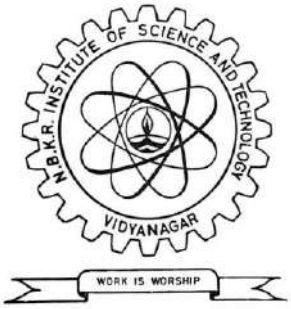
N.B.K.R. INSTITUTE OF SCIENCE & TECHNOLOGY

(AUTONOMOUS)
COLLEGE WITH POTENTIAL FOR EXCELLENCE (CPE)
Affiliated to JNTUA, Ananthapuramu
Re-Accredited by NAAC with 'A' Grade
B.Tech. Courses Accredited by NBA under TIER-I



SYLLABUS

B.TECH. DEGREE COURSE

CIVIL ENGINEERING

(With effect from the batch admitted in the academic year 2020-2021)
&
B.Tech (Lateral entry scheme)
(for the batches admitted from the academic year 2021-22)

VIDYANAGAR - 524413
SPSR Nellore-Dist., Andhra Pradesh
www.nbkrist.org

VISION AND MISSION OF THE INSTITUTE

Vision

- To emerge as a comprehensive Institute that provides quality technical education and research thereby building up precious human resource for the industry and society.

Mission

- To provide a learner-centered environment that challenges individuals to actively participate in the education process.
- To empower the faculty to excel in teaching while engaging in research, creativity and public service.
- To develop effective skills enabling learners to pick up critical thinking thus crafting them to be professionally fit and ethically strong.
- To reach out industries, schools and public agencies to partner and share human and academic resources.

VISION AND MISSION OF THE CIVIL ENGINEERING DEPARTMENT

Vision

- To promote excellence in civil engineering education, enrich research and provide quality professional service to the society in all areas of civil engineering.

Mission

- To provide a learner-centered environment for students to gain comprehensive knowledge in civil engineering.
- To provide a learning experience that fosters an aptitude for research.
- To provide graduates with contemporary skills and tools required to excel in civil engineering profession or alternate fields. To produce graduates to serve within the constraints of complex needs of the society with high integrity.

PROGRAMME EDUCATIONAL OBJECTIVES OF THE DEPARTMENT

PEO 1 : Graduates will be proficient in the fundamental knowledge of basic science, engineering science including mathematical and computational skills appropriate for civil engineering.

PEO 2 : Graduates will be successful practicing engineers in civil engineering and allied fields or alternate careers using their technical knowledge, teamwork, communication skills and leadership qualities.

PEO 3 : Graduates will be innovative problem solvers within the realistic constraints of economic, environmental, social, political, health, safety and sustainability impacts and serve the society as responsible professionals with integrity.

PEO 4 : Graduates will engage in lifelong learning within the profession or through higher studies.

PROGRAMME OUTCOMES OF THE DEPARTMENT

The programme outcomes are the skills and knowledge which the graduates have at the time of graduation:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1: The graduate will excel in software tools related to major diciplines of civil engineering.

PSO2: The graduates will provide innovative solutions to the civil engineering problems.

PSO3: The graduates will exhibit prowess to serve as entrepreneuring civil engineering consultants.

N.B.K.R. INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR

(AUTONOMOUS)

CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the batch admitted in the academic year 2020-2021)

I YEAR OF FOUR YEAR B.TECH. DEGREE COURSE – I SEMESTER

Induction Program:

Induction program (Mandatory)	3 weeks duration			
Induction program for students to be offered right at the start of the first year.	(1) Physical activity	(2) Creative Arts	(3) Universal Human Values	(4) Literary
	(5) Proficiency Modules	(6) Lectures by Eminent People	(7) Visits to local Areas	(8) Familiarization to Dept./Branch & Innovations

S.NO.	Course Code	Course Title	Contact Hours/ Week			Credits	Evaluation									
							Sessional Test-I			Sessional Test-II			Total Sessional Marks (Max. 40)	Semester End Examination		Max. Total Marks
		THEORY	L	T	P		Test-I (2 hrs.)	Assignment-I	Max. Marks	Test-II (2 hrs.)	Assignment-II	Max Marks	0.8(Better of two sessional tests) + 0.2(Other)	Duration In Hours	Max. Marks	
1	20SH1101	Engineering Chemistry[#]	3	0	0	3	34	6	40	34	6	40		3	60	100
2	20SH1102	Engineering Mathematics –I*	3	0	0	3	34	6	40	34	6	40		3	60	100
3	20SH1103	Communicative English[*]	3	0	0	3	34	6	40	34	6	40		3	60	100
4	20CS1101	Programming for Problem Solving [ϕ]	3	0	0	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
1	20SH11P1	Engineering Chemistry Laboratory[#]	0	0	3	1.5	-	-	-	-	-	-	Day-to-day Evaluation and a test (40 marks)	3	60	100
2	20CS11P1	Programming for Problem Solving Laboratory [ϕ]	0	0	3	1.5	-	-	-	-	-	-		3	60	100
3	20ME11P1	Computer Aided Engineering Drawing Laboratory [δ]	0	0	6	3	-	-	-	-	-	-		3	60	100
4.	20SH11P2	English Language Lab [ϕ]	0	0	3	1.5	-	-	-	-	-	-		3	60	100
TOTAL						**19.5**										

CE & ME; ***** Common to all; **$** Other than ME; ϕ CE, ME & ECE; δ CE & ECE

20SH1101-ENGINEERING CHEMISTRY

(Common to CE and ME)

Course Category:	Basic Science	**Credits**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Fundamental concepts of Chemistry	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To familiarize engineering chemistry and its applications 2. To impart the concept of soft and hard waters, softening methods of hard water 3. To train the students on the principles and applications of electrochemistry, polymers, surface chemistry, and cement	
Course Outcomes	CO1	Explain the principles of reverse osmosis and electro dialysis
	CO2	Apply Nernst equation for calculating electrode and cell potentials
	CO3	Demonstrate the factors affecting corrosion and corrosion prevention methods
	CO4	Differentiate between thermoplastics and thermosetting plastics
	CO5	Solve the numerical problems based on Calorific value
	CO6	Enumerate the reactions at setting and hardening of cement

Course content

UNIT I

WATER TECHNOLOGY

Introduction: Hardness of water, types of hardness, units of hardness, disadvantages of hard water, Estimation of hardness of water by EDTA Method - Boiler troubles - scale and sludge, Priming and foaming, caustic embrittlement, Boiler corrosion, Industrial water treatment – Lime-soda, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electro dialysis.

UNIT II

ELECTRO CHEMISTRY AND APPLICATIONS

Electrodes: concepts, Electrode potential, Nernst equation, reference electrodes (Calomel electrode and glass electrode) electrochemical cell, cell potential calculations, numerical problems.

Primary cells: Zinc-air battery.

Secondary cells: lead acid and lithium ion batteries-working of the batteries including cell reactions.

Fuel cells: hydrogen-oxygen fuel cell– working of the cells.

Potentiometry: potentiometric titration (strong acid vs. strong base).

Conductometry: Conductometric titrations (strong acid vs. strong base & weak acid vs. strong base).

UNIT III

CORROSION

Introduction to corrosion, definition, types of corrosion, Mechanism of corrosion- metal oxide formation by dry corrosion, Pilling Bed worth ratios and uses and electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, Factors affecting

	the corrosion, prevention methods of corrosion- Cathodic protection (Sacrificial anodic protection and Impressed current cathodic protection) and Metallic coatings (Electroplating). **UNIT IV** **POLYMER CHEMISTRY** Introduction to polymers, Polymerization and Types of polymerisation (addition, condensation and co-polymerisation). **Plastomers**: Thermoplastics and Thermo setting plastics, Preparation, properties and applications of PVC, Bakelite, Urea-Formaldehyde and Nylons. **Elastomers:** Preparation, properties and applications of Buna S, Buna N and Thiokol. **UNIT V** **FUEL TECHNOLOGY** **Chemical fuels**: Introduction, classification, characteristics of a good fuel, calorific value, determination of calorific value (Bomb and Boy's gas calorimeters), numerical problems based on calorific value. **Solid Fuels -** Analysis of coal (Proximate and Ultimate analysis). **Liquid Fuels -**Refining of petroleum, knocking and anti-knock agents, Octane and Cetane values. **Gaseous Fuels-**Flue gas analysis by Orsat's apparatus. **UNIT VI** **ADVANCED ENGINEERING MATERIALS** **Refractories:** Classification, properties, criteria for a good Refractory material and Applications **Lubricants:** Classification, Functions of lubricants, Mechanism, Properties of lubricants- Viscosity, viscosity index, Flash and Fire points, Cloud and Pour points and Applications Building materials- Cement – classification, Portland Cement - constituents, Setting and Hardening of Portland Cement.
Textbooks & Reference books	**TEXTBOOKS:** 1. Jain and Jain, *"Engineering Chemistry"*, Dhanpat Rai Publishers, 16th edition, 2013. 2. Peter Atkins, Julio de Paula and James Keeler, *"Atkins' Physical Chemistry"*, 10th edition, Oxford University Press, 2010. **REFERENCE BOOKS:** 1. K N Jayaveera, G V Subba Reddy and C Rama Chandraiah, *"Engineering Chemistry"* 1st edition, Mc Graw Hill Education (India) Pvt. Ltd, New Delhi 2016. 2. Dr. S.S. Dara and Dr. S.S Umare, *"A Text book of Engineering Chemistry"*, 1st edition, Chand & Company Ltd., 2000. 3. K Sesha Maheswaramma and Mridula Chugh, *"Engineering Chemistry"* 1st edition, Pearson India Education Services Pvt. Ltd, 2016. 4. D. J. Shaw, *"Introduction to Colloids and Surface Chemistry",* 4th edition, Butterworth Heineman, 2013.

20SH1102-ENGINEERING MATHEMATICS –I

(Common to all branches)

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre – requisite:	Intermediate Mathematics	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	To make the student learn about 1. The concepts of Newton's law of cooling, Law of natural growth and decay. 2. Solving higher order differential equations with RHS of different types by using analytical techniques. 3. The concepts of first shifting theorem, Change of scale property, Laplace transformation of multiplied by t and division by t and transformation of derivatives and integrals. 4. The application of solutions of Ordinary Differential Equations. 5. The basic concepts of Matrices. 6. Taylor's and Maclaurin's series, Maxima and Minima of the functions of two and three variables. Learn about Gamma and Beta functions	
Course Outcomes	CO1	Attains skills in solving first order differential equations and its applications.
	CO2	Acquire knowledge in solving higher order differential equations by using various types.
	CO3	Acquire basic knowledge in Laplace transforms and their applications.
	CO4	Develop analytical skills in solving the Ordinary Differential Equations by using the Laplace transform technique.
	CO5	Understand effectively the analyzation of the Rank of the matrix, Consistency of system of linear equations, Eigen values and Eigen vectors.
	CO6	Attains skills in analyzing the Taylor's and Maclaurin's series and Maxima and Minima of the functions of two and three variables. Apply Gamma and Beta functions to evaluate integrals.

Course Content

UNIT – I

Differential equations of first order and first degree – Exact, linear and Bernoulli equations. Applications: to Newton's law of cooling, law of natural growth and decay, orthogonal trajectories.

UNIT - II

Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type e^{ax}, Sin ax, cos ax, polynomials in x, e^{ax} V(x), x^kV(x), method of variation of parameters.

	UNIT - III Laplace transform of standard functions – First shifting Theorem, Change of scale property – Laplace transformation of multiple by t and division by t –Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Laplace transform of Periodic function. **UNIT - IV** Inverse Laplace transform of standard functions – Method of partial fractions – Shifting property – Inverse Laplace transform of a multiple by s and division by s – Differentiation and integration of Inverse Laplace transform – Convolution theorem – Application of Laplace transforms to ordinary differential equations of first and second order. **UNIT - V** **Matrices:** Rank of Matrix by Echelon form, System of homogenous and non- homogenous linear equations, Eigen values and Eigen vectors and their properties. Cayley-Hamilton Theorem (without proof). **UNIT - VI** **Calculus**: Taylor's and Maclaurin's series – Maxima and Minima of function of three variables with Lagrangian multipliers method – Beta and Gamma functions and their applications.
Textbooks & Reference books	**TEXTBOOKS:** 1. B. S. Grewal, *"Higher Engineering Mathematics"*, Khanna Publishers, New Delhi. 44th edition, 1965. 2. B.V. Ramana, *"Engineering Mathematics"*, Tata McGraw-Hill Education Pvt. Ltd, New Delhi, 1st editon, 2017. **REFERENCES:** 1. H.K. Dass, Er. Rajnish Verma, *"Higher Engineering Mathematics"*, S. Chand Publications, New Delhi, 2014. 2. N.P. Bali & M. Goyal, *"Advanced Engineering Mathematics*", Lakshmi Publishers, New Delhi. 1st edition, 2015. 3. Erwin Kreyszig, *"Advanced Engineering Mathematics*" Wiley publications, India. 10th edition, 2010.

20SH1103 - COMMUNICATIVE ENGLISH

(Common to all Branches)

Course Category:	Humanities and Social Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic Level of LSRW skills	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected: 1. To develop basic writing skills in English. 2. To achieve specific linguistic and communicative competence. 3. To acquire relevant skills and make use them effectively in realistic working context. 4. To inculcate the habit of reading and aware of appropriate reading strategies. 5. To learn writing paragraphs effectively with unity and coherence. 6. To learn writing simple and analytical essays.	
Course Outcomes	CO1	Relate activity based teaching-learning methods to ensure that learners would be engaged in use of language.
	CO2	Demonstrate effective listening skills for better comprehension of academic lectures and English spoken by native speakers.
	CO3	Improve knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing.
	CO4	Interpret graphic elements used in academic texts and produce a coherent paragraph interpreting a figure/graph/chart/table
	CO5	Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
	CO6	Make use of appropriate reading strategies of comprehension in various academic texts and authentic materials and comprehend, discuss and respond to academic texts orally and in writing

Course Content	**UNIT-I** **Lesson: On the Conduct of Life: William Hazlitt** **Writing:** Paragraph Writing: Sentence Structures- use of phrases and clauses in sentences- importance of proper punctuation- creating coherence- beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences, **Vocabulary : Word formation - Suffixes** **UNIT-II** **Lesson: The Brook: Alfred Tennyson** **Writing:** Descriptions: Nature and style of sensible writing - describing - defining - classifying –providing examples and evidence - writing introduction and conclusion **Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article, prepositions, **Vocabulary: Word formation- Prefixes** **UNIT-III** **Lesson: The Death Trap: Saki** **Writing:** Drafting of Public Speech**:** Introduction – structure -content - informing facts - conclusion. **Grammar:** Pronoun – Agreement, subject-verb agreement **Vocabulary:** Synonyms **UNIT-IV** **Lesson: Innovation: Muhammad Yunus:** **Writing:** Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison **Vocabulary:** Antonyms **UNIT-V** **Lesson: Politics and the English Language: George Orwell** **Writing:** Letter Writing: Official Letters & E-mail letters **Grammar:** Verbs - Tenses; Active voice & Passive Voice, Question Tags, Reported speech **Vocabulary:** One word substitutes **Vocabulary:** Common Abbreviations

	UNIT –VI **Reading:** Comprehension: Different Reading Strategies - skimming – scanning - inferring, predicting and responding to content - guessing from context and vocabulary extension. **Writing:** Essay writing: Writing structured essays on specific topics - introducing the issue - analyzing and arguing - creating coherence –usage of proper punctuation – importance of conclusion **Grammar:** Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement).
Textbooks & Reference books	**TEXTBOOKS:** 1. Orient Black Swan *"Language and Life: A Skills Approach",* Orient Black Swan publications, 1st edition 2018. **REFERENCE BOOKS:** 1. Bailey, Stephen, "*Academic writing: A hand book for international students",* Routledge Publishers, 5th edition 2017. 2. Chase, Becky Tarver, "*Pathways: Listening, Speaking and Critical Thinking"*, Heinley ELT, 2nd edition, 2018. 3. Louis Rogers, Jennifer Wilkin and Dorothy Zemach, *"Skillful Level 2 Reading & Writing Student's Book*") Macmillan Educational, 2013. 4. Raymond Murphy, "*English Grammar in Use",* Cambridge English 4th edition E-book, 2012. 5. Hewings, Martin, "*Cambridge Academic English"*, Cambridge University Press; Student edition, 2012. **WEB LINKS:** 1. www.englishclub.com 2. www.easyworldofenglish.com 3. www.languageguide.org/english/ 4. www.bbc.co.uk/learningenglish 5. www.eslpod.com/index.html 6. www.myenglishpages.com

20CS1101 - PROGRAMMING FOR PROBLEM SOLVING

(Civil Engineering)

Course category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture – Tutorial – Practical:**	3-0-0
Prerequisite:	Knowledge on computer fundamentals and basic mathematics	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To learn the procedure how to develop algorithms, representations and programming development steps 2. To learn the basic building blocks of C language. 3. Usage of C constructs (arrays, structures, pointers and file management) to develop various programs. 4. To create better awareness how effectively utilizes the concepts of C for application development.	
Course Outcomes	CO1	Learn the fundamentals of programming development, structure of C and basic data types
	CO2	Find the usage of operators in expression evaluation and construction of I/O Statements.
	CO3	Acquire knowledge on various control structures to develop simple programs
	CO4	Explore the concept of arrays, strings and its effective utilization
	CO5	Understand the concepts of Pointers and Functions for exploring the dynamic memory usage
	CO6	Explore the basics of Structures, Unions, File operations and supporting implementations
Course Content	**UNIT – I** **INTRODUCTION:** Algorithms, Flow charts, Program development steps. **FUNDAMENTALS OF C:** History, Structure of a C program, Programming rules and execution. Character set, Delimiters, C keywords, Identifiers, Constants, Variables, Rules for defining Variables, Data types, Declaration and Initialization of Variables. **UNIT – II** **OPERATORS AND EXPRESSIONS:** Introduction, Operator Precedence and Associativity, Operator Types **INPUT AND OUTPUT IN C:** Formatted and Unformatted functions, Commonly used library functions. **UNIT – III** **DECISION STATEMENTS:** Introduction, Types of If statements, switch statement, break, continue, go to.	

	ITERATIVE STATEMENTS: while, do-while and for loops. **UNIT – IV** **ARRAYS**: Definitions, Initialization, Characteristics of an array, Array Categories. **STRINGS:** Declaration and Initialization of strings, String handling functions. **STORAGE CLASSES**: Automatic, External, Static and Register Variables. **UNIT – V** **POINTERS:** Fundamentals, Declaration and initialization of Pointers, Arithmetic Operations, Pointers and Arrays. **FUNCTIONS:** Definition, Function Prototypes, Types of functions, Call by Value and Call by Reference, Recursion. **UNIT – VI** **STRUCTURES:** Definition, Declaration and Initialization of Structures. **UNIONS:** Definition, Declaration and Initialization of Union. **FILES:** Introduction, File Types, Basic operations on Files, File I/O, Command Line Arguments.
Text Books and Reference Books	**TEXT BOOKS:** 1. Ashok N. Kamthane, *"Programming with ANSI & TURBO C"*, Pearson Education, 3rd edition, 2007. **REFERENCE BOOKS:** 1. Al Kelley, Ira Pohl, *"Programming in C"*, Addison-Wesley, 4th edition, 1999. 2. Yashavant Kanetkar, *"Let Us C"*, BPB Publications, 16th edition, 2019. 3. Balaguruswamy, *"Programming in ANSI C"*, 6th edition, Tata McGraw Hill Education, 2018.

20SH11P1 - ENGINEERING CHEMISTRY LABORATORY

(Common to CE and ME**)**

Course Category:	Basic Science	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Fundamental concepts of Chemistry	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	The main objective is to provide students to learn about experimental techniques in chemistry with knowledge in theoretical aspects so that they can excel in that particular field.	
Course Outcomes	CO1	Determine the cell constant and conductance of solutions
	CO2	Prepare advanced polymer materials
Course Content	Minimum of 8 experiments to be completed out of the following: **LIST OF EXPERIMENTS** 1. Determination of total hardness of water by EDTA method 2. Determination of total alkalinity of water 3. Estimation of chlorides using potassium chromate indicator 4. Determination of cell constant and conductance of solutions 5. Conductometric titration of strong acid vs. strong base 6. Conductometric titration of weak acid vs. strong base 7. Determination of pH of unknown solution 8. Potentiometry - determination of redox potentials and emfs 9. Determination of Strength of an acid in Pb-Acid battery 10. Preparation of a polymer 11. Determination of viscosity of oils with Redwood viscometer 12. Estimation of calcium in Portland cement	
Text Books	**TEXT BOOKS:** 1. Mendham J et al, *"Vogel's text books of quantitative chemical analysis"*, 5th edition, Pearson publications, 2012. 2. KN Jayaveera, Subba Reddy & Chandra Sekhar, *"Chemistry Lab Manual"*, SM Enterprises, Hyderabad, 1 edition, 2014. 3. Chatwal & Anand, *"Instrumental methods of chemical analysis"*, 2nd edition, Himalaya Publications, 2006.	

20CS11P1 - PROGRAMMING FOR PROBLEM SOLVING LABORATORY

(Civil Engineering)

Course Category:	Engineering Science	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 3
Prerequisite:	Basic mathematical knowledge to solve problems and computer fundamentals	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected:	
	To learn the C programming constructs and its implementation	
Course Outcomes	Upon successful completion of the course , the students will be able:	
	CO1	To Solve problems using C programming concepts
Course Content	**LIST OF EXPERIMENTS** 1. To evaluate expressions. 2. To implement if constructs. 3. To implement Switch statement. 4. To implement all iterative statements. 5. To implement Arrays. 6. To implement operations on Strings without using Library functions. 7. To implement arithmetic operations using pointers. 8. Implement both recursive and non-recursive functions. 9. To implement parameter passing techniques. 10. To implement Structures. 11. To implement basic File operations.	
Text Books and Reference Books	**TEXT BOOKS:** 1. Ashok N. Kamthane, *"Programming with ANSI & TURBO C"*, Pearson Education, 3rd edition, 2007. **REFERENCE BOOKS:** 1. Al Kelley, Ira Pohl, *"Programming in C"*, Addison-Wesley, 4th edition, 1999. 2. Yashavant Kanetkar, *"Let Us C"*, BPB Publications, 16th edition, 2019. 3. Balaguruswamy, *"Programming in ANSI C"*, 6th edition, Tata McGraw Hill Education, 2018.	

20ME11P2-COMPUTER AIDED ENGINEERING DRAWING LABORATORY

(Common to CE & ECE)

Course Category	Engineering Science	**Credits**	3
Course type	Practical	**Lecture- Tutorial-Practical**	0-0-6
Prerequisite	Geometrical Construction	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course	Marks	Examination and Evaluation		Scheme of examination
Computer Aided Engineering Drawing	60	Semester end Examination for 3 hours duration in the CAD Laboratory		60 marks are allotted for the drawing examination during semester end.
	40	20	Day-to-Day evaluation during the practice.	Marks are evaluated based on average performance of student in day-to-day exercises and finalized for 20 marks
		20	Drawing examination	Two drawing examinations are conducted for 20 marks. 80% of better one and 20% of the other are added and finalized for 20 marks. Drawing examination-I: Shall be conducted just before I mid-term examinations. Drawing examination-II: Shall be conducted just before II mid-term examinations.

Course Objectives	Students are made to understand / learn 1. To enable the students with various concepts like dimensioning, construction of conic sections, polygons, cycloids and involutes. 2. To impart and inculcate proper understanding of AutoCAD fundamentals. 3. To apply the knowledge of AutoCAD for the projections of points, lines and solids. 4. To know about sections and developments of solids. 5. To improve the visualization skills with isometric projections.	
Course Outcomes	At the end of the course, the student will be able to	
	CO1	Understand the conventions and methods of engineering drawings
	CO2	Sketch the solutions to the problems on projection of points, lines, planes and solids
	CO3	Demonstrate orthographic and Isometric principles
	CO4	Understand and apply the knowledge of engineering drawing in modern CAD tools.

1. INTRODUCTION TO CAD SOFTWARE

Introduction: Importance of Computer Aided Drawing, software tool environment, drawing size and scale, main menu, tool bar and menus, co-ordinate system, drafting settings.

Creation and Editing: Points, Lines, Poly lines, Polygons, Splines, circle, ellipse, text, move, copy, off-set, pan, mirror, rotate, trim, extend, break, chamfer, fillet, curves, block, layers, line representations, dimensioning and hatching.

2. GEOMETRICAL CONSTRUCTIONS, AND CONIC SECTIONS

Importance of Drawing, Drawing Instruments, Sheet layout, BIS Conventions, Types of lines, Lettering, and dimensioning methods.

Geometrical Constructions: Regular Polygons.

Course Content	**Conic Sections:** Introduction, Construction of Ellipse, Parabola and Hyperbola using Eccentricity method and Rectangular/ Oblong methods, Rectangular hyperbola. **3. SPECIAL CURVES** Construction of Cycloidal curves – Cycloid, Epi-cycloid and Hypo- cycloid. Involutes – Involutes of circle and polygons. **4. PROJECTIONS OF POINTS AND LINES** **Projections of Points:** Principles of projections, Planes of projection, Points in four quadrants. **Projections of Lines:** Line inclined to both the principal planes (first angle projection only). **5. PROJECTIONS OF PLANES** **Projections of Planes:** Plane (triangle, square, rectangle, pentagon, hexagon and circular) inclined to both the principal planes. **6. PROJECTIONS OF SOLIDS** **Projections of Solids:** Solids such as Prisms, Pyramids, Cylinders and Cones inclined to both the principal plane. **7. SECTIONS OF SOLIDS** Solids such as Prisms, Pyramids, Cylinders and Cones resting on their bases on HP. **8. DEVELOPMENT OF SURFACES** Lateral surfaces of solids such as Prisms, Pyramids, Cylinders and Cones (cut by a plane inclined to HP). **9. ISOMETRIC VIEWS AND PROJECTIONS** Isometric views of planes and solids. Isometric scale, Isometric Projections of simple objects**.** **10. ORTHOGRAPHIC PROJECTIONS** Conversion of Pictorial views into Orthographic Views.
Textbooks & Reference Books	**TEXTBOOKS:** 1. N.D. Bhatt, *"Engineering Drawing"* Charotar Publishing House Pvt. Ltd, 53rd edition, 2014. 2. Prof. Sham Tickoo and Anurag, *"AutoCAD 2013 for Engineers and Designers*", Dreamtech Press India Pvt., 2013. **REFERENCES:** 1. K. Venugopal, *"Engineering Drawing and Graphics + AutoCAD"*, New Age International Pvt. Ltd., 2007. 2. D.M. Kulkarni, A.P. Rastogi and A.K. Sarkar, *"Engineering Graphics with Auto CAD",* PHI Learning Private Limited, Revised Edition, August 2010. 3. T. Jeyapoovan, *"Engineering Drawing and Graphics Using AutoCAD"*, Vikas Publishing House Pvt. Ltd., 3rd Edition, 2010. 4. P. Kannaiah, K. L. Narayana and K. Venkata Reddy, *"A Textbook on Engineering Drawing"*, Radiant Publishing House, 2012.

20SH11P2 - ENGLISH LANGUAGE LABORATORY

(Common to CE, ME & ECE)

Course Category:	Humanities and Social Science	**Credits:**	1
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-2
Pre-requisite:	Basic Level of LSRW skills	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	The main objective is to prepare the students to improve their communicative ability in English with emphasis on LSRW skills and enable them to communicate effectively in different socio- cultural and professional contexts.	
Course Outcomes	CO1	These activities practiced in the laboratory are helpful in comprehending the important language aspects which are useful for the real-life situations.
	CO2	These are also helpful in enhancing the language competency and communicative level of students.

Course Content

LIST OF ACTIVITIES

1. Listening Skills
a) Listening for Identifying key terms, understanding concepts
b) Listening for specific information
c) Listening for global comprehension and summarizing
d) Listening to short audio texts and answering a series of questions.

2. Common Everyday Conversations:
(Asking and answering general questions on familiar topics such as home, family, work, studies and interests)
a) Expressions in various situations
b) Making requests and seeking permissions
c) Interrupting and apologizing
d) Role plays / Situational dialogues

3. Communication at Work Place:
a) Introducing oneself and others
b) Ice Breaking Activity and JAM Session
c) Greetings
d) Taking leave

4. Debates & Group Discussions
a) Discussion in pairs/ small groups on specific topics
b) Short structured talks
c) Reporting/ summarizing

5. Presentations (Oral presentation, PPT & Poster presentation):
a) Pre-planning
b) Non- verbal communication
c) Formal oral presentations on topics from academic contexts

6. Giving directions

Textbooks & Reference Books	**REFERENCES:** 1. Dr. D. Sudha Rani, *"A Manual for English Language Laboratories"*, Pearson Publications, 1st edition, 2009. 2. https://www.talkenglish.com 3. www.esl-lab.com 4. www.englishmedialab.com 5. www.englishinteractive.net

N.B.K.R. INSTITUTE OF SCIENCE & TECHNOLOGY :: VIDYANAGAR

(AUTONOMOUS)

CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the batch admitted in the academic year 2020-2021)

I YEAR OF FOUR YEAR B.TECH. DEGREE COURSE – II SEMESTER

S.NO.	Course Code	Course Title	Contact Hours/ Week			Credits	Evaluation									
							Sessional Test-I			Sessional Test-II			Total Sessional Marks (Max. 40)	Semester End Examination		Max. Total Marks
		THEORY	L	T	P		Test-I (2 hrs.)	Assignment-I	Max. Marks	Test-II (2 hrs.)	Assignment-II	Max Marks		Duration In Hours	Max. Marks	
1	20SH1201	Engineering Physics[#]	2	1	0	3	34	6	40	34	6	40	0.8(Better of two sessional tests) + 0.2(Other)	3	60	100
2	20SH1202	Engineering Mathematics – II*	3	0	0	3	34	6	40	34	6	40		3	60	100
3	20CE1201	Building Materials & Construction[Δ]	3	0	0	3	34	6	40	34	6	40		3	60	100
4	20CE1202	Engineering Mechanics[Δ]	3	0	0	3	34	6	40	34	6	40		3	60	100
5	20EE1203	Elements of Electrical and Electronics Engineering	3	0	0	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
1	20CE12P1	Building Materials and Construction Lab[Δ]	0	0	3	1.5	-	-	-	-	-	-	Day-to-day Evaluation and a test (40 marks)	3	60	100
2	20SH12P1	Engineering Physics Laboratory[#]	0	0	3	1.5	-	-	-	-	-	-		3	60	100
3	20ME12P3	Engineering Workshop [ϕ]	0	0	3	1.5	-	-	-	-	-	-		3	60	100
		MANDATORY COURSE											0.8(Better of two) + 0.2 other			
1	20MC1201	Universal Human Values	2	0	0	0	34	6	40	34	6	40		3	60	100
TOTAL						**19**										

CE & ME; ***** Common to all; **$** Other than ME; Δ CE; ϕ CE, ME & ECE

20SH1201 - ENGINEERING PHYSICS

(Common to CE&ME)

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-1-0
Pre-requisite:	Fundamental concepts of Physics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To acquire knowledge of interference, diffraction and polarization of light. 2. Analyze principles of lasers and optical fibers applied in Engineering Field 3. Apply principles of Quantum Mechanics to various atomic phenomena. 4. Explain & provide the knowledge about semiconductors and their use in electronic devices. 5. To gain knowledge about dielectrics & magnetic materials focusing on their applications. 6. To understand importance and role of ultrasonics and nanomaterials in Civil & Mechanical engineering	
Course Outcomes	CO1	Understand the phenomena of wave optics and its principles
	CO2	Understand & analyses different kinds of lasers and principles of optical fibers.
	CO3	Able to understand the basic concepts of quantum physics applicable to solids.
	CO4	To know the concepts of electron theory of solids and properties of semiconductor materials by projecting the view of energy bands.
	CO5	Understand the concept of polarization& magnetization and also applications of dielectric& magnetic materials in various disciplines.
	CO6	Basic idea about ultrasonics production & properties and nanomaterials with their uses in various fields of Science & Technology.
Course Content	**UNIT-I** **WAVE OPTICS** Interference: Introduction – Superposition of waves – interference by division of wave front (Young's double slit experiment) & by division of amplitude (Newton rings) – Diffraction: Introduction - Fraunh offer diffraction due to single slit, double slit– Diffraction grating – Polarization – Introduction – Representation of light – Double refraction and positive & negative crystals – Nicol prism – Half and quarter wave plates. **UNIT-II** **LASERS & OPTICAL FIBERS** **Lasers:** Spontaneous & simulated emission - Population inversion - Types of Lasers: Solid state lasers (Nd-YAG), Gas lasers (He–Ne) – Properties of laser beam: monochromacity, coherence, directionality & brightness – Applications of lasers in science, engineering & medicine. **Optical fibers:** Introduction – Construction and working principle of optical fiber – Acceptance angle –Numerical Aperture – Types of optical fibers – Block diagram of optical fiber communication system – Applications of optical fibers.	

UNIT-III

PRINCIPLES OF QUANTUM MECHANICS

Black body radiation – Laws of explaining the energy distribution- Planks quantum theory of black body radiation – Stefan-Boltzmann, Wein's displacement & Rayleigh Jean's law - Photon & its properties - Wave and particle duality – de-Broglie hypothesis – Properties of matter waves – de-Broglie wave length – Heisenberg uncertainty principle – Schrodinger time independent wave equation – Physical significance of wave function - Particle in a one dimensional potential box.

UNIT-IV

ELECTRON THEORY AND SEMICONDUCTORS

Electron theory: Free electron theory (classical & quantum: postulates, success& drawbacks) - Fermi–Dirac distribution function & its temperature dependence – Kronig–Penny model (nonmathematical treatment) – Concept of band – Classification of solids into conductors , semiconductors & insulators.

Semiconductors: Intrinsic & extrinsic semiconductors (qualitative) – Fermi level in extrinsic semiconductors – Conductivity in semiconductors: Drift & diffusion – Einstein relation – Hall effect & its applications.

UNIT-V

DIELECTRIC AND MAGNETIC PROPERTIES

Dielectric Properties: Basic definitions – Electronic, ionic (quantitative) & orientation (qualitative) polarizations – Internal field in solid dielectrics – Clausius- Mossotti relation – Ferroelectricity.

Magnetic properties: Introduction – Basic definitions – Origin of magnetic moment – Classification in to dia, para, ferro, anti-ferro & ferri magnetic materials – Hysteresis – Soft & hard magnetic materials - Applications of magnetic materials.

UNIT VI

ULTRASONICS AND PHYSICS OF NANOMATERIALS

Ultrasonics: Introduction and properties of ultrasonics – Production by Piezo electric method – Detection of ultrasonics – Applications of ultrasonics.

Physics of Nanomaterials: Introduction – Significance of nanoscale – Types of nanomaterials – Properties of nanomaterials: physical, mechanical, magnetic and optical – Synthesis of nanomaterials: Top-down-Ball millings, bottom up – Chemical vapour deposition – Applications of nanomaterials.

Text Books & Reference Books	**TEXTBOOKS:** 1. R K Gaur and S L Gupta, *"Engineering Physics"*, Dhanpat Rai Publishing Co. Pvt. Ltd., 8th Edition, 2012. 2. P K Palanisamy, *"Engineering Physics*" SciTech **Publications (India) Pvt. Ltd,** Vol-I, **2015.** 3. S Mani Naidu, *"Engineering Physics"*, Pearson Education India, 2009. **REFERENCE BOOKS:** 1. K Thyagarajan, *"Engineering Physics*", McGraw Hill Education. 2. S L Gupta and Sanjeev Gupta, "*Unified Physics"*, (Mechanics and Waves & Oscillations), Vol-I, Jai Prakash Nath Publications, 2018.

ENGINEERING MATHEMATICS –II

(Common to all branches)

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre – requisite:	Intermediate Mathematics	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. The concepts of Double and triple integrals, Areas and Volumes 2. The Gradient, Divergence and Curl operators, Solenoidal and Irrotational vectors. 3. The basic concepts of Vector Integration. 4. The determination of Fourier coefficients, Fourier series, Even and Odd Functions and Change of intervals. 5. The concepts of Fourier Transforms. 6. Concepts of z-transform and its inverse trans form.	
Course Outcomes	CO1	Attains skills in analyzing the Double integrals and triple integrals also its Areas and Volumes.
	CO2	Acquire knowledge in analyzing the Curl, Divergence and Gradient operators, Solenoidal and Irrotational vectors with their applications.
	CO3	Attains skills in analyzing the applications of Green's, Stokes's and Gauss-divergence theorems.
	CO4	Develop analytical skills in solving the problems involving Fourier Series.
	CO5	Understand effectively Fourier Sine and Cosine integral, Fourier Transforms, Fourier Sine and Cosine transforms.
	CO6	Learn the concepts of Z- transform and its inverse transform. Student able to apply z-transforms to solve difference equations.
Course Content	**UNIT - I** **Multiple integral**: –Evaluation of double integrals – Change the order of integration – Change of Variables – Area by double integration – triple integrals (only in Cartesian form) – Volume by triple integral. **UNIT - II** **Vector Differentiation:** Scalar and vector point function – Del operator: Gradient, Divergence, Curl – Solenoidal and Irrotational vectors – Scalar potential. **UNIT - III** **Vector Integration:** Line integral, circulation, work done – Surface integrals, flux – Green's theorem in the plain (Without proof) – Stokes's theorem (Without proof) – Volume integral, Gauss-divergence theorem (without proof). **UNIT - IV**	

	Fourier Series: Fourier Series: Determination of Fourier coefficients for Fourier series of f(x) in $(0,2\pi)$ and $(-\pi,\pi)$ - Fourier series for an Even and Odd functions - Change of intervals. **UNIT-V** **Fourier Transforms:** Fourier Integral Theorem (Without proof)-Fourier Sine and Cosine integral - Fourier Transforms and its inverse transform - Fourier Sine and Cosine transforms. **UNIT-VI** **Z-Transforms:** Z-Transform of some standard functions, Properties of Z-Transforms, Shifting Properties, Initial value theorem and final value theorem, Inverse Z-Transform, Convolution theorem, Inversion by partial fractions and Applications to difference equations.
: **Text Books & Reference Books**	**TEXTBOOKS:** 1. B. S. Grewal, *"Higher Engineering Mathematics"*, Khanna Publishers, New Delhi. 44th edition, 1965. 2. B.V. Ramana, *"Engineering Mathematics"*, Tata McGraw-Hill Education Pvt. Ltd, New Delhi, 1st editon,2017. **REFERENCES:** 1. H.K. Dass, Er. Rajnish Verma, *"Higher Engineering Mathematics"*, S. Chand Publications, New Delhi, 2014. 2. N.P. Bali & M. Goyal, *"Advanced Engineering Mathematics*", Lakshmi Publishers, New Delhi. 1st edition, 2015. 3. Erwin Kreyszig, *"Advanced Engineering Mathematics*" Wiley publications, India. 10th edition, 2010.

20CE1201-BUILDING MATERIALS AND CONSTRUCTION

(Civil Engineering)

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3-0-0
Prerequisite:	None	**Sessional Evaluation :** **End Exam. Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To know the significance of various building materials used in construction industry. 2. To explain the materials used in concrete and different types of mortars and their applications. 3. To explain various types of masonry construction. 4. To explain various types of building components. 5. To explain types of roofs, roof coverings and temporary works used in buildings. 6. To learn about types of wall finishes and thermal and acoustic insulating materials in buildings.	
Course Outcomes	CO1	Select suitable materials for various types of buildings.
	CO2	Gain an in-depth knowledge on components of concrete and mortars.
	CO3	Compare the various types of masonry and their construction practices.
	CO4	Identify various types of building components and their construction techniques.
	CO5	Select the appropriate flooring, roof and temporary work for a given building and illustrate their construction techniques.
	CO6	Exhibit the knowledge of building finishes and special treatments for thermal and acoustic insulation materials.
Course Content	**UNIT – I** **INTRODUCTION TO BUILDING MATERIALS** Stone: Dressing of stones- artificial stones and applications; wood: classification of timber- characteristics of good timber- ply wood- types and uses; bricks: manufacturing process- testing of bricks; ceramic products: manufacturing process; glass: functions of glass in buildings; building materials for low cost housing- utilization of waste for alternative building materials- sustainable materials in construction- IS specifications. **UNIT- II** **CEMENT CONCRETE AND MORTARS** **Constituents of Cement Concrete:** **Cement:** Manufacturing process - types of cement - Portland cement- hydration of	

cement- tests on cement- IS specifications.

Aggregate: Introduction - classification of aggregate – characteristics - IS specifications.

Water: Quality of mixing water.

Building Mortars: Introduction- classification (cement mortar, lime mortar, lime-cement mortar, special mortar) - characteristics of good mortar- grouting- guniting.

UNIT- III

MASONRY CONSTRUCTION

Stone masonry: Technical terms – joints; types: random (un-coarsed) rubble – coarsed rubble – dry rubble masonry – ashlar masonry; ashlar fine – chamfered fine; supervision.

Brick masonry: Technical terms; bonds in brick work: English bond – single & double Flemish bond; defects; comparison of brick masonry and stone masonry.

Cavity walls: Brick cavity walls- position of cavity at foundation, roof and opening levels.

UNIT- IV

BUILDING COMPONENTS

Introduction to Building Components: Types of buildings; components of buildings; types and uses of shallow and deep foundations.

Lintels and arches: Lintels: types- construction; arches: technical terms- types (brick arches, rough, axed stone arches, flat and semi-circular arches).

Doors: Location- technical terms – types – suitability.

Windows: Location – types – suitability – fixtures and fastenings.

Stairs and Stair cases: technical terms- requirements of good stair – classification- elevators and escalators.

UNIT- V

FLOORS, ROOFS AND TEMPORARY WORKS

Floors: Introduction- requirements of a good floor; types of floorings: cement concrete (regular and precast) - mosaic- tiled- marble- timber.

Roofs and Roof coverings: Technical terms- classification (pitched roofs and flat roofs) - advantages and disadvantages; roof coverings: A.C sheets and G.I sheets.

Temporary works: Form work: Introduction- stripping of formwork- timbering in trenches- types of scaffolding- shoring and underpinning.

UNIT– VI

WALL FINISHES AND SPECIAL TREATMENTS

Wall finishes: Plastering: objectives of plastering- requirements of good plaster- tools used in plastering; types of pointing.

	Thermal Insulation: Introduction- thermal properties and selection of the insulating materials- classification of thermal insulating materials - methods of thermal insulation. **Acoustic Construction:** Introduction- characteristics of audible sound- behaviour of sound in enclosure- reflection of sound- reverberation and absorption- types of acoustic materials.
Textbooks & Reference Books	**TEXTBOOKS:** 1. S.C Rangwala, "*Engineering Materials*" Charotar Publishing House Pvt. Ltd, 2008. 2. Dr. B.C.Punmia, Er. Ashok Kumar Jain and Dr. Arun Kumar Jain, "*Building Construction"* Lakshmi publications, 11th Edition, 2019. 3. T. D. Ahuja and G. S. Birdie, "*A Text Book of Building Construction and Construction Materials*" Dhanpat Rai publishing company, Revised 4th Edition, 2012. **REFERENCES:** 1. S.C Rangwala, "*Building Construction*" Charotar Publishing House Pvt. Ltd, 33rd Edition, 2019. 2. M. L. Gambhir and Neha Jamwal, "Building *and Construction Materials: Testing and Quality Control*" McGraw Hill Education, 2017. 3. *"National Building Code of India,"* Bureau of Indian Standards, Vol-I, 2016.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	1	-	-	-	-	2	2	1
CO2	3	3	2	3	1	-	-	-	-	-	1	2	-
CO3	3	3	2	3	1	-	-	-	-	-	1	3	2
CO4	3	3	3	3	2	-	-	-	-	-	2	3	1
CO5	3	3	3	3	1	-	-	-	-	-	2	2	1
CO6	3	3	3	2	2	-	-	-	-	-	2	2	1

20CE1202 - ENGINEERING MECHANICS

(Civil Engineering)

Course category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3-0-0
Prerequisite:	Engineering Physics, Engineering Mathematics	**Sessional Evaluation :** **End Exam. Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To analyse the system of forces acting in a plane in different conditions. 2. To calculate unknown force components under the action of frictional forces. 3. To explain the properties of surfaces by calculating centroid, moment of inertia and other related concepts. 4. To evaluate motion characteristics of body subjected to given force. 5. To analyse the system of forces using D Alembert principle and Work-Energy equations. 6. To analyze the components of forces in trusses and learn about mechanical vibrations	
Course Outcomes	CO1	Determine the components of forces in rectangular and non-rectangular coordinates.
	CO2	Determine the support reactions on structures and analyze systems that include frictional forces.
	CO3	Locate the centroid of an area, calculate the second moment and principal second moment of an area
	CO4	Calculate the motion characteristics of a body subjected to a given force system
	CO5	Determine the resultant forces using moment of momentum principle, D Alembert principle and Work-Energy equations.
	CO6	Determine resultant forces in trusses and frequency and amplitude for a given system.
Course Content	**UNIT-I** **STATICS**: Introduction – Units and Dimensions – Laws of mechanics – Vectors – Vectorial representation of forces and moments –Vector operations – Coplanar and concurrent forces –Resolution and composition of forces – Equilibrium of a particle – Equivalent systems of forces –Principle of transmissibility – Single equivalent force and Free body diagram – Types of supports and their reactions –Equilibrium of rigid bodies in two dimensions.	

	UNIT – II **FRICTION:** Types of friction – Laws of friction – Limiting friction – Cone of limiting friction - Static and dynamic frictions – Motion of bodies – Wedge, Screw jack and differential jack. **UNIT – III** **CENTROID AND CENTRE OF GRAVITY:** Centroids of simple figures – Centroids of composite figures - Centre of gravity of bodies – Area moment of inertia - Parallel axis theorems and perpendicular axis theorems – Moment of inertia of composite figures. **MASS MOMENT OF INERTIA:** Moment of inertia of simple solids – Moment of inertia of composite masses (Simple problems only) **UNIT – IV** **DYNAMICS-1**: Displacement – Velocity and acceleration and their relationship – Relative motion – Curvilinear motion – Newton's law of motion. **UNIT – V** **DYNAMICS-2**: Basic terms – General principles in dynamics - Types of motion – instantaneous centre of rotation in plane motion (simple problems) - Work energy equation – D Alembert's Principle and its uses – kinetics of rigid body rotation. **UNIT – VI** **ANALYSIS OF PLANE TRUSSES:** Assumptions – rigid and non-rigid trusses – Simple truss, analysis by method of joints, method of sections and tension coefficient method. **MECHANICAL VIBRATIONS:** Basic terminology – Free and forced vibrations – resonance and its effects – degree of freedom – Derivation of frequency and amplitude of free vibrations without damping and single degree of freedom system (simple problems) – Types of pendulum – Use of simple and compound pendulum.
Textbooks & Reference books	**TEXTBOOKS:** 1. A. K. Tayal, *"Engineering Mechanics"* Umesh Publications, 14th edition, 2008. 2. R.K. Bansal, *"A Textbook of Engineering Mechanics"* Laxmi Publications, 8th edition, 2015. 3. S. Timoshenko, D.H. Young, J V Rao and Sukumar *"Engineering Mechanics"* McGraw Hill Education, revised 4th edition.

	REFERENCE BOOKS: 1. J .L .Meriam, L. G. Kraige and J.N.Bolton, *"Engineering Mechanics"* Wiley Publishers, 2017. 2. Irving. H. Shames, G. Krishna Mohana Rao, *"Engineering Mechanics-Statics and Dynamics"* Pearson Publishers, 4th edition. 3. P.B. Beer & E. R. Johnston, *"Mechanics of Materials"* McGraw Hill Series.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	1	-	-	1	2	2	2	3
CO2	3	2	2	2	1	1	1	1	2	2	2	2
CO3	3	3	2	3	1	1	2	1	2	2	1	3
CO4	3	2	2	2	1	1	1	1	2	2	1	2
CO5	3	2	1	2	1	1	1	1	2	2	2	3
CO6	3	2	2	2	1	1	1	1	2	2	1	2

20EE1203-ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING

(Civil Engineering)

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial-Practical:**	3-0-0
Pre-requisite:	1. Basics of Mathematics 2. Basics of Electricity	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100

Course Objectives	1. The basic concepts of DC circuits. 2. The basic concepts of AC circuits 3. The operations of AC Generator and Induction motor. 4. The construction and working principle of the transformers. 5. The fundamentals of electrical safety and wiring. 6. The transducers and electric welding.	
Course Outcomes	CO1	Comprehend the fundamental concepts of DC circuits.
	CO2	Understand the fundamental concepts of AC circuits.
	CO3	Know the operations of AC Generator and Induction motor.
	CO4	Acquire the knowledge about the transformers.
	CO5	Understand the fundamentals of electrical safety and wiring system.
	CO6	Understand about different transducers and methods of welding.
Course Content	**UNIT-I** **Fundamentals of DC Circuits:** Introduction to DC circuits, Active and passive elements, Voltage - Current relations for resistor, Inductor and Capacitor, Kirchhoff's laws-simple problems. **UNIT-II** **Fundamentals of AC Circuits:** Generation of sinusoidal voltage, Average and RMS values, Form Factor and peak factors for sinusoidal waveforms, Analysis of R, L, C circuits with sinusoidal source, j notation, Concept of Impedance, introduction to three phase system and comparison between three phase and single phase system. **UNIT-III** **AC Generator:** Working principle, Construction and applications of alternators **Induction motor:** Classification of Induction motors, Working principle, Construction and applications of capacitor start and capacitor start & run motors (descriptive only) **UNIT-IV** **Single Phase Transformers:** Principle and operation of a transformer, Construction, EMF equation, Losses and efficiency of transformer, Three phase transformer	

	connections (descriptive only). **UNIT-V** **Electrical Safety and Wiring:** Importance of electrical safety, Introduction to Personal protective equipment (PPE), Types of wiring, Wiring accessories, Staircase and fluorescent lamp connections, Earthing, Pipe and plate earthing, Types of conductors used in wiring. **UNIT-VI** **Transducers:** Resistance temperature detector (RTD), Thermocouple, Strain gauge, Piezo electric transducer. **Electric welding:** Introduction, resistance welding and arc welding techniques.
Textbooks & Reference Books	**TEXT BOOKS:** 1. Dash .S.S, Subramani. C and Vijayakumar.K, *"Basic Electrical Engineering"*, 1st edition, Vijay Nicole Imprints Pvt.Ltd, 2013. 2. R. Muthusubramanian and S. Salivahanan, *"Basic Electrical and Electronics Engineering"* 1st edition, Tata McGraw Hill publications, 2009. 3. Metha.V.K, Rohit Metha, *"Basic Electrical Engineering"*, 5th edition, Chand. S & Co, 2016. **REFERENCE BOOKS:** 1. Kothari .D.P and Nagrath.I.J, *"Basic Electrical Engineering",* 2nd edition, Tata McGraw - Hill, 2009. 2. Bhattacharya. S.K, *"Basic Electrical and Electronics Engineering", ,* Pearson Education, 1st edition Reprint, 2015. 3. A. Chakrabarti, M.L. Soni, P.V.Gupta, U.S. Bhatnagar and Dr. A Chakrabarti, *"A Text book on Power System Engineering"*, Dhanpath Rai & Company Pvt. Ltd, 2009.
E-Resources	1. http://nptel.ac.in/courses. 2. http://iete-elan.ac.in. 3. http://freevideolectures.com/university/iitm.

20CE12P1 – BUILDING MATERIALS & CONSTRUCTION LABORATORY

(Civil Engineering)

Course Category	Professional Core	**Credits**	1.5
Course Type	Practical	**Lecture - Tutorial - Practical**	0-0-3
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam. Evaluation	60
		Total Marks	100

Course Objective(s)	To understand the basic building materials and elementary construction practices.	
Course Outcomes	CO1	Understand the manufacturing and testing processes of various types of bricks.
	CO2	Construct 1½ brick wall and carry out wall finishing works.
	CO3	Prepare base for flooring and lay tile flooring.
	CO4	Install plumbing and fixtures.
	CO5	Prepare steel reinforcement cage for building components.
	CO6	Repairing and strengthening of reinforced concrete elements using epoxy resin and fiber materials.
Course Content	**LIST OF EXPERIMENTS** 1) a) Casting and testing of burnt bricks and fly ash bricks. b) Preparation of concrete cover blocks. 2) Construction of 1 ½ brick wall using English bond. 3) Plastering and finishing of wall. 4) Application of wall-putty and painting a wall. 5) Preparation of base for flooring. 6) Application of base coat and laying of tile flooring. 7) Installation of plumbing and fixtures like tap, T-joint, elbow, bend and threading. 8) Bending stirrups, binding steel reinforcement cage and placing cover blocks (beam/column/slab). 9) Strengthening of reinforced concrete elements using fiber materials. 10) Repairing of cracks in structural members using epoxy resin.	

	EXPERIMENTS FOR DEMONSTRATION 11) Construction of a brick arch. 12) Identification of various types of aggregates, glass and tiles.

20SH12P1 - ENGINEERING PHYSICS LABORATORY

(Common to CE & ME)

Course Category:	Basic Science	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Engineering Physics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	To provide student to learn about some important experimental techniques in physics with knowledge in theoretical aspects so that they can excel in that particular field.	
Course Outcomes	CO1	These experiments in the laboratory are helpful in understanding important concepts of physics through involvement in the experiments by applying theoretical knowledge.
	CO2	It helps to recognize where the ideas of the students agree with those accepted by physics and where they do not.
Course Content	Minimum of 8 experiments to be conducted out of the following : **LIST OF EXPERIMENTS** 1. Determination of rigidity modulus of wire material – Torsional pendulum. 2. Melde's experiment – Transverse & longitudinal modes. 3. Resonance in LCR circuit. 4. Magnetic field along the axis of a coil (Stewart – Gee's Method). 5. Study of characteristics of LED 6. Newton rings 7. Wedge method 8. Diffraction grating - Wavelength of given source. 9. Dispersive power of prism material using spectrometer. 10. P-N- junction diode characteristics. 11. Evaluation of Numerical Aperture of given optical fiber. 12. Energy gap of a P-N junction diode material. 13. Transistor characteristics. 14. Solar cell characteristics. 15. Logic gates.	

20ME12P3- ENGINEERING WORKSHOP

(Common to CE, ME and ECE)

Course Category	Engineering Science	**Credits**	1
Course type	Practical	**Lecture- Tutorial-Practical**	0-0- 2
Prerequisite	No Prerequisite	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	1. To understand the usage of work shop tools and prepare the models in the trades such as carpentry, fitting, sheet metal & foundry. 2. To understand the usage of wiring tools and to execute house wiring connections. 3. To understand and demonstrate the usage of tools of welding, black smithy and machine tools.	
Course Outcomes	CO1	Identify, Distinguish and Choose the tools of various trades (carpentry, fitting, sheet metal, foundry, wiring, welding, black smithy and machine tools).
	CO2	Demonstrate and Describe the usage of tools of various trades (carpentry, fitting, sheet metal, foundry, wiring, welding, black smithy and machine tools).
	CO3	Documenting the procedure adopted while preparing the model.
Course Content	**LIST OF EXPERIMENTS** 1. **Carpentry**: Half Lap, Mortise and Tenon and Bridle joint. 2. **Fitting:** Square, V, half round and dovetail fittings 3. **Tin-Smithy:** Tray, cylinder, hopper, cone 4. **House-wiring:** One lamp controlled by one switch, Two lamps (bulbs) controlled by two switches independently, Stair - case connection, Two lamps controlled by one switch in series, Two lamps controlled by on switch in parallel and Water pump connected with single phase starter. 5. **Foundry**: single-piece pattern and Two- piece pattern **TRADES FOR DEMONSTRATION:** 6. Machine Tools 7. Welding 8. Black Smithy	
Textbooks	**TEXTBOOKS:** 1. V. Ramesh Babu, *"Engineering Workshop practice for JNTU"*, VRB Publishers Pvt. Ltd, 2009. 2. P. Kannaiah, K. L. Narayana, "*Workshop Manual"*, SciTech Publishers, 2004. 3. Jeyapoovan, Saravana Pandian, *"Engineering Practices Lab Manual"*, Vikas Publishers, 2007.	

20MC1201 - UNIVERSAL HUMAN VALUES

(Common to All Branches)

<table>
<tr><td colspan="2">Course Category:</td><td>Mandatory</td><td>Credits:</td><td>0</td></tr>
<tr><td colspan="2">Course Type:</td><td>Theory</td><td>Lecture -Tutorial-Practical:</td><td>2-0-0</td></tr>
<tr><td colspan="2">Pre – requisite:</td><td>SIP-Universal Human Values 1 (desirable)</td><td>Sessional Evaluation:
External Evaluation:
Total Marks:</td><td>40
60
100</td></tr>
<tr><td>Course Objectives:</td><td colspan="4">Students undergoing this course are expected:
1. Development of a holistic perspective based on self-exploration about human being, family, society and nature/existence.
2. Developing clear understanding of the harmony in the human being, family, society and nature/existence.
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.
5. Know about appropriate management patterns with harmony.</td></tr>
<tr><td rowspan="7">Course Outcomes:</td><td colspan="4">After completing the course, the student will be able to</td></tr>
<tr><td>CO1</td><td colspan="3">Understand more about of themselves, and their surroundings (family, society, nature);</td></tr>
<tr><td>CO2</td><td colspan="3">Become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.</td></tr>
<tr><td>CO3</td><td colspan="3">Develop as a socially and ecologically responsible engineers</td></tr>
<tr><td>CO4</td><td colspan="3">Justify the need for universal human values and harmonious existence</td></tr>
<tr><td>CO5</td><td colspan="3">Relate human values with human relationship and human society</td></tr>
<tr><td>CO6</td><td colspan="3">Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.</td></tr>
<tr><td>Course Content:</td><td colspan="4">UNIT-I

Introduction to Value Education: Universal Human Values-I - Self-Exploration - content and process; ‘Natural Acceptance’ and Experiential Validation - Self-exploration - Continuous Happiness and Prosperity - Basic Human Aspirations - Current scenario - Method to fulfill the above human aspirations- Understanding and living in harmony at various levels.

UNIT-II

Understanding Harmony in the Human Being - Harmony in Myself: Human being as a co-existence of the sentient ‘I’ and the material ‘Body’ - The needs, happiness and physical facility - The Body as an instrument of ‘I’ - The characteristics and activities of ‘I’ and harmony in ‘I’ - The harmony of I with the Body

UNIT-III

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship: Values in human relationship; meaning of Justice; Trust and Respect; Difference between intention and competence; the other salient values in relationship - the harmony in the society: Resolution, Prosperity, fearlessness (trust) and co-existence</td></tr>
</table>

	as comprehensive Human Goals - Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. **UNIT-IV** **Understanding Harmony in the Nature and Existence - Whole existence as Coexistence:** The harmony in the Nature - Interconnectedness and mutual fulfillment among the four orders of nature - Recyclability and self-regulation in nature - Understanding Existence as Co-existence of mutually interacting units in all-pervasive space - Holistic perception of harmony at all levels of existence. **UNIT-V** **Implications of the above Holistic Understanding of Harmony on Professional Ethics**: Natural acceptance of human values - Definitiveness of Ethical Human Conduct - Basic for Humanistic Education - Humanistic Constitution and Humanistic Universal Order - Competence in professional ethics: Professional competence - People friendly and eco-friendly production systems - Appropriate technologies and management patterns for above production systems. **UNIT-VI** **Case studies and Strategy:** Case studies of typical holistic technologies, management models and production systems - Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations.

Text Books & Reference Books	**TEXTBOOKS:** 1. R R Gaur, R Asthana, G P Bagaria, "*A Foundation Course in Human Values and Professional Ethics"*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1. **REFERENCE BOOKS:** 1. R R Gaur, R Asthana, G P Bagaria, *"A Foundation Course in Human Values and Professional Ethics-Teachers' Manual"* 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2. 2. A Nagaraj, "*Jeevan Vidya Prakashan*", Amarkantak "*Jeevan Vidya: Ek Parichaya"*, 1999. 3. A.N. Tripathi, *"Human Values"*, New Age Intl. Publishers, New Delhi, 2004. 4. Annie Leonard, *"The Story of Stuff (Book)"*. Free Press, Reprint edition, 2011. 5. Mohandas Karamchand Gandhi, *"The Story of My Experiments with Truth"*Abhishek Publications, 1st edition, 2020. 6. E. F Schumacher, *"Small is Beautiful: A Study of Economics as if People Mattered"* RHUK publications; Latest edition, 1993. 7. Cecile Andrews, "*Small is Beautiful*", New Society Publishers, 2006. 8. J C Kumarappa, *"Economy of Permanence"* Sarva Seva Sangh Prakashan, 2017. 9. Pandit Sunderlal *"Bharat Mein Angreji Raj"*, Publications Division, M/O Information & Broadcasting, Govt. of India, 2016. 10. Dharampal, *"Rediscovering India"* 2004. 11. Mohandas K. Gandhi, *"Hind Swaraj or Indian Home Rule"* International Printers, 1909. 12. Abdul Kalam Azad Maulana, "*India Wins Freedom*" Orient Black Swan Publishers 1stedition 1988. 13. Romain Rolland, *"The Life of Vivekananda and the Universal Gospel"* Advaita Ashrama, India, 2nd edition, 2010. 14. Romain Rolland, "*Gandhi*", Srishti Publishers & Distributors, 2002.
E-Resources	1. https://aktu.ac.in/hvpe 2. http://www.storyofstuff.com 3. https://fdp-si.aicte-india.org/download.php#1

N.B.K.R. INSTITUTE OF SCIENCE &TECHNOLOGY:: VIDYANAGAR

(AUTONOMOUS)

CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the batch admitted in the academic year 2020-2021)

II YEAR OF FOUR YEAR B.TECH. DEGREE COURSE – I SEMESTER

S.NO.	Course Code	Course Title	Contact Hours/ Week			Credits	Evaluation									
							Sessional Test-I			Sessional Test-II			Total Sessional Marks (Max. 40)	Semester End Examination		Max. Total Marks
		THEORY	L	T	P		Test-I (2 hrs.)	Assignment-I	Max. Marks	Test-II (2 hrs.)	Assignment-II	Max Marks		Duration In Hours	Max. Marks	
1	20SH2101	Engineering Mathematics-III	3	0	0	3	34	6	40	34	6	40	0.8(Better of two sessional tests) + 0.2(Other)	3	60	100
2	20CE2101	Strength of materials	2	1	0	3	34	6	40	34	6	40		3	60	100
3	20CE2102	Surveying	3	0	0	3	34	6	40	34	6	40		3	60	100
4	20CE2103	Geotechnical Engg. - I	2	1	0	3	34	6	40	34	6	40		3	60	100
5	20CE2104	Engg. Geology	3	0	0	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
1	20CE21P1	Surveying Lab	0	0	3	1.5	-	-	-	-	-	-	Day-to-day Evaluation and a test (40 marks)	3	60	100
2	20CE21P2	Engineering Geology Lab	0	0	3	1.5	-	-	-	-	-	-		3	60	100
3.	20CE21P3	Strength of material Lab	0	0	3	1.5	-	-	-	-	-	-		3	60	100
		SKILL ORIENTED COURSE														
1	20SC2101	Basic computing skills	0	1	2	2	34	6	40	34	6	40	0.8(Better of two) + 0.2(Other)	3	60	100
		TOTAL				**21.5**										

20CE2101 - STRENGTH OF MATERIALS
(Civil Engineering)

Course Category	Professional Core	**Credits**	3
Course Type	Theory	**Lecture - Tutorial -Practical**	2 -1 -0
Pre-requisite	Engineering Mechanics	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Objectives	1. To understand the behavior of ductile and brittle materials under uni-axial loading. 2. To apply analytical and graphical method of Mohr's circle for principal stresses and strains and understand theories of failures. 3. To construct shear force and bending moment diagrams of beams under various loads and study the relationships among shear force, bending moment and rate of loading. 4. To apply the concept of theory of simple bending for calculating flexural and shear stresses. 5. To calculate stresses and strains in thin and thick cylinders. 6. To implement the concept of theory of pure torsion for calculating shear stresses and understand the mechanical behavior of spring.	
Course Outcomes	CO1	Understand the types of material and their behavior under uni-axial loading.
	CO2	Calculate the principal stresses and strains by analytical methods and also by Mohr's circle method.
	CO3	Construct shear force and bending moment diagrams for various types of beams under different types of loading.
	CO4	Understand and analyze the variation of flexural and shear stresses across the cross-section due to shear force and bending moment.
	CO5	Calculate hoop and longitudinal stresses and strains in thin and thick cylinders.
	CO6	Calculate shear stress due to pure torsion and understand the mechanical behavior of spring.
Course Content	**UNIT – I** **SIMPLE STRESSES&STRAINS:** Properties of materials - Ductile and brittle; Concept of stress; Types of stress; Types of strain - Normal strain, shear strain and volumetric strain; Stress-Strain curves - Ductile (mild steel, HYSD bars), brittle (Concrete); Hooke's law; Poisson's ratio; Volumetric strain-Derivation of expression for volumetric strain of rectangular bar and cylindrical bar subjected to axial loading; Relation between Young's modulus, shear modulus and bulk modulus; Analysis of prismatic bars subjected to axial loading- Uniform cross sections, varying sections and uniform tapering – circular, rectangular bars. Compound bars- Analysis of bars of composite sections. Factor of safety – Endurance limit. Introduction to thermal stresses – Analysis of thermal stresses – Expression for	

thermal stresses and strains in simple bars.

UNIT – II

PRINCIPAL STRESSES: Introduction to compound stresses; Methods of analysis – Application of analytical methods for the analysis of members subjected to direct stress in one plane, in two mutually perpendicular planes, subjected to simple shear stress alone and direct stresses in two mutually perpendicular planes accompanied by simple shear stress.

INTRODUCTION TO GRAPHICAL METHOD– Mohr's Circle- Application of graphical method for the above cases.

INTRODUCTION TO THEORIES OF FAILURE (No derivations).

UNIT –III

SHEAR FORCE AND BENDING MOMENT IN BEAMS: Concept of shear force and bending moment – Relation between shear force, bending moment and rate of loading at a section of beam; shear force and bending moment diagrams for simply supported and cantilever beams subjected to point loads, uniformly distributed load, uniformly varying loads, couple and their combinations; Concept of point of contra flexure; shear force and bending moment diagrams of an overhanging beam subjected to point loads, uniformly distributed load, uniformly varying loads, couple and their combinations.

UNIT –IV

FLEXURAL AND SHEAR STRESSES IN BEAMS: Concept of theory of simple bending; Assumptions made in simple bending – Derivation of pure bending (simple bending) equation. Introduction to shear stress – Derivation of equation for general shear stress; Shear stress distribution diagrams for rectangular, circular, I-section and T-sections; Bending stresses in unsymmetrical sections – I-section and T- sections;

Shear centre – Introduction - Derivation of expression for shear centre of I-section and Channel section.

UNIT –V

CYLINDERS: Introduction – Types of cylinders - thin cylinders - Expressions for hoop and longitudinal stresses - Efficiency of joints; Thick cylinders – Introduction - Lame's theorems – Assumptions – Derivation of expressions (internal and external pressure); Compound cylinders – Introduction – Distribution of stresses (internal and external pressure).

UNIT – VI

TORSION OF CIRCULAR SHAFTS: Theory of pure torsion - Assumptions made in pure torsion equation - Derivation of pure torsion expression for solid and hollow circular shafts; Transmission of power in solid circular shafts.

SPRINGS: Introduction –Types of springs – Expression for deflection of close and open coiled helical springs under axial loading; Concept of springs in series and parallel; Carriage/leaf springs - Introduction- Expression for deflection.

Textbooks **& Reference books**	**TEXTBOOKS:** 1. S. Ramamrutham and R. Narayanan, *Strength of Materials,* Dhanpat Rai publishing house, 20th edition, 2020. 2. R.K. Bansal, *A Textbook of Strength of Materials*, Laxmi Publications, 6st edition, 2019. 3. Dr. H .J. Shah and S. B. Junnarkar, *Mechanics of Structures Vol-I* , Charotor Publishing house, 32ndedition, 2016. **REFERENCE BOOKS:** 1. Timoshenko S, *Strength of Materials Part 1 Elementary Theory and Problems*, D. Van Nostrand Company Incorporated, 3rd edition, 2002. 2. Vazirani and Ratwani, *Analysis of structures Vol-I*, Khanna Publishers, 17th edition, 2015. 3. B.C. Punmia, *SMTS-I, Strength of Materials*, Laxmi Publications, 10th edition, 2019.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	1	1	-	-	-	-	2	2
CO2	3	3	2	3	1	-	-	-	-	-	1	2
CO3	3	3	2	3	1	-	-	-	-	-	1	3
CO4	3	3	3	3	2	-	-	-	-	-	2	3
CO5	3	3	3	3	1	-	-	-	-	-	2	2
CO6	3	3	3	2	2	-	-	-	-	-	2	2

20CE2102 –SURVEYING

(Civil Engineering)

Course Category	Professional Core	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3-0-0
Prerequisite	Mathematics	**Sessional Evaluation**	40
		Semester End Exam. Evaluation	60
		Total Marks	100

Course Objectives	1. To apply knowledge of mathematics, science and engineering for use of measurement techniques and basic equipment used in land surveying. 2. To perform the operation of automatic level and recording observations, reduce levels, interpolation and plotting of contours. 3. To outline various methods of angular measurements and perform traverse computations. 4. To analyze the basics of curve setting and various methods of computing areas and volumes. 5. To apply the principles, usage of total station and GPS in surveying. 6. To apply the knowledge of surveying for setting-out works.	
Course Outcomes	CO1	Outline chain and plane table surveying principles to record observations and make necessary calculations.
	CO2	Be able to determine the elevations using various methods of levelling and prepare contour maps using levelling data.
	CO3	Calculate azimuths, latitudes and departures, error of closure; adjust latitudes and departures and determine coordinates for a closed traverse using a prismatic compass and theodolite.
	CO4	Calculate the data required to set out horizontal and vertical curves. Calculate areas and volumes from survey data using mathematical principles.
	CO5	Operate a total station to measure distance, angles, and to calculate differences in elevation. Make GPS measurements and relate them to conventional surveying.
	CO6	Carryout setting-out for laying pipeline and tunneling.

Course Content	**UNIT – I** **BASICS OF SURVEYING**: Definition, principles, purpose of surveying, basic measurements – linear and angular - chain surveying - principle, methods and applications, pacing, ranging, chaining, selection of survey stations and lines, well-conditioned triangle, field book entries, scales-types and uses, plan and map – comparison, cross staff survey, plane table survey - principle, methods and errors. **UNIT – II** **LEVELLING** – Definition, principles, methods and classification of levelling, equipment and types of level instruments, recording observations and reduction of levels, calculation of gradient and plotting longitudinal and cross sections. **CONTOURING** – Contour interval, characteristics, uses; methods of locating contours, interpolation of contours. **UNIT – III** **ANGULAR MEASUREMENTS**: Compass surveying - bearings, meridians, directions, included angles, local attraction, dip and deflection, Theodolite surveying - measurements of horizontal and vertical angles, deflection angles. Traversing – methods, types, computations and checks for traverse. Tacheometry - principle, methods and determination of tacheometric constants. **UNIT – IV** **CURVES:** Types of curves, elements, methods of setting out of horizontal and vertical curves (only simple curves for examination). **AREAS and VOLUMES**: Area calculation- plotting of survey work, methods of area and volume computations, minor instruments. **UNIT –V** **MODERN FIELD SURVEY SYSTEMS**: Principle of electronic distance measurement, modulation, types of EDM instruments, distomat, Total Station – Parts of a total Station ,accessories, advantages and applications, field Procedure for total station survey, Errors in Total Station Survey, Global Positioning Systems-Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations. **UNIT – VI** **CONSTRUCTION SURVEYS:** Introduction-staking out buildings-pipelines and sewers-highways-culverts. Bridge surveys-determining the length of bridge-locating centre's of piers- surface surveys and tunnel alignment-underground surveys-connection of surface and underground surveys-levelling in tunnels.
Textbooks and reference books:	**TEXTBOOKS:** 1. N. N. Basak, *Surveying and leveling*, McGraw Hill Education (India) Pvt. Ltd, 2nd edition, 2014. 2. Dr. K.R. Arora *Surveying Vol-I, II and III*, Standard Book House, 17th edition, 2019. 3. B. C. Punmia, Ashok K Jain and Arun K Jain, *Surveying Vol.I*, Laxmi Publications, 17th edition, 2018.

	REFERENCE BOOKS: 1. C. Venkatramaiah, *Text Book of Surveying*, Universities Press, revised edition, 2011. 2. T. P. Kanetkar and S. V. Kulkarni, *Surveying and Levelling*, Pune Vidyarthi Griha Prakashan publishers, 2010. 3. A. M. Chandra, *Plane Surveying*, New Age International Ltd. Publishers, 3rd Edition, 2018.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	-	2	1	-	-	-	2	2	1	1
CO2	3	3	-	2	2	1	-	-	1	2	2	1
CO3	3	3	-	2	1	-	-	-	1	1	1	2
CO4	3	3	1	2	1	1	-	-	1	2	2	2
CO5	3	3	-	2	3	-	1	1	1	2	3	2
CO6	3	3	1	2	3	1	1	1	3	2	3	2

19CE3103 – GEOTECHNICAL ENGINEERING-I

Course Category	Professional Core	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	2-1-0
Prerequisite	Engineering Geology, Engineering Mechanics and Fluid Mechanics	**Sessional Evaluation**	40
		Semester End Exam. Evaluation	60
		Total Marks	100

Course Objectives	1. To study the physical properties of soil and their relations. To demonstrate the plasticity characteristics of the soil and classification of soil by different systems. 2. To study the compaction characteristics of the soils. To understand the stress distribution in soils due to external loads. 3. To illustrate the concept of total stress and effective stress and to study the hydraulic properties of soils 4. To study flownets under different hydraulic structures 5. To describe the deformation characteristics of soil. 6. To study the strength characteristics of soil under load.	
Course Outcomes	CO1	Determine basic soil properties and classify the soil as per relevant IS codes.
	CO2	Determine OMC and MDD for Light and Heavy compaction. Calculate vertical stresses at any point in the soil for various types of loadings.
	CO3	Evaluate effective stress under different flow conditions and plot stress distribution diagrams. Determine the permeability of soils.
	CO4	Sketch flownets under different hydraulic structures and compute flow parameters.
	CO5	Understand the basics of soil consolidation and be able to derive Terzaghi's 1D equation. Be able to calculate consolidation stresses and settlements.
	CO6	Evaluate Mohr-Coulomb failure criteria for shear strength and calculate the shear parameters from different types of tests and under different drainage conditions.
Course Content	**UNIT - I** **PHYSICAL PROPERTIES OF SOILS:** Introduction -Soil as a 3-phase system –Fundamental relationships by volume and weight - Index properties of soils – Sieve analysis – Sedimentation analysis – Atterberg limits and density index. **IDENTIFICATION AND CLASSIFICATION OF SOILS**: Tests for field identification and classification of soils – Textural classification, Unified soil classification and Indian Standard classification systems. **UNIT - II** **COMPACTION OF SOIL:** Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density - Compaction in field, compaction specifications and field control. **STRESS DISTRIBUTION IN SOILS:** Boussinesq's equation – Vertical stress due to line load, strip load, and uniformly loaded circular area – Newmark's chart – Westergard's approach – Pressure bulb concept –	

	Approximate methods. **UNIT - III** **EFFECTIVE STRESS PRINCIPLE:** Introduction - effective stress principle, nature of effective stress, effect of water table – Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure and quick sand condition. **PERMEABILITY OF SOIL:** Introduction - Darcy's law, validity of Darcy's law – Determination of coefficient of permeability - constant head, falling head method – pumping-in test, pumping - out test – Permeability aspects - permeability of stratified soils, factors affecting permeability of soil. **UNIT - IV** **SEEPAGE ANALYSIS:** Introduction, Laplace equation, characteristics of flow nets, uses of flow nets - Determination of discharge, total head, pressure head, uplift pressure, hydraulic gradient and critical hydraulic gradient, types of piping failure, prevention of piping failure – Flow net in earth dams with and without horizontal filters. **UNIT - V** **CONSOLIDATION OF SOIL:** Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, consolidation test results, basic definitions - Terzaghi's theory of consolidation, coefficient of consolidation - square root of time method and logarithm of time method - preconsolidation pressure - final settlement of soil deposits - consolidation settlement - one-dimensional method, secondary consolidation. **UNIT - VI** **SHEAR STRENGTH:** Mohr-Coulomb theory, types of shear test - direct shear test, triaxial compression tests, UU, CU and CD tests, relation between major and minor principal stresses, unconfined compression test, vane shear test, skemptons pore pressure parameters.
Textbooks and Reference Books	**TEXTBOOKS:** 1. A.S. Rao & Gopal Ranjan, *Basic and applied soil mechanics*, New Age International publishers, 3rd edition, 2016. 2. K.R. Arora, *Soil Mechanics and Foundation Engineering*, Standard publisher's distributions, 6th edition, 2017. 3. B.C. Punmia, A. K. Jain & A. K. Jain, *Soil Mechanics and Foundation Engineering*, Laksmi publications, 17th edition, 2017. **REFERENCE BOOKS:** 1. B. M. Das, *Principles of Geotechnical Engineering*, Cengage learning, 9th edition, 2017. 2. V.N.S. Murthy, *Soil Mechanics and Foundation Engineering*, CBS Publishers, 4th edition, 2018. 3. C. Venkatramaiah, *Geotechnical Engineering*, New Age International Private Limited, 5th edition, 2017.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	-	1	1	-	-	-	-	-	1	2
CO2	2	3	-	2	2	-	-	-	1	1	1	2
CO3	2	2	1	1	1	-	-	-	-	-	1	1
CO4	3	2	1	2	-	-	-	-	-	-	1	1
CO5	3	2	1	2	1	-	-	-	1	-	1	2
CO6	3	2	1	2	1	-	-	-	1	-	1	2

20CE2104 - ENGINEERING GEOLOGY

(Civil Engineering)

Course Category	Professional Core	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3-0-0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam. Evaluation	60
		Total Marks	100

Course Objectives	1. To describe the basic concepts of geology and mineralogy. 2. To identify and describe physical properties of various rock types through basic concepts of petrology. 3. To classify various landforms of the earth throughthe concepts of geomorphology. 4. To contrast the basic concepts of structural geology, different geological structures and core logging to estimate rock quality. 5. To understand the general geological hazards and their mitigation. 6. To apply the geological concepts for suitable site selection of major civil engineering structures.	
Course Outcomes	CO1	Relate the importance of geology in civil engineering and identify various minerals.
	CO2	Recognize various types of rocks and their properties.
	CO3	Classify surface geological process and landforms of earth surface.
	CO4	Identify various geological structures to rate the quality of rock mass.
	CO5	Summarize the different geological hazards.
	CO6	Apply the geological concepts for suitable site selection of major civil engineering structures.
Course Content	**UNIT - I** **INTRODUCTION**: Branches of geology useful to Civil Engineering, Scope of geological studies in GSI and NIRM, Role of engineering geologist in planning, design and construction of civil engineering structural features. **MINERALOGY**: Definition, Origin and Physical properties of minerals and megascopic identification of common rock forming, economic and clay minerals. **UNIT - II** **PETROLOGY AND PROPERTIES OF ROCKS:** Definition, origin (Rock cycle), textures, structures and classification of igneous, sedimentary and metamorphic rocks; Physical identification of acidic igneous rocks –Granite, Rhyolite; Basic igneous rocks –Gabbro, Dolerite and Basalt; Physical identification of sedimentary rocks –Conglomerate, Breccia, Sandstone,	

	Mudstone and Shale, Limestone; Physical identification of metamorphic rocks –Gneiss, Schist, Slate, Marble and Quartzite. **Properties of rocks**–Density, unit weight and porosity. **UNIT - III** **PHYSICAL GEOLOGY:** Factors causing weathering, erosion and denudation; Soil as product of weathering and engineering consideration, its profile and types in India; Geomorphologic (landforms) features of various geological agents such as water falls, Gorges, River meanderings, Superficial deposits, alluvium, glacial deposits, laterite (engineering aspects), desert landforms, loess, residual deposits of clay with flints, solifluction deposits, mudflows, coastal deposits. **UNIT - IV** **BASICS OF STRUCTURAL GEOLOGY:** Concept of rock deformation and plate tectonics; Geological Structural elements such as Dip and Strike; Fold-classification and nomenclature, Criteria for their recognition in the field. Faults - Classification, nomenclature and their recognition in the field; Types of joints, unconformity. **Strength index measurements of rocks**: Rock Mass Rating (RMR) and Rock Quality Designation (RQD), Core logging, Calculation of true thickness and vertical thickness of bed rock. **UNIT - V** **GEOLOGICAL HAZARDS**: Rock instability and slope movement, Concept of sliding blocks, Different controlling factors, Instability in vertical rock structures and measures to prevent collapse,Types of landslide and their prevention. **Ground water:** Factors controlling water bearing capacity of rock – Pervious and impervious rocks and lowering of water table. **Earthquake:** Magnitude and intensity of an earthquake, Seismic zones in India and its Importance in civil engineering. **UNIT - VI** **GEOLOGICAL INVESTIGATION FOR DAMS, RESERVOIRS AND TUNNELS:** Required geological consideration for selecting dam (geological profile from catchment area to dam site, topography, slope, drainage system.), reservoir and tunnel site; Failure of Reservoir; Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions for dams, reservoirs and tunnels. Two case studies on failure of dams due to ignorance of geological aspects.

Textbooks and Reference books	**TEXTBOOKS:** 1. ParbinSingh, *Engineering and General Geology*, S K Kataria& Sons, 2013. 2. P.C.Varghese, *Engineering Geology for Civil Engineers*, PHI Learning Private Ltd., 2012. 3. SubinoyGangopadhyay, Engineering *Geology*, Oxford University Press, 2013. **REFERENCE BOOKS:** 1. K.M.Bangar, *Principles of Engineering Geology*, Standard Publishers, 2020. 2. N. W. Gokhale, *A Manual of problems in structural geology*, CBS Publishers, 2018. 3. Dimitri P. Krynine and William R. Judd, *Principles of Engineering Geology and Geotechnics*, CBS Publishers and Distributers Private Ltd., 2018.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2	-	-	-	1	-	-	-	-	-	1
CO2	-	-	-	-	-	-	1	-	2	-	-	-
CO3	2	-	-	2	-	2	-	-	-	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	1	1
CO5	-	-	-	1	-	-	3	-	-	-	-	2
CO6	-	-	-	2	-	-	-	1	2	1	-	-

20CE21P1 - SURVEYING LABORATORY

(Civil Engineering)

Course Category	Program core	**Credits**	1.5
Course Type	Laboratory	**Lecture - Tutorial - Practical**	0 - 0 - 3
Prerequisite	Surveying	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Objective	To obtain knowledge of various basic and advanced surveying equipment and their field applications.	
Course Outcomes	CO1	Apply geometric and trigonometric principles for basic surveying calculations.
	CO2	Measure elevations of points using auto level.
	CO3	Measure elevations using Theodolite along with chain/tape and also carry out tacheometric surveying.
	CO4	Construct a simple curve in field with survey instruments.
	CO5	Demonstrate the application of total station instrument in basic engineering works.
	CO6	Comprehend the use of advanced surveying instruments.

Course Content

EXERCISE -1

Demonstration on conventional equipment such as chain, ranging rod, compass, cross staff, Dumpy level etc.

EXERCISE -2

Determination of elevations of given points using auto level.

EXERCISE-3

a) Determination of difference in elevation between two points using auto level.
b) Locating a bench mark by fly levelling using auto level.

EXERCISE -4

a) Plotting profile of given road section by obtaining longitudinal and cross sections using auto level.

b) Plotting a contour map for the given area using auto level.

	EXERCISE -5 Measurement of horizontal and vertical angles using theodolite **EXERCISE -6** Measurement of elevation and gradient between points by using tacheometry. **EXERCISE -7** Set out a simple curve by one theodolite method. **EXERCISE -8** Introduction and setting up of total station. **EXERCISE -9** a) Measurement of distance and direction using total station. b) Measurement of area of given field using total station. c) Measurement of height of an object in REM using total station. **EXERCISE -10** Setting out work using total station **DEMONSTRATION:** Introduction to advanced surveying instruments like hand held G.P.S, optical theodolite and electronic theodolite.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	1	1	2	2	1	-	1	-	3	2	2
CO2	3	3	2	2	2	1	-	2	2	1	1	1
CO3	3	2	2	3	2	1	-	1	2	2	2	2
CO4	3	3	2	2	2	-	-	1	1	2	2	2
CO5	3	3	2	3	3	1	2	1	2	3	3	3
CO6	2	2	2	2	3	-	1	1	2	1	3	2

20CE21P2 - ENGINEERING GEOLOGY LABORATORY

(Civil Engineering)

Course Category	Professional Core	**Credits**	1.5
Course Type	Laboratory	**Lecture - Tutorial - Practical**	0-0-3
Prerequisite	Engineering Geology	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Objective(s)	To understand various geological aspects of minerals, rocks and landforms for their application in engineering projects.	
Course Outcomes	CO1	Identify the minerals using basic geologic classification systems.
	CO2	Identify the rocks using basic geologic classification systems.
	CO3	Categorize the various landforms of the earth surface.
	CO4	Calculate the elements of structural geology and thickness of rock strata.
	CO5	Study the structural elements of surface and subsurface strata.
	CO6	Interpret various types of topographical and geological maps.

Course Content

LIST OF EXPERIMENTS.

1. Study of physical properties of minerals
2. Identification of minerals
3. Identification of Rocks
4. Study of Dipping beds and their thickness
5. Study of true dip, apparent dip and strike direction of beds
6. Three-point problem or Borehole problem
7. Study of geological maps of
   - i. Horizontal beds
   - ii. Dipping beds
   - iii. Dipping beds with dyke
   - iv. Folded beds
   - v. Faulted beds
   - vi. Beds with unconformity
   - vii. Completion of outcrop
8. Study of geological models
9. Handheld GPS – Demonstration.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	1	-	2	-	-	-
CO3	2	-	-	2	-	2	-	-	-	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	1	1
CO5	-	2	-	-	2	-	-	-	-	-	1	1
CO6	-	-	-	2	-	-	-	1	2	1	-	-

20CE21P3 - STRENGTH OF MATERIALS LABORATORY

(Civil Engineering)

Course Category	Professional Core	**Credits**	1.5
Course Type	Laboratory	**Lecture - Tutorial - Practical**	0 - 0 - 3
Prerequisite	Strength of Materials	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Objectives	To determine the characteristics of various materials and their behaviour used in buildings and infrastructure.	
Course Outcomes	CO1	Determine the elastic modulus and flexural rigidity of various types of beams.
	CO2	Evaluate the stiffness property of the spring.
	CO3	Determine the strength and elastic modulus of various materials used in buildings and infrastructure.
	CO4	Evaluate the hardness property of steel, copper and brass.
	CO5	Compute the rigidity modulus of mild steel.
	CO6	Evaluate the impact strength of mild steel.
Course Content	**LIST OF EXPERIMENTS** 1. Deflection test on fixed beam 2. Deflection test on simply supported beam 3. Deflection test on over hanging beam 4. Deflection test on close-coiled helical springs 5. Tension test on mild steel bar 6. a) Rockwell hardness test b) Brinell hardness test 7. Tension test on HYSD bar 8. Torsion test 9. Compression test on wood 10. a) Direct shear test on mild steel bar b) Charpy impact test c) Izod impact test	

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	1	-	-	-	1	1	-	1	1
CO2	3	2	-	1	-	-	-	1	1	-	1	1
CO3	3	3	-	2	-	-	-	2	2	1	2	3
CO4	3	2	-	1	-	-	-	1	1	-	1	1
CO5	3	2	-	1	-	-	-	1	1	-	1	1
CO6	3	2	-	1	-	-	-	1	1	-	1	1

20CE21SC – BASIC COMPUTING SKILLS

(Civil Engineering)

Course Category	Skill oriented course	**Credits**	2
Course Type	Theory and practical	**Lecture - Tutorial - Practical**	0-1-2
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam. Evaluation	60
		Total Marks	100

Course Objective(s)	To understand the basic MS-Office (word, excel, power point) & Topographic plotting using appropriate software	
Course Outcomes	CO1	Prepare professional documents using word.
	CO2	Modify and formatting excel work sheet.
	CO3	Perform mathematical calculations using excel.
	CO4	Calculate linear regression using excel template.
	CO5	Acquainted with user interface, map types, worksheet of software
	CO6	Prepare 3D maps, contour maps and saving, exporting and printing

Course Content

LIST OF EXPERIMENTS

1. Creating professional documents using Word
2. Management and archival of documents
3. Working with an Excel worksheet
4. Modifying and formatting a worksheet
5. Performing calculations using Excel
    a. Simple addition/subtraction/multiplication/division
    b. Finding minimum and maximum values
    c. Using Excel formula to compute partial correlation matrix
    d. Calculate Frequency Distribution in Excel
    e. Descriptive Statistics Using Excel
    f. Normal Distribution Using Excel
    g. Compute Correlation Matrix
    h. Compute partial correlation matrix
    i. Calculating Simple Linear Regression - Excel Template
6. Developing a workbook and printing workbook contents using Excel
7. Presenting data using charts (Bar/column/scatter charts) using Excel
8. Creating and managing presentation using Power Point
9. Topographic plotting using appropriate software(QGIS/Surfer)
    a. Introduction, User Interface, Map Types, Worksheet
    b. Gridding, Advanced Gridding
    c. 3D View
    d. Contour Maps
    e. 3D Surface Maps
    f. Combining Maps
    g. Map Properties
    h. Saving, Exporting and Printing

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, -- Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	2	1	1	-	2	-	1	-
CO2	2	-	1	1	3	-	-	-	2	-	2	2
CO3	1	-	1	-	3	-	-	-	2	-	1	-
CO4	2	-	-	-	3	1	-	-	3	-	2	-
CO5	1	-	-	-	2	-	-	-	2	-	1	-
CO6	2	1	1	-	3	1	2	-	2	-	3	2

NBKR INSTITUTE OF SCIENCE &TECHNOLOGY:: VIDYANAGAR

(AUTONOMOUS)

CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the batch admitted in the academic year 2020-2021)

II YEAR OF FOUR YEAR B.TECH. DEGREE COURSE – II SEMESTER

S.No.	Course Code	Course Title	Contact Hours/ Week			Cred-its	Evaluation									
							Sessional Test-I			Sessional Test-II			Total Sessional Marks (Max. 40)	Semester End Examination		Max. Total Marks
		THEORY	L	T	P		Test-I (2 hrs.)	Assignment-I	Max. Marks	Test-II (2 hrs.)	Assignment-II	Max. Marks	0.8(Better of two sessional tests) + 0.2(Other)	Duration in Hours	Max. Marks	
1	20CE2201	Fluid Mechanics	2	1	0	3	34	6	40	34	6	40		3	60	100
2	20CE2202	Structural Analysis	2	1	0	3	34	6	40	34	6	40		3	60	100
3	20CE2203	Geo. Tech. Engg - II	2	1	0	3	34	6	40	34	6	40		3	60	100
4	20CE2204	Transportation Engineering	3	0	0	3	34	6	40	34	6	40		3	60	100
5	20SH2201	Economics & Accountancy	3	0	0	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
1	20CE22P1	Fluid mechanics Lab	0	0	3	1.5	-	-	-	-	-	-	Day-to-day Evaluation and a test (40 marks)	3	60	100
2	20CE22P2	Geo. Tech Lab	0	0	3	1.5	-	-	-	-	-	-		3	60	100
3.	20CE22P3	Transportation Engg. Lab	0	0	3	1.5	-	-	-	-	-	-		3	60	100
		SKILL ORIENTED COURSE														
1	20CE22SC	3D Modeling	0	1	2	2	34	6	40	34	6	40	0.8 (Better of two) + 0.2(Other)	3	60	100
		MANDATORY														
1	20MC2101	Environmental Studies	2	0	0	0	34	6	40	34	6	40	0.8(Better of two) + 0.2(Other)	3	60	100
		TOTAL				**21.5**										

20CE2201 - FLUID MECHANICS

(Civil Engineering)

Course Category	Professional Core	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	2-1-0
Prerequisite	Engineering Mathematics, Engineering Physics.	**Sessional Evaluation**	40
		Semester End Exam. Evaluation	60
		Total Marks	100

Course Objectives	1. To familiarize with various fluid properties and measurement of pressure using manometers. 2. To understand the concepts of pressure acting on submerged and floating bodies. 3. To study the concepts of fluid motion. 4. To imbibe the basic concepts of fluid dynamics and its applications. 5. To know various energy losses in pipes which influencing the efficiency of a pipe network. 6. To understand the flow of fluid in pipes and in between two parallel plates.	
Course Outcomes	CO1	Determine the fluid properties, and fluid pressure in various conditions using manometers.
	CO2	Evaluate the hydrostatic pressure and buoyant force on plane & curved surfaces in floating and submerged conditions.
	CO3	Determine the velocity and acceleration components of a fluid flow relation between shear function and velocity potential.
	CO4	Apply the concepts of fluid dynamics to fluid flow problems.
	CO5	Compute the losses and efficiency of pipe networks.
	CO6	Analyze and apply the laminar and turbulent flow conditions for flow through pipes.
Course Content	**UNIT – I** **DEFINITIONS& BASIC CONCEPTS:** Definition of fluid & solid; fluid properties – density, specific weight, specific gravity, specific volume; viscosity – kinematic and dynamic viscosity, Newton's law of viscosity, variation of viscosity with temperature; concepts of - compressibility, bulk modulus, surface tension, capillarity, vapour pressure and cavitation. **PRESSURE MEASUREMENT:** Fluid pressure - fluid pressure at a point; Pascal's law; pressure variation in a fluid at a rest; types of fluid pressure – absolute, gauge, atmospheric & vacuum pressure; measurement of pressure – manometers, mechanical gauges; simple manometers- piezometer, U-tube manometer, single column manometer, differential manometers – U-tube	

	differential manometer, inverted U-tube differential manometer. **UNIT – II** **FLUID STATICS:** Total pressure and centre of pressure on – vertical plane surface, horizontal plane surface, inclined plane surface, curved plane surface; buoyancy, centre of buoyancy, meta-centre, meta-centric height equation, conditions of equilibrium of a floating & submerged bodies. **UNIT – III** **FLUID KINEMATICS:** Methods of describing fluid motion; types of fluid flow; description of the flow patterns – streamline, stream tube, path line, streak line; basic principles of fluid flow- conservation of energy & momentum; continuity equation in Cartesian coordinates; velocity and acceleration – local & convective acceleration; velocity potential function and stream function, equipotential line, relationship between velocity potential function and stream function. **UNIT – IV** **FLUID DYNAMICS:** Equations of motion- Euler's equation of motion, Bernoulli's equation – assumptions, applications; impulse momentum equation; forces excreted by a flowing fluid on a pipe bend. **ORIFICES, MOUTHPIECES, NOTCHES & WEIRS:** Types of orifice and mouthpiece; hydraulic coefficients; classification of notches & weirs; discharge over rectangular and triangular notches. **UNIT – V** **ANALYSIS OF PIPE FLOW:** Reynolds experiment on pipe flow, loss of energy due to friction – Darcy-Weisbach equation; minor losses; hydraulic gradient line and total energy line; flow through syphon; pipes in series& parallel; equivalent pipe; branched pipes; water hammer in pipes – gradual closure of valve, sudden closure of valve in rigid and elastic pipes, control measures. **UNIT VI** **LAMINAR & TURBULENT FLUID FLOW IN PIPES:** Flow of incompressible fluid through circular pipe and between two rigid parallel plates – velocity distribution, ratio of maximum to average velocity, drop of pressure, shear stress distributions for given length of pipe. Coefficient of friction in terms of shear stress, shear stress in turbulent flow, Prandtl's mixing length theory.
Textbooks and Reference books	**TEXTBOOKS:** 1. Dr. P.N. Modi, Dr. S.M. Seth, *Hydraulics and Fluid Mechanics Including Hydraulics Machine*, Standard Book House, 21st Edition, 2017. 2. R.K. Bansal, *A Textbook of Fluid Mechanics and Hydraulic Machines*,

	Laxmi Publications, 10th Edition, 2019. 3. A. K. Jain *Fluid Mechanics including Hydraulic Machines*, Khanna Publications, 2016. **REFERENCE BOOKS:** 1. Frank M White, *Fluid Mechanics in SI Units*, McGraw Hill Education India Private Limited, 8th Edition, 2017. 2. Yunus A. Cengel, Dr. John M. Cimbala, *Fluid Mechanics: Fundamentals and Applications*, McGraw-Hill Education India Private Limited, 4th Edition, 2018. 3. Okiishi, Hubesh and Rothmayer, *Fluid Mechanics*, Munson Johnwiley Publications, 7th Edition, 2017.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	1	1	-	-	-	1	-	2	2
CO2	3	1	-	2	1	-	-	-	1	1	2	2
CO3	3	2	-	3	1	-	-	-	2	-	2	2
CO4	3	2	1	2	1	-	-	-	2	1	2	2
CO5	3	3	3	3	2	-	-	-	-	1	3	2
CO6	3	2	2	2	2	-	-	-	2	-	2	2

20CE2202 - STRUCTURAL ANALYSIS

(Civil Engineering)

Course Category	Professional Core	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	2-1-0
Prerequisite	Engineering Mechanics and Strength of Materials	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Objectives	1. To apply the various methods for calculating slope and deflection of beams under point and uniformly distributed loads. 2. To calculate the crippling load of columns for different end conditions subjected to axial load and moments and estimate stresses in sections subjected to direct load and bending moment. 3. To analyse and draw the shear force and bending moment diagrams of propped cantilever and fixed beams under various loading conditions including the effect of sinking of supports. 4. To analyze and draw the shear force and bending moment diagrams of continuous beams using Clapeyron's theorem of three moments. 5. To understand the concept of energy theorems and calculate the slope and deflection of beams and trusses. 6. To calculate the support reactions, shear force, and bending moment of determinate structures using influence line diagram method.	
Course Outcomes	CO1	Determine the slope and deflection of determinate beams under various loading conditions.
	CO2	Analyze the columns subjected to different loading conditions and also calculate the stresses subjected to direct load and bending moment.
	CO3	Calculate and draw shear force diagram and bending moment diagram for propped cantilever and fixed beams.
	CO4	Calculate and draw shear force diagram and bending moment diagram for continuous beams using Clapeyron's theorem.
	CO5	Apply the energy theorems for determining slope and deflection of beams and trusses.
	CO6	Analyze determinate beams subjected to moving loads using influence line diagram method.
Course Content	**UNIT – I** **SLOPE AND DEFLECTION OF STATICALLY DETERMINATE BEAMS:** Relationship between curvature, slope and deflection (Differential equation for elastic line of a beam) –Slope and deflection of cantilevers and simply supported beams by double integration method, Macaulay's method, moment area method and conjugate beam method for point loads, uniformly distributed loads and combination of these loads.	

UNIT – II

COLUMNS: Introduction – Unsupported and effective lengths of columns – Slenderness ratio – Types of columns – Types of failure of columns – Crippling load - Assumptions made in Euler's theory – Expressions for Euler's crippling load of columns for various end conditions - limitations of Euler's theory.

DIRECT AND BENDING STRESSES: Stresses under the combined action of direct loading and bending moment – Core of a section – Circular and rectangular (solid and hollow).

UNIT – III

ANALYSIS OF STATICALLY INDETERMINATE BEAMS:

PROPPED CANTILEVER BEAMS: Analysis of propped cantilevers for point loads and uniformly distributed loads– Shear force and bending moment diagrams.

FIXED BEAMS: Analysis of fixed beams for point loads, uniformly distributed loads, uniformly varying load, shear force and bending moment diagrams– Effect of sinking of supports.

UNIT – IV

ANALYSIS OF CONTINUOUS BEAMS: Introduction – Clapeyron's theorem of three moments – Analysis of continuous beams with constant moment of inertia with one or both ends fixed – Continuous beam with overhang – Effect of sinking of supports – Shear force and bending moment diagrams.

UNIT – V

ENERGY THEOREMS: Strain energy due to axial load, bending moment and shear force – Castigliano's first theorem for beams – Castigliano's second theorem for indeterminate trusses.

UNIT – VI

INFLUENCE LINES: Influence lines for reactions, shear force and bending moment for determinate structures – Maximum shear force and bending moment for single, two and multipoint loads – UDL longer than span - UDL shorter than span and EUDL.

Textbooks and Reference books	**TEXTBOOKS:** 1. T.S. Thandavamoorthy, *Structural Analysis,* Oxford University Press, 1st edition, 2011. 2. R. Vaidyanathan, Dr. P. Perumal, *Structural Analysis*, Laxmi Publications, 3rd (Revised) edition, 2019. 3. R.K. Bansal, *A Text Book of Strength of Materials*, Laxmi Publications, 6th edition, 2019. **REFERENCE BOOKS:** 1. G.S. Pandit, S.P. Gupta, R. Gupta, *Theory of Structures*, Vol.I, McGraw Hill Publications. 2. C.K.Wang, *Intermediate Structural Analysis*, McGraw Hill Education, Indian edition, 2017. 3. V. N. Vazirani and M. M. Ratwani, *Analysis of Structures Vol. I & II*, Khanna Publishers, 17th edition, 2016.

CO-PO Mapping:3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	-	-	-	-	-	-	1	-	-	-	1
CO2	2	2	-	1	-	-	-	1	-	-	1	1
CO3	2	2	-	1	-	-	-	1	-	-	1	1
CO4	2	2	-	1	-	-	-	1	-	-	1	1
CO5	3	-	-	-	-	-	-	1	-	-	-	1
CO6	2	2	-	1	-	-	-	1	-	-	1	1

20CE2203 – GEOTECHNICAL ENGINEERING – II

(Civil Engineering)

Course Category	Professional Core	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	2 - 1 - 0
Prerequisite	Geotechnical Engineering – I	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Objectives	1. To analyze slope stability of infinite and finite slopes. 2. To explain various types of earth pressure in various soils under different types of loading and demonstrate stability of retaining walls. 3. To study the various methods of site exploration and preparation of site investigation reports. 4. To study the bearing capacity of shallow foundations. 5. To understand the design of pile foundation 6. To illustrate the various types and characteristics of caisson and well foundation.	
Course Outcomes	CO1	Analyze infinite and finite slopes.
	CO2	Calculate earth pressure in various soils under different types of loading using analytical and graphical methods. Analyze stability of retaining walls.
	CO3	Understand the various methods of site exploration and write site investigation reports.
	CO4	Evaluate bearing capacity of shallow foundations.
	CO5	Compute pile load capacities of individual piles and design of pile groups
	CO6	Outline the basic concepts of caisson and well foundation.
Course Content	**UNIT – I** **STABILITY OF SLOPES:** Stability analysis of infinite slopes – Stability analysis of finite slopes – Swedish circle method – Friction circle method – Tailor's stability number and use of charts – Bishop's method - Improving stability of slopes. **UNIT – II** **EARTH PRESSURES:** Theories of lateral earth pressure – Active and passive earth pressures in cohesion less and cohesive soils (with and without surcharge) – Rankine's and Coulomb's earth pressure theories. Graphical methods due to Rebhann and Culmann. **EARTH RETAINING STRUCTURES:** Types of retaining structures – Stability consideration of gravity and cantilever retaining walls – Drainage in retaining walls – Joints in retaining walls **UNIT – III** **SITE INVESTIGATIONS AND SUB-SOIL EXPLORATION:** Site reconnaissance – Depth of exploration – Lateral extent of exploration – Test pits	

	– Auger borings – Wash borings – Soil sampling – Split – spoon sampler – Penetration tests – Geophysical methods – Seismic refraction and electrical resistivity methods – Sub soil investigation reports. **UNIT – IV** **BEARING CAPACITY OF SHALLOW FOUNDATIONS :** Types of foundations – Depth of foundation – Terzaghi's bearing capacity equation – Bearing capacity of square, circular, rectangular and continuous footings – Meyerhof's theory – Skempton's method – Brinch Hansen's method – Effect of ground water table on bearing capacity – Bearing capacity from building codes - Types of settlements – Tolerable settlements – Settlement analysis. **UNIT – V** **PILE FOUNDATIONS:** Classification of piles – Pile driving – Load carrying capacity of piles – Dynamic formulae – Static formulae – pile load tests – In situ penetration tests – Group action of piles – Negative skin friction. **UNIT – VI** **CAISSONS**: Introduction – types of caissons – design and construction aspects of caissons – component parts of pneumatic caisson – Merits and demerits of pneumatic and floating caisson. **WELL FOUNDATIONS:** Introduction – Different shapes of wells – Components of wells – Functions - depth of well foundation – forces acting on a well foundation – construction and sinking of wells – Tilts and shifts.
Textbooks and References	**TEXTBOOKS:** 1. A.S. Rao & Gopal Ranjan, *Basic and applied soil mechanics*, New Age International Publishers, 3rd edition, 2016. 2. K. R. Arora, *Soil Mechanics and Foundation Engineering*, Standard Book House, 7th edition, 2018. 3. B.C. Punmia, A. K. Jain & A. K. Jain, *Soil Mechanics and Foundation Engineering*, Laksmi publications, 17th edition, 2017. **REFERENCE BOOKS:** 1. B. M. Das, *Principles of Geotechnical Engineering*, Cengage learning, 9th edition, 2017. 2. V.N.S. Murthy, *Soil Mechanics and Foundation Engineering*, CBS Publishers, 4th edition, 2018. 3. C. Venkatramaiah, *Geotechnical Engineering*, New Age International Private Limited, 5th edition, 2017.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	1	2	-	-	-	2	2
CO2	2	1	2	2	2	1	1	-	1	-	1	2
CO3	2	-	1	2	2	-	-	-	-	-	2	2
CO4	3	3	3	2	3	-	-	-	-	-	2	2
CO5	3	3	3	2	3	-	-	-	-	-	2	2
CO6	2	3	2	2	3	2	-	-	-	2	2	3

20CE2204- TRANSPORTATION ENGINEERING
(Civil Engineering)

Course Category	Professional Core	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	2-1-0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam. Evaluation	60
		Total Marks	100

Course Objectives	1. To demonstrate the importance of transportation engineering along with the basics of highway alignment. 2. To analyze various highway geometrical elements. 3. To outline the properties of bitumen and aggregate in pavement construction. 4. To design flexible pavements and rigid pavements. 5. To summarize methods of construction and maintenance of pavements. 6. To evaluate methods of traffic surveys and types of traffic control devices.	
Course Outcomes	CO1	Outline the scope and functions of transportation engineering along with the concepts of highway alignment.
	CO2	Analyze and relate highway geometric elements such as super elevation, sight distances, horizontal alignment and vertical curves.
	CO3	Perform tests on bitumen and aggregate for assessing their properties and judge their suitability as highway construction materials.
	CO4	Design flexible pavements and rigid pavements
	CO5	Understand the construction and maintenance procedures of bituminous and cement concrete pavements.
	CO6	Perform different types of Traffic studies and understand different types of traffic control devices
Course Content	**UNIT - I** **HIGHWAY ENGINEERING:** Importance of transportation, Modes of transportation, Characteristics of road transport, Classification of roads, Highway alignment – Basic requirements – Controlling factors – Master plan and its phasing , problems on saturation system concept. **UNIT - II** **GEOMETRIC DESIGN:** Highway cross sectional elements - camber, width of pavement, kerbs, road margins, formation width, right of way , Sight distance – types, PIEV theory, factors affecting sight distance, design of sight distance , Pavement surface characteristics, Horizontal alignment – design speed, super elevation, extra widening, Curves - types of curves, elements of curves, length of transition curve, Gradient, Vertical curves – Types of summit curves, length of summit curve - problems - Types of valley curves, length of valley curves –problems. **UNIT - III** **HIGHWAY MATERIALS:** Aggregates and bitumen – Desirable properties, tests on aggregate- crushing test, impact test, angularity number test, flakiness index test, elongation index test, specific gravity and water absorption test, Tests on bitumen- specific gravity test, ductility test, softening point test,	

	penetration test, flash and fire point test, types of bitumen, desirable properties of bituminous mix – Marshall method of bituminous mix design **UNIT - IV** **DESIGN OF FLEXIBLE PAVEMENTS**: Types of pavements - components and their functions, Comparison of flexible and rigid pavements, Design of flexible pavements – design factors, group index method and IRC method based on CBR value. **DESIGN OF RIGID PAVEMENTS:** Material for rigid pavement and their requirements, Design of rigid pavements -westergaard's stress equations and problems, critical combination of stresses, types of joints – problems on spacing of joints, joint filler materials, joint sealer materials. **UNIT - V** **CONSTRUCTION OF PAVEMENTS**: Construction and maintenance of Bituminous pavements – types of bituminous construction, interface treatment, Bituminous surface dressing - seal coat, tack coat, prime coat, built-up spray grout- Premix methods, Bituminous macadam- penetration macadam, bituminous concrete, sheet asphalt, mastic asphalt, Cement concrete pavements - dry lean concrete, paving quality concrete - Construction procedure, tie bars and dowel bars, methods of construction – continuous bay method and alternate bay method. **UNIT - VI** **TRAFFIC ENGINEERING:** Road user and vehicular characteristics, Traffic studies - volume, speed, origin and destination, parking & accident studies (uses, field procedure and presentation of data only), PCU values, types of traffic signs, road markings, traffic signals, signal indications – signal face and types of traffic signal systems.
Textbooks and Reference Books	**TEXTBOOKS:** 1. S.K. Khanna and C.E.GJusto & Veeraraghavulu, "*Highway Engineering"*, Nemchand &bros, 10th edition, 2018. 2. Dr. L.R Kadiyali, "*Principles and Practice of Highway Engineering"* Khanna publishers, 7th edition, 2019. 3. C.Venkatramaiah, "*Transportation Engineering Vol. I",* Universities Press (India) Private Ltd, 1st edition, 2016. **REFERENCE BOOKS:** 1. Dr. L.R Kadiyali, "*Traffic engineering and Transport planning"*, Khanna publishers, 9th edition, 2017. 2. Guidelines for the Design of flexible pavements, IRC:37-2001. 3. Guidelines for the Design of rigid pavements for highways, IRC:58-1988.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	2	1	1	1	2	3	1	-	1	2	1	-
CO2	3	2	2	3	2	-	1	-	2	2	1	1
CO3	1	3	-	1	1	-	-	-	1	2	1	2
CO4	3	1	2	2	1	-	1	2	2	2	2	2
CO5	1	-	2	2	3	-	1	-	1	1	2	1
CO6	2	3	2	1	2	-	1	2	-	3	2	1

20CE22P1 - FLUID MECHANICS LABORATORY

(Civil Engineering)

Course Category	Professional Core	**Credits**	1.5
Course Type	Laboratory	**Lecture - Tutorial - Practical**	0-0-3
Prerequisite	Fluid Mechanics	**Sessional Evaluation**	40
		Semester End Exam. Evaluation	60
		Total Marks	100

Course Objective(s)	To impart knowledge of evaluating various flow measuring devices and hydraulic machines.	
Course Outcomes	CO1	Calibration of orifice and mouthpiece.
	CO2	Determination of efficiency of notches, venturimeter and orifice meter.
	CO3	Evaluate the major and minor losses in pipe network.
	CO4	Evaluate the performance characteristics of pump.
	CO5	To demonstrate performance characteristics of turbine.
	CO6	Evaluate the Chezy's and Manning's coefficient in open channel flow.

Course Content

LIST OF EXPERIMENTS

I. EXPERIMENTS ON CALIBRATION OF

a. Orifice
b. Mouth piece
c. Notch
d. Venturimeter
e. Orifice meter
f. Bend meter
g. Friction loss through a pipe
h. Gate valve
i. Bend loss
j. Sudden contraction
k. Sudden Expansion
l. Open channel

II. EXPERIMENTS ON PERFORMANCE CHARACTERISTICS OF

a. Turbines
b. Pumps

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	-	-	-	1	2	1	1
CO2	3	3	2	2	1	-	-	-	1	3	1	2
CO3	3	3	1	1	1	-	-	-	1	2	2	1
CO4	3	2	1	2	2	2	-	-	1	2	2	1
CO5	3	3	2	2	1	2	-	-	1	3	1	2
CO6	3	2	1	2	2	-	-	-	1	2	1	1

20CE22P2 – GEOTECHNICAL ENGINEERING LABORATORY

Course Category	Professional Core	**Credits**	1.5
Course Type	Practical	**Lecture - Tutorial - Practical**	0 - 0 - 3
Prerequisite	Geo technical engineering-I	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Objectives	To determine the engineering properties of soil in the field and laboratory	
Course Outcomes	CO1	Determine index properties of soils and classify them.
	CO2	Determine the compaction characteristics.
	CO3	Determine the permeability of soils.
	CO4	Determine the California Bearing Ratio value.
	CO5	Determine the shear parameters of the soil.
	CO6	Evaluate the distribution of soil particles by sedimentation process.

Course Content

LIST OF EXPERIMENTS

1. (a) Specific Gravity test
   (b) Grain Size Distribution by Sieve Analysis.
2. (a) Determination of Liquid Limit & Plastic Limit.
   (b) Determination of Shrinkage Limit.
3. (a) In-Situ density by core cutter method.
   (b) In-Situ density by Sand replacement method.
4. I.S. light Compaction Test.
5. California Bearing Ratio Test.
6. Direct Shear test
7. a) Coefficient of Permeability by constant Head method
   b) Coefficient of Permeability by Falling Head method.
8. Triaxial shear test (UU)
9. Determination of coefficient of consolidation.
10. Hydrometer Analysis.

DEMONSTRATION

1. Plate Load cone Apparatus
2. SPT test

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	1	1	1	1
CO2	3	3	2	2	1	-	-	-	1	1	1	1
CO3	3	3	2	2	1	-	-	-	1	1	1	1
CO4	3	3	2	2	1	-	-	-	1	1	1	1
CO5	3	3	2	2	1	-	-	-	1	1	1	1
CO6	3	3	2	2	1	-	-	-	1	1	1	1

20CE22P3 – TRANSPORTATIONENGINEERING LABORATORY

Course Category	Professional Core	**Credits**	1.5
Course Type	Laboratory	**Lecture - Tutorial - Practical**	0 - 0 - 3
Prerequisite	Transportation Engineering	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Objectives	1. To assess the quality of bitumen and its suitability for highway construction works. 2. To learn the testing procedure of aggregate and to judge its suitability as highway construction material.	
Course Outcomes	CO1	Determine water absorption percentage of road aggregates.
	CO2	Evaluate the toughness property of the aggregate and its suitability for highway construction.
	CO3	Examine shape criterion of road aggregate.
	CO4	Determine temperature suspect ability of paving grade bitumen.
	CO5	Determine penetration value of bitumen.
	CO6	Assess the quality of bitumen and bituminous mix.

Course Content

LIST OF EXPERIMENTS

TESTS ON AGGREGATES

1. Specific Gravity and Water Absorption Test.
2. Aggregate Impact Test
3. Elongation Index Test
4. Flakiness Index Test
5. Angularity Number Test
6. Los Angles Abrasion Test
7. Aggregate Crushing Test

TESTS ON BITUMEN

8. Flash & Fire Point Test
9. Softening Point Test
10. Specific Gravity Test
11. Penetration Test
12. Ductility Test

	13. Viscosity test 14. Demonstration on Marshall method of mix design

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	2	1	2	2	2	-	-	2	1	2	2	2
CO2	2	3	1	1	2	2	-	-	2	1	3	2
CO3	2	2	1	1	2	-	-	1	1	1	1	1
CO4	2	1	2	2	2	-	-	2	1	2	2	2
CO5	2	3	1	1	2	2	-	-	2	1	3	2
CO6	2	2	1	1	2	-	-	1	1	1	1	1

20CE22SC -3D MODELLING

(Civil Engineering)

Course Category	Skill oriented course	**Credits**	2
Course Type	Theory and practical	**Lecture - Tutorial - Practical**	1-0-2
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam. Evaluation	60
		Total Marks	100

Course Objective(s)	1. To introduce the 3D modelling, navigating and 3D view commands in AUTOCAD. 2. To make use of Extrude, Press pull, Revolve and Sweep Commands. 3. To develop editing and visualizing solids by using various operational commands. 4. To illustrate the User Coordinate system and originating 2D layout from 3D drawings. 5. To explain about various tools of making basic surfaces. 6. To study about creation and saving renderings and to produce Walkthrough videos.	
Course Outcomes	CO1	Know about 3D modelling, navigating and 3D view commands in AUTOCAD
	CO2	Be aware of Extrude, Press pull, Revolve and Sweep Commands.
	CO3	Demonstrate about editing and visualizing the solids
	CO4	Acknowledge the User Coordinate system
	CO5	Comprehend the making of basic surfaces using tools.
	CO6	Generating the walk through videos.
Course Content	**LIST OF EXPERIMENTS** 1. Introduction to 3D solid modelling, navigating to workspace and 3D view Commands. 2. Extrude, Press pull, Revolve and Sweep Commands. 3. Editing and visualizing solids using Boolean operation, fillet, chamfer, extrude, taper, move face, 3D Array. 4. Understanding the UCS (User Coordinate system) and creating 2D layout from 3D drawings. 5. Making basic surfaces using Patch, Fillet, Offset and surface blend tool 6. Creating, saving renderings and making walkthrough video.	

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - - Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	2	1	1	-	2	-	1	-
CO2	2	-	1	1	3	-	-	-	2	-	2	2
CO3	1	-	1	-	3	-	-	-	2	-	1	-
CO4	2	-	-	-	3	1	-	-	3	-	2	-
CO5	1	-	-	-	2	-	-	-	2	-	1	-
CO6	2	1	1	-	3	1	2	-	2	-	3	2

N.B.K.R. INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR

(AUTONOMOUS)

CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the batch admitted in the academic year 2020-2021)

III YEAR OF FOUR YEAR B.TECH. DEGREE COURSE – I SEMESTER

S.NO	Course Code	Course Title	Contact Hours/ Week			Credits	Evaluation									
							Sessional Test-I			Sessional Test-II			Total Sessional Marks (Max. 40)	Semester End Examination		Max. Total Marks
		THEORY	L	T	P		Test-I (2 hrs.)	Assignment-I	Max. Marks	Test-II (2 hrs.)	Assignment-II	Max. Marks		Duration In Hours	Max. Marks	
1	20CE3101	Elemental Design of RC structures	2	1	0	3	34	6	40	34	6	40	0.8(Better of two sessional tests) + 0.2(Other)	3	60	100
2	20CE3102	Concrete Technology	3	0	0	3	34	6	40	34	6	40		3	60	100
3	20CE3103	Steel Structural design	2	1	0	3	34	6	40	34	6	40		3	60	100
		OPEN ELECTIVE COURSE / JOB ORIENTED COURSE														
4	20XX3101	*Open Elective Course /Job Oriented Course**	3	0	0	3	34	6	40	34	6	40		3	60	100
5	20CE31EX	**Professional Elective-I**	3	0	0	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
1	20CE31P1	Concrete Technology Laboratory	0	0	3	1.5	-	-	-	-	-	-	Day-to-day Evaluation and a test (40 marks)	3	60	100
2	20CE31P2	CACED Lab	0	0	3	1.5	-	-	-	-	-	-		3	60	100
		SKILL ADVANCEDCOURSE / SOFT SKILL COURSE														
1	20CE31SC	Revit Architecture	0	0	4	2	-	-	-	-	-	-		3	60	100
		MANDATORY COURSE											0.8(Better of two) + 0.2(Other)			
1	20MC3103	*Advanced Aptitude and Reasoning Skills*	2	0	0	0	34	6	40	34	6	40		3	60	100
		INTERNSHIP:														
1	20CE31IS	Summer Internship (Community Service Projects)	0	0	0	1.5	-	-	-	-	-	-	40 marks	-	60	100
		TOTAL				**21.5**										
1	20xx31xx	Honors/Minor Course	4	0	0	4	The hours distribution can be 3-0-2 or 3-1-0 also									

Professional Elective-I: **20CE31E1**: **Hydraulics & Hydraulic Machineries** 20CE31E2: Ground Water Hydrology 20CE31E3: Traffic Engg. & Management 20CE31E4: Adv. Foundation Engg.

***** Any one of the open electives (III-I/III-II/IV-I) during the four year UG Programme may be taken by the students under MOOCs.

20CE3101- ELEMENTAL DEISGN OF RC STRUCTURES

(Civil Engineering)

Course Category	Professional Core	**Credits**	3
Course Type	Theory	**Lecture – Tutorial –Practical**	2-1-0
Prerequisite	Strength of Materials	**Sessional Evaluation**	40
		Semester End Exam. Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Understand the design principles of reinforced concrete members and design singly reinforced, doubly reinforced and flanged beams for flexure.
	CO2	Design RC beams for shear, torsion and bond.
	CO3	Carry out design and detailing of different types of slabs and continuous beams.
	CO4	Carry out design and detailing of stair case and columns for various loading conditions.
	CO5	Carry out design and detailing of different types of isolated footings under axial load and Analyze reinforced concrete members for serviceability conditions.
	CO6	Analyze slabs using yield line theory.

Course Content

UNIT – I

DESIGN PRINCIPLES: Basic design principles – Stress Strain curves of concrete and steel – Characteristic strengths and loads – Partial safety factors – Stress block – Various limit states.

DESIGN FOR FLEXURE: Limit state of collapse in flexure – Ultimate flexural strength – Balanced, under and over – Reinforced sections – Design of singly and doubly reinforced rectangular beams – Design of flanged beams.

UNIT – II

DESIGN FOR SHEAR, TORSION AND BOND: Shear-Truss analogy – Design of beams for shear and torsion – Anchorage and development length.

UNIT – III

DESIGN OF SLABS AND BEAMS: Design of one way and two way slabs – Design of continuous beams and slabs.

UNIT – IV

	DESIGN OF COMPRESSION MEMBERS: Columns – Reduction factors – Axially loaded, eccentrically loaded columns – Uni-axial moment. **DESIGN OF STAIRCASE:** Types of staircase – Specifications – Design of doglegged stair case. **UNIT – V** **DESIGN OF FOUNDATIONS:** Types of footings– Design of isolated (Square, Rectangular and Circular) footings subjected to axial load. **LIMIT STATES OF SERVICEABILITY:** Deflection (short and long term) – Cracking. **UNIT – VI** **YIELD LINE THEORY:** Introduction – Behavior of slab up to failure – Assumptions – Guidelines for predicting yield line pattern – Yield criterion – Methods of analysis and basic principles – Virtual work – Equilibrium method – Corner levers – Circular slabs.
Textbooks and Reference books	**TEXTBOOKS:** 1. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, *RCC Designs (Reinforced Concrete structures)*, Laxmi Publications,10th edition, 2019. 2. N. Krishna Raju, R. N. Pranesh, *Reinforced Concrete Design: IS: 456-2000 Principles and Practice*, New Age International (P) Ltd. Publishers, 1st edition, 2018. 3. Unni Krishna Pillai and Devdas Menon, *Reinforced Concrete Design*, Tata McGraw-Hill Educational Private Ltd., 3rd edition, 2017. **REFERENCE BOOKS**: 1. S. N. Sinha, *Reinforced Concrete Design*, Tata McGraw-Hill Educational Private Ltd., 3rd edition, 2017. 2. Dr. Ramchandra, *Reinforced Concrete Structures (Limit State Design)*, Raj sons Publications Pvt. Ltd, 3rd edition, 2014. 3. S. R. Karve & V. L. Shah, *Limit State Theory and Design of Reinforced Concrete*, Structures Publications, 8th edition, 2014.

IMP: *At the end of the course work, complete analysis and design of a RC building must be explained to the students using appropriate software. This should be followed by an exercise.*

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	2	2	2	-	2	-	-	-	2	2	-	1
CO2	3	1	3	2	2	2	-	1	-	-	-	2	2	-	1
CO3	3	2	3	2	2	2	-	2	-	-	-	3	2	-	1
CO4	3	1	3	2	2	2	-	2	-	-	-	3	2	-	1
CO5	3	1	3	1	2	2	-	2	-	-	-	2	2	-	1
CO6	3	1	2	1	1	2	-	3	-	-	-	2	1	-	1

20CE3102 – CONCRETE TECHNOLOGY

(Civil Engineering)

Course Category	Professional Core	**Credits:**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	Building Materials & Construction	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Identify various types of cements and admixtures.
	CO2	Determine the properties of aggregates used in concrete.
	CO3	Identify the properties of concrete in the fresh state and Methods of curing.
	CO4	Perform destructive and non-destructive tests on concrete.
	CO5	Understand the durability requirements of concrete.
	CO6	Design the concrete mix using various codes and apply various special concretes for their specific applications.
Course Content	**UNIT– I** **CEMENT:** Introduction – Chemical composition of cement – Physical properties of cement – Types of cement: Ordinary portland cement – Rapid hardening cement – Sulphate resisting cement – Portland slag cement – Quick setting cement – Super sulphated cement – Low heat cement – Portland pozzolana cement – Air entraining cement– Coloured cement – High alumina cement – Masonry cement – Expansive cement – Oil well cement. **ADMIXTURES:** Introduction – Classification: Plasticizers – Super plasticizers – Accelerators – Retarders – Waterproofing admixtures – Colouring admixtures – corrosion inhibiting admixtures – Air entraining agents – Pozzolanic (mineral) admixtures: Fly-ash – Silica fume. **UNIT – II** **CONCRETE AGGREGATES:** Introduction – Classification: Heavy weight aggregates – Normal weight aggregates –Mechanical properties – Moisture content and its effects – Deleterious substances – Alkali-aggregate reaction – Thermal properties – Grading curves and grading requirements – Gap-graded aggregate – Maximum aggregate size – Use of 'Plums' – Handling of aggregates. **UNIT – III** **FRESH CONCRETE:** Introduction – Workability – Factors affecting	

	workability – Measurement of workability – Comparison of workability tests – Segregation – Bleeding – Mixing of concrete – Concrete mixers – Vibration of concrete – Types of vibrators – Ready mixed concrete – Pumped concrete –Pre-packed concrete and Vacuum processed concrete. **CURING OF CONCRETE:** Introduction – Curing conditions – Methods of curing – Influence of temperature – Steam curing at atmospheric pressure – High pressure steam curing. **UNIT – IV** **HARDENED CONCRETE:** Introduction – Water/Cement ratio –Duff Abram's law – Gel/ Space ratio – Griffith's hypothesis – Maturity concept of concrete – Factors affecting strength- Nature of strength of concrete – Strength in tension and compression – Relation between compression and tensile strengths – Testing of hardened concrete – Compression tests – Tension tests – Flexure tests – Cylinder splitting tension tests – Non-destructive testing methods: Rebound hammer test – Ultrasonic pulse velocity test. **UNIT – V** **ELASTICITY, SHRINKAGE AND CREEP:** Modulus of elasticity – Types – Factors affecting modulus of elasticity –Poisson's ratio – Mechanism of shrinkage – Factors affecting shrinkage – Types of shrinkage: Plastic shrinkage – Drying shrinkage – Autogeneous shrinkage – Carbonation shrinkage – Creep of concrete – Factors affecting creep – Relation between creep and time – Nature of creep – Effect of creep. **DURABILITY:** Introduction – Factors affecting durability – Permeability – Chemical attack of Concrete – Efflorescence – Thermal properties of concrete – Resistance of concrete to fire. **UNIT – VI** **CONCRETE MIX DESIGN:** Introduction – Objectives of mix design – Basic considerations – Factors influencing the choice of mix proportions – Design of concrete mixes by IS 10262 :2019 & ACI methods. **SPECIAL CONCRETES:** Light weight concrete – Cellular concrete – No-fines concrete – High density concrete – Fibre reinforced concrete –Polymer concrete – Self compacting concrete.
Text and Reference books	**TEXT BOOKS:** 1. M.S. Shetty, *Concrete Technology Theory and Practice,* S. Chand & Company Ltd., 8th Revised Edition, 2019. 2. Dr. R. P. Rethaliya, *Concrete Technology*, Charotar Publishing House, 2nd Edition, 2018. 3. V. N. Vazirani and S. P. Ratwani, *Concrete Technology*, Khanna Publishers, 6th Edition, 2016. **REFERENCE BOOKS:** 1. A. M. Neville, J. J. Brooks, *Concrete Technology,* Pearson. 2nd Edition, 2019, Concrete Manual by U.S. Bureau of Reclamation.

	2. P. Kumar Mehta, Paulo J.M. Monteiro, *Concrete: Microstructure, Properties, and Materials*, McGraw Hill Education, 4th edition, 2017. 3. M. L. Gambhir, *Concrete Technology Theory and Practice*, McGraw Hill Education, 5th edition, 2017.

CO-PO Mapping: 3-High mapping, 2-Moderate mapping, 1-Low mapping, - Not mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	1	-	-	1	-	-	1	1	-	2	1
CO2	1	1	-	-	-	-	-	1	-	-	1	1	-	1	1
CO3	1	1	1	-	-	-	-	-	-	-	-	1	-	1	1
CO4	2	1	1	2	-	-	-	-	-	-	-	2	-	1	2
CO5	1	1	-	-	-	-	1	-	-	-	-	1	-	2	-
CO6	3	3	-	1	-	-	-	-	-	-	1	2	1	3	3

20CE3103– STEEL STRUCTURAL DESIGN

(Civil Engineering)

Course Category	Professional Core	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	2 - 1 - 0
Prerequisite	Strength of Materials, Structural Analysis	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Compare types of connection and select the suitable connection.
	CO2	Design steel tension members with lugs and splices.
	CO3	Design steel laced and battened compression members.
	CO4	Design laterally supported beams and their connections.
	CO5	Design simple laterally unsupported beams and gantry girders.
	CO6	Design various types of bases and grillage foundation.

Course Content

UNIT – I

INTRODUCTION: Properties of sections – Types of loads – Permissible stresses in tension, compression and shear as per IS code.

BOLTED CONNECTIONS: Types of bolted joints – Modes of failure of bolted joints – Strength and efficiency of bolted joints – Strength of lap and butt joints – Design of Bolted joints – Design of bracket connections (beam to column and beam to beam connections).

WELDED CONNECTIONS: Types of welded joints – Strength of fillet and butt welds – Design of welded joints – Design of bracket connections (beam to column and beam to beam connections).

UNIT – II

DESIGN OF TENSION MEMBERS: Design of tension members – Lug angles – Tension splice.

UNIT – III

DESIGN OF COMPRESSION MEMBERS: Design of compression members – Single and built-up columns – Design of lacing and battens – Design of eccentrically loaded columns.

UNIT – IV

	LATERALLY SUPPORTED BEAMS: Design of simple beams – Design of built-up beams- Curtailment of flange plates – Connection of flange plate with flange of beam. **UNIT – V** **LATERALLY UNSUPPORTED BEAMS:** Permissible bending compressive stress – Effective length of compression flange – Design of simple beams – Design of Gantry Girders. **UNIT – VI** **DESIGN OF COLUMN BASES:** Slab base – Gusseted base – Bases subjected to moment – Grillage foundation.
Text books and References	**TEXTBOOKS:** 1. S.K. Duggal, *Design of Steel Structures,* McGraw-Hill education publishers, 2nd edition, 2017. 2. S.S. Bhavikatti, *Design of Steel Structures*, I K International Publishing house, 4th edition, 2014. 3. N. Subramanian, *Design of Steel Structures,* Oxford University press, 2nd edition, 2018. **REFERENCE BOOKS:** 1. M.R. Shiyekar, *Limit State Design in Structural Steel*, PHI Learning publishers, 3rd edition, 2016. 2. Dr. V. L. Shah & Dr. S. R. Karve, *Limit State Design of Steel Structures*, Jain Book Agency, 3rd edition, 2012. 3. P. Dayaratnam, *Design of Steel Structures,* S Chand Publishers, 3rd edition, 2012.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	-	-	-	-	-	-	2	-	-	-
CO2	3	-	2	-	1	-	-	1	-	-	-	2	1	1	-
CO3	3	1	2	-	1	-	-	1	-	-	-	3	1	1	-
CO4	3	1	2	-	1	-	-	1	-	-	-	2	1	1	-
CO5	3	1	2	-	1	-	-	1	-	-	-	1	1	1	-
CO6	3	-	2	-	1	-	-	1	-	-	-	2	1	-	-

20CE31E1 - HYDRAULICS AND HYDRAULIC MACHINERIES

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	2-1-0
Prerequisite	Engineering Mathematics- I &II, Fluid Mechanics.	**Sessional Evaluation**	40
		Semester End Exam. Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Apply the concepts of modeling and similitude for a given flow condition.
	CO2	Illustrate the fundamental characteristics of the boundary layer and compute the lift and drag forces.
	CO3	Design the most economic geometric section of open channel.
	CO4	Analyze open channel flow and calculate key properties of hydraulic jump.
	CO5	Compute the forces exerted by a jet of fluid on stationary and moving plates and also determine the efficiency of turbine and draft-tube.
	CO6	Compute the losses in centrifugal pump and examine the importance of characteristic curves, cavitation and lift.

Course Content

UNIT – I

DIMENSIONAL ANALYSIS, HYDRAULIC SIMILITUDE & MODEL TESTING: Derived quantities; dimensional homogeneity; methods of dimensional analysis – Rayleigh's method, Buckingham's Pie-theorem; similitude – types and similarities; types of forces acting in moving fluid; dimensionless number; model laws.

UNIT – II

BOUNDARY LAYER THEORY: Definitions – types of boundary layer; boundary layer theory, types of boundary layer thickness; drag force on a flat plate due to boundary layer; separation of boundary layer- effects and prevention.

UNIT – III

OPEN CHANNEL FLOW – I: Types of flow in channel; geometric properties of channel section; velocity distribution in a channel section; uniform flow in channels – Chezy's formula, Ganguillet-Kutter formula, Bazin's formula, Manning's formula; most economical channel section; specific energy & critical depth, critical flow and its computation – rectangular channel section; determination of mean velocity of flow in channel.

UNIT – IV

	OPEN CHANNEL FLOW – II: Gradually varied flow: dynamic equation of gradually varied flow; classification of channel bottom slopes and surface profiles; characteristics of surface profiles; hydraulic jump – assumptions, hydraulic jump in rectangular channel, types and application of hydraulic jump. **UNIT – V** **IMPACT OF JETS:** Forces exerted by a jet on a vertical plate, inclined plate and curved plate - stationary and moving. **HYDRAULIC TURBINES:** Turbines – classification of turbines; definitions of heads and efficiencies of a turbine; Pelton wheel, Francis turbine, Kaplan turbine – velocity triangles, work done& efficiency; draft tube- classification, functions of draft tube; specific speed – derivation, significance, unit quantities and its uses; performance characteristics curves of hydraulic turbines; selection of turbines. **UNIT – VI** **CENTRIFUGAL PUMPS :** Components of centrifugal pump; work done by impeller of the centrifugal pump; head of the pump – suction head, delivery head, static head; losses and efficiency of centrifugal pump – manometric, mechanical and overall efficiencies; minimum speed for a centrifugal pump; multistage centrifugal pump – parallel, series; expression for specific speed of a centrifugal pump; unit quantities; priming of a centrifugal pump; characteristic curves of centrifugal pump; cavitation; maximum suction lift, Net Positive Suction Head (NPSH).
Textbooks and Reference books	**TEXTBOOKS:** 1. Dr. P.N. Modi, Dr. S.M. Seth, *Hydraulics and Fluid Mechanics Including Hydraulics Machines*, Standard Book House, 21st edition, 2017. 2. R.K. Bansal, A *Textbook of Fluid Mechanics and Hydraulic Machines*, Laxmi Publications, 10th edition, 2018. 3. K Subramanya, *Flow in Open Channels*, Tata McGraw-Hill Educational Private Ltd., 5th edition, 2019. **REFERENCE BOOKS:** 1. Madan Mohan Das, *Open Channel Flow*, PHI Publications, 3rd edition, 2009. 2. Ven Te Chow, *Open-Channel Hydraulics*, The Blackburn Press, 7th edition, 2009. 3. Terry W Sturm, *Open Channel Hydraulics*, Tata McGraw-Hill Educational Private Ltd., 2nd edition.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	3	2	-	-	-	1	-	1	2	-	3	2
CO 2	3	2	2	2	1	-	-	-	1	-	2	2	-	1	-
CO 3	3	3	3	3	-	-	1	-	1	-	3	2	-	2	1
CO 4	3	2	1	2	1	-	-	-	1	-	2	2	-	1	-
CO 5	3	3	3	3	2	1	-	-	2	-	2	2	-	1	-
CO 6	3	2	3	3	1	2	-	-	2	-	3	2	-	1	1

20CE31E2 – GROUNDWATER HYDROLOGY

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0- 0
Prerequisite	Fluid Mechanics	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Understand the nature of groundwater and its role in the water cycle.
	CO2	Apply the concept of Darcy's law for estimating discharge and understand their characteristics and classifications.
	CO3	Demonstrate the technology of water wells and groundwater monitoring.
	CO4	Explain the technology of investigating the surface and subsurface water.
	CO5	Understand the importance of artificial recharge and employ the artificial ground water recharge techniques and identify the saline water intrusion locations.
	CO6	Determine the characteristics of the aquifers with the help of modeling techniques.
Course Content		**UNIT – I** **INTRODUCTION:** Ground water utilization and historical background – Ground water in hydrologic cycle - Ground water budget and ground water level fluctuations and environmental influence – Literature – Data-Internet resources. **UNIT – II** **OCCURRENCE AND MOVEMENT OF GROUND WATER**: Origin & age of ground water – Rock properties affecting groundwater – Groundwater column, zones of aeration & saturation, aquifers and their characteristics and classification –Groundwater basins & springs – Darcy's Law – Permeability & its determination –Dupuit's assumptions – Heterogeneity & anisotropy – Ground water flow rates & flow directions – General flow equations through porous media. **UNIT – III** **ADVANCED WELL HYDRAULICS:** Steady and unsteady uniform radial

	flow to a well in a confined, unconfined and leaky aquifer – Well flow near aquifer boundaries for special conditions, partially penetrating, horizontal wells & multiple well systems – well completion – Development protection – Rehabilitation – Testing for yield. **UNIT – IV** **SURFACE AND SUB-SURFACE INVESTIGATION OF WATER:** Geological – Geophysical Exploration – Remote Sensing – Electric Resistivity – Seismic refraction based methods for surface investigation of ground water – Test drilling & ground water level measurement – Sub-surface ground water investigation through geophysical – Resistivity – Spontaneous Potential – Radiation – Temperature – Caliper – Fluid Conductivity – Fluid Velocity – Miscellaneous Logging. **UNIT – V** **ARTIFICIAL GROUND WATER RECHARGE:** Concept and methods of artificial ground water recharge – Recharge mounds and induced recharge – Waste water recharge for reuse – Water spreading. **SALINE WATER INTRUSION IN AQUIFERS:** Ghyben-Herzberg relation between fresh & saline waters – Shape & structure of the fresh and saline water interface – Upcoming of saline water – Fresh-saline water relations on oceanic islands – Seawater intrusion in karst terrains – Saline water intrusion control. **UNIT – VI** **MODELING AND MANAGEMENT OF GROUND WATER:** Ground water modeling through porous media analog, electric analog and digital computer models – Ground water basin management concept – Hydrologic equilibrium equation. Ground water basin investigations – Data collection & field work – Dynamic equilibrium in natural aquifers – Management potential & safe yield of aquifers, stream– Aquifer interaction.

Textbooks and References	**TEXTBOOKS:** 1. David K. Todd, Larry W. Mays, *Groundwater Hydrology*, Wiley India Pvt. Ltd., 3rd edition, 2011. 2. H. M. Raghunath, *Groundwater*, New age publishers, 3rd edition, 2007. 3. R. N. Saxena and D.C. Gupta, *Elements of Hydrology and Groundwater*, PHI Learning, 3rd edition, 2017.

	REFERENCE BOOKS: 1. K. Subramanya, *Engineering Hydrology*, Tata McGraw Hill Publishing Company, 4th edition, 2019. 2. K. Karanth, *Groundwater Assessment, Development and Management*, McGraw Hill Education, 2nd edition, 2017. 3. Bhagu R. Chahar, *Groundwater Hydrology*, McGraw Hill Education, 1st edition, 2017.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	2	-	-	-	1	-	1	-	-	-	-	1	-	1	-
CO 2	3	-	-	1	1	-	1	-	-	-	-	1	1	2	1
CO 3	3	2	-	-	1	-	1	-	-	-	1	2	1	-	1
CO 4	2	2	-	1	1	-	1	-	-	-	1	1	-	1	-
CO 5	3	-	-	2	1	-	1	-	-	-	2	-	-	2	2
CO 6	2	-	-	1	1	-	1	-	-	-	1	-	1	1	1

20CE31E3–TRAFFIC ENGINEERING AND MANAGEMENT

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	Transportation Engineering	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Apply methods of traffic forecast in transport planning.
	CO2	Understand the design of rotary intersection.
	CO3	Understand the different types environmental degradation due to vehicular traffic
	CO4	Apply the road safety concepts in different stages of highway planning.
	CO5	Understand different regulations and methods for effective traffic management.
	CO6	Understand different types of road markings and concepts of street furniture
Course Content		**UNIT – I** **TRAFFIC FORECAST:** Function of traffic engineering – Need for traffic forecast– Limitations of traffic forecasting – Types of traffic – Different methods of traffic forecasting – Forecast based on past trends cud extrapolation – Forecasts and mathematical models – Period of forecasting. **UNIT – II** **ROTARY INTERSECTIONS:** Design hourly volume, passenger car unit (PCU) – Factors affecting PCU values – Highway capacity – Factors affecting capacity – Level of service and types – Rotary intersection – Advantages and disadvantages. Guidelines for selecting a rotary type of intersection – Rotary design elements – Capacity of rotary intersection problems. **UNIT –III** **TRAFFIC AND ENVIRONMENT:** Effects of traffic on environment, noise pollution, air pollution, vibration, visual intrusion and degrading the aesthetics.

	UNIT –IV **ACCIDENT STUDIES:** Causes of road accidents – Highway design and road safety – Road safety in various stages of highway system – Road safety incorporated at planning stage – Collection of accident data – Standard accident representing forms. **UNIT – V** **TRAFFIC MANAGEMENT**: Traffic management measures – Restrictions of turning movements – One way streets – Tidal flow operation– Closing side streets– Exclusive bus lanes. **TRAFFIC REGULATIONS:** Basic principles of regulation, regulation of speed, vehicles, driver, mixed traffic, parking regulations and enforcement of regulations. **UNIT – VI** **ROAD MARKINGS:** Introduction – Classification of road markings – Line markings – Centre line, transverse markings, arrow markings, facility markings, directional markings, object markings – Road studs. **TRAFFIC CONTROL AND SAFETY:** Traffic control aids and street furniture – Speed breakers – Rumble strips – Guard rails. **TRAFFIC FLOW:** Traffic stream parameters– Space headway and time head way – Line occupancy – Density – Lane capacity– Types of traffic capacity.

Textbooks and References	**TEXTBOOKS:** 1. Khanna, S.K. Justo C.E.G & Veeraraghavulu, "*Highway Engineerin*g" Nem chand&bros, 10th edition, 2018. 2. C. Venkatramaiah "*Transportation Engineering Vol I*" Universities Press (India) Private Ltd, 1st edition, 2016. 3. Dr. L.R. Kadiyali, "*Traffic engineering and Transport planning*" Khanna publishers, 9th edition, 2017. **REFERENCE BOOKS:** 4. Dr. L.R. Kadiyali, "*Principles and Practice of Highway Engineering*" Khanna publishers, 7th edition, 2019. 5. Vazirani and Chandola *"Transportation Engineering, Vol. I*" Khanna publishers, 5th edition, 1998.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	2	1	1	1	1	1	1	2	1	1	1	1	2
CO2	1	-	2	2	2	-	-	1	1	3	1	1	1	-	2
CO3	2	-	1	2	1	2	-	1	2	3	1	1	-	-	1
CO4	2	2	3	2	2	1	1	1	2	3	1	1	2	1	1
CO5	3	-	-	1	2	1	-	1	2	2	2	1	-	-	-
CO6	1	-	1	2	2	1	1	3	3	2	1	1	-	1	-

20CE31E4- ADVANCED FOUNDATION ENGINEERING

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture-Tutorial-Practical**	3-0-0
Prerequisite	Geotechnical Engineering-II	**Sessional Evaluation**	40
		External Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Estimate the pressure distribution for bulk heads.
	CO2	Design anchored bulk head.
	CO3	Design various components of bracing.
	CO4	Design of mat foundations by conventional method.
	CO5	Evaluate design parameters for dynamic loading.
	CO6	Outline the design of foundation on problematic soils

Course Content

UNIT – I

BULKHEADS: Uses of sheet piling walls – Common types of sheet piling walls – Common sheet pile sections – Cantilever sheet piling walls in cohesionless soils – cantilever sheet piling walls in cohesive soils (Approximate analysis only).

UNIT – II

ANCHORED BULKHEADS: Anchored bulkhead design by free earth support method – Anchored bulkhead design by fixed earth support method – Methods of reducing lateral pressure – Types of anchorage.

UNIT – III

BRACED EXCAVATIONS: Braced cut – Apparent pressure diagrams for cuts in both sands and clays – Types of bracing systems – Design of various components of bracing – Bottom heave of cuts in soft clays – Piping failure of cuts in sands.

UNIT – IV

MAT FOUNDATIONS: Allowable bearing pressure for mat foundations – conventional design of mat foundations – Modulus of sub-grade reaction.

UNIT – V

SOIL DYNAMICS AND MACHINE FOUNDATIONS: Introduction - Fundamentals of vibration – Fundamentals of soil dynamics - Machine Foundation –Special features - Vibration Analysis - Elastic Half-Space Theory -

	Mass-Spring-Dashpot Model - Foundations for reciprocating machines and impact machines - Vibration isolation and control- Construction aspects of machine foundations **UNIT – VI** **EXPANSIVE SOILS:** Identification and characteristics of Expansive soils, Free swell index and swell potential, Swell pressure – Factors –Test, Effect of swelling on building foundations, Fundamental design in expansive soil – CNS layer, Under reamed pile and other concepts, Problems.
Textbooks & References	**TEXTBOOKS:** 1. K.R. Arora, *Soil Mechanics and Foundation Engineering*, Standard publishers distributions, 6th edition, 2017. 2. A.S. Rao & Gopal Ranjan, *Basic and applied soil mechanics*, New Age International publishers, 3rd edition, 2016. 3. Swami saran, *Soil Dynamics and Machine Foundations*, Galgotia Publications Private Limited, 2nd edition, 1999. **REFERENCE BOOKS:** 1. B. M. Das, *Principles of Geotechnical Engineering*, Cengage learning, 8th edition, 2017. 2. B.C. Punmia, A. K. Jain & A. K. Jain, *Soil Mechanics and Foundation Engineering*, Laxmi publications, 17th edition, 2018. 3. C. Venkatramaiah, *Geotechnical Engineering*, New Age International Private Limited, 4th edition, 2010.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	1	-	1	-	1	-	1	1	1	-	2	2
CO2	2	-	3	2	1	1	-	1	-	1	1	1	-	2	2
CO3	2	-	2	1	-	1	-	1	-	1	1	1	-	2	2
CO4	2	-	3	2	1	1	-	1	-	1	1	1	-	2	2
CO5	3	2	2	2	2	1	-	1	-	1	1	1	-	3	2
CO6	2	-	2	2	1	1	1	1	-	1	1	1	-	3	2

20CE31P1 -CONCRETE TECHNOLOGY LABORATORY

(Civil Engineering)

Course Category	Professional Core	**Credits**	1.5
Course Type	Practical	**Lecture - Tutorial - Practical**	0 - 0 - 3
Prerequisite	Building Materials and Construction	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Evaluate the physical properties of cement.
	CO2	Determine the physical properties of fine aggregates.
	CO3	Determine the physical properties of Coarse aggregates.
	CO4	Evaluate the fresh properties of concrete.
	CO5	Evaluate the hardened properties of concrete.
	CO6	Assess the physical and mechanical properties of bricks.

Course Content

LIST OF EXPERIMENTS

TESTS ON CEMENT

1. a) Determination of Fineness by dry sieving
   b) Determination of Specific gravity
2. Determination of Normal consistency, initial & final setting times
3. Determination of Compressive Strength

TESTS ON AGGREGATES

4. a) Determination of Specific gravity and water absorption of coarse aggregate.
   b) Determination of Bulk density
5. Sieve analysis of coarse and fine aggregates
6. a) Bulking of sand by volume method
   b) Bulking of sand by weight method

TESTS ON CONCRETE

7. Workability of fresh concrete by slump test
8. Workability of fresh concrete by compaction factor test
9. Workability of fresh concrete by Vee-Bee test
10. Workability of fresh mortar by flow table test

	11. Determination of Compressive strength **TESTS ON BRICKS** 12. a) Determination of Compressive strength b) Determination of Water absorption c) Determination of Efflorescence

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	-	-	-	-	-	-	2	2	-	2	1
CO2	3	2	2	1	-	-	-	-	-	-	2	2	-	1	1
CO3	3	2	2	1	-	-	-	-	-	-	2	2	-	1	1
CO4	3	2	2	1	-	-	-	-	-	-	2	2	-	1	1
CO5	3	2	2	1	-	-	-	-	-	-	2	2	-	1	1
CO6	3	2	2	1	-	-	-	-	-	-	2	2	-	1	1

20CE31P2 - COMPUTER AIDED CIVIL ENGINEERING DRAWING LABORATORY

(Civil Engineering)

Course Category	Professional Core	**Credits**	1.5
Course Type	Practical	**Lecture - Tutorial - Practical**	0-0-3
Prerequisite	Building Materials and Construction	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Prepare the detail drawings of doors and windows
	CO2	Prepare detail drawings of single stored residential building and its components.
	CO3	Prepare detail drawings of multi stored residential building and its components.
	CO4	Prepare detail drawings of layouts and detailing of beams, columns, footings and slabs.
	CO5	Develop 3D model of a residential building
	CO6	Prepare detail drawing of surplus weir.
Course Content	**List of Experiments** 1. Paneled and flush doors - Glazed windows 2. Steel roof truss- king post truss 3. Queen post truss. 4. Preparation of plan, section and elevation of single storied residential buildings with flat roof 5. Preparation of plan, section and elevation of multi storied residential buildings with flat roof. 6. Preparation of plan, section and elevation of Commercial buildings. 7. Grade beam layout and RCC beam detailing. 8. Floor slab reinforcement detailing. 9. Column layout and RCC column details. 10. Foundation layout and RCC foundation detailing. 11. 3D Modelling of residential building by AutoCAD 12. Surplus weir	

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	1	-	-	1	-	-	-	1	1	-	3	-	2
CO2	2	-	1	-	2	2	1	1	-	1	3	-	3	-	2
CO3	2	-	1	-	3	2	1	1	-	1	3	1	3	-	2
CO4	1	-	1	-	3	2	1	-	-	1	3	3	3	-	2
CO5	1	-	1	-	3	2	1	-	-	1	3	2	3	-	2
CO6	1	-	1	-	2	1	1	-	-	1	1	-	2	-	1

20CE31SC – REVIT ARCHITECTURE

(Civil Engineering)

Course Category	Skill oriented course	**Credits**	2
Course Type	Practical	**Lecture – Tutorial –Practical**	0-0-4
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam. Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Know edit tools, modify tools and site elements.
	CO2	Use materials, section sets and can manage family categories.
	CO3	Structure, manage sheets and design options.
	CO4	Check the model for interfaces
	CO5	Transfer project standards and edit object style.
	CO6	Apply render and massing tools
Course Content	**List of Experiments** 1. Creating the Walls 2. Creating the Curtain elements 3. Working with Elevation and Section Views 4. Placing of Dimensions, Doors, Windows and Components 5. Creating the Roofs and ceilings 6. Creating the Floors 7. Creating the Architectural columns 8. Placing of Railings, Rams and Stair by components 9. Creating the Openings 10. Giving Annotation, sheets, model text and Model lines 11. Exploring Walkthrough Tools & Import & Exporting Files, Camera 12. Rendering, Massing & site Tools	

Textbooks and Reference books	**REFERENCES:** https://bimscape.com/beginners-guide-to-revit-architecture/ https://www.youtube.com/c/CADinblack

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	1	3	1	-	1	2	3	3	3	3	-	2
CO2	2	1	3	1	3	1	-	1	2	3	3	3	3	-	2
CO3	3	1	3	1	3	1	-	1	2	3	3	3	3	-	2
CO4	3	1	3	1	3	1	-	1	2	3	3	3	3	-	2
CO5	2	1	3	1	3	1	-	1	2	3	3	3	3	-	2
CO6	1	1	3	1	3	1	-	1	2	3	3	3	2	-	1

N.B.K.R. INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR

(AUTONOMOUS)

CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the batch admitted in the academic year 2020-2021)

III YEAR OF FOUR YEAR B.TECH. DEGREE COURSE – II SEMESTER

S.NO	Course Code	Course Title	Contact Hours/ Week			Credits	Evaluation									
							Sessional Test-I			Sessional Test-II			Total Sessional Marks (Max. 40)	Semester End Examination		Max. Total Marks
		THEORY	L	T	P		Test-I (2 hrs.)	Assignment-I	Max. Marks	Test-II (2 hrs.)	Assignment-II	Max. Marks		Duration In Hours	Max. Marks	
1	20CE3201	Quantity Surveying and Valuation	2	1	0	3	34	6	40	34	6	40	0.8(Better of two sessional tests) + 0.2(Other)	3	60	100
2	20CE3202	RS & GIS	3	0	0	3	34	6	40	34	6	40		3	60	100
3	20CE3203	Environmental Engg.	3	0	0	3	34	6	40	34	6	40		3	60	100
4.	20CE32EX	**Professional Elective-II**	3	0	0	3	34	6	40	34	6	40		3	60	100
		OPEN ELECTIVE COURSE / JOB ORIENTED ELECTIVE														
5	20XX3201	*Open Elective Course/Job Oriented Course*	3	0	0	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
1	20CE32P1	EE Laboratory	0	0	3	1.5	-	-	-	-	-	-	Day-to-day Evaluation and a test (40 marks)	3	60	100
2	20CE32P2	RS & GIS Lab	0	0	3	1.5	-	-	-	-	-	-		3	60	100
3	20CE32P3	STAAD lab	0	0	3	1.5	-	-	-	-	-	-		3	60	100
		SKILL ADVANCED COURSE / SOFT SKILL COURSE														
1	20CE32SC	Advanced Communication Skills	0	0	4	2	-	-	-	-	-	-		3	60	100
		MANDATORY COURSE											0.8(Better of two sessional tests) + 0.2(Other			
1	20ME32MC	Entrepreneurship	2	0	0	0	34	6	40	34	6	40		3	60	100
		TOTAL				**21.5**										
1	20xx32xx	Honors/Minor Course	4	0	0	4	The hours distribution can be 3-0-2 or 3-1-0 also									
		Industrial/Research: Internship (Mandatory) 2 months during summer vacation														

Industrial/Research: Internship (Mandatory) 2 months during summer vacation (to be evaluated during VII semester)

Professional Elective-II:

20CE32E1 : Hydrology & WRE

20CE32E2 : Urban Transportation Planning

20CE32E3 : Finite Element Analysis

20CE32E4 : Advanced Reinforced Concrete Design

20CE3201– QUANTITY SURVEYING AND VALUATION

(Civil Engineering)

Course Category	Professional Core	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	2 - 1 - 0
Prerequisite	Building Materials and Construction	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Prepare approximate and detailed estimates of simple buildings and road works.
	CO2	Gain thorough knowledge of specifications of various materials and items of building construction.
	CO3	Perform rate analysis for earthwork, various types of masonry, and flooring.
	CO4	Perform the rate analysis for roofing, plastering, pointing, woodworks of simple buildings, and road works.
	CO5	Evaluate contracts and tenders in construction practices.
	CO6	Calculate the value of tangible assets.
Course Content		**UNIT – I** **INTRODUCTION:** General items of work in buildings – Standard units – Principles of working out quantities for detailed and abstract estimates – Approximate and detailed estimates of simple buildings and road works. **UNIT – II** **SPECIFICATIONS:** Types – Standard specifications for different materials and items of building construction– Sand – Lime – Cement – Kankar – Mortars – Earth work for foundations – Foundation concrete – Reinforced concrete – Brick work – Stone masonry –Mosaic Flooring – R.C.C. roof and G.I. sheet roof – Plastering – Pointing – Painting and wood works. **UNIT – III** **RATE ANALYSIS-I:** Earthwork for foundations and basement of buildings. Mortars: Lime mortar (1:1.5) and Cement Mortar (1:4). Foundation Concrete: Lime concrete (1:2:4) and Cement Concrete (1:5:10). Reinforced Concrete: Lintels, Slabs, Beams, and Columns (1:2:4). Brickwork: Constructed with first-class bricks with L.M. (1:1.5) and

C.M.(1:6)

Stone Masonry: C.R.S. – 1st sort constructed with C.M. (1:2) and

R. R. Masonry: Lime mortar (1:1.5) and C.M. (1:2).

Flooring:

a) With Cuddapah or Shahabad slabs.

b) Mosaic flooring.

UNIT – IV

RATE ANALYSIS-II:

Roofing:	a) R.C.C. roof 10cm thick, two courses of flat tiles to top.
	b) A.C. corrugated sheet roofing on steel purlins.
Plastering :	a) With L.M. (1:1.5) 2 coats (20mm thick)
	b) C.M. (1:4) 12mm thick.
Pointing:	a) With C.M. (1:3) flush pointing to R.R. Masonry.
	b) C.M. (1:3) for brick masonry.
Painting:	a) Whitewashing and colour washing of walls: 2 coats.
	b) Painting iron and woodwork: 3 coats.
Woodwork:	Panelled doors and windows.
Road work:	W.B.M. road with bituminous carpet 20mm thick.

UNIT –V

CONTRACTS: Essential requirements of a valid contract - Forms of contract- Types of contracts– Contract document – Conditions of contracts– Contract procedure – Termination of contracts – Specifications – Important conditions of contract – Arbitration of tenders.

UNIT – VI

VALUATION: Introduction – Technique of valuation–Elements of valuation and Factors affecting valuation–Methods of valuation of land property and building property– Rate of interest for sale– Purchase– Mortgage– Capital gain– Tax– Estate duty and death duty –Types of valuation – Valuation for renewal of lease– Extension of lease– Methods of Ascertaining standard rent– Easement rights– Preparation of feasibility reports– Valuation reports – Awards.

Textbooks and References	**TEXTBOOKS:** 1. B.N. Dutta, *Estimating and Costing in Civil Engineering*, UBS Publishers' Distributors Ltd publications, 28th revised Edition, 2016. 2. G.S.Birdie, *A Textbook of Estimating and Costing in Civil Engineering*, Dhanpat Rai Publishing Company Private Limited, 6th Edition, 2014. 3. M.Chakraborti, *Estimation, costing, specifications and valuation in civil engineering*, Published by M. Chakraborthi, 29th revised Edition, 2006 **REFERENCE BOOKS:** 1. D. D. Kohli, Ar. R. C. Kohli, *A Text book of Estimating and Costing (Civil),* S. Chand Publications, 13th edition, 2013. 2. R. Ambalavanan, *Estimation and Costing in Civil Construction*, Ane Books Pvt. Ltd, 2021. 3. A.K. Upadhyay, Civil Estimating and Costing, S.K.Kataria & Sons, Revised Edition, 2014.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1	-	-	-	-	1	-	1	-	1	1	-	1	-	2
CO2	1	-	-	-	-	2	-	-	-	2	-	1	-	-	-
CO3	2	-	-	-	-	2	-	1	-	-	1	-	1	-	2
CO4	2	-	-	-	-	2	-	1	-	-	1	-	1	1	2
CO5	-	-	-	-	-	3	-	1	2	3	2	1	-	1	2
CO6	2	-	-	-	-	3	-	2	-	2	2	2	-	-	2

20CE3202 – REMOTE SENSING & GIS

(Civil Engineering)

Course Category	Professional Core	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	None	**Sectional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Understand various terminologies and interaction of EMR with atmosphere and earth's surface.
	CO2	Explain the different technical aspects of a remote sensing network with special emphasis on Indian remote sensing technology.
	CO3	Compare different types of data obtained from a remote sensing network with tools specifically designed for the purpose.
	CO4	Understand various corrections applied to the data collected and techniques of image classification.
	CO5	Apply remote sensing in earth resources management.
	CO6	Demonstrate the basic concepts of Geographical Information System.
Course Content		**UNIT – I** **FUNDAMENTAL CONCEPTS OF REMOTE SENSING:** Definition of Remote Sensing; History of Remote Sensing and Indian Space Program; Remote Sensing Process; Source of energy – Concept of energy, Electromagnetic radiation, Electromagnetic Spectrum; Interaction of electromagnetic radiation with atmosphere, Vegetation, soil and water – Absorption, Scattering, Refraction, Reflection; Spectral Reflectance Curve; Atmospheric windows; Advantages and Limitations of Remote Sensing. **UNIT – II** **REMOTE SENSING SYSTEM:** Introduction; Types of Remote Sensing - Classification Based on Platform, Energy Source, Imaging Media, Regions of Electromagnetic Spectrum, Number of Bands; Characteristics of Images; Orbital Characteristics of Satellite; Remote Sensing Satellites; Definitions – Swath, Nadir, path, row, Orbital calendar. **SENSOR CHARACTERISTICS:** Resolutions- Spatial Resolution, Spectral Resolution, Radiometric Resolution, Temporal Resolution.

	UNIT – III **VISUAL IMAGE INTERPRETATION:** Introduction; Information Extraction by Human and Computer; Remote Sensing Data Products; Image Interpretation; Elements of Visual Image Interpretation -Location, Size, Shape, Shadow, Tone, Colour, Texture, Pattern, Height and Depth, Site, Situation and Association; Interpretation Keys. **UNIT – IV** **DIGITAL IMAGE PROCESSING:** Introduction; Categorization of Image Processing; Image Processing Systems; Data Formats of Digital Image; Pre-processing - Radiometric Correction of Remotely Sensed Data, Geometric Correction of Remotely Sensed Data, Miscellaneous Pre-processing; Image Enhancement - Image Reduction, Image Magnification, Colour Compositing, Transect Extraction, Contrast Enhancement; Filtering; Image Classification - Information Class and Spectral Class - Supervised Versus Unsupervised Classification; Decision Rules for Supervised Classification; Decision Rules for Unsupervised Classification; Accuracy Assessment. **UNIT – V** **APPLICATIONS OF REMOTE SENSING FOR EARTH RESOURCES MANAGEMENT:** Agriculture – crop production forecasting, agricultural drought assessment, precision farming; Forestry – Type and density mapping, forest cover change, forest status in India; Land cover/Land use mapping – Wastelands, Urban sprawl; Water Resources; Coastal Zone Management – Coastal zone ecosystem, Coastal regulation zone, integrated coastal zone management. **UNIT – VI** **GEOGRAPHICAL INFORMATION SYSTEM:** Definition of GIS; Key components of GIS; Functions of GIS, Application areas of GIS, Advantages of GIS – Advantages over traditional map, mapping software, Conventional DBMS, Analysis-modeling-Presentation and decision making; Functional Requirements of GIS; Limitations of GIS; Spatial data models – raster data model, vector data model.

Textbooks and References	**TEXTBOOKS:** 1. B. Bhatta, *Remote sensing and GIS*, Oxford University Press, 3rd edition, 2021. 2. George Joseph and C. Jeganathan, *Fundamentals of remote sensing*, Universities Press, 3nd Edition, 2018. 3. Tsurg Charg, *Introduction to Geographic information system*, Tata McGraw-Hill Education Private Limited. 2nd edition, 2014. **REFERENCES:** 1. John R. Jensen, *Remote sensing of the environment– An earth resources perspective*, Pearson Education, 2ndedition, 2014. 2. Peter A Burragh and Rachael McDonnnell, *Principals of Geo physical Information system*, Oxford Publications 2nd edition, 2004. 3. A. Kumar, *Basics of remote sensing & GIS*, Laxmi publications, 3rd edition, 2009.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	1	-	-	1	-	-	1	-	-	-	-	1	-	1	-
CO 2	1	-	-	-	-	1	1	-	-	-	-	1	-	-	-
CO 3	2	-	-	-	1	-	1	-	-	-	-	-	2	1	2
CO 4	2	-	-	1	1	-	1	-	-	-	-	-	2	-	1
CO 5	1	-	-	1	1	-	1	-	-	-	-	-	-	2	3
CO 6	1	-	-	2	1	1	2	-	-	-	1	1	1	1	2

20CE3203 – ENVIRONMENTAL ENGINEERING

(Civil Engineering)

Course Category	Professional Core	**Credits:**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	Engineering Chemistry and Fluid Mechanics	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Identify the sources of water and wastewater and determine the quality. Forecast the population for water demand and estimate the wastewater flows.
	CO2	Identify the intake structures; Analyze and design pipe network system.
	CO3	Design circular sewers; Select materials and appurtenances for sewers.
	CO4	Understand the methods of water treatment
	CO5	Understand conventional wastewater treatment methods.
	CO6	Understand the sludge treatment methods; Select proper effluent disposal method and design a septic tank.

Course Content

UNIT I

SOURCES, QUALITY AND QUANTITY PERSPECTIVES OF WATER AND WASTEWATER: Sources, Characteristics - physical, chemical and biological, water demands – types and factors affecting water demand, fluctuations in rate of water demand, design period, population forecasting methods, estimation of dry weather flow and wet weather flow.

UNIT II

COLLECTION AND CONVEYANCE OF WATER: Intakes, types of Intakes, factors governing selection of location for intakes.

DISTRIBUTION SYSTEM: Requirements of a good distribution system, methods of distribution, systems of supply of water, Distribution reservoirs, layout of

	distribution system, design and analysis of pipe networks of distribution system – Hardy cross method. **UNIT III** **HYDRAULIC DESIGN OF SEWERS:** Hydraulic formulae for design of circular sewers, minimum and maximum velocity of flow in sewers. **SEWER MATERIALS AND APPURTENANCES:** Factors affecting the selection of material, materials for sewers, shapes of sewers, valves and joints, sewer appurtenances. **UNIT IV** **WATER TREATMENT METHODS:** General layout of water treatment plant, Aeration, Sedimentation, Sedimentation aided with Coagulation, Filtration – Rapid sand filters, Disinfection – methods, Chlorination – types and forms, Membrane processes, Ion exchange process. **UNIT V** **CONVENTIONAL WASTEWATER TREATMENT:** General layout of wastewater treatment plant, **Primary treatment of sewage:** Screening, Grit Chambers, Sedimentation, Sedimentation aided with coagulation. **SECONDARY TREATMENT OF WASTEWATER:** Activated sludge process, Trickling filters, Oxidation Pond. **UNIT VI** **SLUDGE MANAGEMENT:** Sludge - Types, Sludge treatment – Thickening, Stabilization/Digestion, Conditioning, Dewatering – Drying/Incineration, Sludge disposal methods. **EFFLUENT DISPOSAL:** Methods – Dilution, Marine disposal, Land disposal, Self-purification of water bodies, Oxygen Sag Curve, Sewage Sickness. Design of septic tank, Septic tank effluent disposal methods.
Textbooks and	**TEXTBOOKS:**

References	1. S.K. Garg, *Water supply engineering – Environmental Engineering I),* Khanna Publishers, 33rd edition, 2019. 2. B.C. Punmia, *Wastewater engineering – environmental engineering II*, laxmi publications, 2nd edition, 2016. 3. S.K. Garg, *Sewage Disposal and Air Pollution Engineering* – Environmental Engineering (Vol.II), Khanna Publishers, 37th edition, 2019. **REFERENCES:** 1. Metcalf & Eddy, Inc., *Waste water Engineering Treatment and Reuse*, McGraw Hill education, 4rth edition, 2017. 2. Ruth F. Weiner and Robin A. Matthews, *Environmental Engineering*, Butterworth- Heineman. Publishers, 4th edition 2003. 3. B.C. Punmia, *Water supply engineering - Environmental engineering I*, laxmi publications, 2nd edition, 2016.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	-	1	-	-	1	2	1	2	-	1	-	1	2
CO2	2	2	2	1	-	-	-	1	2	1	1	1	1	1	-
CO3	2	2	2	-	-	1	1	1	1	1	-	1	-	1	-
CO4	1	1	1	2	3	2	2	2	2	2	-	1	-	1	-
CO5	1	1	1	2	3	2	2	2	2	2	-	1	-	1	-
CO6	2	1	2	2	1	2	2	3	1	1	-	1	-	1	-

20CE32E1 –HYDROLOGY & WATER RESOURCES ENGINEERING

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3- 0 - 0
Prerequisite	Fluid Mechanics	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Understand the theories and principles governing the hydrologic processes.
	CO2	Determine the loss due to evapotranspiration and infiltration.
	CO3	Determine the runoff due to precipitation and develop runoff hydrographs.
	CO4	Assess and analyze floods and flood control measures.
	CO5	Determine aquifer parameters and yield of wells.
	CO6	Explain the basic concepts of irrigation engineering.

Course Content

UNIT – I

INTRODUCTION: Definition and scope; Hydrologic cycle; Sources of hydrological data.

PRECIPITATION: Forms of precipitation; Measurement of precipitation; Rain gauge network; Preparation and presentation of rainfall data; Mean precipitation of rainfall data; Depth-Area-Duration relationship; Frequency of point rainfall Maximum Intensity/Depth-Duration-Frequency relationship; Probable maximum Precipitation (PMP).

UNIT – II

ABSTRACTIONS FROM PRECIPITATION: Evaporation process; Evaporimeters; Empirical evaporation equations; Analytical methods - estimation of evaporation and transpiration.

EVAPOTRANSPIRATION: Measurement of evapotranspiration; Evapotranspiration equations – Potential evapotranspiration and Actual evapotranspiration; Infiltration; Factors affecting infiltration; Infiltration indices.

UNIT – III

RUNOFF: Runoff characteristics; Factors affecting runoff – Catchment

	characteristics; Flow-duration curve; Flow-mass curve. **HYDROGRAPHS:** Components of hydrograph; Base flow separation; unit hydrograph – Derivation of unit hydrograph – Unit hydrograph of different durations – Uses and limitations of unit hydrograph – Duration of the unit hydrograph; S-curve hydrograph; Instantaneous unit hydrograph. **UNIT – IV** **FLOODS:** Introduction– Rational method– Empirical formulae – Unit hydrograph method; Flood frequency studies – Gumbel's method – Log-Pearson type III distribution; Partial duration series; Regional flood; Frequency analysis; Data for frequency studies; Design flood – Design storm – Risk, reliability and safety factor; Flood routing-channel routing; Flood control – Classification of methods for flood control or management; Flood control reservoir; Channel improvement; Floodways. **UNIT – V** **GROUNDWATER:** Introduction – Forms of subsurface water; Saturated formation; Aquifer properties; Geologic formations as aquifers; Equation of motion; Wells – Steady flow into a well – Open wells; Unsteady flow in a confined aquifer; Well loss – Specific capacity; Sea-water intrusion – Recharge. **UNIT – VI** **IRRIGATION:** Necessity and importance – Principal crops and crop seasons – Types – Methods of application – Soil-water – Plant relationship – Soil moisture constants – Consumptive use – Estimation of consumptive use – Crop water requirement – Duty and delta – Factors affecting duty – Depth and frequency of irrigation – Irrigation efficiencies – Water logging and causes – Standards of quality for irrigation water – Crop rotation.
Textbooks and References	**TEXTBOOKS:** 1. K. Subramanya, *Engineering Hydrology*, Tata McGraw-Hill Education Pvt. Ltd, 5th edition, 2017. 2. P. Jayarami Reddy, *Engineering Hydrology*, Laxmi Publications Pvt. Ltd., 3rd edition, 2016. 3. P.N. Modi, *Irrigation water resources and water power engineering*, Standard Book House publication, 11th Edition, 2019. **REFERENCES:** 1. K.N. Duggal and J.P. Soni, *Elements of water resources engineering*, New Age International Publishers, 2nd edition, 2005. 2. G.L. Asawa, *Irrigation Engineering*, New Age International Publishers, 2nd edition, 2000.

	3. S.K. Garg, *Irrigation Engineering and Hydraulic Structures*, Khanna Publishers, 36th edition, 2020.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	2	-	-	2	-	-	1	-	-	-	-	1	-	-	-
CO 2	3	2	-	1	1	-	1	-	1	-	-	1	-	1	1
CO 3	2	-	-	2	1	-	1	-	1	-	-	2	1	3	2
CO 4	2	-	-	1	1	-	1	-	-	-	-	1	1	3	2
CO 5	2	2	-	1	-	-	1	-	1	-	-	1	1	-	1
CO 6	3	-	1	-	-	2	-	-	1	-	1	1	-	1	-

20CE32E2 - URBAN TRANSPORTATION PLANNING

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	Transportation Engineering	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Understand the basic concepts of transportation planning along with method of traffic forecast analysis.
	CO2	Able to conduct transportation surveys which are essential in urban transportation planning.
	CO3	Apply the basic concepts, factors affecting Trip generation and also use multiple linear regression analysis in Trip generation calculations.
	CO4	Understand different methods of trip distribution.
	CO5	Understand the concept of model spilt analysis.
	CO6	Perform evaluation of transportation plans and also prepare transportation plan for a small town.
Course Content		**UNIT – I** **TRANSPORT PLANNING PROCESS:** Scope of the Subject – Interdependence of the land use and traffic – Systems approach to transport planning –stages in transport planning – Survey and analysis of existing conditions – Forecast analysis of future conditions and plan synthesis – Evaluation – Programme adoption and implementation – Continuing study – Citizen participation – Difficulties in the transport planning process. **UNIT – II** **TRANSPORTATION SURVEY:** Introduction – Definition of the study area – Zoning – Type of Surveys – Home interview surveys – Commercial vehicles surveys – Taxi surveys –Roadside interview surveys –Postcard questionnaire – Registration number plate surveys – tags on vehicles – Public transport surveys – Inventory of transport facilities – Inventory of land use and economic activities **UNIT – III** **TRIP GENERATION:** Introduction and definitions – Trip purpose – Factors

	governing Trip generation and Trip attraction rates – Multiple linear regression analysis – Category analysis – Trip based and activity based approach. **UNIT – IV** **TRIP DISTRIBUTION:** Introduction, Methods of trip distribution – Growth factor methods - Uniform (Constant) factor method – Average factor method – Synthetic methods – Gravity model. **UNIT – V** **TRAFFIC ASSIGNMENT**: Purpose of traffic assignment – General principles – assignment techniques – All-or-nothing assignment (free assignment or desire assignment) – Multiple route assignment – Capacity restraint assignment – Diversion curves. **MODAL SPLIT**: Introduction – Factors affecting model split –Modal split in the transport planning process. **UNIT – VI** **EVALUATION**: Need for Evaluation – Several plans to be formulated – Testing – Considerations in evaluation – Economic evaluation. **VEHICLE OPERATING COSTS**: Theory of Vehicle operating cost (VOC) – Component, factors affecting VOC. **TRANSPORT PLANNING FOR SMALL AND MEDIUM SIZED CITIES**: Introduction – Difficulties in transport planning for small and medium cities – Quick response techniques.
Textbooks and References	**TEXTBOOKS:** 1. Khanna, S.K. Justo C.E.G & Veeraraghavulu, "*Highway Engineering*" Nem chand & bros, 10th edition, 2018. 2. Dr. L.R.Kadiyali, "*Principles and Practice of Highway Engineering*" Khanna publishers, 7th edition, 2019. 3. C. Venkatramaiah "*Transportation Engineering Vol I*" Universities Press (India) Private Ltd, 1st edition, 2016. **REFERENCE BOOKS:** 1. Dr.LR Kadiyali "*Traffic engineering and Transport planning*" Khanna publishers, 9th edition, 2017. 2. Vazirani and Chandola "*Transportation Engineering"* Vol. I" Khanna publishers, 5th edition, 1998. 3. A. K. Jain, *" Urban Transport Planning and Management",* APH Publishing corporation, 2009.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	2	1	1	1	1	1	1	2	1	1	-	-	2
CO2	1	-	2	2	2	-	-	1	1	3	1	1	-	-	2
CO3	2	-	1	2	1	2	-	1	2	3	1	1	-	-	1
CO4	2	2	3	2	2	1	1	1	2	3	1	1	-	-	2
CO5	3	-	-	1	2	1	-	1	2	2	2	1	-	-	2
CO6	1	-	1	2	2	1	1	3	3	2	1	1	-	1	1

20CE32E3 - FINITE ELEMENT ANALYSIS

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture-Tutorial-Practical**	3-0-0
Prerequisite	Structural Analysis	**Sessional Evaluation**	40
		External Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Understand the basic principles of finite element method.
	CO2	Comprehend the concepts of finite element modelling and discretization, shape functions.
	CO3	Apply the finite element method in one dimensional elements.
	CO4	Utilize the finite element method in analyzing plane trusses.
	CO5	Make use of finite element formulation for beam elements and apply plane stress and plane strain concepts to plane elements.
	CO6	Apply the knowledge of isoperimetric elements for analysis.

Course Content

UNIT –I

INTRODUCTION: Historical background - Functional approximation- weighted residual methods – Rayleigh ritz method -Basic steps in Finite element method– Advantages and disadvantages – Limitations.

UNIT – II

FINITE ELEMENT MODELING AND DISCRETIZATION: Finite element modeling and discretization – Interpolation and shape functions – Types of elements –Nodes and degrees of freedom- serendipity elements.

UNIT – III

ONE DIMENSIONAL FINITE ELEMENTS: Introduction – Bar element – Beam element – Bar and beam elements of arbitrary orientation —Element stiffness matrices –Assembly of element stiffness matrices—Loads—Boundary conditions — Applications.

UNIT – IV

TWO DIMENSIONAL FINITE ELEMENTS: Plane trusses – Local and global coordinate systems – Direction cosines – element stiffness matrix – Assembly of element stiffness matrices – Stress calculation - Temperature effects.

UNIT – V

	FINITE ELEMENT FORMULATION: Introduction – Beam stiffness matrix– Assembly of beam stiffness matrices – Loads – Boundary conditions – temperature effects. Plane stress analysis – Plane strain analysis. **UNIT – VI** **ISOPARAMETRIC ELEMENTS:** Introduction– coordinate transformation - shape functions for isoparametric elements - Mesh generation – Mesh refinement– Numerical integration – Application to plane stress problems –Introduction to analysis software (for practice purpose only).
Text & Reference books	**TEXT BOOKS:** 1. C. S. Krishnamoorthy, *Finite Element Analysis*, McGraw–Hill Education, 2nd Edition, 2017. 2. S. S. Bhavikatti, *Finite Element Analysis*, New age international publishers, 3rd Edition, 2015. 3. Tirupathi R. Chandrupatla & Ashok D. Belegundu, *Introduction to Finite Elements in Engineering*, Pearson Education, 4th Edition, 2011. **REFERENCE BOOKS:** 1. O.C. Zienkiewicz, R.L. Taylor and J.Z. Zhu, *The Finite Element Method: Its basics and Fundamentals*, Butterworth-Heinemann publishers, 7th Edition, 2013. 2. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, *Concepts and Applications of Finite Element Analysis*, John Wiley& Sons Publishers, 4th Edition, 2001. 3. Daryl L. Logan, *A First Course in the Finite Element Method*, CL Engineering, 5th Revised Edition, 2010.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	-	2	1	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	2	3	3	1
CO3	3	2	-	2	1	-	-	-	-	-	-	1	2	2	1
CO4	3	2	-	1	1	-	-	-	-	-	-	1	2	2	1
CO5	3	2	-	1	1	-	-	-	-	-	-	1	2	2	1
CO6	2	1	1	1	2	-	-	-	-	-	-	2	3	3	-

20CE32E4 –ADVANCED REINFORCED CONCRETE DESIGN

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3-0-0
Prerequisite	Elemental design of Reinforced Concrete Structures	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Design combined rectangular footings, raft foundation and pile foundation.
	CO2	Design cantilever and counterfort retaining walls for different loadings.
	CO3	Design bunkers and silos
	CO4	Design liquid retaining structures resting on ground
	CO5	Design elevated liquid retaining structures.
	CO6	Analyze pre-stressed rectangular sections for losses and stresses.
Course Content		**UNIT – I** **DESIGN OF FOUNDATIONS:** Design of combined rectangular footings– Design of raft foundation with continuous slab – Design of pile foundation. **UNIT – II** **DESIGN OF RETAINING WALLS:** Design of cantilever retaining walls with horizontal backfill and sloping back fill – Design of counter fort retaining walls. **UNIT – III** **BUNKERS AND SILOS:** Bunkers–Design of square bunkers– Design of circular Bunkers– Design of silos. **UNIT – IV** **DESIGN OF WATER TANKS RESTING ON GROUND:** Review of working stress design method – joints in water tanks– IS code method of design of circular tank with flexible joint between floor and wall–Approximate design of circular tank with restrained base –Approximate design of rectangular water tanks resting on ground. **UNIT – V** **DESIGN OF ELEVATED WATER TANKS:** Nature of stresses in spherical

	and conical domes – Design of RC domes – Design of Intze tanks. **UNIT – VI** **PRESTRESSED CONCRETE:** Principles of prestressing – Materials used – Methods and Systems of prestressing– Analysis of rectangular sections for stresses – Losses of prestress.
Textbooks and References	**TEXTBOOKS:** 1. Dr. B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain, *RCC DESIGNS (Reinforced Concrete Structures)*, Laxmi Publications, 11th edition, 2022. 2. S. Ramamrutham, *Design of Reinforced Concrete Structures*, Dhanpat Rai Publishing Company (P) Ltd., 1st edition, 2016. 3. N. Krishna Raju, *Pre-stressed Concrete*, McGraw Hill Education, 6th edition, 2018. **REFERENCE BOOKS:** 1. S. R. Karve & V. L. Shah., *Limit State Theory and Design of Reinforced Concrete*, Structures publications, 7th edition, 2015. 2. C.K Wang, C.G. and J.A. Pincheira, *Reinforced Concrete Design*, Oxford university press, 8th edition, 2017. 3. N. Subramanian, *Design of Reinforced Concrete Structures*, Oxford university press, Illustrated edition, 2013.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	-	1	1	-	1	-	-	1	2	-	1	-
CO2	3	1	2	-	1	1	-	1	-	-	1	1	-	1	-
CO3	3	1	2	-	1	1	-	1	-	-	1	1	-	1	-
CO4	3	1	2	-	2	1	-	1	-	-	1	2	-	1	-
CO5	3	1	2	-	2	2	-	1	-	-	1	2	-	1	-
CO6	3	1	1	-	1	1	-	1	-	-	1	3	-	1	1

20CE32P1 - ENVIRONMENTAL ENGINEERING LABORATORY

(Civil Engineering)

Course Category	Professional Core	**Credits**	1.5
Course Type	Practical	**Lecture - Tutorial - Practical**	0 - 0 - 3
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Determine color and turbidity of water
	CO2	Determine total, dissolved, suspended and settleable solids in water.
	CO3	Determine pH, acidity and alkalinity of water.
	CO4	Determine hardness of water and chlorides in water
	CO5	Determine BOD, COD and sulphates in water.
	CO6	Determine Optimum Coagulant Dose.
Course Content	**LIST OF EXPERIMENTS** 1. Determination of Residual chlorine 2. Determination of Turbidity 3. Determination of total solids, suspended solids and dissolved solids 4. Determination of Settleable solids 5. Determination of pH 6. Determination of Acidity 7. Determination of Alkalinity 8. Determination of Hardness 9. Determination of Chlorides 10. Determination of Sulphates using UV-Vis spectrophotometer. 11. Determination of COD 12. Determination of Optimum Coagulant Dose 13. Demonstration of BOD, Colour	

Textbooks	**TEXTBOOKS:** 1. Dr. Kotaiah and Dr. N. Kumara Swamy, *Environmental Laboratory Manual*, Charotar publishing house, 1994. 2. Indian standards for Analysis of water and Wastewater.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	-	1	-	-	1	-	-	-	1	2	-	-	1
CO2	2	2	-	1	-	-	1	-	-	-	1	2	-	-	1
CO3	3	2	-	1	-	-	1	-	-	-	1	2	-	-	1
CO4	3	2	-	1	-	-	1	-	-	-	1	2	-	-	1
CO5	3	2	-	1	2	-	1	-	-	-	1	2	-	-	1
CO6	2	2	-	1	-	-	1	-	-	-	1	2	-	-	1

20CE32P2 –REMOTE SENSING & GIS LABORATORY

(Civil Engineering)

Course Category	Professional core	**Credits**	1.5
Course Type	Practical	**Lecture - Tutorial - Practical**	0 - 0 - 3
Prerequisite	Remote sensing & GIS	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Interpret a satellite image
	CO2	Perform orientation of photographs
	CO3	Map earth surface features
	CO4	Compute geometric measurements
	CO5	Perform spatial analysis
	CO6	Integrate different geospatial layers

Course Content

LIST OF EXPERIMENTS

1. Importing maps and layers from various sources
2. Spatial resolution of a satellite image
3. Image enhancement
4. Generation of map with legends
5. Georeferensing
6. Supervised classification of a satellite image
7. Unsupervised classification of a satellite image
8. Digitization of points, lines and polygons
9. Attribute data entry
10. Overlay analysis- intersection, union, erase, identity
11. Buffer analysis
12. Data interpolation-Inverse distance weighting method
13. Generation of contour map from point data
14. Generation of digital elevation model from point data

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	-	1	-	1	3	-	-	-	2	-	-	1	3	-	2
CO 2	-	-	-	-	3	-	-	-	2	-	-	1	3	-	2
CO 3	-	-	-	-	3	-	-	-	2	1	-	1	3	-	2
CO 4	1	2	-	2	3	-	-	-	2	1	1	1	3	2	3
CO 5	1	2	-	2	3	-	-	-	2	1	1	1	3	2	3
CO 6	1	3	-	3	3	2	-	-	2	1	1	1	3	3	3

20CE32P3 – STRUCTURAL ANALYSIS AND DESIGN LABORATORY

(Civil Engineering)

Course Category	Professional core	**Credits**	1.5
Course Type	Practical	**Lecture – Tutorial –Practical**	0-0-3
Prerequisite	Strength of Materials, Structural Analysis, Elemental Design of RC Structures	**Sessional Evaluation**	40
		Semester End Exam. Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Carryout analysis of simple beam and frame
	CO2	Analyze and design of multi storey RCC building
	CO3	Carryout wind and seismic analysis of RCC buildings
	CO4	Analyze and design of footings
	CO5	Carryout analysis and design of industrial warehouse
	CO6	Carryout analysis and design of conventional center
Course Content	**LIST OF EXPERIMENTS** 1. Introduction to STAAD pro and STRAP 2. Analysis of simple beam and single storey frame. 3. Analysis and design of multi-storey frame 4. Analysis of multi-storey building 5. Design of multi-storey building 6. Wind load analysis on RCC building 7. Seismic analysis of RCC building 8. Analysis and design of steel truss 9. Analysis and design of isolated footing 10. Analysis of industrial warehouse 11. Design of industrial warehouse 12. Analysis and design of conventional center	

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	-	3	-	-	3	2	1	-	3	3	2	2
CO2	3	3	3	-	3	-	-	3	2	1	-	3	3	2	2
CO3	3	3	3	-	3	-	-	3	2	1	-	3	3	2	2
CO4	3	3	3	-	3	-	-	3	2	1	-	3	3	2	2
CO5	3	3	3	-	3	-	-	3	2	1	-	3	3	2	2
CO6	3	3	3	-	3	-	-	3	2	1	-	3	3	2	2

N.B.K.R. INSTITUTE OF SCIENCE & TECHNOLOGY:: VIDYANAGAR

(AUTONOMOUS)

CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the batch admitted in the academic year 2020-2021)

IV YEAR OF FOUR YEAR B.TECH. DEGREE COURSE – I SEMESTER

S.NO	Course Code	Course Title	Contact Hours/ Week			Credits	Evaluation									
							Sessional Test-I			Sessional Test-II			Total Sessional Marks (Max. 40)	Semester End Examination		Max. Total Marks
		THEORY	L	T	P		Test-I (2 hrs.)	Assignment-I	Max. Marks	Test-II (2 hrs.)	Assignment-II	Max. Marks		Duration In Hours	Max. Marks	
1	20CE41EX	**Professional Elective-III**	3	0	0	3	34	6	40	34	6	40	0.8(Better of two sessional tests) + 0.2(Other)	3	60	100
2	20CE41EX	**Professional Elective-IV**	3	0	0	3	34	6	40	34	6	40		3	60	100
3	20CE41EX	**Professional Elective-V**	3	0	0	3	34	6	40	34	6	40		3	60	100
		OPEN ELECTIVE COURSE / JOB ORIENTED COURSE														
4	20XX4101	Open Elective Course/Job Oriented Course	3	0	0	3	34	6	40	34	6	40		3	60	100
5	20XX4102	Open Elective Course/Job Oriented Course	3	0	0	3	34	6	40	34	6	40		3	60	100
		HUMANITIES & SOCIAL SCIENCES ELECTIVE														
6	20SH4101	Managerial Sciences	3	0	0	3	34	6	40	34	6	40	0.8(Better of two+ 0.2(Other)	3	60	100
		SKILL ADVANCEDCOURSE / SOFT SKILL COURSE											Day-to-day Evaluation and a test (40 marks)			
1	20CE41SC	Comp. Design Lab	0	0	4	2	-	-	-	-	-	-		3	60	100
		INTERNSHIP														
1	20CE41IS	Industrial/Research Internship	0	0	0	3	-	-	-	-	-	-	40marks	-	60	100
		TOTAL				**23**										
1	20xx41xx	Honors/Minor course	4	0	0	4	The hours distribution can be 3-0-2 or 3-1-0 also									

Industrial/Research: Internship (Mandatory) 2 months during summer vacation (to be evaluated during VII semester)

Professional Elective-III: 20CE41E1:Pavement Construction & Management ; **20CE41E2:Solid Waste Management**.; 20CE41E3:Structural Health Monitoring; 20CE41E4:Advanced Structural Design

Professional Elective-IV: 20CE41E5:Prestressed Concrete; 20CE41E6:Bridge Engineering.; **20CE41E7:Railway Airport & Harbour Engineering**; 20CE41E8:Integrated Watershed Management

Professional Elective-V: 20CE41E9:Repair & Rehabilitation of Structures; **20CE41EA:Construction Planning & Management**; 20CE41EB:Air & Noise pollution Control ; 20CE41EC:Ground Improvement Techniques

20CE41E1 – PAVEMENT CONSTRUCTION AND MANAGEMENT

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	Transportation Engineering	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Understand the construction procedure of embankment, gravel road and WBM road.
	CO2	Able to explain the construction procedure of bituminous and cement concrete pavements.
	CO3	Understand different methods of soil stabilization.
	CO4	Acquire knowledge about utilization of various highway construction machinery.
	CO5	Understand the need and methods of maintenance of different types of pavements.
	CO6	Understand methods of evaluation of different types of existing pavements and also different techniques to strengthen them.

Course Content

UNIT – I

CONSTRUCTION OF EARTHEN ROADS AND W.B.M ROADS: Typical components of highway on embankment and in cutting, steps for construction of new highway on embankments and in cutting, functions and design elements of embankment – construction of sub grade – materials, construction method and quality control check. Method of compaction of soil and equipment - construction of embankment – construction of gravel road and WBM road.

UNIT – II

CONSTRUCTION OF BITUMINOUS AND CEMENT CONCRETE PAVEMENTS: Construction of bituminous roads – Interface treatments, Bitumen surface dressing and penetration macadam – Built up spray grout – Premix methods construction of cement concrete pavements – Construction of joints in cement concrete pavements – Types of joints, arrangement of joints, joint filler and scalar.

UNIT – III

SOIL STABILIZED PAVEMENT LAYERS: Objectives, application of soil stabilization techniques, mechanics of stabilization and investigations for soil stabilized roads and soil stabilization methods. Mechanical soil stabilization properties of soil –Aggregate mixtures –Factors affecting mechanical stabilization

	– Minimum design in mechanical stabilization, construction procedure – Stabilization using soft aggregates – Mehras's method of stabilization. **UNIT – IV** **HIGHWAY CONSTRUCTION EQUIPMENT**: Various types of equipment for excavation, grading and compaction - their working principle, advantages and limitations. Paving equipment for bituminous and cement concrete pavement. Equipment for stabilized soil road construction. **UNIT – V** **HIGHWAY MAINTENANCE:** Need – Causes of pavement failures – Classification of maintenance works maintenance management system – Failures in flexible pavements – Failures in sub grade – Failures in sub base or base course – Typical flexible pavement failures – Failures in cement concrete pavement – Typical rigid pavement failures –Different types of maintenance for Bituminous surfaces – Special repairs in flexible pavements – Waves and corrugations – Skidding of pavement surfaces – Maintenance of cement concrete pavements. **UNIT – VI** **PAVEMENT EVALUATION:** Structural evaluation of pavements –need and application of structural evaluation studies- different methods- factors affecting pavement deflection, general principle deflection approach, principle of structural evaluation of flexible pavements - Evaluation of pavement surface condition – Strengthening of existing pavements -objectives– Flexible overlay over flexible pavement by conventional design method – Overlay design by Benkelman beam deflection studies- rigid overlay over rigid pavement – Flexible overlay over rigid pavement.

Textbooks and Reference Books	**TEXTBOOKS:** 1. S.K. Khanna and C.E.GJusto &Veeraraghavulu, *Highway Engineering*, Nemchand&bros, 10th edition, 2018. 2. Dr. L.R Kadiyali, *Principles and Practice of Highway Engineering*, Khanna publishers, 7th edition, 2019. 3. C.Venkatramaiah, *Transportation Engineering Vol. I*, Universities Press (India) Private Ltd, 1st edition, 2016. **REFERENCE BOOKS:** 1. Dr. L.R Kadiyali, *Traffic Engineering and Transport Planning*, Khanna publishers, 9th edition, 2017. 2. AnimeshDas, Analysis of pavement structures, CRC Press, 2nd edition, 2014.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO 3**
CO1	1	-	2	1	1	1	1	1	1	3	1	1	-	1	3
CO2	1	-	2	1	2	-	-	1	1	3	1	1	-	1	3
CO3	2	-	1	1	1	2	-	1	2	3	1	1	-	3	1
CO4	2	2	3	2	2	1	1	1	2	3	1	1	-	2	1
CO5	3	-	-	1	1	1	-	1	2	2	2	1	-	1	-
CO6	1	-	1	2	2	1	1	1	2	2	1	1	-	1	-

20CE41E2 – SOLID WASTE MANAGEMENT

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Know the impacts of solid waste generation
	CO2	Identify different sources of solid waste.
	CO3	Apply the onsite handling, processing techniques and transfer techniques.
	CO4	Apply processing techniques and recovery of products from solid waste.
	CO5	Know various disposal techniques and management options for solid waste.
	CO6	Identifies hazardous wastes and apply the disposal techniques.
Course Content		

UNIT – I

INTRODUCTION: Goals and objectives of solid waste management – Impacts of solid waste generation in a technological society – Principle of solid waste management – Social and economic aspects – Public awareness – Quantities of solid wastes.

UNIT –II

SOURCES AND TYPES OF MUNICIPAL SOLID WASTES: Sources and types of solid wastes – Factors affecting generation of solid wastes – functional elements - Characteristics - Effects of improper disposal of solid wastes – Public health effects.

UNIT – III

ONSITE HANDLING – STORAGE AND PROCESSING: Onsite handling – Methods used at residential and commercial sources – Onsite storage dust bins – Community containers, container locations, onsite processing methods

COLLECTION AND TRANSFER: Methods of Collection – Types of vehicles – Manpower requirement – Collection routes –Transfer stations – Selection of

	location - Options under Indian conditions. **UNIT – IV** **PROCESSING TECHNIQUES AND EQUIPMENT:** Purpose of processing-sorting - shredding and incineration and types of incinerators. **RECOVERY OF PRODUCTS AND ENERGY:** Material processing and recovery systems – Recovery of chemical conversion products –Recovery of biological conversion products, recovery of energy from conversion products. **UNIT – V** **DISPOSAL OF SOLID WASTES:** Sanitary landfills – General considerations – Site selection – Operational management systems in land fill – Gas and leachate control – construction –Ocean disposal of solid wastes – Application of GIS in Land Fill. **UNIT – VI** **HAZARDOUS WASTES:** Special wastes - Hazardous wastes – Hospital wastes – Sewage sludge – Industrial solid wastes – Methods of disposal.
Textbooks and References	**TEXTBOOKS:** 1. Iqbal H Khan, Naved Ahsan, *Textbook of Solid Wastes Management,* CBS publishers and distributors pvt ltd, 1st edition, 2017. 2. George Tchobanoglous & Hilary Theison, *Solid Waste: Engineering principles and management,* McGraw-Hill Publishers, 1993. 3. Bhide, A.D. and Sundaresam B.B, *Solid Waste Management in developing countries*, Indian National Scientific Documentation Centre, 2016. **REFERENCE BOOKS:** 1. Datta.M Parida & B S Guha B.K.and Sreekrishna. T. R, *Industrial Solid Waste Management & Land Filling Practice,* Narosa publishing house, 2001 2. K. Sasi kumar and Sanoop Gopi Krishna, *Solid Waste Management,* PHI publishers, 2013. 3. Rajaram Vasudevan, Siddiqui Faisal Zia, Sanjeev Agrawal & Mohmmad Imran Khan, *Solid And Liquid Waste Management*, PHI publishers.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	1	3	3	3	2	3	1	3	-	-	-
CO2	-	2	1	-	-	3	2	3	2	2	2	1	-	-	1
CO3	3	2	2	1	2	2	2	3	2	3	3	2	-	2	2
CO4	2	3	3	2	3	2	2	2	3	3	2	3	-	2	2
CO5	1	1	2	1	2	3	3	3	2	3	2	2	1	1	1
CO6	2	2	-	-	2	3	3	3	3	3	1	3	-	-	1

20CE41E3 – STRUCTURAL HEALTH MONITERING

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Objectives	1. To understand basic concepts of structural health monitoring in civil engineering. 2. To interpret structural heath failure in bridge structure. 3. To overview the Non Destructive Test techniques for detecting the defects in concrete structures. 4. To understand the concept of condition survey. 5. Gain-in knowledge in quality control of concrete structures. 6. Gain-in knowledge of Rehabilitation of concrete structures.	
Course Outcomes	CO1	Understand basic concepts of structural health monitoring and analyse between system of a man and a structure with structural health monitoring.
	CO2	List out structural failures in bridge structure.
	CO3	Overview the non-destructive test techniques and methods for concrete structures.
	CO4	Perform condition survey for evaluation of concrete structures.
	CO5	Evaluate the non-destructive test techniques of concrete structures and case studies.
	CO6	Develop sustainable maintenance and rehabilitation of concrete structures.
Course	**UNIT-I** **INTRODUCTION TO STRUCTURAL HEALTH MONITORING (SHM):**Definition & motivation for SHM – SHM – A way for smart materials and structures – SHM and Biomimetic – Analog 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.	

Content	
	UNIT-II **APPLICATION OF SHM IN CIVIL ENGINEERING:** 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:** 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 – Electromagnetic methods – Radiographic Testing – ultrasonic testing – Infrared thermography – Ground penetrating radar – Radio isotope gauges – Other methods. **UNIT-IV** **CONDITION SURVEY & NDE OF CONCRETE STRUCTURE:** Definition –Objective of condition survey – Stages of condition survey (Preliminary – Planning – Inspection and Testing stages) – Possible defects in concrete structures. **UNIT-V** **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-VI** **REHABILITATION AND RETROFITTING OF CONCRETE STRUCTURE:** Repair rehabilitation & retrofitting of structures –Damage assessment of concrete structures – Materials and methods for repairs and rehabilitation – Modeling of repaired composite structure –Structural analysis and design – Importance of re-analysis –Execution of rehabilitation strategy – Case studies.

Textbooks and References	**TEXTBOOKS:** 1. Gandhi and Thompson, *Smart Materials and Structures*, Springer, 1992. 2. Fu Ko Chang, *Structural Health Monitoring: Current Status and Perspectives*, CRC Press 1st edition, 1998. 3. Ravi shankar.K and Krishna moorthy.T.S, *Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures*, Allied Publishers, 2004. **REFERENCES:** 1. Shetty M.S., *Concrete Technology – Theory and Practice*", S.Chand and Company, 2008. 2. Dov Kominetzky .M.S., *Design and Construction Failures*, Galgotia Publications Pvt. Ltd., 2001. 3. CPWD and Indian Buildings Congress, Hand Book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	1	2	2	2	1	-	-	2	1	2	2	2
CO2	2	1	-	1	2	2	2	1	-	-	2	1	2	2	2
CO3	2	1	1	-	-	2	1	-	-	-	2	1	2	1	3
CO4	2	2	1	2	2	2	1	1	-	-	2	1	-	1	2
CO5	2	1	1	1	1	1	2	2	-	-	1	1	2	2	2
CO6	2	1	1	1	1	2	1	1	-	-	1	1	2	2	2

20CE41E4 – ADVANCED STRUCTURAL DESIGN

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3-0- 0
Prerequisite	Elemental Design of Reinforced Concrete Structures	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Design slender reinforced concrete columns, concrete walls and grid floors.
	CO2	Analyze multi storey building frames for seismic forces.
	CO3	Perform Plastic design of beams and columns.
	CO4	Perform Plastic design of frames according to BIS code of practices.
	CO5	Design pre-stressed concrete beams by using limit state design.
	CO6	Perform the design of prestressed concrete slabs, pressure pipes and railway sleepers.
Course Content		**UNIT – I** Design of slender columns - Concrete walls under vertical loads - Grid floors. **UNIT – II** Introduction to seismic analysis - Different methods of computing seismic forces on buildings –Analysis of multi-storey building frames - Ductility considerations in earthquake resistant design of RC buildings based on IS 13920. **UNIT – III** Plastic design of simply supported and continuous beams –Columns **UNIT – IV** Plastic design of frames– Steps/process to as per the most recent BIS code of practices- Deign of purlins. **UNIT – V** Design of Pre- stressed beams for strength in limit state in flexure and shear – Limit state strength at transfer conditions – Limit state of deflection and cracking. **UNIT – VI** Design of reinforcement in anchor zones – Design of Pre- stressed rectangular slabs – Design of pressure pipes – Design of railway sleepers.
Textbooks		**TEXTBOOKS:**

and References	1. P.C. Varghese, *Advanced Reinforced Concrete Design*, PHI Publisher, 2nd revised edition, 2011. 2. Dr. S. Ramchandra and V. Gehlot, *Design of Steel Structures Vol-2*, standard publishers distributors, 9th revised and enlarged edition, 2015. 3. N. Krishna Raju, *Prestressed Concrete*, McGraw hill education, 6th Edition, 2018. **REFERENCES:** 1. G.S.Pandit & S.P.Gupta, *Prestressed Concrete*, CBS Publishers, and distributors Pvt. Ltd., 1st Edition, 2019. 2. N. Krishna Raju, *Advanced Reinforced Concrete Design*, CBS Publishers, and distributors Pvt. Ltd., 3rd Edition, 2016. 3. Pankaj Agarwal & Manish Shrikhande, *Earthquake Resistant Design of Structures*, Prentice Hall of India Pvt. Ltd, 2011.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	-	1	-	-	2	-	-	-	2	-	1	1
CO2	3	3	1	-	1	-	-	-	-	-	-	1	-	1	1
CO3	3	3	2	-	1	-	-	2	-	-	-	2	-	1	1
CO4	3	3	2	-	1	-	-	2	-	-	-	2	-	1	1
CO5	3	3	2	-	1	-	-	2	-	-	-	3	-	1	1
CO6	3	3	2	-	1	-	-	2	-	-	-	1	-	1	1

20CE41E5 - PRESTRESSED CONCRETE

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	Elemental Design of Reinforced Concrete structures	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Calculate the resultant stresses in rectangular prestressed concrete.
	CO2	Analyze the losses and design the prestressed concrete sections.
	CO3	Design Pre-tensioned concrete members.
	CO4	Analyze and design partially post-tensioned members.
	CO5	Analyze and design composite prestressed concrete members.
	CO6	Design prestressed concrete slabs.

Course Content

UNIT – I

INTRODUCTION: Basic concepts of prestressing – Historical development – Advantages of prestressed concrete – High strength concrete – High tensile steel.

PRESTRESSING SYSTEM: Introduction –Tensioning devices – Pretensioning and post tensioning systems –Thermo-electric and chemical prestressing.

ANALYSIS OF PRESTRESSED CONCRETE SECTIONS: Basic assumptions – Analysis of prestress –Resultant stress at a section – Pressure line – Concept of load balancing –Stress in tendons and cracking moment.

UNIT – II

LOSSES OF PRESTRESS: Nature of losses of prestress – Loss due to elastic deformation of concrete – Shrinkage of concrete – Creep of concrete – Relaxation of stress in steel – Friction and anchorage slip – Total losses.

DESIGN OF PRESTRESSED CONCRETE SECTIONS: Design of sections for Flexure, Axial tension, Compression bending and Shear – Design of members for bond and bearing.

UNIT – III

DESIGN OF PRE-TENSIONED MEMBERS: Dimensioning of flexural members – Estimation of self-weight of beams – Ultimate flexure strength – Ultimate shear strength – design of pre tensioned members.

UNIT – IV

DESIGN OF POST-TENSIONED MEMBERS: Ultimate moment and shear –

	Cross sectional dimensions – Moment and shear forces – Minimum section modules – Permissible tendon zone – Deflection and serviceability – Design of partially prestressed members. **UNIT – V** **COMPOSITE CONCRETE STRUCTURES:** Composite structural members – Types of composite construction – Analysis of stress – Differential shrinkage – Deflection of composite members –Flexural strength of composite sections and design of composite sections. **UNIT – VI** **PRESTRESSED CONCRETE SLABS**: Types of prestressed concrete floor slabs – Design of prestressed concrete one way slabs, Two way slabs and simple flat slabs.
Textbooks & References	**TEXTBOOKS:** 1. N. Krishna Raju, *Prestressed Concrete,* McGraw Hill Education, 6th Edition, 2018. 2. P. Dayaratham and P. Sarah, *Prestressed Concrete Structures*, Medtech Publishers, 7th Edition, 2017. 3. S. Ramamrutham, *Prestressed Concrete Structures*, Dhanpatrai publishing company, 6th Edition, 2018. **REFERENCE BOOKS:** 1. N. C. Sinha and S. K. Roy, *Fundamentals of Prestressed Concrete*, S Chand Publishing, 3rd Edition, 2011. 2. T.Y. Lin & N.H. Burns, *Design of Prestressed Concrete Structures*, Wiley India Private Limited, 3rd Edition, 2010. 3. Shrikan B.Yanakudre, Ashish A.Yoligar, *Prestressed Concrete*, Khanna Publishing, 1st edition, 2018.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	-	1	-	3	-	-	-	-	-	3	-	1	1
CO2	3	-	1	1	-	2	2	1	-	-	-	3	-	1	1
CO3	3	-	1	-	2	1	-	1	-	-	1	2	-	2	1
CO4	3	-	1	1	1	1	-	1	-	-	1	2	-	1	1
CO5	3	-	1	1	2	2	1	1	-	-	1	1	-	1	1
CO6	3	-	1	-	2	1	1	1	-	-	1	1	-	2	2

20CE41E6 – BRIDGE ENGINEERING

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3-0- 0
Prerequisite	Elemental Design of Reinforced Concrete Structures and Structural Analysis	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Classify bridge loading standards and be able to recommend suitable bridge type.
	CO2	Analyze and design box culvert and deck slab bridge.
	CO3	Design RC T- beam bridge using Pigeaud's method.
	CO4	Design plate girder bridge and composite bridge.
	CO5	Analyze Piers and abutments for stability.
	CO6	Design bridge bearings and identify the types and importance joints in bridges.

Course Content

UNIT - I

INTRODUCTION: General – Classification of bridges – Site selection - Importance of site investigation in bridge design - Choice of bridge type - Location of piers and abutments - Subsoil exploration – Economical span- Traffic projection – Scour depth.

IRC LOADING STANDARDS: Various loads on bridges - Highway bridge loading standards–Impact factor–Railway Bridge loading standards (Broad Gauge Main Line Bridge).

UNIT – II

BOX CULVERT: General aspects – Design loads, Design of Box culvert subjected to IRC class AA tracked vehicle only.

DECK SLAB BRIDGE: Introduction – Effective width method– Design of deck Slab Bridge (simply supported) subjected to IRC class AA tracked vehicle only.

UNIT - III

BEAM AND SLAB BRIDGE (T-BEAM BRIDGE): General features – Design of interior panel of slab – Pigeaud's method – Design of a T-beam bridge subjected to IRC class AA tracked vehicle only.

UNIT - IV

PLATE GIRDER BRIDGE: Introduction – elements of a plate girder and their design - Design of a deck type welded plate girder bridge for single line broad gauge.

	COMPOSITE BRIDGES: Introduction – Advantages – Design of composite bridges consisting of RCC slabs over steel girders including shear connectors. **UNIT - V** **PIERS AND ABUTMENTS:** General features – Bed block – Materials for piers and abutments – Types of piers – Forces acting on piers – Stability analysis of piers – General features of abutments – Forces acting on abutments – Stability analysis of abutments - Types of wing walls – Approaches – Types of bridge foundations (excluding design). **UNIT - VI** **BRIDGE BEARINGS:** General features – Types of bearings – Design principles of steel rocker and roller bearings – Design of a steel rocker bearing – Design of elastomeric pad bearing – Joints – Expansion joints- Parapets and railings for highway bridges.
Text and Reference books	**TEXT BOOKS:** 1. N. Krishna Raju, *Design of Bridges*, Oxford & IBH Publishing Company Pvt. Ltd., 5th Edition, 2018. 2. N. Raja Gopalan, *Bridge superstructure*, Narosa Publishing House, 2006. 3. S. C. Rangwala, *Bridge engineering*, Charotar Publications, 16th Rev Edition, 2015. **REFERENCE BOOKS:** 1. D. J. Victor, *Essentials of bridge engineering*, Oxford& IBH Publishing Company Pvt. Ltd., 4th Edition, 1994. 2. T. R. Jagadeesh and M. A. Jayaram, *Design of Bridge structures*, PHI Learning Pvt. Ltd., 2nd Edition, 2014. 3. Ponnu Swamy, *Bridge Engineering*, Tata McGraw Hill Company, 3rd Edition, 2017.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	2	-	1	-	1	1	-	-	1	1	-	-	1
CO2	3	-	3	-	1	-	2	-	-	-	1	-	-	2	3
CO3	3	-	3	-	2	-	1	-	-	-	1	-	-	2	3
CO4	3	-	2	-	2	-	1	-	-	-	1	-	-	2	3
CO5	2	-	1	-	-	-	-	-	-	-	-	1	-	2	3
CO6	1	-	1	-	1	-	-	-	-	-	1	-	-	-	2

20CE41E7 - RAILWAY, AIRPORT & HARBOUR ENGINEERING

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	Transportation Engineering	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Objectives	1. To illustrate permanent way and its components. 2. To demonstrate different types of stations, yards, points, crossings and turnouts. 3. To outline the basic concepts of airport transportation, aircraft characteristics and airport. 4. To analyze runway orientation by wind rose method. 5. To relate water and water transportation for providing various facilities required in harbour. 6. To elaborate facilities required in harbour with break waters and dredging.	
Course Outcomes	CO1	Illustrate permanent way, its components and functions in railways.
	CO2	Identify functions, requirements and types of stations, yards, points and crossing, turnouts.
	CO3	Outline air transport features along with airport components.
	CO4	Understand basic concepts of airport planning and runway orientation.
	CO5	Summarize facilities required in harbour and port.
	CO6	Relate importance of break waters, docks and dredging in harbour and port.
Course Content	**UNIT - I** **INTRODUCTION TO RAILWAY ENGINEERING:** comparison of railways and highways, milestones in Indian railways, classification of Indian railways – rail route classification, railway zones. **PERMANENT WAY**: Requirements of ideal permanent way, gauges – selection of gauge- uniformity of gauges, Rails - functions, requirements of rails, types of rail sections, rail failures, coning of wheels, Sleepers – types of sleepers, functions and requirements, adzing of sleepers, spacing of sleepers and sleeper density-problems, Ballast- functions and requirements, types of ballast - (Theory only). **UNIT – II** **STATIONS AND YARDS:** Railway stations - Site selection for railway	

stations, requirements, classification - operational classification and functional classification, platforms - types, loops, sidings, Station yards – types, layouts, Points and crossings – turnouts - left hand turnout, right hand turnout, types of switches, types of crossings, sleepers at points and crossings (Theory only).

UNIT – III

AIR TRANSPORT: Introduction to air transportation, characteristics of air transport, development of national organizations for civil aviation, airport zoning and zoning laws, classification of airports, different kinds of flights, Air traffic control - forecasting air traffic potential (Basic concepts only).

AIR CRAFT AND AIR PORT: Air craft – types, components, basic structure of air craft, aircraft characteristics, Components of airports and functions - terminal area and landing area, planning concepts for terminal building, Parking area - patterns of parking, systems of aircraft parking, Aprons - loading aprons and holding aprons, hangers - T hangers, nose hangers and grouped hangers.

UNIT - IV

AIRPORT PLANNING: Airport planning – Master plan, regional plan, factors affecting site selection for an airport, characteristics of well-planned airport layout, typical airport layout patterns, blast considerations, blast fences.

RUNWAY ORIENTATION: Runway - patterns, types, Orientation - wind rose analysis in runway orientation – problems on runway orientation**,** Length of runway – Problems.

UNIT - V

WATER TRANSPORTATION: Salient features of water transportation in India - types of water transportation - inland and ocean transportation**,** Tides, Wind and waves – factors governing the characteristics of water waves, Currents, uses and effects of tides at harbour.

HARBOUR AND PORT: Classification of harbors and ports, site selection, requirements of good port, components of a harbour and port - loading and unloading facilities of harbor, quays & wharves, piers, dolphins, jetties, fenders, aprons, transit sheds, Docks – classification, shapes of docks , dry docks & wet docks, Different layouts of harbour.

UNIT - VI

BREAK WATERS: Breakwaters – types of break waters, details of energy dissipation in mound break water, characteristics of mound break water, rubble mound breakwater – rubble mound breakwater strengthened by concrete blocks, rubble mound breakwater strengthened by patented blocks.

DREDGING: Classification of dredging, Equipment - mechanical type, hydraulic or suction type dredgers, choice of dredger, navigation facilities – need- types-

	general lights and local lights – fixed light station types only- floating navigation aids types only.
Textbooks and References	**TEXTBOOKS:** 1. S. C. Saxena & S.P.Arora, *A text book of Railway Engineering*, Dhanpat Rai publications, 7th edition, 2015. 2. R. Srinivasan, *Docks and Harbour engineering*, Charotar publishing hose Pvt. Ltd, 29th edition, 2018. 3. C. Venkatramaiah, *Transportation Engineering II",* Universities press (India) Private Limited, 2ndedition, 2016. **REFERENCE BOOKS:** 1. SP Bindra, "*A Course in Docks and Harbour Engineering",* Dhanpat Rai Publication, 8th edition, 2016. 2. S.C. Rangwala , "*A text book of Railway Engineering"*, Charotar publishing house, 26th edition, 2016. 3. K.P. Subramanian, "*Highway, railway, airport and harbour engineering",* SCITECH publishers, 2nd edition, 2015.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	-	2	1	1	1	1	1	1	2	1	1	-	-	-
CO2	1	-	2	2	2	-	-	1	1	3	1	1	-	1	-
CO3	2	-	1	2	1	2	-	1	2	3	1	1	-	1	1
CO4	2	2	3	2	2	1	1	1	2	3	1	1	-	1	1
CO5	3	-	-	1	2	1	-	1	2	2	2	1	-	-	1
CO6	1	-	1	2	2	1	1	3	3	2	1	1	-	1	-

20CE41E8 – INTEGRATED WATERSHED MANAGEMENT

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0- 0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Demonstrate the basic concepts of watershed management
	CO2	Identify and plan for sustainable utilization of available land resources in the watershed.
	CO3	Identify and plan for sustainable utilization of available water resources in the watershed.
	CO4	Identify various crops patterns, soil condition and water salinity in the watershed and suggest remedial measures.
	CO5	Identify various energy resources available in the watershed and plan for sustainable utilization.
	CO6	Apply modern technology for effective integrated watershed management.
Course Content	**UNIT – I** **INTRODUCTION:** Place in Environment - Global Effects, Degradation Trends; Semi-arid Tropics; Status in India - Forests; Soils, Water, Droughts, Cultivation, Irrigation, Power, Food and Nutrition; Neglected Nodes -Social, Technical, Environment, Cooperation, Economy. **WATERSHED CONCEPT:** Watershed; Need; Characteristics. Size, Shape, physiography, Slope, Climate, Drainage, Land Use, Vegetation, Geology and Soils, Hydrology, Management - Degradation Devils; Integrated Multi-Disciplinary Approach - Socioeconomics, Priorities, Tasks, Rural Technological Delivery Systems, Nodes, Economics. **UNIT – II** **LAND:** Survey Layout; Preparation and Development, Contour Demarcation, Bush Clearance, Uprooting, Stone Picking and Packing, Levelling, Shaping and Consolidation, Fencing, Ploughing; Soil and Soil Moisture Conservation - Soil Survey; Conservation Measures. Rainwater Management - Stream Head Cutting, River Bank Management, Flow Irrigation, Waterways; Reclamation of Saline Soils. Alkaline Soils, Saline Soils, Acidic Soils, Sulfide Soils.	

	UNIT – III **WATER:** Investigation. Remote Sensing, Data and Analysis; Exploration, Evaluation and Exploitation; Surface Water. Utilization of Wasted Flows, Salvaging Flood Flows, National Waterway Grid, Dams and Irrigation, Rejected Recharge, Tidal Rivers, Tanks; Rainwater Harvesting. Catchment, Harvesting, Harvesting Structures; Groundwater. Exploitation of Canal Command Areas, Potential Areas, Harvesting; Desalinization of Coastal Saline Stretches, Artificial Recharge; **UNIT – IV** **GREENERY:** Agriculture - Crop Husbandry - Soil Enrichment, Inter, Mixed and Strip Cropping, Cropping Pattern; Sustainable Agriculture - Hybrid and Improved Seeds; Biomass Management - Crop Rotation, Legumes, Organic Fertilization, Spider Fanning; Dryland Agriculture - Runoff Agriculture, Micro-catchment Fanning, Irrigation with Saline Water, Reusing Water, Conserving Water, Sprinkler irrigation, Drip Irrigation, Pot Irrigation, Other Systems, Reducing Cropland Percolation Limes, Reducing Transpiration Losses, Selection of Water Use Efficiency Crops; irrigation - Water Losses, Control of Water Levels, Salinity Problem, Water Distribution. **UNIT – V** **ENERGY:** Renewable resources, Water Power, Solar Energy, Wind Power; Biomass. Firewood. Synthetic Fuels, Burning of Municipal Garbage; Alternative Strategies; Conservation. **SOCIOECONOMICS:** Awareness, Participation, Response; State and Integrated Approach. Appreciation of the Concept, Training, Transfer of Technology, Research and Development, Agro industrial Infrastructure; Sustainable society - Livestock, Small animal fanning, Pisciculture, Sericulture, Health and Hygiene, Education, Transport, Cues; Economics - Per Hectare Provision, NGOs, International Agencies, Future, Economic Viability; Sustainable Society. **UNIT – VI** **TECHNOLOGY**: Farm Equipment; Contour Methods; Check Dams; Water Catchment and Harvesting. Kunds, Depression Harvesting, Harvesting Below Ground Level, Harvesting Below Stream Bed Level, Groundwater Harvesting; Low-Cost Technology. Water Conservation. Utilization of Wasted Natural Resources, Novelties; Rural Technological Delivery Systems. **IMPACT:** Model Watershed; Government Projects. National Projects; World Bank Projects; NGOs Efforts. Society for Promotion of Wasteland Development; ICRISAT.
Textbooks	**TEXTBOOKS:**

and References	1. J.V.S. Murthy, *Watershed Management*, New Age International Publishers, 2nd edition, 2004 2. V.V.N. Murthy, and M.K. Jha *Land and water management*, Kalyani Publishers, 3rd edition, 2015. 3. Madan Mohan Das and M.D. Saikia, *Watershed management*, Prentice Hall of India, 2nd edition 2013. **REFERENCE BOOKS:** 1. P.E. Black, *Watershed Hydrology*, Prentice Hall Englewood Cliffs, 2nd edition, 2001. 2. R. Suresh, *Watershed Hydrology*, Standard Publishers and Distributors, Delhi, 2nd edition, 2007. 3. A. Ranga Reddy, *Watershed Management for Sustainable Development*, A Mittal Publications, 2005.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	-	-	-	-	-	1	1	-	-	-	-	1	-	-	-
CO 2	-	-	-	1	-	1	1	1	-	-	-	-	-	1	1
CO 3	-	-	-	1	-	1	1	1	-	-	-	-	-	1	1
CO 4	2	-	-	1	-	1	1	-	-	-	-	1	-	2	1
CO 5	1	-	-	1	2	-	2	1	-	-	-	1	-	2	1
CO 6	1	-	-	2	1	1	2	1	-	-	-	-	-	1	1

20CE41E9 – REPAIR AND REHABILITATION OF STRUCTURES

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	Concrete Technology	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Apply maintenance and repair strategies to evaluate damaged structures.
	CO2	Evaluate strength and durability characteristics of concrete.
	CO3	Identify various materials used for repair and their applications.
	CO4	Apply non-destructive testing techniques and protective methods to field problems.
	CO5	Recommend repair and demolition procedures of structures.
	CO6	Assess corrosion of embedded steel in concrete and suggest repair techniques.

Course Content

UNIT -I

MAINTENANCE AND REPAIR STRATEGIES: Maintenance – Repair and rehabilitation – Facets of maintenance – Importance of maintenance – Various aspects of inspection – Assessment procedure for evaluating a damaged structure – Causes of deterioration.

UNIT -II

STRENGTH AND DURABILITY OF CONCRETE: Quality assurance for concrete – Strength – Durability and thermal properties of concrete – Cracks – Different types – Causes – Effects due to climate – Temperature – Sustained elevated temperature – Corrosion – Effects of cover thickness.

UNIT -III

MATERIALS FOR REPAIR:–Expansive cement- Ferro cement - Special elements for accelerated strength gain-Sulphur infiltrated concrete – Fibre reinforced concrete -Types of fiber reinforced concrete – High strength concrete – High performance concrete – Vacuum concrete — Geopolymer concrete – Reactive powder concrete – Bacterial concrete.

UNIT -IV

PROTECTION METHODS: Non-Destructive Testing Techniques: Radioactive Method –Nuclear Method-Magnetic Method-Electrical Method. Epoxy Injection – Shoring – Underpinning – Corrosion Protection Techniques – Corrosion Inhibitors – Corrosion Resistant Steels – Coatings to Reinforcement – Cathodic Protection.

	UNIT- V **REPAIR AND DEMOLITION TECHNIQUES OF STRUCTURES**: Strengthening of Structural Elements – Repair of structures distressed due to corrosion – fire – Leakage and earthquake – Engineered demolition methods – Case studies. **UNIT -VI** **CORROSION OF EMBEDDED STEEL IN CONCRETE:** Corrosion of embedded steel in concrete – Mechanism – Stages of corrosion damage – Repair of various corrosion damaged structural elements (slabs, beams, and columns). **JACKETING:** Jacketing – Column jacketing – Beam jacketing – Beam Column joint jacketing – Reinforced concrete jackets – Steel jacketing – FRP jacketing. **STRENGTHENING**: Strengthening of beam: Shear strengthening and Flexural strengthening.
Text and Reference books	**TEXT BOOKS:** 1. Poonam I. Modi and Chirag N. Patel, *Repair and Rehabilitation of Structures*, PHI learning Pvt. Ltd, Eastern Economy Edition, 2016. 2. Denison Campbell, Allen and Harold Roper, *Concrete Structures, Materials Maintenance and Repair*, Longman Scientific and Technical, Illustrated edition, 1991. 3. R.T. Allen and S.C Edwards, *Repair of Concrete Structures*, Blakie and Sons, 2nd edition, 1992. **REFERENCES:** 1. M.S Dov Kominetzky, *Design and Construction Failures*, Galgotia Publications Pvt. Ltd., 2001. 2. K. Ravi Shankar and T.S Krishna Moorthy, *Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures*, Allied Publishers, 2004. 3. M. L. Gambhir., *Concrete Technology*, McGraw Hill Publication, 5th edition 2013.

CO-PO Mapping: 3-High Mapping, 2- Moderate Mapping, 1-Low Mapping, -- Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	1	2	1	2	1	-	-	2	1	-	1	1
CO2	2	1	-	1	2	1	2	1	-	1	2	1	-	1	-
CO3	1	1	-	-	-	-	1	-	-	-	1	1	-	1	1
CO4	2	2	1	2	2	2	1	1	1	1	2	1	-	2	2
CO5	2	1	1	1	1	2	2	2	1	1	1	1	-	3	2
CO6	2	1	1	1	1	2	1	1	1	1	1	1	-	3	2

20CE41EA - CONSTRUCTION PLANNING & MANAGEMENT

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	Building materials and construction	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Demonstrate the basics of construction management.
	CO2	Schedule various components of project and utilize CPM and PERT techniques.
	CO3	Classify the working of various equipment in construction industry.
	CO4	Perform inspection for quality control, ethical audit and prepare audit statement.
	CO5	Illustrate the importance of safety and risk in construction and organizational structures and roles.
	CO6	Illustrate the importance of trade unions connected with the construction industry in India.
Course Content	**UNIT - I** **INTRODUCTION:** Significance of construction management– Objectives and functions of construction management– Types of construction– Resources for construction industry–Stages of construction–Construction team– Engineering drawings. **UNIT - II** **CONSTRUCTION PLANNING:** Stage of planning– Scheduling– Preparation of material– Equipment– Labour and finance schedules– Bar charts– Milestone charts **NETWORK TECHNIQUES IN CONSTRUCTION MANAGEMENT:** Critical Path Method (CPM) –Program Evaluation and Review Technique (PERT) – Network techniques breakdown structures– Classification of activities–Rules for developing networks– Network development–Network analysis– Critical activities and critical path – Cost optimization. **UNIT - III** **CONSTRUCTION EQUIPMENT AND MANAGEMENT:** Equipment requirement in construction industry– Heavy earth moving equipment: Bulldozer, scrapers, loaders, excavator, shovels, and cranes– Compaction equipment– Grading equipment– Aggregate production equipment– Asphalt mixing plant–	

	Asphalt laying equipment– Hauling equipment– Concrete mixing equipment– Material handling devices– Pneumatic equipment–Bridge construction equipment– Drilling and blasting equipment– Pumping and dewatering equipment. **UNIT – IV** **INSPECTION:** Need for inspection and quality control– Principles of inspection–Enforcement of specifications –Stages of inspection and quality control. **QUALITY CONTROL:** Ethical Audit: Introduction – Aspects of project realization – Ethical audit procedures – The decision makers – Variety of interests – Formulation of briefs –The audit statement– The audit reviews. **UNIT – V** **SAFETY AND RISK:** Introduction – Safety and risk – Concept and importance of safety – Types of risk – Safety and engineers – Safety measures in construction works – Design for safety – Risk benefit analysis – Accidents. **ORGANISING CONSTRUCTION:** Principles of organization– Communication – Leadership and human relations– Types of organization– Organization for a construction firm– Temporary services– Job layout**.** **UNIT – VI** **CONSTRUCTION LABOUR** : Status of construction labour - Wages of construction workers – Trade unions connected with construction industry – Trade unions act, 1926 – Labour welfare fund act, 1965 – Payment of wages act – Minimum wages act, 1948 – Workmen's compensation act, 1923 – Contract labour act, 1970.
Textbooks and References	**TEXTBOOKS:** 1. P.S. Gahlot and B.M. Dhir, *Construction Planning and Management*, New age International Publishers, 2nd edition, 2018. 2. S.C. Sharma, *Construction Equipment and Management*, Khanna publishers, 3rd Edition, 2019. 3. B.L Gupta and Amit Gupta, *Construction Management and Machinery*, Standard Publishers Distributors, 2nd Edition, 2005. **REFERENCE BOOKS:** 1. S. Seetharaman, *Construction Engineering and Management*, Umesh publications, 4th edition, 2008. 2. Haripal Singh, *Construction Management and Accounts*, Tata McGraw-Hill

	Publishing Company Limited, 5th edition, 2016. 3. Dr. B. C. Punmia, K. K. Khandelwal, *Project Planning and control with Pert and CPM*, Laxmi Publications, 4th Edition, 2012.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	1	-	-	-	-	-	1	-	-	1	1
CO2	3	3	2	3	2	-	-	-	-	-	1	2	-	2	-
CO3	2	-	-	-	1	-	-	-	-	-	-	1	2	1	-
CO4	2	-	-	-	-	-	-	-	-	-	1	-	-	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	2	1
CO6	2	-	2	-	-	2	1	-	-	-	1	-	-	1	2

20CE41EB – AIR AND NOISE POLLUTION CONTROL

(Civil Engineering)

Course Category	Professional Elective	**Credits:**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Discuss the concepts of air pollution and assess the sources.
	CO2	Estimate the effects of air pollutants on human beings, materials and vegetation.
	CO3	Estimate the quantity of air pollution.
	CO4	Develop the control technologies for particulate pollutants and to Relate the fundamental concept of air quality management.
	CO5	Discuss the concepts of sound, noise and characteristics of noise.
	CO6	Measure the noise and to develop control measures of noise pollution

Course Content

UNIT I

AIR POLLUTION: Definition of Air Pollution - Sources & Classification, Source inventory of Air Pollutants - Air Quality and Emission standards - Sampling of Pollutants in ambient air - Stack sampling.

UNIT II

EFFECTS OF AIR POLLUTANTS: Effects of air pollution on human beings, materials, vegetation, animals – global warming – ozone layer depletion – Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles.

UNIT III

METEOROLOGY AND AIR POLLUTION: Elements of atmosphere- Factors influencing air pollution, Wind rose, Mixing Depths, Lapse rates and dispersion - Atmospheric stability, Plume rise and dispersion.

UNIT IV

CONTROL OF PARTICULATE POLLUTANTS: Particle size distribution - Control mechanism - Dust removal equipment –working principle and operation of settling chambers, cyclones, wet dust scrubbers, fabric filters and Electro Static Precipitator.

AIR QUALITY MANAGEMENT: Air quality standards – Air quality monitoring – Preventive measures – Zoning – Town planning regulation of new

	industries – Legislation and enforcement. **UNIT V** **NOISE POLLUTION:** Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; Sources of Noise, typical range of noise levels, types of noise pollution, Characteristics of noise, Effects of noise on the human health, Reactions to noise, psychological effects. **UNIT VI** **MEASUREMENT OF NOISE:** Assessment and Evaluation, Frequency sensitivity and equal loudness characteristics, Vibration – Measurement - Measuring Noise at workplace and community levels. **NOISE CONTROL AND ABATEMENT MEASURES:** Noise control at the source, Source-Path-Receiver Concept, Control of Noise Source by Design and Redress, Noise control in the transmission path, Acoustical Separation, Physical Barriers, Isolators and Silencers, Protecting the receiver, Equipment and Shelters
Textbooks and References	**TEXT BOOKS:** 1. D. Anjaneyulu, *Air Pollution and Control Technologies*, Allied Publishers, 2nd edition, reprint in 2020. 2. M.N. Rao, and H. V. N. Rao, *Air Pollution Control*, Tata-McGraw-Hill Publication, 1st edition, 2017. 3. S.C. Bhatia, *Noise Pollution and its control,* Atlantic Publication, 2007. **REFERENCES** 1. W. L. Heumann, *Industrial Air Pollution Control Systems*, McGraw-Hill, 1997. 2. S. P Mahajan, *Pollution Control in Process Industries*, Tata McGraw-Hill Publishing Company, 1991. 3. S.W Peavy, D.R. Rowe and G. Tchobanoglous, *Environmental Engineering*, McGraw Hill, 1985.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	1	-	3	-	-	-	-	-	-	-	1	-
CO2	2	1	-	1	1	3	-	1	2	-	-	1	-	2	1
CO3	3	3	-	1	1	-	-	-	-	-	1	1	-	1	-
CO4	2	2	3	3	3	1	2	-	-	-	2	1	-	2	1
CO5	1	1	-	-	-	1	-	-	-	-	-	1	-	1	1
CO6	2	2	3	3	2	2	1	-	-	-	1	2	-	2	1

20CE41EC – GROUND IMPROVEMENT TECHNIQUES

(Civil Engineering)

Course Category	Professional Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	Geo Technical Engineering- II	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Outline the problematic soils and suitability of ground improvement techniques
	CO2	Comprehend various mechanical densification methods of soils.
	CO3	Understand dewatering methods and Evaluate the preloading technique along with construction of different types of vertical drains for accelerating consolidation.
	CO4	Apply the grouting techniques under different conditions.
	CO5	Analyze the design procedure for reinforced earth wall
	CO6	Assess the application geotextiles in various fields and understand the soil confinement systems.

Course Content

UNIT – I

INTRODUCTION: Need for Ground Improvement – Different types of problematic soils – Emerging trends in ground Improvement – classification of ground improvement techniques – factors affecting the selection of ground improvement techniques – Suitability, feasibility and durability of ground improvement techniques

UNIT – II

METHODS OF STABILIZATION: introduction – requirements of soil stabilization – mechanical stabilization – Portland cement stabilization – Bituminous stabilization – chemical stabilization – construction methods.

UNIT – III

HYDRAULIC MODIFICATION: Introduction **–** filter requirements – ground water and seepage control – methods of dewatering – open sumps and ditches, wellpoint systems , deep-well drainage, vacuum dewatering systems and dewatering by Electro-osmosis – Design steps for dewatering systems – Drains – open drains and closed drains – general principle, design of vertical drains, types and construction of vertical drains – efficiency of vertical drains and applications.

UNIT – IV

GROUTING AND INJECTION: Introduction – aspects of grouting – Different varieties of grout materials - grouting procedure – Grouting under difficult conditions.

	UNIT – V **REINFORCED EARTH:** Introduction – mechanism of reinforced soil - components – advantages of reinforced earth structures and other applications of soil reinforcement – procedure for the design of reinforced earth wall **UNIT – VI** **GEOTEXTILES**: Introduction – advantages of geotextiles – functions of geotextiles – use of geotextiles in earth dam construction, road works, railway works, erosion control and bearing capacity improvement – storage, handling and placement of geotextiles. **SOIL CONFINEMENT SYSTEMS**: Concept of confinement, Gabion walls - function, application, advantage - Crib walls, Sand bags, Evergreen systems and fabric form work
Textbooks and References	**TEXTBOOKS:** 1. Dr. P. Purushothama raj, *Ground improvement techniques*, Laxmi Publications, 2nd edition, 2016. 2. Koerner, R. M, *Designing with Geo-synthetics*, Prentice Hall Inc. 2005. 3. G L Sivakumar Babu, *An introduction to soil reinforcement and geosynthetics*, Universities press, 1st edition, 2019. **REFERENCE BOOKS:** 1. Manfred R. Haussmann, *Engineering principles of ground modification*, Pearson Education Inc. New Delhi, 2008. 2. B.C. Punmia, A. K. Jain & A. K. Jain, *Soil Mechanics and Foundation Engineering*, Laksmi publications, 17th edition, 2017. 3. B. M. Das, *Principles of Geotechnical Engineering*, Cengage learning, 9th edition, 2017.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	1	-	1	2	1	-	2	-	-	-	-	1	-	2	2
CO 2	1	2	1	-	1	-	1	-	-	-	-	-	-	2	2
CO 3	2	2	2	1	1	-	1	-	-	-	-	2	-	2	2
CO 4	2	-	-	1	2	-	1	-	-	-	-	-	-	2	2
CO 5	2	2	2	2	1	-	1	-	-	-	-	1	-	2	2
CO 6	2	1	1	1	1	-	2	-	-	-	-	1	-	2	2

20CE41SC - COMPREHENSIVE DESIGN LABORATORY

(Civil Engineering)

Course Category	Skill Oriented	**Credits**	2
Course Type	Practical	**Lecture – Tutorial –Practical**	0-0-4
Prerequisite	Strength of Materials, EDRCS, STAAD Lab	**Sessional Evaluation**	40
		Semester End Exam. Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Carryout analysis and design of Bunker
	CO2	Analyze and design silos
	CO3	Carryout analysis and design of overhead water tank
	CO4	Analyze and design of intz tank
	CO5	Carryout analyze and design of transmission tower
	CO6	Analysis and design of telecommunication tower
Course Content	1. Analysis and design of Bunker (Square/ Rectangular/Circular). 2. Analysis and design of silos. 3. Analysis and design of overhead water tank. 4. Analysis and design of intz tank. 5. Analysis and design of transmission tower. 6. Analysis and design of telecommunication tower.	

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	-	3	-	-	3	2	1	-	3	3	2	3
CO2	3	3	3	-	3	-	-	3	2	1	-	3	3	2	3
CO3	3	3	3	-	3	-	-	3	2	1	-	3	3	2	3
CO4	3	3	3	-	3	-	-	3	2	1	-	3	3	2	3
CO5	3	3	3	-	3	-	-	3	2	1	-	3	3	2	3
CO6	3	3	3	-	3	-	-	3	2	1	-	3	3	2	3

N.B.K.R. INSTITUTE OF SCIENCE &TECHNOLOGY :: VIDYANAGAR

(AUTONOMOUS)

CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the batch admitted in the academic year 2020-2021)

IV YEAR OF FOUR YEAR B.TECH. DEGREE COURSE – II SEMESTER

S.NO.	Course Code	Course Title	Contact Hours/ Week			Credits	Evaluation									
							Sessional Test-I			Sessional Test-II			Total Sessional Marks (Max. 80)	Semester End Examination		Max. Total Marks
		THEORY	L	T	P		Test-I (2 hrs.)	Assignment-I	Max. Marks	Test-II (2 hrs.)	Assignment-II	Max Marks		Duration In Hours	Max. Marks	
		MAJOR PROJECT														
1	20CE42PR	Project Work and Internship	0	0	3	12	-	-	-	-	-	-	Continuous assessment and seminar (40 marks)	-	60	100
		TOTAL				**12**										

List of Open electives to be offered by CED:

S.No	Course Code	Course Name	S.No	Course Code	Course Name
1.	20CEXXO1	Remote Sensing	5.	20CEXXO5	Basics of Transportation Engineering
2.	20CEXXO2	Building Technology	6.	20CEXXO6	Water Resources Management
3.	20CEXXO3	Environmental Impact and Management	7.	20CEXXO7	Cost Effective Housing Techniques
4.	20CEXXO4	Disaster Management	8.	20CEXXO8	Environmental Pollution and Control

19CE42PJ - PROJECT

Course Category	Program Core	**Credits**	2
Course Type	Project	**Lecture - Tutorial - Practical**	0 - 0 - 0
Prerequisite	-	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Identify problem and demonstrate sound technical knowledge in selected problem.
	CO2	Formulate clear objectives and appropriate solution methodology.
	CO3	Identify various tools and techniques which have impact on the solution.
	CO4	Interpret data and meaningful conclusions and recommendations.
	CO5	Prepare technical report and presentation
	CO6	Demonstrate ability to work as an individual and in a team at every stage to produce a project work that exhibits a strong orientation for lifelong learning.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	1	2	2	1	1	-	2	2	1	-	-	1	-
CO2	3	3	3	2	2	1	1	1	2	2	2	1	-	1	1
CO3	3	3	3	2	3	1	2	2	3	2	3	2	2	1	2
CO4	3	2	2	2	2	3	2	1	2	1	-	1	1	1	-
CO5	2	1	1	1	2	2	2	3	3	3	1	-	1	1	-
CO6	-	1	2	3	1	-	-	1	3	1	2	3	-	-	3

N.B.K.R INSTITUTE OF SCIENCE &TECHNOLOGY: VIDYANAGAR

(Autonomous)

Department of Civil Engineering

(With effect from the batch admitted in the academic year 2020-2021)

&

B.Tech (Lateral entry scheme)

(For the batches admitted from the academic year 2021-22)

List of Open electives for 2019-20 admitted batch to be offered by CED:

S.No	Course Code	Course Name
1	20CEXXO1	Remote Sensing
2	20CEXXO2	Building Technology
3	20CEXXO3	Environmental Impact and Management
4	20CEXXO4	Disaster Management
5.	20CEXXO5	Basics of Transportation Engineering
6.	20CEXXO6	Water Resources Management
7.	20CEXXO7	Cost Effective Housing Techniques
8.	20CEXXO8	Environmental Pollution and Control

20CEXXO1 –REMOTE SENSING

Course Category	Open Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Understand remote sensing terms and concepts of the physical applications of such a system.
	CO2	Understand the different technical aspects of a remote sensing network with special emphasis on India remote sensing technology.
	CO3	Compare different types of data obtained from a remote sensing network with tools specifically designed for the purpose.
	CO4	Understand about various methods of corrections applied to data to ensure maximum credibility and accountability to the data collected.
	CO5	Apply remote sensing in agriculture and forest resources management.
	CO6	Apply remote sensing in Land use/Land cover and coastal zone management.

Course Content

UNIT – I

BASIC CONCEPTS OF REMOTE SENSING: Definition of Remote Sensing; History of Remote Sensing and Indian Space Program; Remote Sensing Process; Source of energy – Concept of energy, Electromagnetic radiation, Electromagnetic Spectrum; Interaction of electromagnetic radiation with atmosphere, Vegetation, soil and water – Absorption, Scattering, Refraction, Reflection; Spectral Reflectance Curve; Atmospheric windows; Advantages and Limitations of Remote Sensing.

UNIT – II

REMOTE SENSING SYSTEM: Introduction; Types of Remote Sensing - Classification Based on Platform, Energy Source, Imaging Media, Regions of Electromagnetic Spectrum, Number of Bands; Characteristics of Images; Orbital Characteristics of Satellite; Remote Sensing Satellites; Definitions – Swath, Nadir, path, row, Orbital calendar.

SENSORS CHARACTERISITICS: Sensor Resolutions- Spatial Resolution, Spectral Resolution, Radiometric Resolution, Temporal Resolution

UNIT – III

VISUAL IMAGE INTERPRETATION: Introduction; Information Extraction by Human and Computer; Remote Sensing Data Products; Image Interpretation; Elements of Visual Image Interpretation -Location, Size, Shape, Shadow, Tone, Colour, Texture, Pattern, Height and Depth, Site, Situation, and Association; Interpretation Keys

UNIT – IV

DIGITAL IMAGE PROCESSING: Introduction; Categorization of Image Processing; Image Processing Systems; Data Formats of Digital Image; Pre-

	processing - Radiometric Correction of Remotely Sensed Data, Geometric Correction of Remotely Sensed Data, Miscellaneous Pre-processing; Image Enhancement - Image Reduction, Image Magnification, Colour Compositing, Transect Extraction, Contrast Enhancement; Filtering; **UNIT – V** **APPLICATIONS OF REMOTE SENSING FOR EARTH RESOURCES MANAGEMENT – I :** Agriculture – crop production forecasting, agricultural drought assessment, precision farming; Forestry – Type and density mapping, forest cover change, forest status in India; **UNIT – VI** **APPLICATIONS OF REMOTE SENSING FOR EARTH RESOURCES MANAGEMENT – II:** Land cover/Land use mapping – Wastelands, Urban sprawl; Water Resources; Coastal Zone Management – Coastal zone ecosystem, Coastal regulation zone, integrated coastal zone management.
Textbooks and References	**TEXTBOOKS:** 1. Bhatta B, *Remote sensing and GIS*, Oxford University Press, 3rd edition, 2021. 2. George Joseph, C Jeganathan, *Fundamentals of remote sensing*, Universities Press, 3nd Edition, 2018. 3. TsurgCharg, *Introduction to Geographic information system*, Tata McGraw Hill Education Private Limited. 2nd edition, 2014. **REFERENCES:** 1. John R.Jensen, *Remote sensing of the environment – An earth resources perspective*, Pearson Education, 2nd edition, 2014. 2. Peter A Burragh and Rachael McDonnnell, *Principals of Geo physical Information system*, Oxford Publications 2nd edition, 2004. 3. A. Kumar, *Basics of remote sensing & GIS*, Laxmi publications, 3rd edition, 2009.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	2	-	-	-	-	-	-	-	1	-	-	-
CO2	-	2	2	-	-	-	1	-	-	2		2	1	1	1
CO3	2	-	1	-	1	-	1	-	-	-	-	-	2	1	1
CO4	-	1	-	1	-	-	-	-	-	1	-	-	2	1	1
CO5	2	-	1	-	1	-	-	-	-	-	-	1	2	1	1
CO6	2	1	-	2	-	-	2	-	-	2	-	1	2	1	1

20CEXXO2– BUILDING TECHNOLOGY

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 - 0
Prerequisite:	None	**Sessional Evaluation :** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100

Course Outcomes	CO1	Identify the factors to be considered in planning and construction of buildings and Plan a building following the bye-laws
	CO2	Understand various types of stones and methods of manufacturing of bricks and tiles.
	CO3	Identify the importance of ingredients of lime, cement and concrete.
	CO4	Provide scope of smart construction materials alternative for cement and also be able to understand various types of masonry construction.
	CO5	Evaluate various building components and their various types.
	CO6	Understand the techniques and importance of damp proofing and finishing works of the building.

Course Content

UNIT – I

Fundamentals requirements of buildings: Terms used in building drawing as per National Building Code (N.B.C) – Factors affecting in selection of site – Functional requirements of a residential building – Minimum size requirements as per N.B.C. – Standard sizes of Door – Windows and ventilators.

Basic building elements, Principles of planning. Relevant building by-laws (N.B.C) & Municipal, orientation of buildings – Provision of rainwater harvesting – provision for physically handicapped facilities.

UNIT – II

Stones: Properties of building stones – Relation to their structural requirements – Classification of stones.

Bricks: Composition of good brick earth, various types of bricks.

Tile: Characteristics of good tile and types of tiles.

UNIT – III

Lime: Various ingredients of lime –Constituents of lime stone – Classification of lime.

Cement: Portland cement – Chemical Composition – Hydration, setting and fineness of cement – Various types of cement and their properties – Various field and laboratory tests for Cement – Various ingredients of cement concrete and their importance – Various tests for concrete.

UNIT – IV

	Wood: Introduction– Classification of timber (I.S.: 399) – Characteristics of good timber– Defects in timber – Types and Uses of Ply-wood and Engineered wood. –Uses of materials like Aluminium, Gypsum, Glass and Bituminous materials. **Masonry:** Types of masonry – English and Flemish bonds – Cavity, partition and shear walls. **Smart Construction Materials:** Overview and use of Fly ash, Silica fume, Carbon fibers, Self-healing materials and Fiber reinforced plastics – Benefits of Nano-technology in construction industry. **UNIT – V** **Building Components:** Lintels – Arches – Vaults – Stair cases. **Floors:** Different types of floors – Concrete – Mosaic and Terrazzo floors. **Roofs:** Pitched roofs – Lean to roof – Coupled Roofs – Trussed roofs – King and Queen post Trusses – Flat roofs – R.C.C Roofs – Doors and windows. **UNIT – VI** **Building Finishes:** Damp Proofing and water proofing materials and uses. Plastering – Pointing – White washing and distempering. **Paints:** Constituents of paint – Types of paints –Painting of new/old wood – Varnish.
Textbooks and References	**TEXTBOOKS:** 1. S.C. Rangwala, *Engineering Materials*, Charotar publishing house, 43rd Edition, 2019. 2. B.C. Punmia, Arun K Jain, Ashok K Jain, *Building Construction*, Laxmi Publications, 11th Edition, 2016. 3. Dr. N. Kumara Swamy & A. KameswaraRao, *Building Planning and Drawing*, Charotar publishing house, 9th Edition, 2019. **REFERENCE BOOKS:** 1. S.K. Duggal, *Building Materials*, New age international, 4th Edition, 2012. 2. Sushil Kumar, *Building Construction*, Standard Publisher, 19th Edition 2020. 3. S. Mahaboob Basha, *Building Materials, Construction and Planning,* , Anuradha Publications, 2011.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	1	1	-	1	1	-	-	-	1	1	-	-	-
CO2	1	1	2	1	1	-	-	-	-	-	-	1	-	-	-
CO3	1	1	2	-	2	-	-	-	-	-	-	1	-	-	-
CO4	2	-	2	-	1	1	1	-	-	-	1	2	-	-	-
CO5	2	-	2	-	2	1	-	-	-	-	1	1	-	-	-
CO6	1	2	1	-	2	2	-	2	-	2	-	-	1	1	1

20CEXXO3 – ENVIRONMENTAL IMPACT AND MANAGEMENT

Course Category	Open Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Carry out scoping and screening of developmental projects for environmental and social assessments.
	CO2	Explain different methodologies for environmental impact prediction and assessment.
	CO3	Explain impact of development activities and land use.
	CO4	Plan Environmental impact assessments and environmental management plans.
	CO5	Evaluate mitigation and impacts
	CO6	Know the problems related to environment due to industries.

Course Content

UNIT – I

INTRODUCTION TO EIA: Environmental ethics – Need of EIA for Engineering projects – Classification of environmental parameters – Purposes of EIA – Goals of EIA.

UNIT – II

EIA METHODOLOGIES: Introduction – Criteria for the selection of EIA methodology – Categorization of methodologies – Matrix methods – Network method – Environmental Media quality index method – Cost / benefit analysis.

UNIT – III

IMPACT OF DEVELOPMENTAL ACTIVITIES AND LAND USE: Introduction and methodology for the assessment of soil and ground water – delineation of study area – identification of activities – Procurement of relevant soil quality – Impact prediction – Assessment of impacts.

UNIT – IV

METHODOLOGY FOR THE ASSESMENT OF IMPACTS OF SOME ATTRIBUTES: Surface water – Air and biological environment – Methodology and generalized approach for the assessment of impact of development activities on vegetation and wildlife – Environmental impact of deforestation and incorporation of mitigation measures.

UNIT – V

MITIGATION AND IMPACT ASSESMENT: EIA process and mitigation, elements of mitigation, approaches to mitigation, typical mitigation measures.

	UNIT – VI **CASE STUDIES:** Environmental impact of large scale water resources projects – environmental impact of thermal and nuclear power plants and on oil refineries.
Textbooks and References	**TEXTBOOKS:** 1. Anji reddy Maredy, *Environmental Impact Assessment*, Butterworth-Heinemann, 2017. 2. R.R. Barthwal, *Environmental Impact Assessment* New Age International Private Limited; 2nd edition, 2012. 3. Shukla, S.K. and Srivastava, P.R., *Concepts in Environmental Impact Analysis*, Commonwealth Publishers, 1992. **REFERENCES:** 1. Dr. N.S. Raman, Dr. Y.R.M Rao, Environmental Impact Assessment, Laxmi Publications Pvt. Ltd., 2017. 2. R.L Canter, *Environmental Impact Assessment*, McGraw Hill Inc., 1977. 3. John G. Rau and David C Hooten, *Environmental Impact Analysis Handbook*, McGraw Hill higher education, 1980.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	1	-	2	-	1	-	-	1	-	-	-
CO2	2	1	-	-	-	2	1	1	1	-	-	-	-	-	-
CO3	1	1	-	-	-	2	2	1	-	2	-	-	-	-	-
CO4	2	1	2	1	2	1	-	2	-	-	-	-	-	-	-
CO5	1	-	-	-	-	-	2	1	2	-	1	1	-	-	-
CO6	2	2	-	1	-	-	2	-	2	-	1	2	-	-	-

20CEXXO4 –DISASTER MANAGEMENT

Course Category:	Open Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Hazards and disasters and different approaches to disaster and their mitigation.
	CO2	Types of disasters, exogenous disasters and their effects.
	CO3	Endogenous disasters and their effects.
	CO4	Man induced disasters and their effects.
	CO5	Disaster management through engineering applications.
	CO6	Case study on disasters in national and international level.
Course Content		**UNIT-I** **ENVIRONMENTAL HAZARDS & DISASTERS:** Meaning of Environmental hazards – Environmental Disasters Environmental stress – Concept of Environmental Hazards – Different approaches and relation with human Ecology - Landscape Approach –Ecosystem Approach – Perception approach – Human ecology & its application in geographical researches. **UNIT –II** **TYPES OF ENVIRONMENTAL HAZARDS & DISASTERS:** Natural hazards and Disasters – Man induced hazards & Disasters – Natural Hazards – Planetary Hazards/ Disasters – Extra Planetary Hazards/ disasters Planetary Hazards – Endogenous Hazards – Exogenous Hazards Endogenous Hazards. Volcanic Eruption – Earthquakes – Landslides – Volcanic Hazards/ Disasters. Causes and distribution of Volcanoes – Environmental impacts of volcanic eruptions – Earthquake Hazards/ Disasters – Causes of Earthquakes – Distribution of earthquakes – Hazardous effects of earthquakes – Human adjustment – Perception & mitigation of earthquake. **UNIT –III** **EXOGENOUS HAZARDS AND DISASTERS**: Infrequent events – Cumulative atmospheric hazards/ disasters Infrequent events – Cyclones – Lightning – Hailstorms. **CYCLONES:** Tropical cyclones & Local storms – Destruction by tropical cyclones & local storms – Causes – Distribution human adjustment – Perception & mitigation)Cumulative atmospheric hazards and disasters – Floods – Droughts – Cold waves – Heat waves. Floods: – Causes of floods –

	Flood control measures (Human adjustment – Perception & mitigation) – Droughts: – Impacts of droughts – Drought control measures – Extra Planetary Hazards/ Disasters. **UNIT –IV** **SOIL EROSION**: Mechanics & forms of Soil Erosion – Factors and causes of Soil Erosion – Conservation measures of Soil Erosion. Chemical hazards/ disasters – Release of toxic chemicals – nuclear explosion – Sedimentation processes. Sedimentation processes: – Global Sedimentation problems – Regional Sedimentation problems – Sedimentation and Environmental problems – Corrective measures of Erosion and Sedimentation. Biological hazards/ disasters: – Population Explosion. **UNIT –V** **EMERGING APPROACHES IN DISASTER MANAGEMENT:** Three Stages 1. Pre- disaster stage (preparedness). 2. Emergency Stage. 3. Post Disaster stage-Rehabilitation. **UNIT – VI** **CASE STUDIES:** 1. Bhuj Earthquake – Gujarat 2001. 2. Indian Ocean earthquake and Tsunami, 2004. 3. Chernobyl disaster, Ukraine 1986. 4. Bhopal Gas tragedy, 1984. 5. Kerala Floods, 2018.

Textbooks and References	**TEXTBOOKS:** 1. Tushar Bhattacharya, *Disaster Science and Management*, McGraw hill Publications, 1st Edition, 2017. 2. Donald Hyndman and David Hyndman, *Natural Hazards and Disasters*, Brooks/Cole, 5th Edition, 2016. 3. Rajib Shah, RR Krishna Murthy, *Disaster Management: Global Problems and Local Solutions*, CRC Press, 1st Edition, 2009. **REFERENCES:** 1. R B Singh, *Natural Hazards and Disaster Management: Vulnerability and Mitigation*, Rawat Publications, Reprint edition, 2006. 2. Pardeep and Sahni, *Disaster Mitigation: Experiences and Reflections*, Prentice Hall India Learning Private Limited, New title edition, 2001. 3. H.K. Gupta, *Disaster Management*, Universities Press, India, 2003.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	2	-	1	-	-	1	-	-	-
CO2	1	-	-	-	-	2	1	1	1	-	-	-	1	-	-
CO3	-	-	-	-	-	2	2	1	-	2	-	-	1	1	-
CO4	1	-	-	-	-	1	-	2	-	-	-	-	-	1	-
CO5	1	1	-	-	-	-	2	1	2	-	1	1	-	1	-
CO6	-	-	-	-	-	-	2	-	2	-	1	2	-	1	-

20CEXXO5– BASICS OF TRANSPORTATION ENGINEERING

Course Category	Open Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Understand various types of roads and road patterns.
	CO2	Understand concepts of highway geometric design.
	CO3	Understand traffic signs and markings.
	CO4	Understand basics permanent way and its components.
	CO5	Understand basics of air transportation.
	CO6	Understand components of airport.

Course Content

UNIT – I

IMPORTANCE OF TRANSPORTATION modes of transportation, characteristics of road transport, methods of classification of roads, road patterns. Requirements of ideal alignment, factors controlling alignment, master plan and its phasing. Problems on saturating system concept.

UNIT II

HIGHWAY GEOMETRIC DESIGN: design controls and criteria, highway cross- section elements- pavement surface characteristics, camber, width of pavement, kerbs, road margins, right of way, formation width, site distance- stopping sight distance, PIEV theory, analysis of SSD, over taking sight distance and its analysis. Design of a horizontal alignment- horizontal curves- effect of centrifugal force at horizontal curve, derivation of super elevation, extra widening

UNIT III

TRAFFIC SIGNS: Importance-Need for international standardization-Types of traffic signs-Warning signs-Prohibitory signs-Mandatory signs-Informatory signs-Indication signs-Direction signs, advance direction signs and place identification signs-Location height and maintenance of traffic signs

ROAD MARKINGS: Function-Types of road markings, material and color,

	centre lines, traffic lane lines, pedestrian crossings. **UNIT IV** **BASICS OF RAILWAY ENGINEERING:** Permanent way and its components, gauges, types of rails, functions of rails, types of sleepers, functions of sleepers, ballast, types of ballast, List of classification of stations, yards- types only. **UNIT V** **BASICS OF AIRPORT ENGINEERING:** Introduction to air transportation, characteristics of air transport, components of airports and functions- terminal area and landing area, parts of aircraft, classification of airports, different kinds of flights, factors affecting site selection for an airport, Airport terminal building, patterns of parking, aprons, hangers. **UNIT VI** **BASICS OF HARBOUR ENGINEERING:** Water transportation- Importance**,** types-inland and ocean transportation**,** Tides, Wind and waves – Currents, uses and effects of tides at harbor, Classification of harbour's and ports, Site selection, requirements of good port, Loading and unloading facilities of harbour-Quays-wharves- piers- dolphins- Jetties – Fenders – Aprons, Transit sheds - Ware houses , Breakwaters(List of break waters only).
Textbooks and References	**TEXTBOOKS:** 1. Khanna, S.K. Justo C.E.G & veeraraghavulu, "*Highway Engineering*" Nem chand&bros, 10th edition, 2018. 2. S.C.Saxena & S.P.Arora, "*A Text Book of Railway Engineering*" Dhanpat Rai publications, 7th edition, 2015. 3. S.K.Khanna, M.G.Arora & S.S.Jain, "*Airport Planning and Design*" Nem chad brothers, 2nd edition., 1999. 4. R. Srinivasan, "*Docks and Harbour Engineering*" Charotar publishing hose Pvt. Ltd, 29th edition, 2018. **REFERENCE BOOKS:** 1. C.Venkatramaiah "*Transportation Engineering Vol I & II*" Universities Press (India) Private Ltd, 1st edition, 2016. 2. Dr. L.R.Kadiyali, "*Principles and Practice of Highway Engineering*" Khanna publishers, 7th edition, 2019. 3. S.C.Rangwala , *A Text Book of Railway Engineering* , Chartor

	publishing house, 26th edition, 2016.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	2	3	1	-	1	2	1	-	-	-	-
CO2	3	2	2	3	2	-	1	-	2	2	1	1	1	1	1
CO3	1	3	-	1	1	-	-	-	1	2	1	2	-	1	1
CO4	1	-	2	2	3	-	1	-	1	1	2	1	-	-	-
CO5	2	3	2	1	2	-	1	2	-	3	2	1	-	-	-
CO6	1	-	2	1	1	1	1	1	1	2	1	1	-	-	-

20CEXXO6 –WATER RESOURCES MANAGEMENT

Course Category	Open Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0- 0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Understand the nature of groundwater and its role in the water cycle.
	CO2	Apply the concept of Darcy's law for estimating discharge and understand their characteristics and classifications.
	CO3	Familiar with the technology of water wells and groundwater monitoring.
	CO4	Familiar with the technology to investigation the surface and subsurface water.
	CO5	Understand the importance of artificial recharge and employ the artificial ground water recharge techniques.
	CO6	Identify the saline water intrusion locations.

Course Content

UNIT – I

INTRODUCTION: Ground water utilization and historical background – Ground water in hydrologic cycle. Ground water budget and ground water level fluctuations and environmental influence.

UNIT – II

OCCURRENCE AND MOVEMENT OF GROUND WATER: Origin & age of ground water – Rock properties affecting groundwater – Groundwater column, zones of aeration & saturation, aquifers and their characteristics and classification –Groundwater basins & springs – Darcy's Law – Permeability & its determination –Dupuit's assumptions.

UNIT – III

ADVANCED WELL HYDRAULICS: Steady and unsteady uniform radial flow to a well in a confined, unconfined and leaky aquifer – Well flow near aquifer boundaries for special conditions, partially penetrating.

UNIT – IV

SURFACE SUB-SURFACE INVESTIGATION OF GROUND WATER: Geological – Geophysical Exploration – Remote Sensing – Electric Resistivity –Seismic refraction based methods for surface investigation of ground water – Test drilling & ground water level measurement – Sub-surface ground water investigation through geophysical – Resistivity.

UNIT – V

ARTIFICIAL GROUND WATER RECHARGE: Concept and methods of artificial ground water recharge – Recharge mounds and induced recharge – Waste water recharge for reuse – Water spreading.

	UNIT – VI **SALINE WATER INTRUSION IN AQUIFERS:** Ghyben-Herzberg relation between fresh & saline waters – Shape & structure of the fresh and saline water interface – Upcoming of saline water – Fresh-saline water relations on oceanic islands – Seawater intrusion in karst terrains – Saline water intrusion control.
Textbooks and References	**TEXTBOOKS:** 1. David K. Todd, Larry W. Mays,*Groundwater hydrology*, Wiley India Pvt Ltd., 3rd edition, 2011. 2. H. M. Raghunath, *Ground Water*, Newage publishers, 3rd edition, 2007. 3. R. N. Saxena and D.C. Gupta, *Elements of Hydrology and Groundwater*, PHI Learning, 3rd edition, 2017. **REFERENCE BOOKS:** 1. K.Subramanya, *Engineering Hydrology*, Tata McGraw Hill Publishing Company, 4th edition, 2019. 2. K. Karanth, Ground Water Assessment, Development and Management, McGraw Hill Education, 2nd edition, 2017. 3. Bhagu R. Chahar, *Groundwater Hydrology*, McGraw Hill Education, 1st edition, 2017.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	1	2	-	-	2	-	-	-	-	1	-	-	-
CO2	-	3	-	-	-	-	-	-	-	1	-	-	-	-	-
CO3	-	-	2	-	-	-	1	-	-	2	-	2	-	1	-
CO4	2	-	-	-	1	-	-	-	-	-	-	-	-	1	-
CO5	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-
CO6	-	2	-	-	1	-	2	-	-	2	-	1	-	1	-

20CEXXO7 – COST EFFECTIVE HOUSING TECHNIQUES

Course Category	Open elective	**Credits**	3
Course Type	Theory	**Lecture-Tutorial-Practical**	3-0-0
Prerequisite	None	**Sessional Evaluation**	40
		External Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Acquire basic knowledge in housing.
	CO2	Acquire basic knowledge in housing programmes.
	CO3	Able to design, evaluation, construction and financing of housing projects.
	CO4	Familiar with the innovative construction materials.
	CO5	Be in position to adopt the suitable techniques in rural areas.
	CO6	Be in position to adopt the suitable techniques in disaster prone areas by using locally available materials.

Course Content

UNIT – I

INTRODUCTION TO HOUSING: Definition of Basic Terms: House – Home – Household – Apartments – Multi storied Buildings – Special Buildings – Objectives and strategies of national housing policies including slum housing policy – Principle of sustainable housing – Integrated approach on arriving holding capacity and density norms – All basic infrastructure consideration – Institutions for housing at national – State and Local levels.

UNIT – II

HOUSING PROGRAMMES: Basic Concepts – Contents and standards for housing programmes – Sites and services – Neighborhoods – Plotted land development programs – Open development plots – Apartments – Gated communities – Townships – Rental housing – Co-operative housing – Slum housing programmes – Slum improvement – Slum redevelopment relocation.

Use of GIS and MIS in Slum Housing Projects – Role of public housing agencies –Private sector in supply – Quality – Infrastructure and pricing – Role of Non-Government Organizations in slum housing.

UNIT – III

DEVELOPMENT AND ADOPTION OF LOWCOST HOUSINGTECHNOLOGY: Introduction – Adoption of innovative cost

	effective construction techniques – Adoption of precast elements – Adopting of total prefabrication of mass housing in India – General remarks on pre-cast rooting/flooring systems – Economical wall system – Single brick thick loading bearing wall – 19cm thick load bearing masonry walls – Half brick thick load bearing wall – Fly ash gypsum thick for masonry – Stone block masonry – Adoption of precast R.C. plank and join system for roof/floor in the building. **UNIT – IV** **ALTERNATIVE BUILDING MATERIALS FOR LOW COST HOUSING AND INFRASTRUCTURE SERVICES:** Introduction – Substitute for scarce materials – Ferrocement – Gypsum boards – Timber substitutions – Industrial wastes – Agricultural wastes – Low cost infrastructure services: Introduce – Present status – Technological options – Low cost sanitation – Domestic wall – Water supply – Energy. **UNIT – V** **RURAL HOUSING:** Introduction traditional practice of rural housing continuous – Mud housing technology – Mud Roofs – Characteristics of mud – Fire treatment for thatch roof – Soil stabilization – Rural housing programs. **UNIT – VI** **HOUSING IN DISASTER PRONE AREAS:** Introduction – Earthquake – Damages to houses – Traditional prone areas – Type of damages and railways of Non-engineered buildings – Repair and restore action of earthquake damaged non -engineered buildings recommendations for future constructions – Requirements of structural safety of thin pre-cost roofing units against earthquake forces – Status of R& D in earthquake strengthening measures – Floods – Cyclone – Future safety.
Textbooks & References	**TEXTBOOKS:** 3. G. C. Mathur, Low *Cost Housing in Developing Countries*, Oxford & IBH Publishing Co. Pvt. Ltd., 1993. 4. A. K. Lal, *Hand Book of Low Cost Housing*, New Age International Publishers, 1995. 5. Kiado- Rudhai. G, *Light weight concrete,* Publishing home of Hungarian Academy of Sciences, 1963. **REFERENCES:** 1. A.G. Madhava Rao, D.S. Rama Chandra Murthy & G. Annamalai, *Modern Trends In Housing In Developing Countries,* 1984. 2. Neville A.M. Pitman, *Properties of Concrete,* Publishing home of

	Hungarian Academy of Sciences, 1963.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	2	2	1	2	1	2	2	2	-	-	1
CO2	-	2	1	1	2	2	1	3	-	2	2	3	-	-	1
CO3	1	2	2	1	2	2	2	2	-	2	2	2	1	1	1
CO4	-	2	1	1	2	2	1	3	-	2	2	2	-	1	2
CO5	-	3	2	2	2	3	2	2	-	2	2	2	-	1	-
CO6	-	2	1	1	2	3	2	2	1	2	2	3	-	1	-

20CEXXO8 - ENVIRONMENTAL POLLUTION AND CONTROL

Course Category	Open Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial – Practical**	3-0-0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Understand the nature, significance and effects of pollution.
	CO2	Understand the effects of air pollution and various controlling parameters.
	CO3	Understand the effects of water pollution and various controlling parameters.
	CO4	Understand the various methods for solid and hazardous waste disposal.
	CO5	Understand the environmental legislation acts for industrial pollution control.
	CO6	Understanding the characteristics and effects of noise pollution.

Course Content

UNIT – I

THE NATURE OF POLLUTION:
Air pollution and its effects on living and non-living things. Water pollution and its effects on living and non-living things, solid wastes and land pollution.

UNIT – II

AIR POLLUTION CONTROL:
Influence of metereological parameters, physical principles, dry systems, fabric collectors, wet scrubbers, electrostatic precipitations, fume incineration tall sacks. Physical separation systems gravity setting chambers, inertial separators, cyclones, fabric collectors, wet scrubbers, electrostatic precipitators, fume incineration.

UNIT – III

WATER POLLUTION CONTROL:
Routine methods for removal of suspended and dissolved impurities, advance methods like chemical oxidation, membrane separation process, and biological process for removal of phosphorous and nitrogen. Land treatment, eutrophication control.

UNIT – IV

SOLD WASTE MANAGEMENT:

	Quantities and characterizations of municipal solid wastes, recovery of materials and energy, sanitary land filling. Disposal of hazardous wastes. **UNIT – V** **ENVIRONMENTAL LEGISLATION AND INDUSTRIAL POLLUTION CONTROL:** Legislation conserving water pollution air pollution and hazards wastes. Caste studies of pollution control in cement industries, paper, & pulp industries, brewing. **UNIT – VI** **NOISE POLLUTION CONTROL:** Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; Sources of Noise, typical range of noise levels, types of noise pollution, Characteristics of noise, Effects of noise on the human health, Reactions to noise, psychological effects.
Textbooks and Reference books	**TEXT BOOKS:** 1. CS Rao, *Environmental Pollution Control Engineering*, New Age International Private Limited; 4th edition, October 2021. 2. P. R. Trivedi, *Environmental Pollution and Control*, APH Publishing Corporation, December 2004. 3. J. Jeffrey Peirce, P Aarne Vesilind, Ruth Weiner, *Environmental Pollution and Control*, Butterworth-Heinemann publishers, 4th edition , January 1998. **REFERENCE BOOKS:** 1. Howard Peavy, Donald Rowe, George Tchobanoglous, *Environmental Engineering*, McGraw Hill Education publishers, First edition, July 2017 2. S.C. Bhatia, *Noise Pollution and its control*, Atlantic Publication, 2007. 3. P.A Vesilind, J.J. Peirce, *Environmental pollution and control*, Butterworth-Heinemann publishers, 4th edition, November 1997.

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	-	-	-	2	1	-	-	-	-	1	-	1	-
CO2	2	2	1	1	1	2	1	-	-	-	-	2	-	2	1
CO3	2	2	1	1	2	2	1	-	-	-	-	2	-	2	1
CO4	1	2	1	1	2	2	1	-	-	-	-	2	-	2	1
CO5	2	2	1	1	2	2	1	-	-	-	-	2	-	2	1
CO6	-	1	-	-	1	2	1	-	-	-	-	2	-	2	1

List of MOOC'S Platforms

1. http://nptel.ac.in
2. https://swayam.gov.in/