COURSE OBJECTIVES**

- To impart knowledge the properties of soil and to determine the behaviour soil under various conditions and loads
- To explain the principles of Terzaghi's theory of primary consolidation, settlement in soils and associated properties.
- To determine the shear stress and shear strength properties in soils, Mohr diagrams, and methods of finding the shear strength parameters of soils using direct shear test, unconfined compression test and tri-axial shear tests.
- To adequate knowledge on mechanism of stress transfer in two-phase systems and stability analysis of slope.

<b>UNIT I</b>	<b>SOIL CLASSIFICATION AND COMPACTION</b>	<b>9</b>
Nature of soil – phase relationships – Soil description and classification for engineering purposes, their significance – BIS Classification system – Soil compaction – Theory, comparison of laboratory and field compaction methods – Factors influencing compaction behaviour of soils.		
<b>UNIT II</b>	<b>SOIL WATER AND WATER FLOW</b>	<b>9</b>
Soil water – static pressure in water – capillary stress – Permeability measurement in the laboratory and field – pumping in and pumping out tests – factors influencing permeability of soils – Seepage – introduction to flow net – Simple problems (sheet pile and wier).		
<b>UNIT III</b>	<b>STRESS DISTRIBUTION AND SETTLEMENT</b>	<b>9</b>
Effective stress concepts in soils – Stress distribution in soil media – Boussinesq theory – Use of Newmarks influence chart – Components of settlement — immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – computation of rate of settlement- $\square t$ and $\log t$ methods - Factors influencing settlement characteristics of soils.		

<b>UNIT IV</b>	<b>SHEAR STRENGTH</b>	<b>9</b>								
Shear strength of cohesive and cohesion less soils – Mohr – Coulomb failure theory – Measurement of shear strength, direct shear – Triaxial compression, UCC and Vane shear tests – Cyclic loading – Pore pressure parameters– Factors influences shear strength of soil.										
<b>UNIT V</b>	<b>SLOPE STABILITY</b>	<b>9</b>								
Infinite slopes and finite slopes — Friction circle method – Use of stability number –Guidelines for location of critical slope surface in cohesive and c - soil – Slope protection measures.										
<b>TOTAL: 45 PERIODS</b>										
<b>COURSE OUTCOMES:</b>										
<b>Learners are able to</b>										
<ol style="list-style-type: none"> <li>1. Classify the soil and assess the engineering properties, based on index properties.</li> <li>2. Understand the stress concepts in soils</li> <li>3. Learn and identify the settlement in soils.</li> <li>4. Analyze the shear strength of soil</li> <li>5. Learn and identify the slope stability of soil</li> </ol>										
<b>TEXT BOOKS</b>										
<ol style="list-style-type: none"> <li>3. Gopal Ranjan, A S R Rao, “Basic and Applied Soil Mechanics” New Age International Publication, 3<sup>rd</sup>Edition, 2016.</li> <li>4. Punmia, B.C., “Soil Mechanics and Foundations”, Laxmi Publications Pvt. Ltd. New Delhi, 16<sup>th</sup> Edition, 2017.</li> </ol>										
<b>REFERENCES</b>										
<ol style="list-style-type: none"> <li>6. Arora, K.R., “Soil Mechanics and Foundation Engineering”, Standard Publishers and Distributors, New Delhi, 7<sup>th</sup> Edition, 2017(Reprint).</li> <li>7. Braja M Das, “Principles of Geotechnical Engineering”, Cengage Learning India Private Limited, 8<sup>th</sup> Edition, 2014.</li> <li>8. Murthy, V.N.S., “Text book of Soil Mechanics and Foundation Engineering”, CBS Publishers Distribution Ltd., New Delhi. 2014.</li> <li>9. Palanikumar.M. “Soil Mechanics”, Prentice Hall of India Pvt. Ltd, Learning Private Limited Delhi, 2013.</li> <li>10. Venkatramaiah.C. “Geotechnical Engineering”, New Age International Pvt. Ltd., New Delhi, 2017.</li> </ol>										
<b>U20CE402</b>	<b>STRENGTH OF MATERIALS-II</b>	<table border="1"> <thead> <tr> <th>L</th> <th>T</th> <th>P</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>0</td> <td>0</td> <td>3</td> </tr> </tbody> </table>	L	T	P	C	3	0	0	3
L	T	P	C							
3	0	0	3							
<b>Prerequisite:</b> U20CE301, U20GE202										
<b>COURSE OBJECTIVES</b>										
<ul style="list-style-type: none"> <li>• To analyze the column with different end conditions.</li> <li>• To study the different methods of finding deflection of beam.</li> <li>• To analyze the stress in thick and thick cylinders.</li> <li>• To calculate the theories of failure.</li> <li>• To analyze the plane members.</li> </ul>										
<b>UNIT I</b>	<b>COMPRESSION MEMBERS</b>	<b>9</b>								
Column: Types- Modes of failure-Buckling load-Factor of safety- Euler’s theory- Different end conditions- Rankine’s-Gordon formula. Axial and eccentric loads- Direct, bending and combined bending stress- Calculation of combined bending stress: Core section- Middle third and Middle fourth rule.										
<b>UNIT II</b>	<b>DEFLECTION OF DETERMINATE BEAMS</b>	<b>9</b>								

Governing differential equation-Elastic curve for various types of beams-Slope and deflection: Macaulay's method- Moment area method- Conjugate beam method.			
<b>UNIT III</b>	<b>CYLINDERS</b>	<b>9</b>	
Thin cylinder: Circumferential and longitudinal stress- Shear stress- Volumetric strain. Thick cylinder: Lamé's equation- Hoop and radial stress distribution- Compound cylinders.			
<b>UNIT IV</b>	<b>PRINCIPAL STRESS AND THEORIES OF ELASTIC FAILURE</b>	<b>9</b>	
Two dimensional state of stress at a point-Normal and shear stresses: Analytical method. Theories of failure: Maximum principal stress theory- Maximum shear stress theory- Maximum principal strain theory- Strain energy theory- Maximum shear strain energy theory-Simple Problems.			
<b>UNIT V</b>	<b>ANALYSIS OF PLANE MEMBERS</b>	<b>9</b>	
Elements and types of a truss-Determinacy and stability- Analysis of statically determinate plane truss: Method of joints-Method of sections- Method of tension coefficient.			
<b>TOTAL: 45 PERIODS</b>			
<b>COURSE OUTCOMES :</b> <b>Learners are able to</b>			
<ol style="list-style-type: none"> <li>1. Familiarize the behavior of column under axial and eccentric loads.</li> <li>2. Establish the slope and deflection in beams by using various methods.</li> <li>3. Examine the problems related to thin and thick cylinders subjected to fluid pressure.</li> <li>4. Understand the basic concepts of principle plane and stresses, theory of elasticity.</li> <li>5. Determine the forces in plane truss members.</li> </ol>			
<b>TEXT BOOKS</b>			
<ol style="list-style-type: none"> <li>1. Rajput R.K. "Strength of Materials", S.Chand and Co, New Delhi, 2014.</li> <li>2. Bansal R.K, "Strength of Materials", Laxmi Publications, New Delhi, 2017.</li> </ol>			
<b>REFERENCES</b>			
<ol style="list-style-type: none"> <li>1. Basavarajiah and Mahadevapa, Strength of Materials, University press, Hyderabad, 2016</li> <li>2. Chandramouli P.N, "Fundamentals of Strength of Materials", PHI Learning Private Limited, New Delhi, 2013.</li> <li>3. Egor P Popov, "Engineering Mechanics of Solids", 2<sup>nd</sup> edition, PHI Learning Pvt. Ltd., New Delhi</li> <li>4. Singh. D.K., " Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2016</li> <li>5. Subramanian R, "Strength of Materials", Oxford University Press, New Delhi, 2010.</li> </ol>			
<b>U20CE403</b>	<b>HYDRAULICS AND HYDRAULIC MACHINERY</b>	<b>L</b>	<b>T</b>
		<b>3</b>	<b>0</b>
		<b>P</b>	<b>C</b>
		<b>0</b>	<b>3</b>
<b>Pre-requisite:</b> U20GE202			
<b>COURSE OBJECTIVES</b>			
<ul style="list-style-type: none"> <li>• To design open channel sections in a most economical fashion with minimum wetted perimeter and learn about critical flows</li> <li>• To study about uniform flows in open channel and longitudinal slopes in open channel</li> <li>• To develop an understanding of Characteristics of flow profiles and Hydraulic jump</li> <li>• To analyze the impact of jets and curved plates and classification of turbine.</li> <li>• To examine the classification of pumps and characteristics of pumps</li> </ul>			
<b>UNIT I</b>	<b>OPEN CHANNEL FLOW</b>	<b>9</b>	
Definition and differences between pipe flow and open channel flow - Types of Flow in channels - Properties of open channel - Velocity distribution in open channel — Determination of roughness coefficients – Manning's and Chezy's formula –Most economical sections – Wide open channel.			
<b>UNIT II</b>	<b>UNIFORM FLOW</b>	<b>9</b>	
Uniform flow – Flow measurement by notches and weirs – Specific energy– Determination of normal depth and velocity - Critical flow and its computation – Channel Transition –Non erodible channels.			

<b>UNIT III</b>	<b>VARIED FLOW</b>	<b>9</b>								
Dynamic equations of gradually varied flow – Assumptions – Characteristics of flow profiles – Draw down and back water curves – Profile determination – Graphical integration, direct step and standard step method – Flow through transitions – Hydraulic jump – Types – Energy dissipation – Surges.										
<b>UNIT IV</b>	<b>TURBINES</b>	<b>9</b>								
Impact of jets on plane and curved plates - Classification of Turbines - Reaction turbines Francis turbine, Radial flow turbines, draft tube and Cavitation- Propeller and Kaplan turbines - Impulse turbines - Performance of Turbine - Runway Speed - Similarity laws.										
<b>UNIT V</b>	<b>PUMPS</b>	<b>9</b>								
Classification of Pumps - Centrifugal pump - Work done - minimum speed to start the pump – NPSH - multistage Pumps – Characteristics curve - reciprocating pump – negative slip - flow separation conditions - air vessels -indicator diagram and its variation – savings in work done - rotary pumps, Gear pump.										
<b>TOTAL: 45 PERIODS</b>										
<b>COURSE OUTCOMES :</b>										
<b>Learners are able to</b>										
<ol style="list-style-type: none"> <li>1. Explain concepts of open channel flow, Channel transition and Identify economical Section</li> <li>2. Compute the flow measurement and specific energy</li> <li>3. Explain the rapidly varied channel-flow and dam flow profile characteristics</li> <li>4. Illustrate the performance characteristics of various types of turbines</li> <li>5. Examine the pumps for various engineering applications based on their performance Curves</li> </ol>										
<b>TEXT BOOKS</b>										
<ol style="list-style-type: none"> <li>1. Bansal R.K., “Fluid Mechanics and Hydraulic Machines”, Laxmi Publications, New Delhi, 2017.</li> <li>2. Rajput R.K., “Fluid Mechanics and Hydraulic Machines”, S. Chand Publishing Ltd, New Delhi, 2013.</li> </ol>										
<b>REFERENCES</b>										
<ol style="list-style-type: none"> <li>1. Modi P.N and Seth, “Hydraulics and Fluid Mechanics including Hydraulic Machines”, Standard Book House New Delhi. 2004.</li> <li>2. Jain.A.K., " Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2016.</li> <li>3. Rajesh Srivastava, "Flow through open channels", Oxford University Press, New Delhi, 2008.</li> <li>4. Subramanya K, “Fluid Mechanics and Hydraulic Machines-Problems and Solutions”, Tata McGraw Hill Education, New Delhi, 2010.</li> <li>5. Ven Te Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2009.</li> </ol>										
<b>U20CE404</b>	<b>TRANSPORTATION ENGINEERING-I</b>	<table border="1"> <tr> <td><b>L</b></td> <td><b>T</b></td> <td><b>P</b></td> <td><b>C</b></td> </tr> <tr> <td><b>3</b></td> <td><b>0</b></td> <td><b>0</b></td> <td><b>3</b></td> </tr> </table>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
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<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>							
<b>Pre-requisite:</b> U20CE201										
<b>COURSE OBJECTIVES</b>										
<ul style="list-style-type: none"> <li>• To know the History of road development in India and factors alignment.</li> <li>• To understand concept of Geometric design of roads and various aspects of traffic engineering.</li> <li>• To design the flexible and rigid pavements</li> <li>• To study the highway design, construction and maintenance of highways.Highway Costs, Vehicle Operation Costs, Economic analysis</li> </ul>										
<b>UNIT I</b>	<b>HIGHWAY PLANNING AND ALIGNMENT</b>	<b>9</b>								
History of road development in India – Classification of highways – Institutions for Highway planning, design and construction at different levels – factors influencing highway alignment – Road ecology - Engineering surveys for alignment, objectives, conventional and modern methods..										
<b>UNIT II</b>	<b>GEOMETRIC DESIGN OF HIGHWAYS</b>	<b>9</b>								
Typical cross sections of Urban and Rural roads — Cross sectional elements – Horizontal curves,										

super elevation, transition curves, widening of curves – Sight distances – Vertical curves, gradients, hairpin bends – Lateral and vertical clearance at underpasses – IRC standards-Road signs and safety. Urban utility services.												
<b>UNIT III</b>	<b>DESIGN OF FLEXIBLE AND RIGID PAVEMENTS</b>			<b>9</b>								
Design principles – pavement components and their role - Design practice for flexible and rigid pavements												
<b>UNIT IV</b>	<b>HIGHWAY CONSTRUCTION AND MAINTENANCE</b>			<b>9</b>								
Highway construction materials, properties, testing methods – Construction practice of flexible and concrete pavements including modern materials and methods, Highway drainage – Special Considerations for hilly roads; Evaluation and Maintenance of pavements.												
<b>UNIT V</b>	<b>HIGHWAY ECONOMICS AND FINANCE</b>			<b>9</b>								
Introduction, Highway User Benefits, Highway Costs, Vehicle Operation Costs, Economic analysis, Highway projects under Public-Private Sector Participation, Bidding process, Highway finance.												
<b>TOTAL: 45 PERIODS</b>												
<b>COURSE OUTCOMES :</b>												
<b>Learners are able to</b>												
<ol style="list-style-type: none"> <li>Understand the concepts and standards adopted in Planning, Design and construction of Highways and its related infrastructures.</li> <li>Apply the knowledge of science and engineering fundamentals in designing the geometrics for an efficient Highway network and design concepts.</li> <li>Designing various types of pavements to meet specified needs of safety, efficiency and long-time sustainability by adopting various design standards.</li> <li>Select appropriate methods for construction, evaluation and maintenance of roadways.</li> <li>Understand the bidding processes and types of highway projects and analyze the economic, financial aspects of the highway projects.</li> </ol>												
<b>TEXT BOOKS</b>												
<ol style="list-style-type: none"> <li>Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nemchand Publishers</li> <li>Subhash C Saxena, Textbook of Highway and Traffic Engineering. CBS Publishers, 2017.</li> </ol>												
<b>REFERENCES</b>												
<ol style="list-style-type: none"> <li>C.Venkatramaiah., Transportation Engineering-Highway Engineering, Universities Press` (India) Private Limited, Hyderabad,2015.</li> <li>Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements, ( Third Revision), IRC: 37-2012</li> <li>Indian Road Congress (IRC), Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, ( Third Revision), IRC: 58-2012</li> <li>Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications, 8th edition Delhi, 2013.</li> <li>Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai, 2010</li> </ol>												
<b>U20CE405</b>	<b>CONCRETE TECHNOLOGY</b>			<table border="1"> <thead> <tr> <th>L</th> <th>T</th> <th>P</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>0</td> <td>0</td> <td>3</td> </tr> </tbody> </table>	L	T	P	C	3	0	0	3
L	T	P	C									
3	0	0	3									
<b>Pre-requisite:</b> U20CE201												
<b>COURSE OBJECTIVES</b>												
<ul style="list-style-type: none"> <li>To understand the in gradients of concrete ,Hydration of cement test on cement and aggregate properties</li> <li>To study the admixtures added in concrete and behaviour.</li> <li>To study about the concrete design mix</li> <li>To study the behaviour of concrete at its fresh ,hardened state and special concrete</li> </ul>												

<b>UNIT I</b>	<b>CONSTITUENT MATERIALS</b>	<b>9</b>								
Cement - Different types - Chemical composition and Properties – Hydration of cement - Tests on cement - IS Specifications - Aggregates – Classification - Mechanical properties and tests as per BIS - Grading requirements – Water - Quality of water for use in concrete.										
<b>UNIT II</b>	<b>CHEMICAL AND MINERAL ADMIXTURES</b>	<b>9</b>								
Accelerators – Retarders - Plasticizers - Super plasticizers - Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline - Effects on concrete properties.										
<b>UNIT III</b>	<b>PROPORTIONING OF CONCRETE MIX</b>	<b>9</b>								
Principles of Mix Proportioning - Properties of concrete related to Mix Design - Physical properties of materials required for Mix Design - Design Mix and Nominal Mix - BIS Method of Mix Design - Mix Design Examples.										
<b>UNIT IV</b>	<b>FRESH AND HARDENED PROPERTIES OF CONCRETE</b>	<b>9</b>								
Workability - Tests for workability of concrete - Segregation and Bleeding - Determination of strength Properties of Hardened concrete - Compressive strength – split tensile strength – Flexural strength - Stress-strain curve for concrete - Modulus of elasticity – durability of concrete – water absorption – permeability – corrosion test – acid resistance.										
<b>UNIT V</b>	<b>SPECIAL CONCRETES</b>	<b>9</b>								
Light weight concretes - foam concrete- self compacting concrete – vacuum concrete – High strength concrete - Fibre reinforced concrete – Ferrocement - Ready mix concrete – SIFCON - Shotcrete – Polymer concrete - High performance concrete - Geopolymer Concrete.										
<b>TOTAL: 45 PERIODS</b>										
<b>COURSE OUTCOMES :</b> <b>Learners are able to</b>										
<ol style="list-style-type: none"> <li>1. The various requirements of cement, aggregates and water for making concrete</li> <li>2. The effect of admixtures on properties of concrete</li> <li>3. The concept and procedure of mix design as per IS method</li> <li>4. The properties of concrete at fresh and hardened state</li> <li>5. The importance and application of special concretes.</li> </ol>										
<b>TEXT BOOKS</b>										
<ol style="list-style-type: none"> <li>1. Santhakumar. A.R., “Concrete Technology”, Oxford University Press India, 2017.</li> <li>2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2016 .</li> </ol>										
<b>REFERENCES</b>										
<ol style="list-style-type: none"> <li>1. Bhavikatti.S.S, “Concrete Technology”, I.K.International Publishing House Pvt. Ltd., New Delhi</li> <li>2. IS10262-2009 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.</li> <li>3. Gambhir, M.L; "Concrete Technology", 3 Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi</li> <li>4. Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.</li> <li>5. Kumar P Mehta., Paulo J M Monterio., “Concrete - Microstructure, Properties and Materials”, McGraw Hill Education (India) Private Limited, New Delhi, 2016</li> </ol>										
<b>U20CE406</b>	<b>GEOTECHNICAL ENGINEERING LABORATORY</b>	<table border="1"> <tr> <td><b>L</b></td> <td><b>T</b></td> <td><b>P</b></td> <td><b>C</b></td> </tr> <tr> <td><b>0</b></td> <td><b>0</b></td> <td><b>4</b></td> <td><b>2</b></td> </tr> </table>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>							
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>							
<b>Pre-requisite:</b> U20CE401										
<b>COURSE OBJECTIVES</b>										

- To Study about the Index Properties of soil
- To determine Density Index properties of soil
- To calculate compaction characteristics of soil.
- To determine the engineering properties such as permeability, direct shear, UCC and laboratory vane shear of the soil.

### LIST OF EXPERIMENTS

<b>1.</b>	<b>DETERMINATION OF INDEX PROPERTIES</b>	<b>22</b>
a.	Special gravity of soil solids	
b.	Grain size distribution – Sieve analysis	
c.	Grain size distribution Hydrometer analysis	
d.	Liquid limit and Plastic limit tests	
e.	Shrinkage limit and Differential free swell tests	
<b>2.</b>	<b>DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS</b>	<b>8</b>
a.	Field density Test	
b.	Determination of moisture – density relationship using standard Proctor compaction test.	
<b>3.</b>	<b>DETERMINATION OF ENGINEERING PROPERTIES</b>	<b>30</b>
a.	Permeability determination (constant head and falling head methods)	
b.	Direct shear test in cohesion-less soil	
c.	Unconfined compression test in cohesive soil	
d.	Laboratory vane Shear test in cohesive soil	

**TOTAL: 60 PERIODS**

### LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:

SI.N o	Description of Equipment	Quantity
1.	Sieves	2 sets
2.	Hydrometer	2 sets
3.	Liquid and plastic limit apparatus	2 sets
4.	Shinkage limit apparatus	3 sets
5.	Proctor compaction apparatus	2 sets
6.	UTM of minimum of 20KN capacity	1
7.	Direct shear apparatus	1
8.	Thermeometer	2
9.	Field density measuring device	2
10.	Triaxial shear apparatus	1
11.	Three gang consolidation test device	1

### COURSE OUTCOMES

The students will be able to do

1. Determine index properties
2. Evaluate the Density Index properties of soil
3. Calculate the engineering properties of soil.
4. Determine the compaction value of the soil
5. Understand shear strength, compressibility and permeability by conducting appropriate tests.

### REFERENCES:

1. Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1990.
2. Saibaba Reddy, E. Ramasastry, K. "Measurement of Engineering Properties of Soils", New age International (P) Limited Publishers, New Delhi, 2002.
3. "Soil Engineering Laboratory Instruction Manual" published by Engineering College Co-operative Society, Anna University, Chennai, 1996.

<b>U20CE407</b>	<b>HYDRAULIC ENGINEERING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-requisite:** U20CE302

**COURSE OBJECTIVES**

- To study flow measurement using rotameter, venturimeter/Orifice meter
- To calculate the Major and minor losses in pipes
- To facilitate the understanding of the behaviour of Flow in Pipes, Pumps and Turbines
- To estimate the characteristics value of turbine.
- To calculate the metacentric height.

**LIST OF EXPERIMENTS**

<b>A.</b>	<b>Flow Measurement</b>
1.	Calibration of Rotameter
2.	Calibration of Venturimeter / Orificemeter
3.	Bernoulli's Experiment
<b>B.</b>	<b>Losses in Pipes</b>
4.	Determination of friction factor in pipes
5.	Determination of minor losses
<b>C.</b>	<b>Pumps</b>
6.	Characteristics of Centrifugal pumps
7.	Characteristics of Gear pump
8.	Characteristics of Submersible pump
9.	Characteristics of Reciprocating pump
<b>D.</b>	<b>Turbines</b>
10.	Characteristics of Pelton wheel turbine
11.	Characteristics of Francis turbine/Kaplan turbine
<b>E.</b>	<b>Determination of Metacentric height</b>
12.	Determination of Metacentric height of floating bodies

**TOTAL: 60 PERIODS**

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:**

<b>Sl.No</b>	<b>Description of Equipment</b>
1.	One set up of Rotometer
2.	One set up of Venturimeter/Orifice meter
3.	One Bernoulli's Experiment set up
4.	One set up of Centrifugal Pump
5.	One set up of Gear Pump
6.	One set up of Submersible pump
7.	One set up of Reciprocating Pump
8.	One set up of Pelton Wheel turbine

9.	One set up of Francis turbines/one set of kaplon turbine
10.	One set up of equipment for determination of Metacentric height of floating bodies
11.	One set up for determination of friction factor in pipes
12.	One set up for determination of minor losses.

### COURSE OUTCOMES

The students will be able to do

- study flow measurement using rotameter, venturimeter / Orifice meter
- calculate the Major and minor losses in pipes
- facilitate the understanding of the behaviour of Flow in Pipes, Pumps and Turbines
- Estimate the characteristics value of turbine.
- Calculate the metacentric height.

### REFERENCES:

1. Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1990.
2. Saibaba Reddy, E. Ramasastri, K. "Measurement of Engineering Properties of Soils", New age International (P) Limited Publishers, New Delhi, 2002.
3. "Soil Engineering Laboratory Instruction Manual" published by Engineering College Co- operative Society, Anna University, Chennai, 1996.

### SEMESTER-V

U20CE501	STRUCTURAL ANALYSIS	L	T	P	C
		3	1	0	4

**Pre-requisite:** Strength of Materials-II

### COURSE OBJECTIVES

- To understand the concept of analysis of indeterminate structures by various classical methods
- To calculate the beam deflection by slope deflection and moment distribution method.
- To analysis the different types of arches.
- To design the member using plastic analysis.

<b>UNIT I</b>	<b>VIRTUAL WORK AND STRAIN ENERGY</b>	<b>12</b>
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Support reactions - Internal forces in beams - Axial forces in trusses - Internal forces in frames  
application of method of virtual work (unit load method) and strain energy method for determination of deflections of statically determinate beams -pin-jointed trusses and rigid frames -temperature effects - Lack of fit.

<b>UNIT II</b>	<b>SLOPE DEFLECTION METHOD</b>	<b>12</b>
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Application of slope deflection method - Analysis of continuous beams with and without settlement - Rigid jointed plane frame with and without sway

<b>UNIT III</b>	<b>MOMENT DISTRIBUTION METHOD</b>	<b>12</b>
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Application of moment distribution methods - Analysis of continuous beams with and without settlement – Rigid jointed plane frames with and without sway.

<b>UNIT IV</b>	<b>ARCHES</b>	<b>12</b>
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Types of Arches - Analysis of three hinged and two hinged arches – Parabolic and circular arches – Three and two hinged arches for calculating horizontal thrust, radial shear and BM at any section

<b>UNIT V</b>	<b>PLASTIC ANALYSIS</b>	<b>12</b>
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Plastic theory - Statically indeterminate structures – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – collapse load - Static and kinematic methods – Upper and lower bound theorems - Plastic analysis of indeterminate beams and frames.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES :**

<b>Learners are able to</b>
<ol style="list-style-type: none"> <li>Analyze the determinate structure by using virtual work method and strain energy method</li> <li>Analyze the continuous beams and rigid frames (indeterminate structures) by slope deflection method</li> <li>Analyze the continuous beams and rigid frames (indeterminate structures) by moment distribution method</li> <li>Analyze the different types of arches.</li> <li>Calculate plastic analysis with different members.</li> </ol>

<b>TEXT BOOKS</b>
<ol style="list-style-type: none"> <li>BhavaiKatti, S.S, “Structural Analysis –Vol. 1 &amp; Vol. 2”, Vikas Publishing Pvt Ltd.,</li> <li>Vaidyanadhan, R and Perumal, P, –“Structural Analysis Vol 1&amp;Vol 2 Laxmi Publications Pvt. Ltd, New Delhi, 2015.</li> </ol>

<b>REFERENCES</b>
<ol style="list-style-type: none"> <li>Bhavikatti, S.S, Matrix Method of Structural Analysis, I. K. International Publishing House Pvt.Ltd.,New Delhi-4, 2014.</li> <li>Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, ” Theory of structures”, Laxmi Publications Pvt. Ltd., New Delhi, 2016</li> <li>Reddy. C.S., “Basic Structural Analysis”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013.</li> <li>Thandavamoorthy T.S, “Structural Analysis”, Oxford University Press, New Delhi. 2011.</li> <li>Vazrani.V.N and Ratwani, M.M, Analysis of Structures, Vol.II, Khanna Publishers, 2015.</li> </ol>

<b>U20CE502</b>	<b>PUBLIC WATER SUPPLY SYSTEM &amp; TREATMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE201

<b>COURSE OBJECTIVES</b>
<ul style="list-style-type: none"> <li>To make the understudies familiar with sources and its interest of water.</li> <li>To Study the basic characteristics of water and its determination.</li> <li>To design various water treatment units</li> <li>Principles and design of water treatment and distribution will be covere and also water distribution design..</li> </ul>

<b>UNIT I</b>	<b>SOURCES OF WATER</b>	<b>8</b>
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Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir -Well hydraulics – Development and selection of source – Source Water quality – Characterization – Drinking Water quality standards. .

<b>UNIT II</b>	<b>CONVEYANCE FROM THE SOURCE</b>	<b>7</b>
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Water supply – intake structures – Functions and drawings; Pipes and conduits for water – Pipe materials – Hydraulics of flow in pipes – Transmission main design- Laying, jointing and testing of pipes –appurtenances- Drawings;– Types and capacity of pumps – Selection of pumps and pipe materials.

<b>UNIT III</b>	<b>WATER TREATMENT</b>	<b>12</b>
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Objectives – Unit operations and processes – Principles, functions design and drawing of flash mixers, flocculators, sedimentation tanks and sand filters; Disinfection –THM; Iron and Manganese removal, Defluoridation - Residue Management – Corrosion Control; Construction, Operation and Maintenance aspects-Layout and Hydraulic Profile of water treatment plants.

<b>UNIT IV</b>	<b>ADVANCED WATER TREATMENT</b>	<b>9</b>
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Water softening - Desalination -demineralization – Adsorption -Membrane Systems Construction and operation & Maintenance aspects – Recent advances.

<b>UNIT V</b>	<b>WATER DISTRIBUTION AND SUPPLY TO BUILDINGS</b>	<b>9</b>
Requirements of water distribution -Components -Service reservoirs -Functions and drawings Network design -Economics -Computer applications -Analysis of distribution networks Appurtenances -operation and maintenance -Leak detection, Methods. Principles of design of water supply in buildings -House service connection -Fixtures and fittings -Systems of plumbing and drawings of types of plumbing.		

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES :**

**Learners are able to**

1. An insight into the structure of drinking water supply systems, including water transport, treatment and distribution
2. The knowledge in various unit operations and processes in water treatment
3. An ability to design the various functional units in water treatment
4. An understanding of water quality criteria and standards, and their relation to public health.
5. The ability to design and evaluate water supply project alternatives on basis of chosen criteria.

**TEXT BOOKS**

1. Garg, S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 2010.
2. Punmia, B.C.,Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi, 2014.

**REFERENCES**

1. Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering" - Tata McGraw Hill, New York, Indian Edition, 2013
2. Karia G.L., and Christian R.A, "Wastewater Treatment Concepts and Design Approach", Prentice Hall of India Pvt. Ltd., New Delhi. 3<sup>rd</sup>, Edition, 2017
3. Modi, P.N., Water Supply Engineering, Vol.I Standard Book House, New Delhi, 2010.
4. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
5. Syed R. Qasim and Edward M. Motley Guang Zhu, Water Works Engineering Planning, Design and Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.

<b>U20CE503</b>	<b>DESIGN OF RC ELEMENTS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE201

**COURSE OBJECTIVES**

- To Understand the stress strain behaviour of steel and concrete
- To study the concept of working stress and limit state methods.
- To design the Limit state Method for Bond, anchorage shear and torsion
- To introduce the different types of attitudes related to design of basic structural elements such as slab, beam, column and footing which form part of any structural system with reference to Indian standard code of practice.

<b>UNIT I</b>	<b>METHODS OF DESIGN OF CONCRETE STRUCTURES</b>	<b>9</b>
Concept of Elastic method, ultimate load method and limit state method – Advantages of Limit State Method over other methods – Design codes and specification – Limit State philosophy as detailed in IS code – Design of beams and slabs by working stress method.		
<b>UNIT II</b>	<b>LIMIT STATE DESIGN FOR FLEXURE</b>	<b>8</b>
Analysis and design of singly and doubly reinforced rectangular and flanged beams - Analysis and design of one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions..		
<b>UNIT III</b>	<b>LIMIT STATE DESIGN FOR BOND, ANCHORAGE SHEAR &amp; TORSION</b>	<b>10</b>

Behaviour of RC members in bond and Anchorage - Design requirements as per current code Behaviour Of RC beams in shear and torsion - Design of RC members for combined bending shear and torsion.												
<b>UNIT IV</b>	<b>LIMIT STATE DESIGN OF COLUMNS</b>			<b>8</b>								
Types of columns – Braced and unbraced columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending.												
<b>UNIT V</b>	<b>LIMIT STATE DESIGN OF FOOTING</b>			<b>10</b>								
Design of wall footing – Design of axially and eccentrically loaded rectangular pad and sloped footings – Design of combined rectangular footing for two columns only.												
<b>TOTAL: 45 PERIODS</b>												
<b>COURSE OUTCOMES :</b> <b>Learners are able to</b>												
<ul style="list-style-type: none"> <li>To understand conceptually the difference between Working stress method, Ultimate load theory method &amp; Limit state Design method.</li> <li>To design the structural elements like RCC beam, slab, column, and footings by limit state Design method as per I.S.456-2000.</li> <li>To design two way slab &amp; one way continuous slabs</li> <li>To design columns &amp; footings for eccentric loads.</li> <li>The student shall be in a position to design the basic elements of reinforced concrete structures.</li> </ul>												
<b>TEXT BOOKS</b>												
<ol style="list-style-type: none"> <li>Krishna Raju.N, "Design of Reinforced Concrete Structures", CBS Publishers &amp; Distributors, New Delhi 2010.</li> <li>Varghese P.C, "Limit State Design of Reinforced Concrete", Prentice Hall of India Pvt. Ltd, New Delhi 2010.</li> </ol>												
<b>REFERENCES</b>												
<ol style="list-style-type: none"> <li>Ashok Kumar Jain, "Reinforced Concrete Limit State Design", Nem Chand Brothers, 2015.</li> <li>Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.</li> <li>IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000.</li> <li>Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete", Laxmi Publication Pvt. Ltd., New Delhi, 2007.</li> <li>Unnikrishna Pillai S, Devdas Menon, "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd, New Delhi 2016.</li> </ol>												
<b>U20CE50</b> <b>4</b>	<b>TRANSPORTATION ENGINEERING-II</b>			<table border="1"> <thead> <tr> <th>L</th> <th>T</th> <th>P</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>0</td> <td>0</td> <td>3</td> </tr> </tbody> </table>	L	T	P	C	3	0	0	3
L	T	P	C									
3	0	0	3									
<b>Pre-requisite:</b> U20CE404												
<b>COURSE OBJECTIVES</b>												
<ul style="list-style-type: none"> <li>To learn about the railway engineering</li> <li>To study the railway construction and maintenance.</li> <li>To understand the airport planning</li> <li>To design the airport and harbour.</li> </ul>												
<b>UNIT I</b>	<b>RAILWAY PLANNING</b>			<b>10</b>								
Significance of Road, Rail, Air and Water transports - Coordination of all modes to achieve sustainability - Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and												

modern methods- - Soil suitability analysis - Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings.		
<b>UNIT II</b>	<b>RAILWAY CONSTRUCTION AND MAINTENANCE</b>	<b>9</b>
Earthwork – Stabilization of track on poor soil -- Tunneling Methods, drainage and ventilation – calculation of Materials required for track laying - Construction and maintenance of tracks – Modern methods of construction & maintenance - Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.		
<b>UNIT III</b>	<b>AIRPORT PLANNING</b>	<b>8</b>
Air transport characteristics-airport classification-airport planning: objectives, components, layout characteristics, socio-economic characteristics of the Catchment area, criteria for airport site selection and ICAO stipulations, Typical airport layouts, Case studies, Parking and circulation area.		
<b>UNIT IV</b>	<b>AIRPORT DESIGN</b>	<b>8</b>
Runway Design: Orientation, Wind Rose Diagram - Runway length - Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles – Elements of Taxiway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings and lighting.		
<b>UNIT V</b>	<b>HARBOUR ENGINEERING</b>	<b>10</b>
Definition of Basic Terms: Harbor, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage – Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works – Environmental concern of Port Operations – Coastal Regulation Zone, 2011.		
<b>TOTAL: 45 PERIODS</b>		
<b>COURSE OUTCOMES :</b>		
<b>Learners are able to</b>		
<ul style="list-style-type: none"> <li>• Understand the methods of route alignment and design elements in Railway Planning and constructions.</li> <li>• Understand the Construction techniques and Maintenance of Track laying and Railway stations.</li> <li>• Gain an insight on the planning and site selection of Airport Planning and design.</li> <li>• Analyze and design the elements for orientation of runways and passenger facility systems.</li> <li>• Understand the various features in Harbours and Ports, their construction, coastal protection works and coastal Regulations to be adopted.</li> </ul>		
<b>TEXT BOOKS</b>		
<ol style="list-style-type: none"> <li>1. Saxena Subhash C, and Sat yopal Arora, “A Course in Railway Engineering”, Dhanpat Rai and Sons, Delhi, 2003</li> <li>2. Khanna S K, Arora M G, and Jain S S, “Airport Planning and Design”, Nemchand and Brothers, Roorkee, 2012.</li> <li>3. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi, 2013</li> </ol>		
<b>REFERENCES</b>		
<ol style="list-style-type: none"> <li>1. Rangwala, "Railway Engineering", Charotar Publishing House, 2013.</li> <li>2. Rangwala, "Airport Engineering", Charotar Publishing House, 2013.</li> <li>3. Rangwala, "Harbor Engineering", Charotar Publishing House, 2013.</li> <li>4. Satish Chandra and Agarwal M.M, "Railway Engineering", 2 Editions, Oxford University Press, New Delhi, 2013.</li> <li>5. Venkatramaiah. C., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels.,Universities Press (India) Private Limited, Hyderabad, 2015.</li> </ol>		

**Pre-requisite:** U20CE401

### **COURSE OBJECTIVES**

- To impart knowledge on common method of sub soil investigation and design of foundation.
- To Analyze shallow and deep foundations
- To Design types of footing such as raft
- To Design the pile foundation
- To Determine the earth pressures on foundations and retaining structures

#### **UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9**

Scope and objectives-Methods of exploration-Depth of boring-Spacing of bore hole-Sampling techniques-Representative and undisturbed sampling-methods - Split spoon sampler, Thin wall sampler, Stationery piston sampler-Penetration tests (SPT and SCPT) - Bore log report- Selection of foundation based on soil condition.

#### **UNIT II SHALLOW FOUNDATION 9**

Introduction-Location and depth of foundation-Codal provisions-Bearing capacity of shallow foundation on homogeneous deposits Terzaghi's formula and BIS formula- Bearing capacity from in-situ tests (SPT, SCPT and plate load) - Settlement -Total and differential settlement-Allowable settlements- Methods of minimizing settlements.

#### **UNIT III FOOTINGS AND RAFTS 9**

Types of foundation- General design principles-proportioning of foundations-spread footings-combined footings-trapezoidal and strap footings-Raft foundation-contact pressure distribution.

#### **UNIT IV PILE FOUNDATION 9**

Types of piles and their function –Load carrying capacity of piles -static formula-dynamic formulae (Engineering news and Hileys)- Load carrying capacity from insitu tests (SPT and SCPT)-Negative skin friction- Group capacity by different methods (Feld's rule, Converse-Labarre formula)-Settlement of pile and pile groups- pile load test (routine test only)-Under reamed piles.

#### **UNIT V RETAINING WALLS 9**

Plastic equilibrium in soils-Active and passive states-Rankine's theory- Coulomb's wedge theory-Condition for critical failure plane Earth pressure on retaining walls of simple configurations-Rebhann's and Culmann's graphical method-Pressure on the wall due to line load-Stability analysis of retaining walls.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES :**

#### **Learners are able to**

- Conduct sub surface investigation and select foundation based on soil condition.
- Estimate the bearing capacity of soil based on shear and settlement criteria.
- Analyze the proportion of various shallow foundations.
- Calculate the load carrying capacity of piles.
- Determine the earth pressure of retaining wall.

### **TEXT BOOKS**

1. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2014.
2. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16<sup>th</sup> Edition 2017.

### **REFERENCES**

1. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7<sup>th</sup> Edition, 2017 (Reprint).

2. Braja m.das, principles of foundation Engineering, Thomson Asia pvt. Ltd, Singapore, 2016.
3. Das, B.M. "Principles of Foundation Engineering" 5 edition, Thompson Asia Pvt. Ltd., Singapore, 2003.
4. Shenbaga R kaniraj, Design aids in Soil mechanics and Foundation, Tata McGraw –Hill Education-2011.
5. Venkatramaiah, C, "Geotechnical Engineering", New Age International Publishers, New Delhi, 2017.

<b>U20HS501</b>	<b>PROFESSIONAL COMMUNICATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Pre-requisite:** U20HS101

**COURSE OBJECTIVES**

**The course aims**

- To Enhance the Employability and Career Skills of students
- To Orient the students towards grooming as a professional
- To Make them Employable Graduates
- To Develop their confidence and help them attend interviews successfully.
- To Strengthen their prospects of success in competitive examinations

<b>UNIT I</b>		<b>06</b>
	Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs	
<b>UNIT II</b>		<b>06</b>
	Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations	
<b>UNIT III</b>		<b>06</b>
	Introduction to Group Discussion— Participating in group discussions – understanding group dynamics- brainstorming the topic -- questioning and clarifying –GD strategies- activities to improve GD skills	
<b>UNIT IV</b>		<b>06</b>
	Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews	
<b>UNIT V</b>		<b>06</b>
	International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Verbal Ability.	

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES :**

**Learners are able to**

1. Make effective presentations
2. Participate confidently in Group Discussions.
3. Attend job interviews and be successful in them.
4. Develop adequate Soft Skills required for the workplace
5. Learn IELTS and TOEFL

**Recommended Software**

1. Globearena
2. Win English

**REFERENCES**

1. Peter, Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw Hill. 2012. Print.
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan:

Hyderabad, 2015

3. Robert M Sherfield and et al. “**Developing Soft Skills**” 4th edition, New Delhi: Pearson Education, 2009..
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. Roberts, Rachael, Joanne Gakonga, and Andrew Preshous (2004) IELTS Foundation: Study Skills. Oxford: Macmillan Education.

<b>U20CE506</b>	<b>Survey Camp</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>(During V semester Summer Vacation 2 weeks)</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>

**Pre-requisite:** U20CE303

### **COURSE OBJECTIVES**

- To enable the students to get practical training in the field work.
- Groups of not more than six members in a group will carry out each exercise in survey camp.
- The camp must involve work on a large area of not less than 40 acres outside the campus (Survey camp should not be conducted inside the campus).

Two weeks Survey Camp will be conducted during summer vacation in the following activities:

1. Traverse - using Total station

2. Contouring

(i). Radial tachometric contouring - Radial Line at Every 45 Degree and Length not less than 60 Meter on each Radial Line 65

(ii). Block Level/ By squares of size at least 100 Meter x 100 Meter at least 20 Meter interval

(III). L.S & C.S - Road and canal alignment for a Length of not less than 1 Kilo Meter atleast L.S at Every 30M and C.S at every 90 M

3. Offset of Buildings and Plotting the Location

4. Sun observation to determine azimuth (guidelines to be given to the students)

5. Use of GPS to determine latitude and longitude and locate the survey camp location

6. Traversing using GPS

7. Curve setting by deflection angle

Apart from above students may be given survey exercises in other area also based on site condition to give good exposure on survey.

### **COURSE OUTCOMES :**

#### **Learners are able to**

At the end of the camp,

- Each student shall have mapped and contoured the area.
- The camp record shall include all original field observations, calculations and plots Be acquainted with the design concepts of the components of industrial structures.

<b>U20CE507</b>	<b>CONCRETE AND HIGHWAY ENGINEERING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-requisite:** U20CE404

### **COURSE OBJECTIVES**

- To learn about test on fresh concrete
- To Learn about Hardened concrete.
- To understand the test on aggregate.
- To study the test on Bitumen

### **LIST OF EXPERIMENTS**

- 1. TESTS ON FRESH CONCRETE**
  - a. Slump cone test
  - b. Flow table
  - c. Compaction factor
  - d. Vee bee test.
- 2. TESTS ON HARDENED CONCRETE**
  - a. Compressive strength - Cube & Cylinder
  - b. Flexure test
  - c. Modulus of Elasticity
- 3. TESTS ON AGGREGATES**
  - a. Specific Gravity
  - b. Gradation of Aggregate
  - c. Crushing Strength
  - d. Abrasion Value
  - e. Impact Value
  - f. Water Absorption
  - g. Flakiness and Elongation Indices
- 4. TESTS ON BITUMEN**
  - a. Penetration
  - b. Softening Point
  - c. Ductility
  - d. Flash and fire points.
  - e. Viscosity
- 5. TESTS ON BITUMINOUS MIXES**
  - a. Determination of Binder Content
  - b. Marshall Stability and Flow values
  - c. Density

**TOTAL: 60 PERIODS**

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:**

<b>Sl.No</b>	<b>Description of Equipment</b>	<b>Quantity</b>
1.	Concrete cube moulds	6
2.	Concrete cylinder moulds	3
3.	Concrete Prism moulds	3
4.	Sieves	1 set
5.	Concrete Mixer	1
6.	Slump cone	3
7.	Flow table	1
8.	Vibrator	1
9.	Trovels and planers	1 set
10.	UTM – 400 kN capacity	1
11.	Vee Bee Consistometer	1
12.	Aggregate impact testing machine	1
13.	CBR Apparatus	1
14.	Blains Apparatus	1
15.	Los - Angeles abrasion testing machine	1
16.	Marshall Stability Apparatus	1

**COURSE OUTCOMES**

**Students will be able to do**

- learn about test on fresh concrete
- Learn about Hardened concrete.
- understand the test on aggregate.
- study the test on Bitumen
- Student knows the techniques to characterize various pavement materials through relevant tests.

**REFERENCES:**

1. Highway Materials and Pavement Testing, Nem Chand and Bros., Roorkee, Revised Fifth Edition, 2009
2. Methods for testing tar and bituminous materials, IS 1201–1978 to IS 1220– 1978, Bureau of Indian Standards
3. Methods of test for aggregates, IS 2386 – 1978, Bureau of Indian Standards
4. Mix Design Methods Asphalt Institute Manual Series No. 2, Sixth Edition, 1997, Lexington, KY, USA.

**SEMESTER VI****U20CE601****MUNICIPAL WASTE WATER ENGINEERING**

L	T	P	C
3	1	0	4

**Pre-requisite:** U20CE502**COURSE OBJECTIVES**

- To study the characteristics and composition of sewage.
- To understand the primary and secondary treatment of sewage
- To study the standard disposal of sewage.
- To Design the sludge treatment and disposal
- To apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants.

**UNIT I PLANNING AND DESIGN OF SEWERAGE SYSTEM 9**

Characteristics and composition of sewage - population equivalent -Sanitary sewage flow estimation – Sewer materials – Hydraulics of flow in sanitary sewers – Sewer design – Storm drainage-Storm runoff estimation – sewer appurtenances – corrosion in sewers – prevention and control – sewage pumping-drainage in buildings-plumbing systems for drainage - Rain Watering.

**UNIT II PRIMARY TREATMENT OF SEWAGE 9**

Objectives – Unit Operations and Processes – Selection of treatment processes -- Onsite sanitation - Septic tank- Grey water harvesting – Primary treatment – Principles, functions and design of sewage treatment units - screens - grit chamber-primary sedimentation tanks – Construction, Operation and Maintenance aspects.

**UNIT III SECONDARY TREATMENT OF SEWAGE 9**

Objectives – Selection of Treatment Methods – Principles, Functions, - Activated Sludge Process and Extended aeration systems -Trickling filters– Sequencing Batch Reactor(SBR) – Membrane Bioreactor - UASB – Waste Stabilization Ponds – - Other treatment methods -Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment – Construction, Operation and Maintenance aspects.

**UNIT IV DISPOSAL OF SEWAGE 9**

Standards for– Disposal - Methods – dilution – Mass balance principle - Self-purification of river- Oxygen sag curve – deoxygenation and reaeration - Streeter–Phelps model - Land disposal – Sewage farming – sodium hazards - Soil dispersion system.

**UNIT V SLUDGE TREATMENT AND DISPOSAL 9**

Objectives - Sludge characterization – Thickening - Design of gravity thickener- Sludge digestion – Standard rate and High rate digester design- Biogas recovery – Sludge Conditioning and Dewatering – Sludge drying beds- ultimate residue disposal – recent advances.

**TOTAL: 45 PERIODS**

**Design and Drawing Exercises for practical component  
Environmental Engineering**

**PART A- Water Supply Engineering**

1. Slow Sand filters
2. Rapid Sand filters
3. Service reservoirs
4. Flocculator

**PART B- Waste Water Engineering**

1. Septic tanks with Soak pit
2. Aeration tank
3. Trickling filter

**TOTAL: 15 PERIODS**

**COURSE OUTCOMES :**

**Learners are able to**

- An ability to estimate sewage generation and design sewer system including sewage pumping stations
- The required understanding on the characteristics and composition of sewage, self-purification Of streams
- An ability to perform basic design of the unit operations and processes that are used in sewage treatment
- Understand the standard methods for disposal of sewage.
- Gain knowledge on sludge treatment and disposal

**TEXT BOOKS**

1. Duggal K.N., "Elements of Environmental Engineering" S.Chand and Co. Ltd., New Delhi, 2014.
2. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers, New Delhi, 2015.

**REFERENCES**

1. Gray N.F, "Water Technology", Elsevier India Pvt. Ltd., New Delhi, 2006.
2. Manual on Sewerage and Sewage Treatment Systems Part A,B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
3. Metcalf and Eddy- Wastewater Engineering–Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi, 2010.
4. Punmia, B.C., Jain, A.K., and Jain.A.K., Environmental Engineering, Vol.II, Laxmi Publications, 2010.
5. Syed R. Qasim "Wastewater Treatment Plants", CRC Press, Washington D.C.,2010

<b>U20CE602</b>	<b>DESIGN OF REINFORCED CONCRETE &amp; BRICK MASONRY STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite: U20CE503**

**COURSE OBJECTIVES**

- To understand the design concept of various structures and detailing of reinforcements
- To design the water tank underground as well above the ground level, Stair case, flat slab foundation and box culvert
- To analyse the yield line theory and collapse load.
- To design the brick masonry wall or coloum with point load and eccentric load.

**UNIT I                      RETAINING WALLS**

Design of Cantilever and Counterfort Retaining walls.

**UNIT II WATER TANKS 9**

Design of rectangular and circular water tanks both below and above ground level - Design of circular slab.

**UNIT III SELECTED TOPICS 9**

Design of staircases (Ordinary and dog logged) – Design of flat slabs – Principles of design of mat foundation, box culvert and road bridges.

**UNIT IV YIELD LINE THEORY 9**

Assumptions - Characteristics of yield line - Determination of collapse load / plastic moment Application Of virtual work method - square, rectangular, circular and triangular slabs – Design problems

**UNIT V BRICK MASONRY 9**

Introduction, Classification of walls, Lateral supports and stability, effective height of wall and columns, effective length of walls, design loads, load dispersion, permissible stresses, design of axially and eccentrically loaded brick walls

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES :**

**Learners are able to**

- Deign the retaining walls with details of structural drawing
- Apply the concepts of liquid retaining structures
- Design the staircase, flat slab, mat foundation and box culvert
- Analyze square, rectangular and triangular slabs using yield line theory.
- Design the brick masonry structure like columns and wall

**TEXT BOOKS**

1. Krishna Raju N, “Design of Reinforced Concrete Structures”, CBS Publishers & Distributors, New Delhi 2010.
2. Unnikrishna Pillai S, Devdas Menon, “Reinforced Concrete Design”, Tata McGraw-Hill Publishing Company Ltd, New Delhi 2016.

**REFERENCES**

1. Ashok Kumar Jain, “Reinforced Concrete Limit State Design”, Nem Chand Brothers, 2015.
2. Gambhir M.L, “Fundamentals of Reinforced Concrete Design”, Prentice Hall of India Pvt. Ltd, New Delhi 2012.
3. Sinha S.N, “Reinforced Concrete Design”, Tata McGraw-Hill Publishing Company Ltd, New Delhi 2014.
4. Subramanian. N., "Design of Reinforced Concrete Structures", Oxford University, New Delhi, 2013.
5. Varghese P.C, “Limit State Design of Reinforced Concrete”, Prentice Hall of India Pvt. Ltd, New Delhi 2010.

<b>U20CE603</b>	<b>DESIGN OF STEEL STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE301, U20CE402

**COURSE OBJECTIVES**

- Gain Knowledge on the of limit state design of steel structures and the design of connections.
- Be familiar with the design concepts of steel structural members subjected to tension.
- Understand the design concepts of the structural steel members subjected to compression.
- Be familiar with the design concepts of structural members subjected to bending .

- Be acquainted with the design concepts of the components of industrial structures.

<b>UNIT I</b>	<b>SECTIONS AND JOINTS</b>	<b>9</b>
Types of steel structures – Properties of rolled steel sections and Light gauge steel sections – Allowable Stresses as per IS code - Riveted and bolted connections – Failures of joints – Single and multiple riveted lap and butt joints under axial and eccentric loading – Strength of fillet and butt welded joints – Design of riveted and welded joints.		
<b>UNIT II</b>	<b>TENSION MEMBERS</b>	<b>9</b>
Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag.		
<b>UNIT III</b>	<b>COMPRESSION MEMBERS</b>	<b>9</b>
Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of laced and battened type columns – Design of column bases – Gusseted base.		
<b>UNIT IV</b>	<b>BEAMS</b>	<b>9</b>
Design of laterally supported and unsupported beams – Built up beams – Beams subjected to uniaxial and biaxial bending – Design of plate girders - Intermediate and bearing stiffeners – Flange and web splices.		
<b>UNIT V</b>	<b>ROOF TRUSSES AND INDUSTRIAL STRUCTURES</b>	<b>9</b>
Roof trusses – Roof and side coverings – Design of purlin and elements of truss; end bearing – Design of gantry girder.		

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES :**

**Learners are able to**

- Apply the IS code practice for the design of steel structural elements, analyses and design tension members.
- Design tension members and tension splice.
- Design compression members and base plates.
- Design various types of flexural members.
- Design various members of roof truss.

**TEXT BOOKS**

1. Bhavikatti S.S, “Design of Steel Structures”, I.K. International Publishing House Pvt. Ltd, New Delhi, 2010
2. Duggal S.K, “Design of Steel Structures”, Tata McGraw-Hill Education, 2009.

**REFERENCES**

1. Gambhir M.L, “Fundamentals of Structural Steel Design”, McGraw Hill Education India Pvt. Ltd, 2013
2. Jayagopal L.S, and Tensing, “Design of Steel Structures” Vikas Publishing House Pvt. Ltd, India, 2016.
3. Negi L.S, “Design of Steel Structures”, Tata McGraw Hill Publishing Pvt Ltd, New Delhi, 2007.
4. Shiyekar M.R, “Limit State Design in Structural Steel”, Prentice Hall of India Pvt. Ltd, 2013.
5. Subramanian N, “Design of Steel Structures”, Oxford University Press, New Delhi 2008.

<b>U20CE604</b>	<b>COMPUTER AIDED DESIGN AND DRAFTING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-requisite:** U20CE503

**COURSE OBJECTIVES**

- To design and draw RCC cantilever and counterfort type
- To design and draw RCC Tee beam bridge
- To Design and Draw RCC Circular and Rectangular water tank
- To design and draw the Plate Girder bridges and connections
- To design and draw hemispherical steel tank.

#### LIST OF EXPERIMENTS

1. Design and drawing of RCC cantilever and counter fort type retaining walls with reinforcement details
2. Design of solid slab and RCC Tee beam bridges for IRC loading and reinforcement details
3. Design and drafting of circular and rectangular RCC water tanks
4. Design of plate Girder Bridge - Truss Girder bridges – Detailed Drawings including connections
5. Design of hemispherical bottomed steel tank

**TOTAL: 60 PERIODS**

#### LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:

Sl.No	Description of Equipment	Quantity
1.	Models of Structures	1 each
2.	Computers Pentium IV	30 Nos
3.	Analysis and Design Software - Minimum 5 use License	1 NO

#### COURSE OUTCOMES

At the end of the course student will able to

- Design and draw RCC cantilever and counterfort type
- Design and draw RCC Tee beam bridge
- Design and Draw RCC Circular and Rectangular water tank
- Design and draw the Plate Girder bridges and connections
- Design and draw hemispherical steel tank.

#### REFERENCES:

1. Krishnaraju,N. "Structural Design & Drawing, Universities Press, 2009.
2. Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., 2003.

U20CE605	WATER AND WASTE WATER ANALYSIS LABORATORY	L	T	P	C
		0	0	4	2

**Pre-requisite:** U20CE601, U20CE502

#### COURSE OBJECTIVES

- To Study the water contamination
- To understand the sampling and preservation methods and significance of characterization of wastewater.

#### LIST OF EXPERIMENTS

1. Determination of PH and turbidity in wastewater.
2. Determination of Hardness in wastewater.
3. Determination of Ammonia Nitrogen in wastewater.
4. Determination of residual chlorine
5. Determination of Optimum Coagulant Dosage

6. Determination of suspended, volatile, and fixed solids
7. Determination of dissolved oxygen
8. Determination of B.O.D. test
9. Determination of C.O.D. test
10. Introduction to Bacteriological Analysis (Demonstration only)

**TOTAL: 60 PERIODS**

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:**

<b>Sl.No</b>	<b>Description of Equipment</b>	<b>Quantity</b>
1.	Oxygen analyzer	1
2.	Spectrophotometer	1
3.	Ion – selective electrode	1
4.	Sodium Potassium Analyzer – Flame Photometer	1
5.	Gas Chromatography	1
6.	Atomic absorption spectroscopy (Ni, Zn, Pb)	1
7.	Nephlo - turbidity meter	1
8.	BOD Analyser	1
9.	COD Analyser	1
10.	Jar Test Apparatus	1
11.	P <sup>H</sup> meter	1
12.	Turbidity meter	1
13.	Conductivity meter	1
14.	BOD incubator	1
15.	Refrigerator	1
16.	Muffle furnace	1
17.	Water bath	1

**COURSE OUTCOMES**

- The students completing the course will be able to characterize wastewater and conduct treatability studies.

**REFERENCES:**

1. Standards Methods for the Examination of Water and Wastewater, Seventh Edition, WPCF, APHA and AWWA, USA, 1989.

**SEMESTER VI**

**PROFESSIONAL ELECTIVE I**

<b>U20CE611</b>	<b>SITE INVESTIGATION METHODS AND PRACTICES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE201

**COURSE OBJECTIVES**

- To study the importance of site investigation.
- To analysis the site investigation using nondestructive Test
- To Examine the various field and lab test on soil.by soil exploration methods for soil sampling
- To impart knowledge of advanced methods of testing of geological materials like soil.

**UNIT I Introduction to Site investigation**

Introduction, the Importance of Site Investigation, Purposes of a Site Investigation, Objectives, Need for Site investigation, Advantages of Site Investigation, Phases in site Investigation process, Approach to site investigation.

**UNIT II Site Investigation using Non-Destructive Tests 9**

Introduction, Electrical Methods, Magnetic Methods, Gravity Methods, Acoustic Emission Methods, Seismic Methods

**UNIT III Site investigation using in situ testing 9**

Introduction, Penetration testing - Standard penetration test & Cone penetration test, Strength and compressibility testing - Field vane shear test, Pressure meter test, Plate loading test.

**UNIT IV Sampling and investigation reports 9**

Introduction , Sample sizes, Undisturbed sampling techniques , Sand Sampling , Preparation of disturbed samples for testing ,Preparation of undisturbed samples for testing .

Preparation of geotechnical investigation reports – geotechnical documentation – preparation of geotechnical features – generalized characteristics properties of soils -Final recommendation to evaluate the bearing capacities and settlement characteristics of soils and for use of proper selection of type of foundations..

**UNIT V Safety Programmes 9**

Problem Areas in Construction Safety – Elements of an Effective Safety Programme – Job-Site Safety Assessment – Safety Meetings – Safety Incentives. Safety Concerns in Construction – Organizing for Safety – Safety Regulations- OSHA 18001,18002

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to,**

1. Describe different site investigation methods
2. Illustrate different subsurface exploration by non-destructive test.
3. Identify the various Soil Exploration methods for soil sampling
4. Interpret how to write the technical report for site investigation
5. Learn about safety in construction

**TEXT BOOKS**

1. Site investigation by Clayton, Mathews and Simons
2. Site Investigation Practice by Joyce, M.D.; ESFN. SPON Publishers, 1982.

**REFERENCES**

1. Compendium of Indian Standards on Soil Engineering Parts 1 and II 1987-1988.
2. Geotechnical Engineering Investigation Manual by R.E. Hunt, McGraw HillCo. New York
3. Geotechnical and Geophysical Site Characterization, An-Bin Huang, Paul WMayne, CRC Press, 2008, ISBN 0415469368, 9780415469364.
4. Hvorslev M.J. Subsurface exploration and sampling of soils for Civil Engg.purposes.
5. Instrumentation in geotechnical engineering by K.R. Saxena and V.M.Sharma.

<b>U20CE612</b>	<b>CONSTRUCTION METHODS AND EQUIPMENTS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE201

**COURSE OBJECTIVES**

- To understand the elements of equipment cost and evaluating investment alternatives.
- To familiarize with construction equipment and their capabilities.
- To properly select heavy equipment based on applications, utilization, productivity and other factors.
- To develop basic understanding of unit price ,earthwork quantities., Concrete Mixtures and

## Batching of Concrete

<b>UNIT I</b>	<b>Equipment Economics</b>	<b>9</b>
Equipment records, Cost of Capital, Elements of ownership Cost, Operating Cost, Replacement Decisions, Rent and Lease Considerations.		
<b>UNIT II</b>	<b>Planning for Earthwork Construction</b>	<b>9</b>
Planning, Graphical Presentation of Earthwork, Earthwork Quantities, Mass Diagram, Pricing Earthwork Operations.		
<b>UNIT III</b>	<b>Compaction and Stabilization Equipment</b>	<b>9</b>
Compaction of Soil and rock, Types of Compacting Equipment, Dynamic Compaction, Stabilizing soils with Lime, Cement Soil Stabilization.		
<b>UNIT IV</b>	<b>Mobile Equipment Power Requirements</b>	<b>9</b>
Required Power, Available power, Usable power, Performance Charts. Dozers, Scrapers, Excavators: Introduction, Performance Characteristics of Dozers, Pushing Material, Land Clearing, Scraper types, operation, Performance Charts, Production cycle, Hydraulic Excavators, Shovels, Hoes.		
<b>UNIT V</b>	<b>Trucks and Hauling Equipment, Finishing Equipment</b>	<b>9</b>
Trucks, productivity, Performance Calculations, Gaders, Trimmers. Concrete and Concrete Equipment, Cranes, Piles and Pile-Driving Equipment, Planning for Building Construction: Concrete Mixtures, Batching of Concrete, Placing of Concrete.		

**TOTAL: 45 PERIODS**

## COURSE OUTCOMES

### Learners are able to

- Select construction equipment appropriate to tasks.
- Estimate equipment ownership and operating costs.
- Estimate and schedule activities using equipment productivity and cost data.
- Usage of the Mobile Equipment Power Requirements
- Understand contemporary issues pertaining to construction methods, equipment usage and management.

## TEXT BOOKS

## REFERENCES

1. Peurifoy, R.L., Ledbetter, W.B.andSchexnayder, C , " Construction Planning Equipment and Methods ", 5th Edition, McGraw Hill, Singapore,
2. Sharma S.C. "Construction Equipment and Management ", Khanna Publishers New Delhi.

<b>U20CE613</b>	<b>CONSTRUCTION CONTRACTS AND SPECIFICATIONS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE201

## COURSE OBJECTIVES

- To study the various types of construction contracts and their legal aspects and provisions.
- To study the tenders, arbitration, legal requirement, and labour regulations.
- To understand the concept on tenders
- To Learn the BOT Contract document

<b>UNIT I</b>	<b>CONSTRUCTION CONTRACT</b>	<b>9</b>
Agreement, Contract, essential conditions, Indian Contract Act 1872, types of contract, terminology of contract.		
<b>UNIT II</b>	<b>CONSTRUCTION SPECIFICATIONS</b>	<b>9</b>
Standard specifications, general specification, development, interpretation. Tender and tender documents: Types of bidding, tender notice, tendering procedure.		
<b>UNIT III</b>	<b>DISPUTE RESOLUTION MECHANISM</b>	<b>9</b>
litigation, arbitration, conciliation, mediation, dispute resolution board. Contractual Problems: Possible contractual problems, creation of claims, development of disputes.		
<b>UNIT IV</b>	<b>CONTRACT DOCUMENT</b>	<b>9</b>
Drafting of clauses, development, and interpretation, CPWD conditions of contract, FIDIC conditions of contract.		
<b>UNIT V</b>	<b>BOT CONTRACT</b>	<b>9</b>
Types of contract, PPP framework, types of risk, concession agreement, drafting of clauses, development, and interpretation.		

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

1. Prepare contract schedules, notice inviting tender, contract documents. and specifications
2. Perform the rate analysis for the various construction activities,
3. Perform the project planning, scheduling, time-cost optimization, resource allocation and project controlling
4. Apply various material & equipment management techniques in a project
5. Assemble bill of quantities

**TEXT BOOKS**

1. C. J. Schexnayder and R. E. Mayo, Construction Management Fundamentals, McGraw Hill, New Delhi. 2003
2. L.S. Ranaga Rao Contract Management and Dispute Resolutions Engineering staff College of India January 2008.

**REFERENCES**

1. D.S. Berrie and B.c. Paulson, Professional construction management including C.M., Design construct and general contracting, McGraw Hill International, Third Edition 1992..
2. General Conditions of Contract, Central Public Works Department, New Delhi, 2010
3. S. Ranaga Rao, Contract Management & Dispute Resolutions, Engineering staff College of India, January 2008
4. V. K. Raina, Construction & Contract Management Practices, SPD, New Delhi

<b>U20CE614</b>	<b>CONSTRUCTION SAFETY MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE201

**COURSE OBJECTIVES**

- To study and understand the various safety concepts and requirements applied to construction industry.

- To study the various construction safety problems and safety programs.
- To study the various laws related to safety in construction industry
- To study the importance of workers compensation insurance.

**UNIT I SAFETY MANAGEMENT 9**

Safety management function, Importance of safety in construction industry, Line versus staff authority, Safety responsibility and accountability in construction industry, Safety organizations, Role of various parties, duties, responsibilities of top management, site managers, supervisors etc., Role of safety officers, Responsibilities of general employees, Safety administration.

**UNIT II CONSTRUCTION SAFETY PROBLEMS 9**

Construction safety problems, Hazards in construction projects, Accident: definition, causes, cost, measurement, investigation and prevention of accidents, Legal and financial aspects of accident, Safety Program: Need, Elements of an Effective and safety program, general safety program in construction industry. Hazard Identifications and Control Techniques – HAZOP, FMEA, FMECA.

**UNIT III SAFETY IN USE OF CONSTRUCTION EQUIPMENT 9**

Safety in use of construction equipment - vehicles, cranes, hoists and lifts etc., Safety of scaffolding, ladders, working platforms etc, safety while using electrical appliances, explosives, blasting etc, fire safety, Fire safety Causes and safety of accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, high rise constructions etc., safety measures for storage and handling of building materials. Safety equipment and gear used on construction site, First aid on site.

**UNIT IV SAFETY PERFORMANCE 9**

Laws related to construction industry, Laws related to the Industrial Safety, Safety Provisions in the Factory Act, Labour laws. Measurement of Safety Performance, Safety Audit. Experience modification rating, workers insurance.

**UNIT V SAFETY ANALYSIS 9**

Case based reasoning, case indexing, retrieval, accident prevention and forecasting using CBR method. Systems safety analysis, faulty tree analysis, failure modes and effects analysis in construction industry.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- Ability to identify safety risks on jobsites.
- Able to create and manage an effective safety program in a construction company.
- Will be aware of various laws related to construction safety
- Understand experience modification rates (EMR) and worker's compensation insurance premiums.

**TEXT BOOKS**

1. John V. Grimaldi. (1996). "Safety Management." AITBS Publishers & Distributors, New Delhi, India.
2. Kwakye, A.A. (1997), "Construction Project Administration", Adisson Wesley Longman, London.

**REFERENCES**

1. James, J.O Brien, "Construction Inspection Handbook – Quality Assurance and Quality Control ", Van Nostrand, New York, 1989. 14
2. Juran Frank, J.M. and Gryna, F.M. " Quality planning and Analysis ", Tata McGraw Hill, 1982.
3. Kwaku A., Tenah and Jose M.Guevera, "Fundamental of Construction Management and Organization ", Prentice Hall of India, 1995.
4. Hand book on Construction Safety Practices, SP:70, BIS, 2001.
5. Safety Management in Construction Industry- A manual for project managers, NICMAR, Mumbai



1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, 2004.
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003).

**SEMESTER VI**  
**PROFESSIONAL ELECTIVE II**

<b>U20CE621</b>	<b>REMOTE SENSING AND GIS APPLICATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE303

**COURSE OBJECTIVES**

- To impart knowledge on concepts and applications leading to modelling of earth resources management using remote sensing.
- To acquire skills in storing, managing digital data for planning and development skills in advance techniques for mapping, modelling and monitoring.
- To Apply the concepts of Photogrametry and its applications such as determination of heights of objects on terrain.
- To Understand the basic concept of Remote Sensing and know about different types of satellite and sensors.
- To Illustrate Energy interactions with atmosphere and with earth surface features, Interpretation of satellite and top sheet maps
- To Understand different components of GIS and Learning about map projection and coordinate system
- To Develop knowledge on conversion of data from analogue to digital and working with GIS software.

**UNIT I INTRODUCTION TO REMOTE SENSING 9**

Definition of remote sensing and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan- Boltzman and Wein's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows –spectral signature concepts –typical spectral reflective characteristics of water, vegetation and soil.

**UNIT II PLATFORMS AND SENSORS 9**

Types of platforms – orbit types, Sun- synchronous and Geosynchronous – Passive and Active sensors – resolution concept – Payload description of important Earth Resources and Meteorological satellites – Airborne and space borne TIR and microwave sensors

**UNIT III IMAGE INTERPRETATION AND ANALYSIS 9**

Types of Data Products – types of image interpretation- basic elements of image interpretation- visual interpretation keys – Digital image processing – Pre-processing –image enhancement techniques – multispectral image classification – supervised and unsupervised.

**UNIT IV GEOGRAPHIC INFORMATION SYSTEM 9**

Introduction – Maps- Definitions – Map projections – types of map projections – mapanalysis – GIS definition – basic components of GIS – standard GIS software – data type –Spatial and non-spatial ( attribute) data – measurement scales- Data base ManagementSystems (DBMS).

**UNIT V DATA ANALYSIS 9**

Data models – vector and raster data – data compression – data input by digitization andscanning – attribute data analysis – integrated data analysis – Application of GIS in highway-alignment studies, Environmental and water resources – land Information system.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- Analyze the principles and components of photogrammetry and remote sensing.
- Process of data acquisition of satellite images and their characteristics.
- Analyze an image visually and digitally with digital image processing techniques.
- Explain the concepts and fundamentals of GIS.
- Apply the knowledge of remote sensing and GIS in different civil engineering filed.

**TEXT BOOKS**

1. Krishna Raju N., Pre-stressed concrete, Tata McGraw Hill Company, New Delhi2012.
2. Mallic S.K. and Gupta A.P., Pre-stressed concrete, Oxford and IBH publishing Co. Pvt.Ltd.2007.

**REFERENCES**

1. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2013
2. IS 3370- Part 4 (2008) Indian standard Code of practice for concrete structures for the storage of liquid- Design tables, code of practice, bureau of Indian standards, New Delhi.
3. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
4. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002.
5. Ramaswamy G.S., Modern pre-stressed concrete design, Arnold Heinimen, New Delhi, 2010.

<b>U20CE622</b>	<b>CADRE SURVEYING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE303

**COURSE OBJECTIVES**

- To introduce the students to the cadastral survey Methods and its applications in generation of Land information system.
- To Learn about cadastral surveying and methods
- To know the photogrammetric methods
- To Study the cadastral map reproduction and map projection.

**UNIT I NTRODUCTION 9**

History of cadastral survey - Types of survey - Tax - Real Property – Legal cadastre -Graphical and Numerical Cadastre, Legal Characteristics of Records, Torrens System.

**UNIT II CADASTRAL SURVEY METHODS 9**

Steps in survey of a village - Instruments used for cadastral survey & mapping - Orthogonal, Polar survey methods - Boundary survey - Rectangulation - Calculation of area of Land- GPS and Total Station in Cadastral survey.

**UNIT III PHOTOGRAMMETRIC METHODS 9**

Photogrammetry for cadastral surveying and mapping - Orthophoto map – Quality control measures - Organisation of cadastral offices – international scenario.

**UNIT IV CADASTRAL MAPPING AND LIS 9**

Cadastral map reproduction - Map projection for cadastral maps – Conventional symbols -map -

reproduction processes - Automated cadastral map, Management of Digital Cadastral. Creation of Land Information System. Integrating LIS –Land administration.

**UNIT V MAINTENANCE AND MEASUREMENTS 9**

Cadastral survey maintenance - Resurveys - Measurement of sub-division - Measurement of obstructed lines - Survey of urban areas - Control requirement for Urban survey use of Satellite Imagery in boundary fixing.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- Gain knowledge about cadastre survey.
- Understand the methods of cadastral survey.
- Get the knowledge about photogrammetric methods.
- Understand Land Record System and computational procedure for modernization of the same.
- The students will be in position to understand the Government procedure in Land Record Management.

**TEXT BOOKS**

1. Paul. R Wolf., Bon A. DeWitt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4th Edition, 2014
2. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.

**REFERENCES**

1. Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, Walter de Gruyter GmbH & Co. 2nd Edition, 2007.
2. E. M. Mikhail, J. S. Bethel, J. C. McGlone, Introduction to Modern Photogrammetry, Wiley Publisher, 2001.
3. James, M. Anderson and Edward N. Mikhail, Introduction to Surveying, McGraw Hill Book Co, 1985.

<b>U20CE623</b>	<b>INTELLIGENT TRANSPORTATION SYSTEM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:**

**COURSE OBJECTIVES**

- To develop an understanding of system engineering processes
- To describe the concepts of system architecture and their evolution.
- To understand the capability of key technologies.
- To understand impact of technology on different modes and movement.
- To understand how to evaluate technologies, applications and services.

**UNIT I FUNDAMENTALS OF ITS 9**

Definition of ITS, the historical context of ITS from both public policy and market economic perspectives, Types of ITS; Historical Background, Benefits of ITS.

**UNIT II SENSOR TECHNOLOGIES AND DATA REQUIREMENTS OF ITS 9**

Importance of telecommunications in the ITS. Information Management, Traffic Management Centers (TMC).Application of sensors to Traffic management; Traffic flow sensor technologies; Transponders and Communication systems; Data fusion at traffic management centers; Sensor plan and specification requirements; Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, video data collection.

**UNIT III ITS USER NEEDS AND SERVICES AND FUNCTIONAL AREAS 9**

Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems

(ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS).

**UNIT IV ITS ARCHITECTURE 9**

Regional and Project ITS architecture; Concept of operations; ITS Models and Evaluation Methods; Planning and human factor issues for ITS, Case studies on deployment planning and system design and operation; ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS planning.

**UNIT V ITS APPLICATIONS 9**

Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations; commercial vehicle operations and intermodal freight; public transportation applications; ITS and regional strategic transportation planning, including regional architectures: ITS and changing transportation institutions Automated Highway Systems- Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- Differentiate different ITS user services
- Select appropriate ITS technology depending upon site specific conditions.
- Design and implement ITS components
- Understand the Concept of operations; ITS Models and Evaluation Methods
- Learn about the application of Transportation network operations; commercial vehicle operations and intermodal freight; public transportation applications

**TEXT BOOKS**

1. Sussman, Joseph. Perspectives on Intelligent Transportation Systems (ITS). New York, NY: Springer, 2010.
2. Mashrur A. Chowdhury, and Adel Sadek, Fundamentals of Intelligent Transportation Systems Planning, Artech House, Inc., 2003.

**REFERENCES**

1. Fundamentals of intelligent transportation systems planning By Mashrur A. Chowdhury, Adel WadidSadek
2. Lawrence A. Klein, Sensor technologies and Data requirements of ITS
3. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.
4. Sussman, J. M., Perspective on ITS, Artech House Publishers, 2005.
5. National ITS Architecture Documentation, US Department of Transportation, 2007.

**U20CE624**

**TRAFFIC PLANNING AND DESIGN**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite: U20CE404**

**COURSE OBJECTIVES**

- To be aware of various methods of collecting traffic data.
- To understand the basics of highway planning and design, and workout problems in design of road geometrics.
- To Provides a basic understanding on Traffic Engineering – Planning, Design, Operation and Management
- To Design of intersection and traffic signal control.
- To study the traffic and management.

<b>UNIT I</b>	<b>TRAFFIC CHARACTERISTICS</b>	<b>9</b>
Physical, Physiological, Psychological, Environmental Characteristics, Traffic Stream Characteristics, Vehicle Characteristics – Static and Dynamic, Urban Road and Road Characteristics – Geometric Design- Overview.		
<b>UNIT II</b>	<b>SURVEYS AND STUDIES IN TRAFFIC ENGINEERING</b>	<b>9</b>
Conventional and Modern Methods of Traffic Survey and Studies – Volume and Capacity – LOS for uninterrupted traffic flow – Headway concepts and applications – Speed and Delay – Origin and Destination, Parking, Accident – Level of Service (LoS)		
<b>UNIT III</b>	<b>DESIGN OF TRANSPORT INFRASTRUCTURE</b>	<b>9</b>
Design of roads – Design Speed, Terrain, Gradient curves – Horizontal and Vertical, Superelevation, Sight Distance – Stopping Sight Distance, Overtaking Sight Distance, Traffic Sign, Road Markings, Traffic Control Aids, Street furniture, Road Arboriculture		
<b>UNIT IV</b>	<b>INTERSECTION DESIGN AND ANALYSIS</b>	<b>9</b>
Design of Intersection – At grade intersection – Uncontrolled, Channelisation, Rotary, Traffic Signal Control, Signal Co-ordination, Grade Separated Intersection - Types ,Design and Analysis.		
<b>UNIT V</b>	<b>TRAFFIC OPERATION AND MANAGEMENT</b>	<b>9</b>
Traffic Regulation, Cost Effective Management Measures – Traffic Systems Management and Travel Demand Management - Congestion Management, Traffic Calming and Pricing-Design of Cycle Tracks, Pedestrian Facilities, Parking Facilities – On Street, Off Street Multi level car Parking - Street Lighting.		
		<b>TOTAL: 45 PERIODS</b>

**COURSE OUTCOMES**

**Learners are able to**

1. Identify the influence of traffic stream components on traffic flow.
2. Establish the relationships between traffic stream parameters.
3. Conduct traffic engineering studies, analyse the data and present the results.
4. Design traffic and road facilities, and intersection control measures for smooth traffic movement.
5. Identify appropriate traffic control and management measures.
6. Students would be aware of the basic Principles and Design, Planning and Management of Transportation system.

**TEXT BOOKS**

1. James L. Pline (Edr) „Traffic Engineering Hand Book“, Institute of Transportation Engineers,
2. Wolfgang S. Homburger et.al., „Fundamentals of Traffic Engineering“ 15<sup>th</sup> Edition, Institute of Transportation Studies, University of California, Berkely, 2001

**REFERENCES**

1. AASHTO A Policy on Geometric Design of Highway and Streets
2. Analysis, Books Cole, UK, 2001
3. Kadiyali, L.R., „Traffic Engineering and Transport Planning“, Khanna Publishers, Delhi, 2006.
4. Nicholas T.Garber, Lester A Hoel, „Traffic and Highway Engineering“, Revised Second Edition, ITP, California, USA, 1999
5. Washington DC, USA, 1999Pignataro, L.J., Traffic Engineering – Theory & Practice, John Wiley, 1985.

<b>U20CE625</b>	<b>URBAN PLANNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:**

**COURSE OBJECTIVES**

1. To study town planning concepts and theories.
2. To perceive the concept of urbanization and various growth patterns.
3. To study norms and aspects of land use planning policies and survey techniques.





## COURSE OUTCOMES :

### Learners are able to

- Estimate the quantities required for building works using the drawings.
- Carry out the analysis of rates
- Prepare the cost estimate for various buildings
- Prepare the estimate of civil engineering structures other than buildings
- Prepare the report on the basis of specifications and valuation of the existing buildings

### TEXT BOOKS

1. Dutta, B.N., Estimating And Costing, S Dutta and Co., Lucknow 2016.
2. Rangawala, S.C., Estimating And Costing, Charotar Anand Publications, 2006.

### REFERENCES

1. B.S.Patil, 'Civil Engineering Contracts and Estimates', University Press, 2006
2. D.N. Banerjee, 'Principles and Practices of Valuation', V Edition, Eastern Law House, 1998.
3. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD
4. Kohli, D.D. And Kohli R.C., A Text Book On Estimating, Costing And Accounts, S.Chand And Co, New Delhi, 2004.
5. Tamil Nadu Transparencies in Tenders Act, 1998.

<b>U20CE702</b>	<b>WATER RESOURCES ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE201

### COURSE OBJECTIVES

- Understand the concept of hydrology and components of hydrologic cycle such as precipitation, infiltration, evaporation and transpiration.
- Quantify runoff and use concept of unit hydrograph.
- Demonstrate different methods of irrigation, methods of application of water and irrigation procedure.
- Design canals and canal network based on the water requirement of various crops.
- Determine the reservoir capacity.

### UNIT I INTRODUCTION 9

**Hydrology:** Introduction, Importance of hydrology, Global distribution of water and Indian water availability, Practical application of hydrology, Hydrologic cycle (Horton's) qualitative and engineering representation.

**Precipitation:** Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data.

### UNIT II HYDRAULIC LOSSES 9

**Losses:** Evaporation: Introduction, Process, factors affecting evaporation, measurement using IS class-A Pan, estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control.

**Evapo-transpiration:** Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation.

**Infiltration:** Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.

### UNIT III RUNOFF 9

**Runoff:** Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis.

**Hydrographs:** Definition, components of hydrograph, base flow separation, unit hydrograph,

assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations.

**UNIT IV BASICS OF IRRIGATION 9**

**Irrigation:** Definition. Benefits and ill effects of irrigation. System of irrigation: surface and ground water, Methods of water application: flow irrigation, lift irrigation and Bandhara irrigation.

**Water Requirements of Crops:** Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.

**UNIT V CANALS AND RESERVOIRS 9**

**Canals:** Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method.

**Reservoirs:** Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam. Reservoir operation strategies and economics of water resources, Water sharing policy and case studies from India

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES :**

**Learners are able to**

- Understand the importance of hydrology and its components.
- Measure precipitation and analyze the data and analyze the losses in precipitation.
- Estimate runoff and develop unit hydrographs.
- Find the quantity of irrigation water and frequency of irrigation for various crops.
- Find the canal capacity, design the canal and compute the reservoir capacity.

**TEXT BOOKS**

1. Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi-2010.
2. K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.2010.

**REFERENCES**

1. Garg S.K, "Irrigation Engineering and Hydraulic Structures" Khanna publications, New Delhi
2. H.M. Raghunath, "Hydrology", Wiley Eastern Publication, New Delhi.
3. Modi P.N "Water Resources and Water Power Engineering"- Standard book house, Delhi.
4. Punmia and LalPandey, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.
5. Sharma R.K., "Irrigation Engineering and Hydraulics", Oxford & IBH Publishing Co., New Delhi.

<b>U20CE703</b>	<b>INTERNSHIP / INDUSTRIAL TRAINING / ACADEMIC ATTACHMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>(4 Weeks During VI Semester – Summer)</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>

**Pre-requisite:** U20CE201

**COURSE OBJECTIVES**

- To train the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks. To develop skills in facing and solving the field problems.

**COURSE CONTENT**

The students will individually undertake training in reputed civil engineering companies for duration of four weeks during the summer vacation of sixth semester. At the end of the training, a report on the work done and lessons learnt will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff members.

**COURSE OUTCOMES :**

**Learners are able to**

- The intricacies of implementation textbook knowledge into practice
- The concepts of developments and implementation of new techniques

U20CE704

DESIGN PROJECT

L	T	P	C
0	0	4	2

Pre-requisite: U20CE503

**COURSE OBJECTIVES**

- To use the knowledge acquired in Civil Engineering to do a mini project, which allows the students to come up with designs, fabrication or algorithms and programs expressing their ideas in a novel way.

**EVALUATION PROCEDURE**

The method of evaluation will be as follows:

- Internal Marks  
(Decided by conducting 3 reviews by the guide appointed by the Institution) : 20 marks  
Evaluation of Project Report
- (Evaluated by the external examiner appointed the University). Every student : 30 marks  
belonging to the same group gets the same mark)  
Viva voce examination
- (Evaluated by the internal examiner appointed by the HOD with the approval of : 50 marks  
HOI, external examiner appointed by the University and Guide of the course –  
with equal Weightage)

TOTAL :100 marks  
**TOTAL: 60 PERIODS**

**COURSE OUTCOMES :**

Learners are able to

- On completion of the design project students will have a better experience in designing various design problems related to Civil Engineering.

**SEMESTER VII**

**PROFESSIONAL ELECTIVE III**

U20CE731

PRE - STRESSED CONCRETE

L	T	P	C
3	0	0	3

Pre-requisite: U20CE503

**COURSE OBJECTIVES**

- To introduce the need for prestressing in a structure.
- To explain the methods, types and advantages of prestressing to the students.
- To make the students to design a prestressed concrete structural elements and systems.
- To introduce the students the effect of prestressing in the flexural and shear behaviour of structural elements.

**UNIT I INTRODUCTION – THEORY AND BEHAVIOUR**

9

Basic concepts – Advantages – Materials required – Systems and methods of pre-stressing –Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – losses of prestress.

**UNIT II DESIGN FLEXURE**

9

Flexural strength – Simplified procedures as per codes – strain compatibility method – Basic concepts in selection of cross section for bending – Effect of tendon profile on deflections –Factors influencing deflections – Calculation of deflections – Short term and long term deflections

**UNIT III DESIGN OF COMPRESSION MEMBER AND END BLOCK**

9

Design of compression members (Axial and Bending) – Design of tension member - Stress distribution in end block, Design of anchorage zone reinforcement – Limit state design criteria – partial pre-stressing –Applications

**UNIT IV COMPOSITE CONSTRUCTION 9**

Analysis for stresses – Estimate for deflections – Flexural and shear strength of compositemembers.

**UNIT V DESIGN OF WATER TANKS AND MISCELLANEOUS STRUCTURES 9**

Design of pre-stressed concrete tanks – Poles and sleepers –design of pre-stressed concretepipes and sleepers

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- Describe the basic properties of pre-stressed concrete constituents and various losses.
- Apply the provisions of IS 1343-1984 to determine the flexural strength of concrete members and also evaluate the deflection in beams
- Analyze and design the end blocks of prestress concrete members.
- Interpret the behavior of composite constructions for propped and unpropped conditions
- Analyze and design of pre-stressed concrete water tanks and pipes.

**TEXT BOOKS**

1. Krishna Raju N., Pre-stressed concrete, Tata McGraw Hill Company, New Delhi2012.
2. Mallic S.K. and Gupta A.P., Pre-stressed concrete, Oxford and IBH publishing Co. Pvt.Ltd.2007.

**REFERENCES**

1. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2013
2. IS 3370- Part 4 (2008) Indian standard Code of practice for concrete structures for the storage of liquid- Design tables, code of practice, bureau of Indian standards, new Delhi.
3. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
4. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002.
5. Ramaswamy G.S., Modern pre-stressed concrete design, Arnold Heinimen, New Delhi,2010.

<b>U20CE732</b>	<b>INDUSTRIALSTRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE603

**COURSE OBJECTIVES**

- To learn the planning, layout, functional aspects of industries and design of major steel and R.C structures needed for industries.
- To know the functional requirements of building structure.
- To Design the R.C. Structures like chimney,Transmission Line towers,plate girders etc..
- To Learn the prefabrication of building structures.

**UNIT I PLANNING 9**

Classification of industries and industrial structures – Site Planning and Selection – Exterior andinterior Layout for Industries and buildings - Guidelines from factories act

**UNIT II FUNCTIONAL REQUIREMENTS 9**

Lighting – Ventilation – Noise and Vibration control – Fire safety

**UNIT III DESIGN OF STEEL STRUCTURES 9**

Pre-engineered and Mill buildings – Transmission Lines Towers – plate girders. Bunkers and Silos – pipe /cable racks- Chimney.

**UNIT IV DESIGN OF R.C. STRUCTURES 9**

Corbels, Brackets and Nibs - Silos and bunkers –Chimney –Cooling Towers (Principles only)

**UNIT V PREFABRICATION 9**

Principles of prefabrication and pre cast construction – Prestressed precast roof trusses – Floor slabs - Wall panels- Handling and erection stresses –joints in precast structures.

**COURSE OUTCOMES**

**Learners are able to**

- Know the requirements of various industries and get an idea about the materials used and planning of various industrial components
- Understand the functional requirements for industrial structures.
- Design special steel structures like bunkers, silos, crane girders, chimneys and pre-engineered buildings.
- Design special RC structures like corbels, silos, bunkers, chimneys, plates and shells.
- Understand the principles of prefabrication and prestressing

**TEXT BOOKS**

1. Ramamrutham.S., Design of Reinforced Concrete Structures, DhanpatRai Publishing company, 2007.
2. Varghese.P.C., Advanced Reinforced Concrete Design, PHI, Eastern Economy Editions, Second Edition, 2005.

**REFERENCES**

1. Henn W. Buildings for Industry, Vol.I and II, London Hill Books, 1995
2. Handbook on Functional Requirements of Industrial buildings, SP32–1986, Bureau of Indian Standards, 1990.
3. Handbook of Industrial Lighting, Stanley L.Lyons, Butterworths, London.1981
4. Koncz, J., Manual of Precast Construction Vol. I and II, Bauverlay GMBH, 1971.
5. Handbook on Precast Construction, An Indian Concrete Institute Publication, 2016

<b>U20CE733</b>	<b>STRUCTURAL DYNAMICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:**

**COURSE OBJECTIVES**

- To Introduce fundamentals of vibrations of SDOF system
- To Introduce damped and undamped system
- To Introduced free and forced vibration of MDOF system
- To Introduced free and forced vibration of continuous system
- To understand the behavior of dynamic loading.
- Study the effect of earthquake loading on the behavior of structures.
- Understand the codal provisions to design the structures as earthquake resistant.

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
	Introduction to structural dynamics, Brief history of vibration and Earthquakes, Major earthquakes, Earthquakes zones, some basic definitions, Vibration of single degree of freedom system, undamped, damped, free vibrations, logarithmic decrement.	
<b>UNIT II</b>	<b>SINGLE DEGREE OF FREEDOM SYSTEM</b>	<b>9</b>
	Forced vibrations of single degree freedom systems, response of undamped and damped systems subjected to harmonic loading, rotation unbalance, reciprocating unbalance.	
<b>UNIT III</b>	<b>MULTI DEGREE OF FREEDOM SYSTEM</b>	<b>9</b>
	Formulation of equation of motion for multi degree of freedom (MDOF) system – Evaluation of natural frequencies and modes – Eigen values and Eigen vectors – Response to free and forced vibration of undamped and damped MDOF systems – Modal superposition methods.	
<b>UNIT IV</b>	<b>BEAMS STIFFNESS MATRICES</b>	<b>9</b>
	Dynamic analysis of beams stiffness matrices, lumped mass and consistent mass formulation equations of motion.	

**UNIT V FORCED VIBRATION MOTION**

**9**

Forced vibration motion of shear buildings, modal super position method, response of shear buildings to base motion, harmonic forced excitation.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- Develop knowledge in the simulation and mathematical model development.
- Trained to identify, formulate and solve complicated problem.
- Understand the role of natural calamity in the damage of structures.
- Develop the skill to analyse data and to apply the same in the practical problems.
- Apply the developed methodologies for the safe and stable design of structures.

**TEXT BOOKS**

1. Mario Paz, Structural Dynamics – Theory and Computations, Fourth Edition, CBS publishers, 1997.
2. Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2007.

**REFERENCES**

1. Anil K Chopra, Dynamics of structures – Theory and applications to Earthquake Engineering, Prentice Hall Inc., 2007.
2. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.
3. Humar.J.L, Dynamics of Structures, Prentice Hall Inc., 1990.
4. Jai Krishna, Chandrasekaran.A.R., and Brijesh Chandra, Elements of Earthquake Engineering, South Asia Publishers, 1994.
5. Minoru Wakabayashi, Design of Earthquake Resistant Buildings, McGraw – Hill Book Company

**U20CE734**

**SOIL DYNAMICS**

L	T	P	C
3	0	0	3

**Pre-requisite:** U20CE505

**COURSE OBJECTIVES**

- To familiarize students with the dynamic properties of soil.
- To create an understanding about the importance of designing machine foundation for reciprocating and impact machines.
- To learn Dynamic properties of soils as per code provisions
- To Design the procedure for foundation reciprocating machines.
- To calculate the vibration isolation for mechanical isolation.

**UNIT I INTRODUCTION**

**9**

Vibration of elementary systems-vibratory motion-single degree freedom system-free and forced vibration with and without damping

**UNIT II WAVES AND WAVE PROPAGATION**

**9**

Wave propagation in an elastic homogeneous isotropic medium- Raleigh, shear and compression waves-waves in elastic half space

**UNIT III DYNAMIC PROPERTIES OF SOILS**

**9**

Elastic properties of soils-coefficient of elastic, uniform and non-uniform compression - shear-effect of vibration dissipative properties of soils-determination of dynamic properties of soil- code provisions

**UNIT IV DESIGN PROCEDURES**

**9**

Design criteria -dynamic loads - simple design procedures for foundations under reciprocating machines - machines producing impact loads - rotary type machines

**UNIT V VIBRATION ISOLATION**

**9**

Vibration isolation technique-mechanical isolation-foundation isolation-isolation by location- isolation by barriers- active passive isolation tests

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- Understand the vibration of elementary system.
- Understand the waves and wave propagation.
- Understand the dynamic behavior of foundations.
- Design machine foundations.
- Identify vibration isolation techniques

**TEXT BOOKS**

1. Prakesh S. and Puri V.K, Foundation for machines, McGraw-Hill, New Delhi, 2013
2. Swamisaran, Soil Dynamics and Machine Foundations, Galgotia Publications Pvt.Ltd.,2014

**REFERENCES**

1. IS code of Practice for Design and Construction of Machine Foundations, McGrawHill,1996.
2. Kramar S.L, Geotechnical Earthquake Engineering, Prentice Hall International series, Pearson Education,Singapore
3. Kameswara Rao, Dynamics Soil Tests and Applications, Wheeler Publishing, New Delhi,2003
4. Moore P.J., Analysis and Design of Foundation forVibration, Oxford and IBH, 1995
5. Srinivasulu, P and Vaidyanathan, Hand book of Machine Foundations, McGraw-Hill,New Delhi,2006.

**U20CE735**

**DISASTER MANAGEMENT**

L	T	P	C
3	0	0	3

**Pre-requisite:**

**COURSE OBJECTIVES**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability,disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

**UNIT I UNDERSTANDING DISASTER**

**9**

Introduction – Types of Disaster (Rapid disaster – Natural, manmade disaster and slow disaster – Natural, manmade disaster) – Factors of Disaster, Geology and topography,Weather and climate, Ecosystems, Human factors

**UNIT II HAZARD, RISK AND VULNERABILITY**

**9**

Hazard classification and assessment - Hazard evaluation and hazard control - Concept And Elements of disaster risk - Techniques of Risk Assessment - Vulnerability Concept and Parameters, Risk and Vulnerability Relationship, Observation and Perception OfVulnerability, Vulnerability Identification, Socio-Economic Factors of Vulnerability,Vulnerability Analysis.

**UNIT III PRE-DISASTER MANAGEMENT ACTIVITIES**

**9**

Introduction - Institutional arrangements - Vulnerability and capacity assessment - Prevention and mitigation - Structural Mitigation And Non-Structural Mitigation - Preparedness and planning - Institutional learning and memory - Warning indicators - Public Awareness, Role Of Education And Training In Disaster Prevention.

**UNIT IV POST-DISASTER MANAGEMENT ACTIVATES**

**9**

Critical stress debriefing – Debriefing Checklist – Claims and follow-up of disaster-Insurance companies

– Sale of debris – The relative risk of communicable disease after disaster – Persistence of many serious communicable disease

**UNIT V      DISASTER MANAGEMENT IN INDIA      9**

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami - Rescue, Relief And Rehabilitation - National Disaster Policy Of India (Salient Features) - News Media In Disaster Management - Impact Of Media On Policy.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- Increase the knowledge and understanding of the disaster phenomenon and, its factors.
- Understand the relationship of hazard, risk and vulnerability
- Obtain the skills in role of education and training in disaster prevention.
- Ensure skills in post disaster management activities
- Get the knowledge in understanding various prone zones in India

**TEXT BOOKS**

1. D.B.N. Murthy, Disaster Management: Text and Case Studies, Deep & Deep Publications Pvt.Ltd.
2. ParagDiwan, “A Manual on Disaster Management”, Ritomate International, Noida Special Economic Zone, India

**REFERENCES**

1. Alexander, D. Natural Disasters, ULC press Ltd, London, 1993.
2. Carter, W. N. Disaster Management: A Disaster Management Handbook, Asian Development Bank, Bangkok, 1991.
3. Chakrabarty, U. K. Industrial Disaster Management and Emergency Response, Asian Books Pvt. Ltd., New Delhi2007.
4. Larry R. Collins, “Disaster Management and Preparedness”, CRC press
5. White, Gilbert F. and J. Eugene Hass, 1975, Assessment of Research on Natural Hazards, Cambridge, the MIT Press, MA

**SEMESTER VII**

**PROFESSIONAL ELECTIVE IV**

<b>U20CE741</b>	<b>MUNICIPALSOLID WASTE MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE601

**COURSE OBJECTIVES**

- To make the students conversant with the types, sources, generation, storage collection, transport, processing and disposal of municipal solid waste.
- To Learn Source reduction, waste storage and recycling of waste
- To know the collection and transfer of wastes
- To analyze the physical processing techniques and equipment, resource recovery from solid waste.
- To Learn Land disposal of solid waste, Sanitary landfills, site selection, design and operation of sanitary landfills

**UNIT I      SOURCES AND CHARACTERISTICS      9**

Sources and types of municipal solid wastes- Public health and environmental impacts of improper disposal of solid wastes- sampling and characterization of wastes- Elements of integrated solid waste management –Requirements and salient features of Solid waste management rules (2016) --- Role of public and NGO’s- Public Private participation

<b>UNIT II</b>	<b>SOURCE REDUCTION , WASTE STORAGE AND RECYCLING</b>	<b>9</b>
Waste Management Hierarchy - Reduction, Reuse and Recycling - source reduction of waste – On-site storage methods – Effect of storage, materials used for containers --Public health and economic aspects of open storage – case studies under Indian conditions		
<b>UNIT III</b>	<b>COLLECTION AND TRANSFER OF WASTES</b>	<b>9</b>
Methods of Residential and commercial waste collection – Collection vehicles – Manpower –Collection routes – Analysis of waste collection systems; Transfer stations –location, operation and maintenance; options under Indian conditions		
<b>UNIT IV</b>	<b>PROCESSING OF WASTES</b>	<b>9</b>
Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.		
<b>UNIT V</b>	<b>WASTE DISPOSAL</b>	<b>9</b>
Land disposal of solid waste- Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor – Dumpsite Rehabilitation		
		<b>TOTAL: 45 PERIODS</b>

**COURSE OUTCOMES**

**Learners are able to**

- Understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.
- Reduction, reuse and recycling of waste.
- Ability to plan and design systems for storage, collection, transport, processing and disposal of municipal solid waste.
- Knowledge on the issues on solid waste management from an integrated and holistic perspective, as well as in the local and international context.
- Design and operation of sanitarylandfill.

**TEXT BOOKS**

1. John Pitchel (2014), Waste Management Practices-Municipal, Hazardous and industrial –CRC Press, Taylor and Francis, New York.
2. William A. Worrell, P. AarneVesilind (2012) Solid Waste Engineering, Cengage Learning, 2012.

**REFERENCES**

1. CPHEEO (2014), “Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi.
2. George Tchobanoglous and FrankKreith (2002).Handbook of Solid waste management,McGraw Hill, New York.
3. Hand book on Solid Waste Disposal.: Pavoni J.L.
4. Solid Waste Management in developing countries.Bhide andSunderashan
5. Solid Waste Engineering by Vesilind.Pa Worrell &Reinhart.D. – 2009, Cengage Learning India Private Limited, New Delhi.

<b>U20CE742</b>	<b>ENVIRONMENTAL IMPACT ASSESSMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20HS202

**COURSE OBJECTIVES**

- To provide a critical overview of the theory and practice of EIA as operated internationally
- To understand methodologies, network, cost benefit analysis and case studies
- To know the prediction and assessment of impact on land, water and air, noise, cultural flora and fauna.
- To study environmental management plan and case studies

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Impact of development projects under Civil Engineering on environment - Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) – EIA capability and limitations – Legal provisions on EIA.		
<b>UNIT II</b>	<b>METHODOLOGIES</b>	<b>9</b>
Methods of EIA –Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives – Case studies.		
<b>UNIT III</b>	<b>PREDICTION AND ASSESSMENT</b>	<b>9</b>
Assessment of Impact on land, water and air, noise, social, cultural flora and fauna; Mathematical models; public participation – Rapid EIA		
<b>UNIT IV</b>	<b>ENVIRONMENTAL MANAGEMENT PLAN</b>	<b>9</b>
Plan for mitigation of adverse impact on environment – options for mitigation of impact on water, air and land, flora and fauna; addressing the issues related to the Project Affected People –ISO 14000		
<b>UNIT V</b>	<b>CASE STUDIES</b>	<b>9</b>
EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storey Buildings – Water Supply and Drainage Projects		

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- Develop of major problems in Environmental impact and control, regulations
- Familiar with different methodologies adopted for predicting impact assessment.
- Describe general environmental impact problems on men and materials.
- Present mitigation of adverse impact on environment.
- Develop the Skill in EIA using different case studies.

**TEXT BOOKS**

1. Canter,L., Environmental Impact Assessment, McGraw-Hill Inc., New Delhi, 2006.
2. Shukla, S.K. and Srivastava, P.R., “Concepts in Environmental Impact Analysis”, Common Wealth Publishers, New Delhi, 2002.

**REFERENCES**

1. Becker H. A., Frank Vanclay, “The International handbook of social impact assessment”conceptual and methodological advances, Edward Elgar Publishing, 2003.
2. Barry Sadler and Mary McCabe, “Environmental Impact Assessment Training Resource Manual”, United Nations Environment Programme, 2002.
3. Environmental Assessment Source book, Vol. I, II &III. The World Bank, Washington, D.C., 1991
4. John G. Rau and David C Hooten (Ed), Environmental Impact Analysis Handbook, McGraw-Hill Book Company, New York, 2010.
5. Judith petts, hand book of environmental impact assessment vol. i& ii, black well science, 1999.

<b>U20CE743</b>	<b>MANAGEMENT OF IRRIGATION SYSTEM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE702

**COURSE OBJECTIVES**

- To understand the irrigation management systems and uses
- To study irrigation scheduling and critical stages of water need of crops.
- To Provide structural and non structural strategies in water use and management
- To calculate the operation and involvement of stake holders

<b>UNIT I</b>	<b>IRRIGATION SYSTEM REQUIREMENTS</b>	<b>9</b>
Irrigation systems – Supply and demand of water – Cropping pattern – Crop rotation – Crop		

diversification – Estimation of total and peak crop water requirements – Effective and dependable rainfall – Irrigation efficiencies.

**UNIT II IRRIGATION SCHEDULING 9**

Time of irrigation – Critical stages of water need of crops – Criteria for scheduling irrigation –Frequency and interval of irrigation.

**UNIT III MANAGEMENT 9**

Structural and non-structural strategies in water use and management – Conjunctive use of surface and ground waters – Quality of irrigation water.

**UNIT IV OPERATION 9**

Operational plans – Main canals, laterals and field channels – Water control and regulating structures – Performance indicators – Case study

**UNIT V INVOLVEMENT OF STAKE HOLDERS 9**

Farmer’s participation in System operation – Water user’s associations – Farmer councils – Changing paradigms on irrigation management – Participatory irrigation management

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

1. Know the irrigation system requirement like cropping pattern, crop diversification and effective and dependable rain fall
2. Understand the irrigation scheduling based on the crop requirement.
3. Irrigation management usage of water use and management and Quality of water.
4. Main canals, laterals and field channel, water control and regulating structures.
5. Create the involvement of stakeholders and changing paradigms on irrigation management.

**TEXT BOOKS**

1. Dilip Kumar Majumdar, “Irrigation Water Management – Principles and Practice”, Prentice Hall of India Pvt. Ltd., New Delhi, 2000
2. Hand book on Irrigation Water Requirement, R.T. Gandhi, et. al., Water Management Division, Department of Agriculture, Ministry of Agriculture, New Delhi

**REFERENCES**

1. Hand Book on Irrigation System Operation Practices, Water Resources Management and Training Project, Technical report No. 33, CWC, New Delhi, 1990
2. Maloney, C. and Raju, K.V., “Managing Irrigation Together”, Practice and Policy in India, Stage Publication, New Delhi, India, 1994.

<b>U20CE744</b>	<b>GROUND WATER HYDROLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE702

**COURSE OBJECTIVES**

- To introduce the student to the principles of Groundwater governing Equations and Characteristics of different aquifers.
- To understand the techniques of development and management of groundwater.
- To study Darcy’s law and hydraulic conductivity.
- To Calculate direct runoff hydrograph, effective rainfall ,unit hydrograph.

**UNIT I HYDROGEOLOGICAL PARAMETERS 9**

Type of aquifers - Aquifer properties –permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation – GEC norms - Steady state flow - Darcy’s Law - Groundwater Velocity – DupuitForchheimerassumption – Steady Radial Flow into a Well

**UNIT II WELL HYDRAULICS 9**

Unsteady state flow - Theis method - Jacob method – Chow’s method – Law of Times – Theis Recovery – Bailer method – Slug method - tests - Image well theory – Partial penetrations of wells – Well losses – Specific Capacity and Safe yield - Collector well and Infiltration gallery

**UNIT III GROUNDWATER MANAGEMENT 9**

Need for Management Model – Database for Groundwater Management – Groundwater balance study – Introduction to Mathematical model – Model Conceptualization – Initial and Boundary Condition – Calibration – Validation – Future Prediction – Sensitivity Analysis – Uncertainty –Development of a model

**UNIT IV DARCY’S LAW AND HYDRAULIC CONDUCTIVITY 9**

Introduction.Darcy’s law. Hydraulic conductivity. Coefficient of permeability and Intrinsic permeability, Transmissibility, Permeability in Isotropic,Unisotropic layered soils. Steady one dimensional flow,different cases with recharge.

**UNIT V RUN OFF HYDROGRAPH 9**

Factors affecting shape of hydrograph, components of direct runoff hydrograph, base flow separation, effective rainfall, unit hydrograph, use and limitation, derivation of unit hydrograph of different duration, S-curve hydrograph

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- Understand aquifer properties and its dynamics
- Get an exposure towards well design and practical problems
- Develop a model for groundwater management.
- Students will be able to understand the importance of artificial recharge and groundwater quality concepts
- Gain knowledge on conservation of groundwater.

**TEXT BOOKS**

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.
2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.

**REFERENCES**

1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2002.
2. Ground Water Resource Evaluation- W.C. Walton, - McGraw Hill - Kogakusha Ltd., New Delhi.
3. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.
4. Subramanya,K., EngineeringHydrology,4/e, McGraw Hill(India),2013.
5. Water wells and Pumps – Michel D.M., Khepar. S.D., Sondhi. S.K., McGraw Hill Education – 2<sup>nd</sup>Edition.

**U20CE745**

**RIVER ENGINEERING**

L	T	P	C
3	0	0	3

**Pre-requisite:** U20CE702

**COURSE OBJECTIVES**

- To understand theoretical concepts of water and sediment movements in rivers.
- To study river Hydraulics and propagative of surface waves.
- To analyse the river mechanics like river equilibrium and river data base.
- To Learn about the river survey and models
- To inculcate the benefits of fluvial system to the society.

**UNIT I RIVER FUNCTIONS 9**

Primary function of a river – River uses and measures – Water and Sediment loads of river – Rivers in India, Himalaya and Peninsular.

<b>UNIT II</b>	<b>RIVER HYDRAULICS</b>	<b>9</b>
Physical Properties and Equations – Steady flow in rivers – uniform and non-uniform – Turbulence and velocity profiles – resistance coefficients – Boundary conditions and back waters – Transitions – Rating Curve – Unsteady flow in rivers : Propagative of surface waves – Characteristics, flood waves – kinematic and diffusion analogy – velocity of propagation of flood waves – Flood wave		
<b>UNIT III</b>	<b>RIVER MECHANICS</b>	<b>9</b>
River Equilibrium : Stability of Channel – regime relations – river bend equilibrium – hydraulic geometry of downstream - Bars and meandering - River dynamics – degradation and aggradation of river bed – Confluences and branches – River Data base.		
<b>UNIT IV</b>	<b>RIVER SURVEYS AND MODEL</b>	<b>9</b>
Mapping – Stage and Discharge Measurements – Sediments – Bed and suspended load Physical hydraulic Similitude – Rigid and mobile bed – Mathematical – Finite one dimensional – multi – dimensional – Water Quality and ecological model		
<b>UNIT V</b>	<b>RIVER MANAGEMENT</b>	<b>9</b>
River training works and river regulation works – Flood plain management – waves and tides in Estuaries - Interlinking of rivers – River Stabilization		

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

1. Primary functions of river, uses and sediments loads of river
2. Steady flow in rivers like uniform, non uniform and boundary conditions and back waters
3. Understand the river equilibrium stability of channel, regime relations, river bend equilibrium and hydraulic geometry of downstream.
4. River survey are discharge measurement, sediments, bed and suspended load.
5. River Managemnt like river training works, river regulation work and river stabilization.

**TEXT BOOKS**

1. River Engineering K.D. Gupta Vayu Education of India

**REFERENCES**

1. Janson PL.Ph., Lvan Bendegam Jvanden Berg, Mdevries A. Zanen (Editors), "Principles of River Engineering – The non-tidal alluvial rivers" – Pitman, 1979.
2. Pierre Y. Julien., "River Mechanics", Cambridge University Press, 2002.
3. K.L Rao, "INDIA"s WATER WEALTH" – Orient Longman Ltd., 1979.

**SEMESTER VIII**

<b>U20CE801</b>	<b>PROJECT WORK</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>12</b>	<b>6</b>

**Pre-requisite:**

**COURSE OBJECTIVES**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

**STRATEGY:**

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

**TOTAL: 180 PERIODS**

**COURSE OUTCOMES :**

**Learners are able to**

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**SEMESTER VIII  
PROFESSIONAL ELECTIVE V**

<b>U20CE851</b>	<b>REPAIR AND REHABILITATION OF STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE503

**COURSE OBJECTIVES**

- To learn various distress and damages to concrete and masonry structures •
- To understand the importance of maintenance of structures
- To study the various types and properties of repair materials
- To assess the damage to structures using various tests
- To learn the importance and methods of substrate preparation
- To learn various repair techniques of damaged structures, corroded structures
- To acquire the knowledge on Quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

**UNIT I      MAINTENANCE AND REPAIR STRATEGIES      9**

Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating damaged structure, causes of deterioration.

**UNIT II      STRENGTH AND DURABILITY OF CONCRETE      9**

Quality assurance for concrete–Strength, Durability- Cracks, different types, causes–Effects due to climate, temperature, Sustained elevated temperature, Corrosion.

**UNIT III      SPECIAL CONCRETES      9**

Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self-compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

**UNIT IV      TECHNIQUES FOR REPAIR AND PROTECTION METHODS      9**

Non-destructive Testing Techniques, Load Test for Stability-Epoxy injection, Shoring, Underpinning, Corrosion protection techniques–Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.

**UNIT V      REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES      9**

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage, earthquake-Transportation of Structures from one place to other –Structural Health Monitoring-demolition techniques-Engineered demolition methods-Case studies

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- The importance of maintenance and assessment method of distressed structures.
- The strength and durability properties, their effects due to climate and temperature.
- Recent development in concrete
- The techniques for repair and protection methods
- Repair, rehabilitation and retrofitting of structures and demolition methods.

## TEXT BOOKS

1. Shetty.M.S. "ConcreteTechnology-Theory and Practice, S.Chand and Company, 2008.
2. Varghese.P.C Maintenance Repair and Rehabilitation & Minor works of building, Prentice Hall India Pvt Ltd 2014.

## REFERENCES

1. Dodge Woodson.R Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann, Elsevier, New Delhi 2012.
2. DovKominetzky.M.S.,-Design and Construction Failures, Galgotia, Publications Pvt.Ltd.,2001
3. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.
4. Ravishankar.K. Krishnamoorthy.T.S, Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures, Allied Publishers, 2004.
5. Vidivelli.B Rehabilitation of Concrete Structures Standard Publishes Distribution.1st edition 2009.

<b>U20CE852</b>	<b>GROUND IMPROVEMENT TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE505

## COURSE OBJECTIVES

1. Understanding the engineering behaviour of various natural and man-made soil deposits
2. Understanding the concept of various ground improvement techniques
3. Selection of site specific method of improvement and its design
4. Exposure to recent ground improvement techniques through various case studies
5. Need for ground improvement and different mechanical, chemical, static and dynamic techniques of ground improvement.
6. Various stabilization techniques for cohesion less and cohesive soils
7. Miscellaneous techniques of ground improvement including geotextiles and reinforced earth.

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
	Need for ground improvement, applications, factors affecting, and different mechanical, chemical, static and dynamic techniques.	
<b>UNIT II</b>	<b>CHEMICAL STABILIZATION</b>	<b>9</b>
	Lime, cement, bitumen, factors influencing – Design approach, construction procedure, laboratory testing, additives. Suspension and solution grouts, principles, methods, equipment, applications, compaction grouting, jet grouting, permeation grouting	
<b>UNIT III</b>	<b>COHESION LESS SOILS</b>	<b>9</b>
	In situ densification, vibro techniques – Mechanisms. Factors affecting, suitability number, compacting piles. Vibro replacement process.	
<b>UNIT IV</b>	<b>COHESIVE SOILS</b>	<b>9</b>
	In situ densification, pre-loading – dewatering-sand drains. Sandwicks, geodrains, ropedrains, band drains, stone columns, lime piles – thermal and vacuum methods.	
<b>UNIT V</b>	<b>MISCELLANEOUS TECHNIQUES</b>	<b>9</b>
	Soil Nailing, Soil Anchoring, Micropiles, Highway Slope Stabilization Techniques Rip Rap method <b>Geotextiles:</b> - Woven and non-woven fabrics, types, functions and application – Geo-textiles, geogrids, tests on geo-textiles. <b>Reinforced earth:</b> Concept of reinforced earth, reinforcing materials, applications of reinforced earth structures	

**TOTAL: 45 PERIODS**

## COURSE OUTCOMES

**Learners are able to**

- Appreciate the need for ground improvement and different mechanical, chemical, static and dynamic techniques
- Recognize various chemical stabilization and grouting techniques
- Understand different ground improvement techniques for cohesionless soils
- Recognize different ground improvement techniques for cohesive soils
- Identify miscellaneous techniques of ground improvement

**TEXT BOOKS**

1. Hausmann R., "Engineering principles of Ground Modification", McGraw Hill Publishing Co, 1990.
2. Purushothama Raj P., Ground Improvement Techniques, Laxmi Publications, 2016.

**REFERENCES**

1. Fang-Hsai – Yang, "Foundation Engineering Hand Book", CBS Publication, New Delhi, 1990.
2. Moseley, M.P., "Ground Improvement", Blackie, Academic & professional, 1993

<b>U20CE853</b>	<b>STRUCTURAL HEALTH MONITORING AND RETROFITTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:**

**COURSE OBJECTIVES**

- Identify the importance of structural health monitoring, which gives the knowledge about the safety & stability of structures
- Assess the present condition and strength of an existing structure by adopting Non destructive testing methods.
- Conduct condition survey concrete structures by Non destructive evaluation.
- Learn the structural health monitoring using fiber-optic and Piezoelectric sensors. 4. Study the structural health monitoring using electrical resistance and electromagnetic techniques

**UNIT I INTRODUCTION TO STRUCTURAL HEALTH MONITORING (SHM) 9**

Definition & motivation for SHM, SHM – a way for smart materials and structures, SHM and bio mimetic - analogy between the nervous system of a man and a structure with SHM, SHM as a part of system management, Passive and Active SHM, NDE, SHM and NDECS, Basic components of SHM, materials for Sensor design.

**UNIT II APPLICATION OF SHM IN CIVIL ENGINEERING 9**

Introduction to capacitive methods, capacitive probe for cover concrete, SHM of a bridge, applications for external post tensioned cables, monitoring historical buildings

**UNIT III NON DESTRUCTIVE TESTING OF CONCRETE STRUCTURES 9**

Introduction to NDT - Situations and contexts, where NDT is needed, classification of NDT procedures, Visual Inspection, Half- Cell Electrical Potential Methods, Schmidt Rebound Hammer Test, Resistivity Measurement, Electro Magnetic Methods, Radiographic Testing, Ultrasonic Testing, Infra-Red Thermography, Ground penetrating Radar, Radio Isotope gauges, Other methods.

**UNIT IV CONDITION SURVEY & NDE OF CONCRETE STRUCTURE 9**

Definition and objective of Condition Survey, Stages of Condition Survey (Preliminary, Planning, Inspection and Testing stages), possible defects in concrete structures, Quality control of concrete structures- Definition and need, Quality control applications in concrete structures, NDT as an option for Non-Destructive Evaluation (NDE) of Concrete structures, Case studies of a few NDT procedures on concrete structures

**UNIT V REHABILITATION AND RETROFITTING OF CONCRETE STRUCTURES 9**

Repair, rehabilitation & retrofitting of structures, damage assessment of concrete structures, materials and methods for repairs and rehabilitation, modelling of repaired composite structure, structural analysis

and design – importance of re-analysis, execution of rehabilitation strategy, case studies

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- Explain the importance of structures health monitoring (SHM) and the basic components of SHM.
- Describe the application of SHM in civil engineering with respect to various types of structures.
- Describe the various methods of Non – destructive testing of concrete structures to know their health condition.
- Examine the various Non – destructive testing methods which are suitable for determining the condition of the existing concrete structures.
- Examine the condition of the existing structures by conducting condition survey to know various defects and to make use NDT methods for evaluation to suggest the methods of rehabilitation.

**TEXT BOOKS**

1. Daniel Balageas, Claus-Peter Fritzenaml Alfredo Guemes, “Structural Health Monitoring” published by ISTE Ltd, U.K. 2006.
2. “Guide book on Non-destructive Testing of Concrete Structures, Training Course series no. 17”, International Atomic Energy Agency, Vienna, 2002

**REFERENCES**

1. Hand book on “Repair and Rehabilitation of RCC Buildings”, published by Director General, CPWD, Govt. of India, 2002.
2. Handbook on Seismic Retrofitting of Buildings, published by CPWD & Indian Building Congress in Association with IIT, Madras, Narosa Publishing House, 2008.

<b>U20CE854</b>	<b>GREEN BUILDING PRACTICES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20HS202

**COURSE OBJECTIVES**

- To get a comprehensive overview of materials used for sustainable buildings.
- To understand the effects of technology on materials and the way they are used with respect to sustainability.
- To Learn the principles of planning and orientation of buildings.
- To Acquire knowledge on various composites aspects of green buildings

<b>UNIT I</b>	<b>ENVIRONMENTAL IMPLICATIONS OF BUILDINGS</b>	<b>9</b>
Energy use, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transportation Energy for Building Materials; Maintenance Energy for Buildings.		
<b>UNIT II</b>	<b>IMPLICATIONS OF BUILDING TECHNOLOGIES EMBODIED ENERGY OF BUILDINGS</b>	<b>9</b>
Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.		
<b>UNIT III</b>	<b>COMFORTS IN BUILDING</b>	<b>9</b>
Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations.		
<b>UNIT IV</b>	<b>UTILITY OF SOLAR ENERGY IN BUILDINGS</b>	<b>9</b>
Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.		

**UNIT V GREEN COMPOSITES FOR BUILDINGS**

**9**

Concepts of Green Composites. Water Utilisation in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- Building materials Energy use, carbon emissions, water use, waste disposal
- Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings
- Thermal comfort buildings issues
- Utility of solar energy in buildings concepts of solar passive cooling and heating
- Explain green composite for buildings like Water utilization, Low energy approaches to water management and Green buildings

**TEXT BOOKS**

1. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
2. Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.
3. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

**REFERENCES**

1. Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke
2. Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
3. Osman Attmann Green Architecture Advanced Technologies and Materials. McGraw Hill, 2010.

<b>U20CE855</b>	<b>GEO-ENVIRONMENTAL AND GEO HAZARD ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:**

**COURSE OBJECTIVES**

- To Learn about geoenvironmental engineering, environmental cycle, sources, production and classification of waste.
- To understand the site selection and safe disposal of waste
- Transport of contaminants of sub surface, advection. Diffusion, dispersion, ion exchange and precipitation.
- To know the waste stabilization, Solidification of wastes, Micro and macro encapsulation, Absorption, Adsorption, Precipitation, Detoxification, Mechanism of stabilization
- The student acquires the knowledge on the Geotechnical engineering problems associated with soil contamination, safe disposal of waste and remediate the contaminated soils by different techniques thereby protecting environment.

**UNIT I GENERATION OF WASTES AND CONSEQUENCES OF SOIL POLLUTION**

**9**

Introduction to Geo environmental engineering – Environmental cycle – Sources, production and classification of waste – Causes of soil pollution – Factors governing soil pollution interaction clay minerals - Failures of foundation due to waste movement.

**UNIT II SITE SELECTION AND SAFE DISPOSAL OF WASTE**

**9**

Safe disposal of waste – Site selection for landfills – Characterization of land fill sites and waste – Risk assessment – Stability of landfills – Current practice of waste disposal – Monitoring facilities – Passive containment system – Application of geosynthetics in solid waste management – Rigid or flexible liners.

**UNIT III TRANSPORT OF CONTAMINANTS**

**9**

Contaminant transport in sub surface – Advection, Diffusion, Dispersion – Governing equations – Contaminant transformation – Sorption – Biodegradation – Ion exchange – Precipitation – Hydrological

consideration in land fill design – Ground water pollution.

**UNIT IV WASTE STABILIZATION 9**

Stabilization - Solidification of wastes – Micro and macro encapsulation – Absorption, Adsorption, Precipitation – Detoxification – Mechanism of stabilization – Organic and inorganic stabilization – Utilization of solid waste for soil improvement – case studies.

**UNIT V REMEDIATION OF CONTAMINATED SOILS 9**

Exists and Insitu remediation-Solidification, bio-remediation, incineration, soil washing, phyto remediation, soil heating, verification, bio-venting.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- Study Geo environmental engineering, Environmental cycle, Sources, production and classification of waste ,Causes of soil pollution
- Understand Safe disposal of waste, Site selection for landfills, Characterization of land fill sites and waste, Risk assessment, Stability of landfills, Current practice of waste disposal.
- Analyze the transport of contaminants.
- Utilization of solid waste for soil improvement
- Exists and Insitu remediation-Solidification, bio-remediation, incineration, soil washing.

**TEXT BOOKS**

1. Hari D. Sharma and Krishna R. Reddy, “Geo-Environmental Engineering” –John Wiley and Sons, INC, USA, 2004.
2. ManojDatta, B.P. Parida, B.K. Guha, “Industrial Solid Waste Management and Landfilling Practice”, Narosa Publishing House, 1999.

**REFERENCES**

1. ASTM Special Tech. Publication 874, Hydraulic Barrier in Soil and Rock, 1985.
2. Lagrega, M.D., Buckingham, P.L. and Evans, J.C., “Hazardous Waste Management” McGraw Hill Inc. Singapore, 1994.
3. Ott, W.R., “Environmental indices, Theory and Practice”, Ann Arbor, 1978.
4. Wentz, C.A., “Hazardous Waste Management”, McGraw Hill, Singapore, 1989
5. Westlake, K, “Landfill Waste pollution and Control”, Albion Publishing Ltd., England, 1995.

**SEMESTER VIII**

**ELECTIVE VI**

U20CE861	<b>PREFABRICATED STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE602

**COURSE OBJECTIVES**

- To get introduced to the concepts of prefabrication, types and its systems.
- To have a knowledge about the structural behaviour of prefabricated structures.
- To obtain knowledge in design of cross section and the joints in structures.
- To have a detailed knowledge in designing and detailing of various prefabricated units.
- To possess a comprehensive knowledge in design of structures subjected to earthquake.
- To impart knowledge to students on modular construction, industrialised construction and design of prefabricated elements and construction methods.

**UNIT I INTRODUCTION 9**

Need for prefabrication – Principles of prefabrication – Modular coordination – Standarization –

Materials – Systems – Production – Transportation – Erection.

**UNIT II PREFABRICATED COMPONENTS 9**

Behaviour and types of structural components – Large panel systems – roof and floor slabs – Walls panels - Beams - Columns - Shear walls

**UNIT III DESIGN PRINCIPLES 9**

Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems.

**UNIT IV JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS 9**

Types of Joints – based on action of forces - compression joints - shear joints - tension joints - based on function - construction, contraction, expansion. Design of expansion joints - Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.

**UNIT V DESIGN FOR ABNORMAL LOADS 9**

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- The student will have good knowledge about design principles, layout of factory and stages of loading in precast construction.
- Acquire knowledge about panel systems, slabs, connections used in precast construction and they will be in a position to design the elements.
- Acquire knowledge about types of floor systems, stairs and roofs used in precast construction.
- Acquire knowledge about types of walls used in precast construction, sealants, design of joints.
- Acquire knowledge about components in industrial building.

**TEXT BOOKS**

1. Bachmann, H. and Steinle, A. "Precast Concrete Structures", Ernst & Sohn, Berlin, 2011
2. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema a. Publishers, USA, 1991.

**REFERENCES**

1. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.
2. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976..
3. Lewitt, M. " Precast Concrete- Materials, Manufacture, Properties And Usage", Applied Science Publishers , London And New Jersey, 1982.
4. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland BetorVerlag, 2009.

<b>U20CE862</b>	<b>DESIGN OF SUBSTRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:** U20CE602

**COURSE OBJECTIVES**

- To Understand design of composite foundation systems of shallow foundations.
- To Understand design of deep foundation systems.
- To Analyze and understand various foundation failures.
- To Calculate the sub grade reaction soil.

**UNIT I Isolated and combined Arch 9**

Design of different isolated and combined footings including eccentric loading, Design of inverted arch foundation.,

**UNIT II** raft foundation **9**

Design of raft foundation. Analysis and design of Abutments, Pier and Retaining walls

**UNIT III** deep foundation **9**

Design of deep foundation such as pile and well foundation.

**UNIT IV** machine foundation. **9**

Introduction to analysis and design of simple machine foundation.

**UNIT V** **9**

Theory of sub grade reaction, beam on elastic foundation, Concrete pavements.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**Learners are able to**

- Design isolated and combined footing
- Design raft foundation
- Design Deep foundation like pile and well foundation
- Design Machine foundation
- Calculate the sub grade reaction soil.

**TEXT BOOKS**

1. Swami Saran , Analysis and Design of Substructures Limit State Design, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, (2007)
2. Kurian N.P., Design of Foundation Systems- Principles and Practices, Narosa Publishing House, New Delhi (2006)
3. Verghese P.C., Reinforced Concrete Design, Prentice hall of India, New Delhi, 2001.
4. Pillai S. V. and MenonD.,Reinforced concrete Design, TMH, New Delhi, 2009

**REFERENCES**

1. Bowles, J. E, Foundation Analysis & Design, McGraw Hill Inc, NY (1999)
2. Swami Saran, Soil Dynamics and Machine Foundations, Galgotia Publications (P) Ltd, New Delhi(2006)
3. Srinivasulu P, Vaidyanathan C V, Handbook of Machine Foundation, tataMc-Graw Hill, New Delhi(2002)
4. Kurian N.P., Modern Foundations, Introduction to Advanced Techniques , Tata McGraw Hill, New Delhi (1982)
5. Ghosh, —Foundatios design in practicell, Phi Publisher, New Delhi
6. Som and Das, —Theory and Practice of Foundation Design, Phi Publisher, New Delhi

<b>U20CE863</b>	<b>BUILDINGSERVICES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-requisite:**

**COURSE OBJECTIVES**

- This subject covers the various aspects of pumps and machinery involved in Civil Engineering practice and the principles of electrical and air conditioning facilities involved.
- Building water supply and drainage have been covered under subjects namely Environmental Engineering and Environmental Engineering Drawing.
- To preserve machinery, building and services, in good operating condition.

- Defining and identifying of engineering services systems in buildings.
- The role of engineering services systems in providing comfort and facilitating life of users of the building.

**UNIT I MACHINERIES 8**  
Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

**UNIT II ELECTRICAL SYSTEMS IN BUILDINGS 10**  
Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations- Computer Application design of electrical equipment handled.

**UNIT III PRINCIPLES OF ILLUMINATION & DESIGN 8**  
Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lamps of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature– Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

**UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS 10**  
Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Subcooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems

**UNIT V FIRE SAFETY INSTALLATION 9**  
Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers- Computer Application of fire safety

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES**

### **Learners are able to**

- Challenges and constraints in dealing with existing buildings (technical, economic, social, IEQ/wellbeing).
- Methods for evaluating existing buildings and their renovation potential
- Renovation solutions
- Design criteria (IEQ, energy performance)
- Economic profitability of measures

## **TEXT BOOKS**

5. E.R.Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 1968.
6. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.

## **REFERENCES**

1. Philips Lighting in Architectural Design, McGraw-Hill, New York, 1964.





## REFERENCES

1. CBRI, Roorkee Publications and Handbook.
2. Publications of Center of Science for Villages such as „Building Dreams in Mud“.
3. „Venu Bharti“ by Ar. Vinoo Kaley, Nagpur and Articles by Ar. Ashok Joshi, Nagpur.
4. Publication of Auroville Building Center, Pondicherry.
5. Publications and manual of Laurie Baker Center, N. Delhi.