NEW HORIZON COLLEGE OF ENGINEERING

Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade, Accredited by NBA

The Trust is a Recipient of Prestigious Rajyotsava State Award 2012 Conferred by the Government of Karnataka
Awarded Outstanding Technical Education Institute in Karnataka-2016
Ring Road, Bellandur Post, Near Marathalli, Bangalore -560 103, INDIA

Academic Year 2022-23

Department of Civil Engineering

Fifth and Sixth Semester

Scheme and Syllabus

VISION

To contribute to society by imparting quality education encompassing Technical, Managerial and Entrepreneurial skills

MISSION

- To create an environment wherein Faculty and Students engage in cutting edge research.
- To undertake Collaborative projects in order to develop a partnership between Institute and Industry
- To motivate Entrepreneurship and to imbibe Professional Ethics
- To promote participation in activities which help in holistic development of students.

Program Education objectives (PEOs)

PEO1	Graduates will be able contribute to the development of sustainable infrastructure
PEO2	Graduates as part of an organization or as Entrepreneurs, will continue to learn to hone-up evolving technologies
PEO3	Graduates will be professional Civil Engineers with ethical and societal responsibility
PEO4	Graduates will be able to work as a team in intra and interdisciplinary endeavors for development of new ideas and products for the betterment of society

Program Specific objectives (PSOs)

PSO1	Enhancing the employability skills by making the students find innovative solutions for challenges and problems in various domains of Civil Engineering
PSO2	Inculcating in students tech suaveness to deal with practical aspects of Civil Engineering

PEO to Mission Statement Mapping

Mission Statements	PEO1	PEO2	PEO3	PEO4
To create an environment wherein Faculty and Students engage in cutting edge research.	2	3	2	3
To undertake Collaborative projects in order to develop a partnership between Institute and Industry.	2	2	2	3
To motivate Entrepreneurship and to imbibe Professional Ethics.	2	3	3	3
To promote participation in activities which help in holistic development of students.	2	3	2	2

Correlation: 3- High, 2-Medium, 1-Low

Program Outcomes (PO) with Graduate Attributes

	Graduate	Program Outcomes (POs)
1	Engineering Knowledge	**PO1:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex civil engineering problems.
2	Problem analysis	**PO2:** Identity, formulate, research literature and analyze complex civil engineering problems reaching substantiated conclusion using first principles of mathematics and engineering sciences.
3	Design/ Development of Solutions	**PO3:** The ability to analyse complexities of various civil engineering elements and design similar such elements.
4	Investigation of Problem	**PO4:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information related to civil engineering problems to provide valid conclusions.
5	Modern Tool usage	**PO5:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex civil engineering activities with an understanding of the limitations.
6	The Engineer and society	**PO6:** Apply reasoning based on the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the civil engineering professional practice.
7	Environment and sustainability	**PO7:** Understand the impact of the civil engineering solutions in societal and environmental contexts and demonstrate the knowledge of need for sustainable development.
8	Ethics	**PO8:** Apply ethical principles, commit to professional ethics, own up responsibilities and abide by the norms of the civil engineering practice.
9	Individual & team work	**PO9:** As a civil engineer function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	**PO10:** Communicate effectively on complex civil 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	**PO11:** Demonstrate knowledge and understanding of the civil engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments as a civil engineer.
12	Lifelong learning	**PO12:** Recognize the need for, willingness to prepare for and to exhibit pro-activeness to engage in independent and lifelong learning in the broadest context of technological change with respect to civil engineering field

Mapping of POs to PEOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	3	3	3	3	2	3	3	2	2	2	2	3
PEO2	3	3	3	3	3	3	2	3	2	2	3	3
PEO3	3	3	3	3	2	3	2	3	2	3	2	3
PEO4	3	3	3	3	2	3	2	3	3	3	3	3

Scheme of V Semester B.E Program

Sl. No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20CIV51	Hydrology & Irrigation Engineering	CIV	3	0	0	0	3	3	50	50	100
2	20CIV52	Design of RCC Structural Elements	CIV	2	1	0	0	3	4	50	50	100
3	20CIV53	Analysis of Indeterminate Structures	CIV	2	1	0	0	3	4	50	50	100
4	20CIV54	Basics of Geotechnical Engineering	CIV	2	1	0	0	3	4	50	50	100
5	20CIV55	Highway Engineering	CIV	3	0	0	0	3	3	50	50	100
6	20CIV56*	Professional Elective-I	CIV	3	0	0	0	3	3	50	50	100
7	20CIV57	Concrete Technology Lab	CIV	0	0	1.5	0	1.5	3	25	25	50
8	20CIV58	Basics of Geotechnical Engineering Lab	CIV	0	0	1.5	0	1.5	3	25	25	50
9	20CIV59	Mini Project – II (Analysis of Indeterminate Structures using STAAD PRO)	CIV	0	0	2	0	2	4	25	25	50
	Total							**23**	**31**	**375**	**375**	**750**

Professional Elective -I	
Course Code	**Course**
20CIV561	Advanced Surveying
20CIV562	Urban Transport Planning
20CIV563	Open Channel Hydraulics
20CIV564	Advanced Concrete Technology

Scheme of VI Semester B.E Program

Sl. No	Course Code	Course	BOS		Credit Distribution			Overall Credits	Contact Hours	Marks		
										CIE	SEE	Total
				L	T	P	S					
1	20CIV61	Environmental Engineering	CIV	3	0	0	0	3	3	50	50	100
2	20CIV62	Design and Detailing of RC Structural Element	CIV	2	1	0	0	3	4	50	50	100
3	20CIV63	Applied Geotechnical Engineering	CIV	2	1	0	0	3	4	50	50	100
4	20CIV64*	Professional Elective-II	CIV	3	0	0	0	3	3	50	50	100
5	20CIV65*	Professional Elective-III	CIV	3	0	0	0	3	3	50	50	100
6	20NHOPXX	Open Elective-I		3	0	0	0	3	3	50	50	100
7	20CIV66	Environmental Engineering-Lab	CIV	0	0	1.5	0	1.5	3	25	25	50
8	20CIV67	Mini project – III (Analysis & Design of RC Structural Elements Lab)	CIV	0	0	1.5	0	1.5	3	25	25	50
9	20CIV68	Mini project – IV (Extensive Survey Project)	CIV	0	0	2	0	2	4	25	25	50
	Total							**23**	**30**	**375**	**375**	**750**

Professional Elective -II		**Professional Elective -III**	
Course code	**Course**	**Course code**	**Course**
20CIV641	Traffic Engineering	**20CIV651**	Structural Dynamics
20CIV642	Alternate Building Material & technology	**20CIV652**	Pre-Fabricated Structures
20CIV643	Ground Improvement Technique	**20CIV653**	Design of Pre Stressed Concrete Structures
20CIV644	Mechanization in Construction	**20CIV654**	Pavement Material & Construction

Open Elective -I	
Course Code	**Course**
20NHOP601	Big Data Analytics using HP Vertica-1
20NHOP602	VM Ware Virtualization Essentials-1
20NHOP604	Big Data Analytics using HP Vertica-2
20NHOP605	VM Ware Virtualization Essentials-2
20NHOP607	SAP
20NHOP608	Schneider-Industrial Automation
20NHOP609	CISCO-Routing and Switching-1
20NHOP610	Data Analytics
20NHOP611	Machine Learning
20NHOP612	CISCO-Routing and switching - 2
20NHOP613	IIOT – Embedded System
20NHOP614	Block Chain
20NHOP615	Product Life Cycle Management
20NHOP617A	Network security and Cryptography
20NHOP618A	Physical Design
20NHOP619A	AI Data Analysis with Python

FIFTH SEMESTER

(SYLLABUS)

HYDROLOGY AND IRRIGATION ENGINEERING

Course Code: 20CIV51 **Credits: 03**

L: T: P: S : 3:0:0:0 **CIE Mark: 50**

Exam Hours: 3 Hours **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Apply Engineering Knowledge to understand various components of hydrological cycle and compute the missing rainfall data.
CO2	Estimate the evaporation, evapotranspiration and infiltration.
CO3	Get acquainted with the concepts of hydrographs, floods and its computation.
CO4	Understand the different methods of irrigation, soil-water-crop relationship and frequency of irrigation for sustainable development.
CO5	Investigate different methods to improve duty of water, assessment of irrigation water and irrigation efficiencies.
CO6	Analyze the concept of canal alignment & design.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Introduction to Hydrology**: Introduction, Hydrologic cycle - Horton's representation, Water budget equation (including numerical problems). *Precipitation:* Forms, Types, Measurement using Simon's gauge, Syphon gauge & Tipped bucket type rain gauge. **Computation of Rainfall:** Selection of rain gauge station, Adequacy of rain gauges (including numerical problems), Methods of computing average rainfall (including numerical problems), Interpolation of missing rainfall data (including numerical problems), Double mass curve method, Hyetograph and mass curve of rainfall.	09	CO1
2	**Evaporation**: Definition, Factors affecting evaporation, Measurement using ISI standard pan, Estimation using Meyer's and Rohwer's equation (including numerical problems), Methods to reduce evaporation losses. **Evapotranspiration**: Definition, Factors affecting evapotranspitation, Measurement using Lysimeter and field plots, Estimation by Blaney criddle method (including numerical problems). *Infiltration:* Definition, Factors affecting infiltration, Measurement using double ring infiltrometer, Infiltration indices (including numerical problems), Horton's equation of infiltration.	09	CO2
3	**Hydrographs**: Definition, Components of hydrographs, Base flow separation, Unit hydrograph – its derivation from simple storm hydrograph, Limitations and uses. Numerical problems related to derivation of T-hour unit hydrograph by superposition method and S-Curve method. **Estimation of flood**: Definition of flood, factors affecting flood, Estimation of floods by using envelope curves, empirical formulae and rational method (including numerical problems).	09	CO3
4	**Introduction to irrigation** Introduction, Need for irrigation, Advantages and disadvantages of irrigation, Types of irrigation system, Methods of irrigation. **Soil-water-crop relationship:** Introduction, Soil profile, Physical properties of soil, Functions of irrigation soils, Maintaining soil fertility, Soil-water-plant relationship and soil moisture - irrigation relationship, Frequency of irrigation (including numerical problems).	09	CO4
5	**Water Requirement of Crops:** Crop seasons of India, Definition of Base period, Crop period, Delta and Duty (including numerical problems), Factors affecting duty, Methods to improving duty of water, Consumptive use, Assessment of irrigation water, Irrigation efficiencies. **Canals**: Definition, Types of canals, Alignment of canals, Design of canals by Kennedy's and Lacey's methods – Numerical problems.	09	CO5 & CO6

TEXT BOOKS:

1. Subramanya. K., "Engineering Hydrology", Tata McGraw Hill, 4th Edition, New Delhi, 2013.
2. Punmia B.C, Pande B.B Lal, Ashok Kumar Jain and Arun Kumar Jain, "Irrigation & Water Power Engineering", Laxmi Publications (P) Ltd., 16th Edition, New Delhi, 2019.
3. Jayarami Reddy., "A Text Book of Hydrology", Laksmi Publications (P) Ltd., 3rd Edition, New Delhi, 2016.

REFERENCE BOOKS:

1. P.N.Modi, "Irrigation, water Resources and water power Engineering", Standard book house, 9th Edition, New Delhi, 2014.
2. R.K.Sharma & T.K.Sharma, "Irrigation Engineering: Including Hydrology", S Chand & Co Ltd., Revised Edition, New Delhi, 2008.
3. S. K. Garg, "Irrigation Engineering and Hydraulic structures", Khanna Publication, 1st Edition, New Delhi, 2006.

CIE/ SEE - Continuous Internal Evaluation/Semester End Examination-(50 Marks) / (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	25	15	10	50
Remember	5	-	-	5
Understand	5	5	5	15
Apply	10	5	5	20
Analyze	5	5	-	10
Evaluate	-	-	-	-
Create	-	-	-	

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	5	5	10	10
Understand	15	15	30	30
Apply	20	20	40	40
Analyze	10	10	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

DESIGN OF RC STRUCTURAL ELEMENTS

Course Code: 20CIV52 **Credits: 03**
L: T: P: S: 2:1:0:0 **CIE Mark: 50**
Exam Hours: 3 Hours **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the philosophy and principle of working stress method of RCC design.
CO2	Understand the philosophy and principle of limit state method RCC design.
CO3	Analyze rectangular and flanged beam sections for flexure, shear and torsion and check for serviceability conditions.
CO4	Design rectangular and flanged beam sections as per IS 456:2000.
CO5	Design slabs (one way and two way slabs for various boundary conditions) and staircases.
CO6	Design column and footing.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Introduction To Working Stress Method:** Relationship between Structural Analysis and Design. Introduction to working stress method, Modular Ratio and Factor of Safety and evaluation of design constants for working stress method. **Introduction To Limit State Method:** Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, Difference between Working stress and Limit State Method of design concept of balanced section, under reinforced and over reinforced section.	9	CO1 & CO2
2	**Limit State Analysis of Beams:** Analysis of singly reinforced and doubly reinforced for flexure and shear. Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. **Limit State Analysis of Beams:** Analysis of flanged beams for flexure and shear. Side face reinforcement, slender limits of beams for stability. Importance of bond, anchorage length and lap length.	9	CO3
3	**Limit State Design of Beams:** Design of singly and doubly reinforced beams as per IS-456. **Limit State Design of Beams:** Design of flanged beams as per IS-456	9	CO4
4	**Limit State Design of Slabs:** Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. **Limit State Design of Stairs:** Design of dog legged and open well staircases.	9	CO5
5	**Limit State Design of Columns:** Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments. **Limit State Deign of Footings:** Design concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment	9	CO6

TEXT BOOKS

1. Unnikrishna Pillai & Devadas Menon."Reinforced Concrete Design", TMH Education Private Limited, NewDelhi. ISBN 10: 007014110X / ISBN 13: 9780070141100, 3rd edition -2017.
2. P.C.Varghese. "Limit state design of reinforced concrete", PHI Learning Private Limited, New Delhi.2008, ISBN-10: 8120320395 ISBN-13:978-8120320390, 2nd edition-2016,.

3. S.S.Bhavikatti. "Design of RCC Structural Elements", New Age International, New Delhi. 2017, ISBNNo.: 9788122440515,2017 edition,

REFERENCE BOOKS

1. Fundamentals of Reinforced concrete Design, 3rdEdition, 2006, ISBN-10: 812033048X, PHI Learning Pvt Ltd.
2. Reinforced concrete Design, ISBN No. 9780070473324, -by S.N.Shinha, 2ndEdition,
3. IS-456-2000: Plain And Reinforced Concrete - Code Of Practice
4. Sp-16 (1980): Design Aids For Reinforced Concrete To Is 456.

CIE/ SEE - Continuous Internal Evaluation/Semester End Examination-(50 Marks) / (50 Marks)

Bloom's Category	Test	Assignment	Quizzes	Exam
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	5			5
Understand	5		5	10
Apply	5	5	5	15
Analyze	10	10		20
Evaluate	-	-	-	-
Create	-	-	-	

Percentage Evaluation of Various Blooms levels

Bloom's	CIE	SEE	TOTAL	%
Remember	5	5	10	10
Understand	10	10	20	20
Apply	15	15	30	30
Analyze	20	20	40	40
Evaluate				
Create				
TOTAL	**50**	**50**	**100**	**100**

ANALYSIS OF INDETERMINATE STRUCTURES

Course Code: 20CIV53 **Credits: 03**
L: T: P: S: 2:1:0:0 **CIE Mark: 50**
Exam Hours: 3 Hours **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the concept of classical and advanced methods of structural analysis
CO2	Analyse continuous beams using classical methods
CO3	Analyse frames using classical methods
CO4	Apply the matrix method to solve beams and frame problems.
CO5	Understand the basic concepts of structural dynamics & finite element method
CO6	Apply the concepts of structural dynamics and solve single degree freedom system

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Slope deflection method**: Introduction, Sign convention, Development of slope-deflection equations and Analysis of continuous beams (including problems with support settlement and rotation) and orthogonal rigid jointed non sway plane frames with kinematic redundancy up to 3 and members assumed to be axially rigid **Analysis of rigid jointed plane frames-sway**, members assumed to be axially rigid and kinematic redundancy up to 3 by slope deflection method.	09	CO1 CO2 CO3
2	**Moment Distribution Method:** Introduction, Definition of terms-Distribution factor, Carry over factor, Analysis of continuous beams (including problems with support settlement and rotation) and orthogonal rigid jointed non sway plane frames with kinematic redundancy up to 3 and members assumed to be axially rigid **Analysis of rigid jointed plane frames-sway,** members assumed to be axially rigid and kinematic redundancy up to 3 by moment distribution method	09	CO1, CO2 & CO3
3	**Kani's Method:** Introduction, Basic Concept, Analysis of continuous beams (including problems with support settlement and rotation) and orthogonal rigid jointed non sway and sway plane frames with kinematic redundancy up to 3 and members assumed to be axially rigid, Analysis of multi storied frames -up to two bay two storey. **Clapeyron's theorem of three moments** – Up to three span continuous beams with & without sinking of supports.	09	CO1, CO2 & CO3
4	**Flexibility Matrix Method**: Introduction, Development of flexibility matrix for beams and axially rigid plane framed structural elements **Stiffness Matrix Method:** Introduction, Development of stiffness matrix for beams and axially rigid plane framed structural elements.	09	CO1 & CO4
5	**Basic Principles of Dynamics:** Basic principles of Vibrations and causes, periodic and aperiodic motion, harmonic and non-harmonic motion. Period and frequency. Forced and Free Vibration, Damping and Equations of Single Degree of Freedom System without damping, Numerical on above **Introduction to Finite Element Method:** type of finite elements, Displacement functions, Beam element, Truss element, Plane Stress, Plane Strain, Modelling concepts.(Without numerical)	09	CO1, CO5 & CO6

TEXT BOOKS

1. Bhavikatti SS, Structural Analysis II, Vikas Publishers, 4th Edition, 2011, New Delhi.
2. Thandavamoorthy TS, Structural Analysis, Oxford University Press, 3rd Edition, 2012, Bengaluru
3. Ramamrutham S, Theory of structures, Dhanpat Rai Publications, 9th Edition, 2014, New Delhi
4. Manish S, Finite Element Method and Computational Structural Dynamics, PHI learning Pvt. Ltd, 1st Edition, 2012, New Delhi

5. Damodarasamy S. R., Kavitha S. Basics of structural dynamics and Aseismic Design, PHI learning Pvt. Ltd, 2nd Edition, 2009, New Delhi

REFERENCE BOOKS

1. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publication Company Ltd., 2nd Edition, 2011, New Delhi
2. S.P. Gupta, G.S. Pandit and R. Gupta,Theory of Structures Vol. 2, n Tata McGraw Hill Publication Company Ltd., 1st Edition, 1999, New Delhi
3. Devdos Menon, Structural Analysis, Narosa Book Distributors Pvt ltd, 1st Edition, 2014, New Delhi.

CIE/ SEE - Continuous Internal Evaluation/Semester End Examination-(50 Marks) / (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	2	-	-	5
Understand	5	-	5	10
Apply	8	8	5	15
Analyze	10	7	-	20
Evaluate	-	-	-	-
Create	-	-	-	

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	2	5	7	7
Understand	10	10	20	20
Apply	21	15	36	36
Analyze	17	20	37	37
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

BASICS OF GEOTECHNICAL ENGINEERING

Course Code: 20CIV54 **Credits: 3**

L: T: P: S: 2:1:0:0 **CIE Marks: 50**

Exam Hours: 03 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the nature of soil, its functional relationship and index properties.
CO2	Classify the soil as per Indian Standards and understand the soil structure and clay mineralogy.
CO3	Estimate the compaction characteristics of soil.
CO4	Evaluate the permeability of soil and to understand the effective stress principle.
CO5	Evaluate the compressibility characteristics of soil and to estimate the settlement of soils.
CO6	Analyze the shear strength characteristics of soil.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Introduction:**: Introduction, Origin and formation of soil. Phase Diagram, phase relationships, definitions and their inter relationships. **Determination of Index Properties:** Specific gravity, water content, in-situ density and particle size analysis (Sieve analysis and Hydrometer analysis), Atterberg's Limits (Casagrande's method), Consistency indices, relative density, activity of clay.	**09**	**CO1**
2	**Soil Classification and Soil Structure & Clay Mineralogy:** Need for soil classification, unified, BIS classification - Plasticity chart and Field identification of soils. Common clay minerals in soil and their structures - Single grained honey-combed, flocculent and dispersed structures. - Kaolinite, Illite and Montmorillonite and their application in engineering. **Compaction of soil**: Definition, Standard and Modified proctor's compaction tests, Factors affecting compaction, Effect of compaction on soil properties, Field compaction control - Proctor's needle method. Field compaction equipment's and their suitability.	**09**	**CO2 & CO3**
3	**Flow of Water through Soils:** Darcy's law- assumptions, validity and limitations, Factors affecting permeability, Coefficient of permeability and its determination (Laboratory methods only), discharge velocity, seepage velocity, percolation, Permeability of stratified deposits. **Effective Stress Principle**: Geostatic stresses, Effective Stress concept – total stress, effective stress and neutral stress in soil mass under different hydrostatic conditions. Quick sand phenomena, critical hydraulic gradient.	**09**	**CO4**
4	**Consolidation of Soils:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory - assumptions and limitations (no derivation). Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils. Pre-consolidation pressure and its determination. Consolidation characteristics of soil (c_c, a_v, m_v and c_v). **Laboratory determination of consolidation of soil:** Laboratory one dimensional consolidation test, Consolidation test results, e – log p curve. Determination of consolidation characteristics of soils - compression index and coefficient of consolidation by square root of time fitting method and logarithmic time fitting method. Primary and secondary consolidation	**09**	**CO5**
5	**Shear Strength of soil**: Concept of shear strength, Mohr-Coulomb failure criterion, Modified Mohr-Coulomb failure criterion. Concept of pore pressure, Total and effective shear strength parameters, factors affecting shear strength of soil. Sensitivity and Thixotropic of Clay. Measurement of shear strength parameters- Direct shear test, unconfined compression, triaxial compression and vane shear test, under three drainage conditions, conditions for liquefaction	**09**	**CO6**

TEXT BOOKS:

1. Dr. Arora K. R, "Soil Mechanics and Foundation Engineering",Standard Publishers and Distributors, 3rd Edition, 2009.
2. Punmia B.C., "Soil Mechanics and Foundation Engineering", Laxmi Publications Co., 16th Edition, New Delhi, 2005.
3. Gopal Ranjan & A.S.R Rao, "Basic and Applied Soil Mechanics", New Age International Pvt Ltd, 3rd Edition, 2016.

REFERENCE BOOKS:

1. Braja, M. Das, "Principles of Geotechnical Engineering", Thomson Asia Pte Ltd., 8th Edition, 2013.
2. MurthyV.N.S., "Textbook of Soil Mechanics and Foundation Engineering", CBS Publishers & Distributors, 2018.
3. Robert D. Holtz, William D. Kovacs, Thomas C. Sheahan, "An Introduction to Geotechnical Engineering", Pearson publishers, 2nd Edition, 2011

CIE/ SEE - Continuous Internal Evaluation/Semester End Examination-(50 Marks) / (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	5	3	-	8
Understand	10	4	6	20
Apply	8	6	4	18
Analyze	2	2		4
Evaluate	-	-	-	-
Create	-	-	-	-

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	8	8	16	16
Understand	20	20	40	40
Apply	18	18	36	36
Analyze	4	4	8	8
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

HIGHWAY ENGINEERING

Course Code: 20CIV55 **Credits: 3**

L: T: P: S 3:0:0:0 **CIE Marks: 50**

Exam Hours: 03 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the principles of road development and planning.
CO2	Apply various surveys in highway alignment.
CO3	Understand the principles of geometric design of highways.
CO4	Understand the applications of various traffic volume studies.
CO5	Identify various pavement materials and Examine the suitability of different construction methods of pavements as per MORTH
CO6	Design Flexible and Rigid pavement as per IRC codes.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Introduction to transportation engineering:** Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute. **Highway Development:** Planning Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd twenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL) Road development plan - vision 2021.	9	CO1
	Highway Alignment: Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance. **Surveys:** Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects.	09	CO2
3	**Geometric Elements:** Importance of highway geometric design –highway Cross sectional elements. Sight distances- elements of horizontal and vertical alignments. **Introduction to Traffic Engineering:** Scope of traffic engineering, traffic characteristics, volume studies, speed studies, origin & Destination studies, PCU and Traffic Capacity. Related problems.	9	CO3 & CO4
4	**Pavement Materials:** Subgrade soil –Desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction-Examples on CBR and Modulus of subgrade reaction, Aggregates-Desirable properties and list of tests, Bituminous materials-Explanation on Tar, bitumen, cutback and emulsion-List of tests on bituminous materials Pavement Construction: Earthwork –cutting-Filling, Preparation of subgrade, Specification and construction of Granular Sub base, WBM Base, WMM base, Bituminous Macadam, Dense Bituminous Macadam Bituminous Concrete, Dry Lean Concrete sub base, PQC and Concrete roads.	9	CO5
5	**PAVEMENT DESIGN:** Pavement types, component parts of flexible and rigid pavements and their functions, design factors, ESWL and its determination - Examples, Flexible pavement - Design of flexible pavements as per IRC : 37 – 2012 with IITPave Software – Examples. **Rigid pavement:** Westergaard's equations for load and temperature stress-Examples - Design of slab thickness only as per IRC: 58 - 2015. Introduction to white topping.	9	CO6

TEXT BOOKS:

1. S.K.Khanna,C.E.G.Justo,A.Veeraragavan, "Highway Engineering", Nem Chand Bros, 10th edition Roorkee,2015.
2. L.R.Kadiyali "Principles and Practices of Highway Engineering", Khanna Publishers, 4th edition, New Delhi, 2005.
3. K P Subramanium "Transportation Engineering", 2nd edition, Scitech Publications, Chennai 2011.

REFERENCE BOOKS:

1. Guidelines for the design of flexible pavements IRC: 37-2012-3rd revision, New Delhi,2013.
2. Guidelines for the design of Plain jointed rigid pavements for Highways IRC: 58-2015-4th revision, New Delhi, 2015.
3. Specifications for Roads and Bridge works, MORT&H-5th revision, New-Delhi, 2013.

CIE/ SEE - Continuous Internal Evaluation/Semester End Examination-(50 Marks) / (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	05	-	-	5
Understand	10	05	05	20
Apply	05	05	05	15
Analyze	05	05	-	10
Evaluate	-	-	-	-
Create	-	-	-	

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	5	5	10	10
Understand	20	20	40	40
Apply	15	15	30	30
Analyze	10	10	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

ADVANCED SURVEYING

Course Code: 20CIV561 **Credits: 3**

L: T: P:S: 3:0:0:0 **CIE Marks: 50**

Exam Hours: 03 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Apply the knowledge of geodetic surveying and theory of errors.
CO2	Understand the concepts of spatial data and Remote Sensing.
CO3	Understand the platforms used in Remote Sensing.
CO4	Analyze different types of sensors used for data collection in Remote Sensing.
CO5	Understand the concepts of GIS and its functions.
CO6	Analyze data and its spatial counterpart in GIS.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Geodetic Surveying and Theory of Errors** Geodetic Surveying: Principle and Classification of triangulation system, Selection of baseline and stations, Orders of triangulation, Triangulation figures, Reduction to Centre, Selection and marking of stations and satellite stations. Theory of Errors: Introduction, types of errors, definitions, laws of accidental errors, laws of weights, theory of least squares, rules for giving weights and distribution of errors to the field observations, determination of the most probable values of quantities.	09	CO1
2	**Remote Sensing** Concept of spatial data, need for spatial data, Data acquisition methods, ground based and image based methods of data acquisition, Definition of remote sensing, remote sensing process, ideal remote sensing system. Physics of remote sensing, electromagnetic energy, electromagnetic spectrum, black body radiation, laws governing electromagnetic radiation, atmospheric effects, scattering and absorption, atmospheric windows, Interaction with earth surface materials, spectral reflectance curves	09	CO2
3	**Remote Sensing Platforms and Sensors** Remote sensing platforms, satellites and orbits, geostationary and sun synchronous satellites, earth resource satellites – IRS, LANDSAT, SPOT, ENVISAT, CARTOSAT, RESOURCESAT, IKONOS etc. Sensors – active and passive sensors, sensor resolutions (spectral, spatial, radiometric and temporal) Creation of remote sensing data, Digital and photographic data. Panchromatic, multispectral and hyper spectral data.	09	CO3 & CO4
4	**Geographic information system** Introduction, basics of GIS – definition of GIS, components of GIS, GIS work flows, representing spatial data, raster and vector data. Coordinate systems and map projections, datums, Spatial data input, Non spatial data.	09	CO5
5	**Spatial Data Analysis of geographic information system** Brief introduction to measurements in GIS, reclassification, geo referencing, map overlays, neighborhood functions, spatial interpolation, network analysis, DEMs, surface analysis, data retrieval and queries, GIS data modeling, spatial data output.	09	CO6

TEXT BOOKS:

1. B.C. Punmia, "Surveying Vol.2", Laxmi Publications pvt. Ltd.,16th edition, New Delhi,2016.
2. Manoj K. Arora, R.C. Badjatia, "Geomatics Engineering", Nemichand & Bros. Roorkee, 2011.
3. Lillesand T.M. and R.W. Kiefer, "Remote sensing and Image interpretation",John Wiley & Sons, 7th Edition,USA, 2016.
4. Floyd F Sabins. "Remote Sensing Principles and Interpretation", Wave Land press. Inc. 3rd Edition,USA, Reissued in 2007.

REFERENCE BOOKS:

1. Mather P.M., "Computer processing of remotely sensed images: an introduction", John Wiley & Sons,3rdEdition,UK, 2005.
2. Jensen J.R., "Introductory digital image processing: A remote sensing perspective", Pearson, 4th edition, New Jersey, 2015.
3. Peter A. Burrough& Rachel A. McDonnel "Principles of geographic information systems", Oxford University press,2nd Edition,UK,2015.

CIE/ SEE - Continuous Internal Evaluation/Semester End Examination-(50 Marks) / (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	05	-	-	10
Understand	05	-	-	10
Apply	10	05	05	20
Analyze	05	10	05	10
Evaluate	-	-	-	-
Create	-	-	-	-

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	05	10	15	15
Understand	05	10	15	15
Apply	20	20	40	40
Analyze	20	10	30	30
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

URBAN TRANSPORT PLANNING

Course Code : 20CIV562 | **Credits :03**
L: T: P :S : 3:0:0:0 | **CIE Marks :50**
Exam Hours : 03 | **SEE :50**

Course outcome: At the end of the Course, the student will be able to:

CO1	Understand the scope, system approach and stages in urban transport planning.
CO2	Apply the knowledge of traffic survey for analyzing traffic flow.
CO3	Understand the concept of trip generation.
CO4	Analyze the factors affecting trip distribution and model split in urban transport planning.
CO5	Forecast traffic volume and preparation of traffic model
CO6	Understand the transportation planning and Mass transit systems by ITS

Mapping of Course Outcome to Program Outcome

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

Module No	Module Contents	Hrs	CO'S
1	**Introduction:** Scope of Urban transport planning – Inter dependency of land use and traffic – System Approach to urban planning.	**9**	**CO1**
	Stages in Urban Transport Planning: Trip generation – Trip production - Trip distribution – Modal split – Trip assignment		
2	**Urban Transport Survey:** Definition of study area-Zoning-Types of Surveys — Expansion of data from sample.	**9**	**CO2 & CO3**
	Trip Generation: Trip purpose – Factors governing trip generation and attraction – Category analysis – Problems on above.		
3	**Trip Distribution:** Methods – Growth factors methods – Synthetic methods – Factor and Furness method and problems on the above	**9**	**CO4**
	Modal Split: Factors affecting – characteristics of split – Model split in urban transport planning – problems on above		
4	**Trip Assignment:** Assignment Techniques – Traffic fore casting – Land use transport models – Lowry Model – Grain Lowry model – Applications in India – (No problems on the above)	**9**	**CO5**
	Graph theory, Entropy in transportation and commodity flows. Problem related to above.		
5	Urban Transport Planning For Small And Medium Cities: Introduction – Difficulties in transport planning – Recent Case Studies	**9**	**CO6**
	Mass Transit Systems: Capacity, Fleet planning and Scheduling, Introduction to Intelligent Transport system		

TEXTBOOKS

1. L.R. Kadiyali, "Traffic Engineering & Transport Planning", Khanna Publishers, 9th edition, New Delhi, 2018.
2. Hutchinson, B.G, "Principles of Urban Transport System Planning", Mc Graw Hill Book Co, 1974.
3. Papacostas,C.A, "Fundamentals of Transportation Engineering", Prentice-Hall of India Private Limited,3rd edition, New Delhi,2009.

REFERENCEBOOKS

1. Jotin Khistey and Kentlal "Introduction to Transportation Engineering", Pearson's publisher, 3rd edition,Bengaluru,2002
2. A. G.Wilson "Urban and Regional Models in Geography and Planning", John Wiley & Sons Inc, Hoboken, New Jersey, United States, 1974.
3. Mayer M and Miller E, "Urban Transportation Planning: A decision oriented Approach", McGraw Hill. New Delhi,2000.

CIE- Continuous Internal Evaluation/Semester End Examination (50 Marks)/ (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	10	-	-	10
Understand	5	5	5	15
Apply	5	5	5	15
Analyze	5	5	-	10
Evaluate	-	-	-	-
Create	-	-	-	-

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	10	10	20	20
Understand	15	15	30	30
Apply	15	15	30	30
Analyze	10	10	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

OPEN CHANNEL HYDRAULICS

Course Code: 20CIV563 **Credits: 03**

L: T: P :S 3:0:0 :0 **CIE Marks: 50**

Exam Hours: 3 Hours **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the various types of drag and lift forces
CO2	Analyze and estimate the drag and lift forces
CO3	Understand the energy and momentum principles in open channel flow.
CO4	Analyze the flow profile for gradually and rapidly varied flow
CO5	Apply the concept of hydraulic jump in rectangular and nonrectangular Channel.
CO6	Calculate energy dissipation below overflow weir and sluice ways using hydraulic jump concept.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Boundary Layer Theory:** Introduction. Laminar and Turbulent flows. Boundary Layer- Definition, Thickness of B.L, Boundary Layer along a long thin plate and its characteristics, Prandtl's Boundary layer equations, Laminar boundary layer, Turbulent boundary layer. Laminar sub-layer, Separation of boundary layer, Methods of controlling boundary layer. **Flow Around Submerged Objects:** Introduction. Drag and Lift - Definitions, Types of drag, Dimensional analysis of drag and lift, Drag on a sphere, cylinder, flat plate and airfoil, Lift on a circular cylinder and airfoil.	**09**	**CO1**
2	**Energy and Momentum Principles in Open Channel Flow:** Introduction, Classification of flow in open channels, Types of channels, Velocity distribution in channel section, pressure distribution in open channel, Energy and Momentum principles, Description of specific energy curve, channel transitions, Metering flumes – Venturi flume, Standing wave flume**.** Energy and Momentum principles, Description of specific energy curve, channel transitions, Metering flumes – Venturi flume, Standing wave flume.	**09**	**CO2 & CO3**
3	**Gradually Varied Flow:** Introduction, Concepts, GVF equation, its different forms, Basic assumptions, Dynamic equation, Characteristics of flow profile and classification & problems. **Analysis of Flows Profiles**: Analysis of flows profiles, transitional depth & Practical problems.	**09**	**CO4**
4	**Gradually Varied Flow Computation** by direct method &standard step method. **Rapidly Varied Flow**: Introduction, Concepts, hydraulic jump in horizontal rectangular channels, classification of jumps and characteristics of jump & computation.	**09**	**CO4**
5	**Hydraulic Jump**: Hydraulic jump in horizontal non- rectangular channels & Sloping rectangle channels. **Application of Hydrauli Jump:** energy dissipation below overflow weir , Energy dissipation below sluice ways : stilling basins – United States Bureau of Reclamation (**USBR**) type II & IV	**09**	**CO5 & CO6**

TEXT BOOKS:

1. Modi P.N, &Seth S.M., "Hydraulics & Fluid Mechanics including Hydraulic Machines", Standard Book Home, New Delhi , 22 nd Edition 2017. (ISBN: 9788189401269, 8189401262).

2. Subramanya K., "Flow in Open Channels" Tata McGraw Hill Publishing Education Pvt. Ltd, New Delhi, 4 th edition, 2015. (ISBN 10: 9789332901339)

3. Rangaraju K.G., "Flow through Open Channel" , Tata McGraw Hill Publishing Co Ltd, New Delhi,2nd Edition 2001 (ISBN-10: 007460497X,ISBN-13: 978-0074604977)

REFERENCE BOOKS:

1. Madan Mohan Das ., "Open Channel Flow" Prentice Hall of India Pvt. Ltd., New Delhi 2008 Edition (IBN 8120335228, 9788120335226)

2. Srivastava R., "Flow Through Open Channels" , Oxford Press, New Delhi 2008 1stEdition (IBN 9780195690385).

3. Richard H .French., "Open Channel Hydraulics" , Water Resources Publication; 1st edition 2007 (ISBN-0: 1887201440,ISBN-13: 978-1887201445)

CIE/ SEE - Continuous Internal Evaluation/Semester End Examination-(50 Marks) / (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	5	-	5	10
Understand	10	5	5	20
Apply	5	5	--	10
Analyze	5	5	-	10
Evaluate	-	-	-	-
Create	-	-	-	

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	10	10	20	20
Understand	20	20	40	40
Apply	10	10	20	20
Analyze	10	10	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

ADVANCED CONCRETE TECHNOLOGY

Course Code: 20CIV564 **Credits: 03**

L: T: P:S: 3:0:0:0 **CIE Marks: 50**

Exam Hours: 3 Hours **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Conceptualize rheology of concrete and various methods for the ecofriendly and sustainable of concrete.
CO2	Design mix proportion for ferro-cement and understand its applications.
CO3	Understand the properties and applications of fiber reinforced concrete.
CO4	Understand the properties and applications of high performance concrete and light Weight & high Density Concrete.
CO5	Analyze the properties of Self-Compacting Concrete and prepare its mix design.
CO6	Understand design concepts and applications of geo polymer concrete.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Rheology Of Concrete**: Introduction, factors affecting, rheology of fresh concrete by Bingham model, equation for measuring its properties. **Brief introduction of concrete** including composite cement & properties, waste materials in concrete, introduction to waste material, including construction and demolition waste -glass, plastic rubber and recycled concrete.	**09**	**CO1**
2	**Ferro cement**: Materials, mechanical properties, strength, cracking and durability of normal Ferrocement. Strength and behavior of light weight Ferrocement, and Prestressed Ferrocement. Mix design procedure **Fiber Reinforced Concrete**: Fibers, types, characteristics, Fiber CO1 distribution, orientation and interfacial bond. Mechanical properties of FRC mix design of FRC, behavior of hardened FRC under compression, tension flexure and impact, SIFCON, Ductal Concrete.	**09**	**CO2 & CO3**
3	**High Performance Concretes**: Concept, materials selection, mineral admixture, proportioning, strength, and durability aspects, Construction & economic Aspects, codal provisions, Applications and their performance. **Light Weight And High Density Concrete**: Definition, Proportioning, Properties and Applications, typical light weight concrete mix.	**09**	**CO4**
4	**Self-Compacting Concrete**: Brief history of development, Definition, Fresh property requirements, Tests as per EFNARC and ASTM, -applications. Mix Design :Mix design procedures, Comparison of hardened properties with conventional concrete, Applications, Economical	**09**	**CO5**
5	**Geo-Polymer Concrete**: Brief history of development, Definition, Reaction chemistry, material characterization. Mix Design: Mix proportioning, properties and applications	**09**	**CO6**

TEXT BOOKS

1. A.M.Neville, "Properties of Concrete",Pearson Education Pt. Ltd.,5th Edition,Singapore, 2015. (ISBN-13: 978-0273755807)
2. P.Kumar Mehta& PauloJ.M.Monteiro, "Concrete Microstructure, Properties, and Materials", byTata McGraw Hill Education, 4th Edition, India, 2012. (ISBN-13: 978-0071797870)
3. KrisnhaRajuN,"Design of Concrete Mixes",CBS Publications,5th Edition, India, 2017.(ISBN-13: 9788123924670),

REFERENCE BOOKS

1. Perumalsamy. N. Balaguru and surendraP.Shah , "Fiber reinforced cement composites" ,McGraw Hill international edition, 1st Edition,1992. (ISBN-13:978-0070564008).
2. R N Sawmy, "Concrete technology and Design-vol.1& 2",New concrete materials, Surrey University Press, London ,1983, ISBN 13:9780903384346,.
3. Geert De Schutter ,PeterJ. M.Bartos and Peter Domone, "Self-Compacting Concrete" Whittles Publishing, 2008.,ISBN- 13: 978-1904445302.
4. IS-10292-2019- Concert Mix Proportioning –Guidelines.

CIE/ SEE - Continuous Internal Evaluation/Semester End Examination-(50 Marks) / (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	5	4	-	10
Understand	5	4	4	10
Apply	10	4	6	15
Analyze	5	3	-	15
Evaluate	-	-	-	-
Create	-	-	-	

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	9	10	19	19
Understand	13	10	23	23
Apply	20	15	35	35
Analyze	8	15	23	23
Evaluate				
Create				
TOTAL	**50**	**50**	**100**	**100**

CONCRETE TECHNOLOGY LAB

Course Code: 20CIV57 **Credits: 1.5**

L: T: P:S: 0:0:1.5:0 **CIE Marks: 25**

Exam Hours: 03 **SEE Marks: 25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Assess the quality of concrete ingredients and its properties
CO2	Comprehend the concept of workability and estimate the properties of fresh concrete.
CO3	Evaluate the properties of hardened concrete.
CO4	Examine the properties of self-compacting concrete.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Course contents			
Experiment no.	**Experiment name**	**Hrs**	**CO's**
1	**Tests on Cement:** To determine the Normal consistency & specific gravity of cement	**3**	**CO1**
2	To determine the Setting time & Compression strength test	**3**	**CO1**
3	Air permeability test for fineness, Soundness by Autoclave method	**3**	**CO1**
4	**Tests on Aggregates:** Tests on Fine aggregates – To determine the Moisture content & Specific gravity of fine aggregates To determine the Bulking & Bulk density of fine aggregates	**3**	**CO1**
5	**Tests on Aggregates:** Tests on Coarse aggregate – To determine the Absorption & specific gravity of coarse aggregates. To determine the moisture content & Bulk density of CA	**3**	**CO1**
6	Shape tests (Flakiness Index, Elongation Index, Angularity number)	**3**	**CO1**
7	**Fresh concrete tests:** To determine the Workability – Slump Test, Compaction factor test, Vee Bee tests	**3**	**CO2**
8	**Hardened concrete tests:** Compression strength, Split Tensile Test, Flexural strength of beams	**3**	**CO3**
9	**Nondestructive tests:** Ultrasonic pulse velocity test, Rebound hammer test. **Test on Admixture:** Marsh cone test	**3**	**CO3 & CO1**
10	**Tests on SCC:** Self-compacting concrete: Slump flow test, V-funnel test, l-box test	**3**	**CO4**
11	Self-compacting concrete: U-box test, fill box test	**3**	**CO4**

TEXT BOOKS:

1. Properties of Concrete, A M Neville, ISBN-13: 978-0273755807, 5th edition ELBS, London.
2. Concrete Technology - Theory and Practice, M.S. Shetty, ISBN: 9788121900034, S.Chand and Company, New Delhi.
3. Concrete Technology - Theory and Practice, M L Gambhir , ISBN-13: 978-1259062551,5th edition, McGraw Hill Education

REFERENCE BOOKS:

1. Design of concrete mixes, N Krishna Raju, ISBN-13: 978-8123902180, 4th edition, CBS Publisher
2. "Concrete Manual", Gambhir M.L, 4th edition, Dhanpat Rai & Sons, New Delhi
3. Highway Materials & Pavement Testing, Sk Khanna, Ceg Justo, A Veeraragavan, ISBN-13: 9788185240213, Nem Chand & Brothers publishers.

CIE/ SEE - Continuous Internal Evaluation/Semester End Examination-(25 Marks) / (25 Marks)

Bloom's Category	**Test**	**Exam**
Marks (out of 50)		
Remember	5	5
Understand	5	5
Apply	10	10
Analyze	5	5
Evaluate	-	-
Create	-	-

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	5	5	10	20
Understand	5	5	10	20
Apply	10	10	20	40
Analyze	5	5	10	20
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**25**	**25**	**50**	**100**

BASICS OF GEOTECHNICAL ENGINEERING LAB

Course Code: 20CIV58 **Credits: 1.5**

L: T: P: S: 0:0:1.5:0 **CIE Marks: 25**

Exam Hours: 03 **SEE Marks: 25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Compute the index properties of fine grained and coarse grained soil
CO2	Analyze the particle size distribution curve for the given sample of soil.
CO3	Estimate the engineering properties of soil.
CO4	Understand equipments such as hand augers, hydrometer, rapid moisture meter.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Experiment No:	Experiments	Hrs	CO
1	Visual soil classification, water content determination by oven drying method, Specific gravity test (for coarse and fine grained soils) (Pycnometer and Density bottle).	**3**	**CO1**
2	Determine Particle size distribution of given soil sample using sieve analysis	**3**	**CO1 & CO2**
3	Determine the In situ density by core cutter and sand replacement methods.	**3**	**CO1**
4	Determine the Consistency Limits – Liquid Limit (Casagrande Method), plastic limit and shrinkage limit	**3**	**CO1**
5	Standard Proctor Compaction Test	**3**	**CO1 & CO3**
6	Modified Proctor Compaction Test	**3**	**CO1 & CO3**
7	Constant head permeability test and Falling head permeability test	**3**	**CO3**
8	Unconfined Compression Test	**3**	**CO1 & CO3**
9	Triaxial shear test	**3**	**CO1 & CO3**
10	Direct Shear Test Laboratory vane shear test	**3**	**CO1 & CO3**
11	Consolidation test	**3**	**CO1 & CO3**
12	Demonstration of miscellaneous equipments such as Augers, Samplers, Hydrometer Test, Rapid Moisture meter, Proctor's needle.	**3**	**CO2, CO3 & CO4**

TEXT BOOKS:

1. Dr. Arora K. R, "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, 3rd Edition, 2009.
2. Punmia B.C., "Soil Mechanics and Foundation Engineering", Laxmi Publications Co., 16th Edition, New Delhi, 2005.
3. Gopal Ranjan & A.S.R Rao, "Basic and Applied Soil Mechanics", New Age International Pvt Ltd, 3rd Edition, 2016.

REFERENCE BOOKS:

1. Braja, M. Das, "Principles of Geotechnical Engineering", Thomson Asia Pte Ltd., 8th Edition, 2013.
2. Murthy V.N.S., "Textbook of Soil Mechanics and Foundation Engineering", CBS Publishers & Distributors, 2018.
3. Robert D. Holtz, William D. Kovacs, Thomas C. Sheahan, "An Introduction to Geotechnical Engineering", Pearson publishers, 2nd Edition, 2011.

CIE/ SEE - Continuous Internal Evaluation/Semester End Examination-(25 Marks) / (25 Marks)

Bloom's Category	**Test**	**Exam**
Marks (out of 50)		
Remember	5	5
Understand	10	10
Apply	10	10
Analyze	-	-
Evaluate	-	-
Create	-	-

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	5	5	10	5
Understand	10	10	20	10
Apply	10	10	20	10
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**25**	**25**	**50**	**100**

MINI PROJECT-II (Analysis of Indeterminate Structures using STAAD PRO)

Course Code: 20CIV59 **Credits: 2**

L: T: P: S: 0:0:2:0 **CIE Marks: 25**

Exam Hours: 03 **SEE Marks: 25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Use software in a professional set up to meet industrial standards
CO2	Model and Analyse continuous beams using software
CO3	Model and Analyse plane frames and 3D multi-storied frames
CO4	Model and Analyse plane trusses using software..

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Experiment No	Description	Hrs	COs
1.	Introduction to structural analysis software package STAAD PRO, various tools and its applications in modelling, analysis and design of various civil engineering structures.	**4**	**CO1**
2.	Modelling and Analysis of Three span continuous beam with fixed end conditions, considering different types of loading conditions	**4**	**CO2**
3.	Modelling and Analysis of Three span continuous beam with pinned end conditions, considering different types of loading conditions	**4**	**CO2**
4.	Modelling and Analysis of continuous beam with over hanging, considering different types of loading conditions	**4**	**CO2**
5.	Modelling and Analysis of continuous beam with differential settlements and rotation of supports, considering different types of loading conditions.	**4**	**CO2**
6.	Modelling and Analysis of plane frame with fixed end conditions, considering different types of loading conditions	**4**	**CO3**
7.	Modelling and Analysis of plane frame with pinned end conditions, considering different types of loading conditions	**4**	**CO3**
8.	Modelling and Analysis of plane frame with over hanging, considering different types of loading conditions	**4**	**CO3**
9.	Modelling and Analysis of multi storied plane frame (up to 2-bay, 2-storey), considering different types of loading conditions	**4**	**CO3**
10.	Modelling and Analysis multi storied 3-D frames, considering different types of loading conditions (Minimum 3-bay, 3-storey)	**4**	**CO3**
11.	Modelling and Analysis of steel truss	**4**	**CO4**

REFERENCES

1. Training and user manuals of STAAD PRO
2. Bhavikatti SS, Structural Analysis II, Vikas Publishers, 4th Edition, 2011, New Delhi.
3. Thandavamoorthy TS, Structural Analysis, Oxford University Press, 3rd Edition, 2012, Bengaluru
4. Ramamrutham S, Theory of structures, Dhanpat Rai Publications, 9th Edition, 2014, New Delhi
5. S.P. Gupta, G.S. Pandit and R. Gupta,Theory of Structures Vol. 2, n Tata McGraw Hill Publication Company Ltd., 1st Edition, 1999, New Delhi
6. Manish S, Finite Element Method and Computational Structural Dynamics, PHI learning Pvt. Ltd, 1st Edition, 2012, New Delhi

CIE/ SEE - Continuous Internal Evaluation/Semester End Examination-(25 Marks) / (25 Marks)

Bloom's Category	Test	Exam
Marks (out of 50)	2.5	2.5
Remember	2.5	2.5
Understand	10	10
Apply	10	10
Analyze	-	-
Evaluate	-	-
Create		

Percentage Evaluation of Various Blooms levels (25+25)

Bloom's	CIE	SEE	TOTAL	%
Remember	2.5	2.5	5	10
Understand	2.5	2.5	5	10
Apply	10	10	20	40
Analyze	10	10	20	40
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**25**	**25**	**50**	**100**

SIXTH SEMESTER

(SYLLABUS)

ENVIRONMENTAL ENGINEERING

Course Code: 20CIV61 **Credits: 03**
L: T: P:S: 3:0:0:0 **CIE Mark: 50**
Exam Hours: 3 Hours **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the quality of water and estimate the demand of water supply.
CO2	Evaluate the quality of water of different sources
CO3	Design efficient treatment units
CO4	Understand the process of disinfection and water softening.
CO5	Develop layout of water supply in buildings
CO6	Understand the effects of air pollution and different elements of solid waste management.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	Introduction: Human activities and environmental pollution. Need for protected water supply. Drinking water standards BIS & WHO guidelines (IS 10500). Objectives of water quality management. Wholesomeness & palatability, water borne diseases. Health significance of Fluoride, Nitrates and heavy metals like Mercury, Cadmium, Arsenic etc. and toxic / trace organics. Demand of Water: Types of water demands- domestic, institutional, commercial, public and fire. Per capita consumption –factors affecting per capita demand, population forecasting, different methods with merits & demerits- variations in demand of water. Fire demand – estimation by Kuichling's formula, peak factors, design periods & factors governing the design periods	09	CO1
2	Sources and Collection: Sources- Surface and subsurface sources – suitability with regard to quality and quantity. Intake structures – different types of intakes; factor of selection and location of intakes. Quality of Water: Sampling of water for examination Water quality parameters – Testing Physical- Temperature, Electrical conductivity, Turbidity, colour, odour, taste. Chemical – Total solids, Hardness, Chlorides, Chlorine, pH, Sulphates, nitrogen compounds, iron, DO, BOD, COD, sodium and potassium. Microbiological analysis.	09	CO2
3	Water Treatment: Objectives – Treatment flow-chart. Sedimentation: Theory, settling tanks, types, design. Coagulant aided sedimentation, jar test, chemical feeding, flash mixing, and clari- flocculator Filtration: Mechanism – theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning and their design (excluding under drainage system) , back washing of filters. Operational problems in filters.	09	CO3
4	Disinfection: Theory of disinfection, types of disinfection, Chlorination, chlorine demand, residual chlorine, use of bleaching powder. Softening – Definition, methods of removal of hardness by lime soda process and zeolite process, RO & Membrane technique. Miscellaneous Treatment-Aeration- Types of Aeration. Adsorption technique. Conveyance of water- Design of the economical diameter for the rising main; Nomograms.	09	CO4
5	Layout of water supply pipes in buildings. Distribution Systems: System of supply, service reservoirs and their capacity determination, methods of layout of distribution systems. Introduction to Solid Waste management and Air Pollution –Types of solid waste, Sources and properties, Solid waste management. Air pollution, effects, classification of pollutants and air quality management concepts.	09	CO5 & CO6

TEXT BOOKS:

1. S.K.Garg"Water supply Engineering", Khanna Publishers, 33 rd edition, ISBN: 9788174091208.
2. Punmia B C & Ashok Jain., "Environmental EngineeringI",Laxmi Publications, ,2nd edition. ISBN:**10:** 9788131807033
3. Birdie, G S & Birdie J S., "Water supply & Sanitary engineering", DhanpatRai Publishing company,8th edition, 2012. ISBN-10: 8187433795

REFERENCE BOOKS:

1. Hammer, M.J., "Water and Wastewater Technology –SI Version", 7th Edition, Pearson publishers, .ISBN:13: 978-0135114049
2. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G.,,"Environmental Engineering",McGraw Hill Edition (India) 2013, .ISBN: 13: 9789351340263 .
3. Sincero, A.P., and Sincero, G.A., (1999), Environmental Engineering – A Design Approach– Prentice Hall of India Pvt. Ltd., New Delhi.ISBN: 10: 0024105643.

CIE/SEE- Continuous Internal Evaluation/Semester End Examination (50 Marks)/ (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	-	5	5	5
Understand	10	5	3	20
Apply	10	3	2	15
Analyze	5	2		10
Evaluate	-	-	-	-
Create	-	-	-	-

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	10	5	15	15
Understand	18	20	38	38
Apply	15	15	30	30
Analyze	7	10	17	17
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

DESIGN AND DETAILING OF RCC STRUCTURAL ELEMENTS

Course Code: 20CIV62 **Credits: 03**
L: T: P :S : 2:1:0:0 **CIE Mark: 50**
Exam Hours: 3 Hours **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Apply IS provisions in structural detailing.
CO2	Prepare detailed structural drawings of beams and slabs.
CO3	Prepare detailed structural drawings of column and Isolated footing.
CO4	Prepare detailed structural drawings of staircases.
CO5	Design and Prepare detailed structural drawings of Portal frame and Combined Footing
CO6	Design and Prepare detailed structural drawings of Retaining wall and Water Tanks

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	Introduction to detailing of RC structures, Codal provisions as per SP34-1987. General layout, Reinforcement specifications, Detailing functions, Structural drawing for detailing. General detailing requirements, bar bending schedule. Layout Drawing: General layout of building showing, position of columns, footings, beams, slabs and staircase with standard notations	09	CO1& CO2
2	Detailing of simply supported, cantilever, and continuous beams. Detailing of One Way continuous and Two Way continuous slab.	09	CO1 & CO2
3	Detailing of columns and isolated footing. Detailing of Dog legged & open well staircase.	09	CO1, CO3& CO4
4	Portal Frames: Design of Portal Frames with fixed and hinged based supports Footing: Design of Rectangular combined footing, Beam and Slab type combined footing	09	CO5
5	Retaining Wall: Design of Cantilever Retaining wall and Counter fort Retaining wall. Water Tanks : Design of Circular Water Tanks resting on ground (Rigid and Flexible base). Design of Rectangular water tanks resting on ground. As per IS : 3370(Part IV).	09	CO6

Text Books:

1. N. Krishnaraju .,"Structural Design & Drawing: Reinforced Concrete & Steel", University Press , 2nd edition,Bangaluru, 2005
2. B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain , "R.C.C. Designs (Reinforced Concrete Structures)", Laxmi Publications, 10th edition, New Delhi 2012.
3. N. Subramanian, "Design of Reinforced Concrete Structures", Oxford University Press, 1st edition, New Delhi, 2013

Reference Books:

1. **SP 34** - 1987 Handbook on Concrete Reinforcement and Detailing.
2. Krishnamurthy., "Elementary Structural Design and Drawing",CBS publishers,1st edition, 2006, (Concrete Structures), CBS publishers, New Delhi. 1999.
3. S.N.Sinha., "Reinforced Concrete Design",McGrawHill Education, 3rdedition, New Delhi,2014.
4. Ghosh Karuna Moy, "Practical Design of Reinforced Concrete Structures", PHI Learning, 1st edition, New Delhi, 2010.

CIE/SEE- Continuous Internal Evaluation/Semester End Examination (50 Marks)/ (50Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**SEE Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember			5	-
Understand	5		5	10
Apply	10	5		20
Analyze	10	10		20
Evaluate	-	-	-	-
Create	-	-	-	-

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	5	-	5	5
Understand	10	10	20	20
Apply	15	20	35	35
Analyze	20	20	40	40
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

APPLIED GEOTECHNICAL ENGINEERING

Course Code: 20CIV63 **Credits: 3**

L: T: P: S : 2:1:0:0 **CIE Marks: 50**

Exam Hours: 03 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Identify the suitability of a site by applying the knowledge of various soil exploration methods and execute geotechnincal site investigation for engineering purposes.
CO2	Apply the concept of slope stability analysis for various slope conditions and analyze the stresses due to applied loading for safe design of structures.
CO3	Estimate the lateral earth pressures on earth retaining structures using numerical and graphical methods.
CO4	Compute safe bearing capacity of soil under different hydraulic conditions for design of shallow foundation.
CO5	Analyze seepage of water through soil under hydraulic structures and examine the settlement of foundations.
CO6	Estimate single pile and pile group capacity under various soil conditions

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Soil Exploration:** Importance of soil exploration, objectives and importance, Methods of exploration: Boring (Auger, Rotary, percussion drilling), sampling techniques, types of samples, Samplers, Sample disturbance, Area ratio, Recovery ratio, clearance, Stabilization of boreholes - Typical bore log. Number and depth of borings for various civil engineering structures, Standard penetration test and cone penetration test, geophysical methods of exploration. Preparation of Soil exploration report.	09	CO1
2	**Stresses in Soils**: Introduction, Boussinesq's and Westergaard's theories for different types of loadings such as point load, line load, strip load, circular load and rectangular load) (no derivations), pressure distribution diagrams. Comparison of Boussinesq's and Westergaard's analysis, Newmark's chart. **Stability of Earth Slopes:** Introduction, assumptions, Types of slopes, Causes and Types of slope failures. Definition of Factor of safety, Stability of infinite slopes for cohesive and cohesion less soil, Stability of finite slopes by Swedish slip circle method, Taylor's stability number.	09	CO2
3	**Lateral Earth Pressure**: Active and Passive earth pressures, Earth pressure at rest. Rankine's and Coulomb's Earth pressure theories-–assumptions and limitations, Graphical solutions for active and passive earth pressures - Culmann's and Rebhann's methods (only theory). **Bearing Capacity**: Definitions of bearing capacity, ultimate, net and safe bearing capacities, and allowable bearing pressure. Determination of bearing capacity by Terzaghi's and BIS methods. – assumptions and limitations (no derivation), Types of shear failure, Effect of ground water table on bearing capacity. Plate load test.	09	CO3 & CO4
4	**Seepage Analysis:** Laplace equation, assumptions, limitations and its derivation. Flow nets- characteristics and applications. Flow nets for sheet piles and below the dam section. Unconfined flow, phreatic line (Casagrande's method –with and without toe filter), flow through dams, design of dam filters. **Settlement analysis**: Distribution of contact pressure- estimation of immediate and consolidation settlement - causes of settlement - permissible, total and differential settlement - methods of reducing differential settlement.	09	CO5
5	**Pile foundation:** Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static and Dynamic formulas, efficiency of Pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, under reamed piles (only introductory concepts – no derivation).	09	CO6

TEXT BOOKS:

1. Dr. Arora K. R, "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, 3rd Edition, 2009.
2. Punmia B.C., "Soil Mechanics and Foundation Engineering", Laxmi Publications Co., 16th Edition, New Delhi, 2005.
3. Gopal Ranjan & A.S.R Rao, "Basic and Applied Soil Mechanics", New Age International Pvt Ltd, 3rd Edition, 2016.

REFERENCE BOOKS:

1. Braja, M. Das, "Principles of Foundation Engineering", PWS Publishing Company, 3rd Edition, 2007.
2. Murthy V.N.S., "Textbook of Soil Mechanics and Foundation Engineering", CBS Publishers & Distributors, 2018.
3. Bowles J.E., "Foundation Analysis and Design", McGraw Hill Book Co. New York, 5th Edition.

CIE/SEE- Continuous Internal Evaluation/Semester End Examination (50 Marks)/(50Marks)

Bloom's Category	Test	Assignment	Quizzes	Exam
Marks	**25**	**15**	**10**	**50**
Remember	4	2	-	5
Understand	5	3	2	15
Apply	10	4	6	20
Analyze	6	6	2	10
Evaluate				-
Create				-

Percentage Evaluation of Various Blooms levels

Bloom's	CIE	SEE	TOTAL	%
Remember	5	5	10	10
Understand	15	15	30	30
Apply	20	20	40	40
Analyze	10	10	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

TRAFFIC ENGINEERING

Course Code: 20CIV641 **Credits: 03**
L: T: P: S : 3:0:0:0 **CIE Mark: 50**
Exam Hours: 3 Hours **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand Road user and Vehicular traffic characteristics.
CO2	Apply various traffic studies in traffic planning and management.
CO3	Understand the flow principles and their applications.
CO4	Analyze the traffic data by using various statistical methods.
CO5	Understand the various techniques of traffic forecasting simulation.
CO6	Identify the importance of signs , regulations and intelligent transport system

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Introduction and traffic characteristics:** Definition, objectives of Traffic Engineering and scope of Traffic Engineering, Road user characteristics, vehicular characteristics – static and dynamic. **Characteristics:** Power performance of vehicles, Resistance to the motion of vehicles – Reaction time of driver – Numerical problems.	09	CO1
2	**Traffic studies:** Various types of traffic engineering studies, data collection, analysis objectives and method of study – Definition of study area – Sample size and analysis. Classified traffic Volume at mid-block and intersections, PCU, origin and destination, spot speed, speed and delay, parking – on street parking, off street parking, Accident – causes, analysis measures to reduce accident – Problems on above.	09	CO2
3	**Traffic flow theories:** Traffic flow theory, Green shield theory – Goodness of fit – correlation **Linear regression analysis:** Queuing theory, Car following theory and Numerical problems.	09	CO3 & CO4
4	**Statistical analysis:** Poisson's distribution and application to traffic engineering. Normal Distribution – Significance tests for observed. Traffic data, Chi Square test – problems on above. Traffic forecast – Simulation technique.	09	CO5
5	**Traffic regulation and control:** Driver, vehicle and road controls – Traffic regulations – one way – Traffic markings, Traffic signs, Traffic signals – Vehicle actuated and synchronized signals – Signals co-ordination. Webster's method of signal design, IRC Method, traffic rotary elements and designs, traffic operation – Street lighting, Road side furniture, Numerical problems. **Intelligent transport system:** Definition, Necessities, Application of ITS in the present traffic scenario.	09	CO6

TEXT BOOKS:

1. L.R. Kadiyali, "Traffic Engineering & Transport Planning", Khanna Publishers, 9th edition, New Delhi, 2018.
2. S.K.Khanna, C.E.G.Justo, A.Veeraragavan "Highway Engineering", Nem Chand Bros, 10th edition, Roorkee, 2015.
3. Drew "Traffic flow theory and control" Mc. Graw Hill and Co, New York, United States,1968.

REFERENCE BOOKS:

1. Pignataro,"Traffic Engineering", Prentice Hall, Highway Capacity Manual, 2000.
2. Jotin Khistey and Kentlal "An introduction to traffic engineering", PHI publishers,3rd edition, New Delhi,2002.
3. Mc Shane & Roess "Traffic Engineering", PHI publishers, 4th edition, New Delhi, 2010.

CIE/SEE- Continuous Internal Evaluation/Semester End Examination (50 Marks)/(50Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exams**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	5	-	-	5
Understand	5	5	-	10
Apply	10	5	5	20
Analyze	5	5	5	15
Evaluate	-	-	-	-
Create	-	-	-	-

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	5	5	10	10
Understand	5	10	20	20
Apply	10	20	40	40
Analyze	5	15	30	30
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

ALTERNATIVE BUILDING MATERIALS & TECHNOLOGY

Course Code: 20CIV642 **Credits: 03**
L: T: P: S : 3:0:0:0 **CIE Mark: 50**
Exam Hours: 3 Hours **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the environmental issues related to construction.
CO2	Apply the knowledge of various masonry units used in construction.
CO3	Apply the knowledge of alternative methods of wall construction.
CO4	Apply the knowledge of alternative methods of the Roofing system.
CO5	Design Structural Masonry elements under axial Compression with the appropriate type of masonry unit and mortar.
CO6	Understand the alternative materials and technologies available for mass construction.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Introduction:** Energy in building materials, Environmental issues concerned to building materials, Global warming, and construction industry. Environmental friendly and cost effective building technologies, Requirements for building of different climatic regions, Traditional building methods and vernacular architecture.	09	CO1
2	**Alternative Masonry units:** Characteristics of building blocks for walls, Stones and Laterite blocks, Bricks and hollow clay blocks, Concrete blocks, Stabilized blocks: mud blocks, steam cured blocks, Fal-G Blocks, stone masonry block.	09	CO2
3	**Alternative Building Technologies wall construction** – types, construction methods, masonry mortars – types, preparation and properties, Ferro cement and ferroconcrete building components – materials and specifications, properties, construction methods and applications. **Roofing system** – concepts, filler slabs, composite beam panel roofs, Masonry vaults and domes.	09	CO3 & CO4
4	**Structural Masonry:** Compressive strength of masonry elements, Factors affecting compressive strength, strength of units, prisms / wallettes and walls. Effect of Bond/joint strength on strength of masonry – Flexure and shear – Elastic properties of masonry materials and masonry – IS 1905 - 1987 provisions – Design of masonry elements – axial, eccentric compression and lateral loads.	09	CO5
5	**Cost effective Construction:** Mass housing – economic construction, Planning – need for using precast housing components – usage of alternative materials and technologies for mass construction.	09	CO6

TEXT BOOKS:

1. Jagadish.K.S, Venkatarama Reddy.B.V and Nanjunda Rao.K.S. "Alternative Building Materials and Technologies" ,New Age International (P) Ltd., New Delhi, 2008.
2. Jagadish.K.S. "Structural Masonry" I K International Publishing House; 1st edition, New Delhi,2015.
3. Hendry A.W., "Structural Masonry", Palgrave Macmillan Publishers,2nd edition, Noida 1988.

REFERENCE BOOKS:

1. Proceedings of workshop on "Alternative building material and technology" 19th – 20th dec 2003 @ bvb college of engineering & tech, hubli,2003.
2. Manuals published by hudco.9ch. 7 & 8)
3. IS 2250 : 1985, IS 3466 : 1999, IS 4098 : 1999, IS 2116 :1998, IS 1095 : 1998,Bureau of Indian Standards, New Delhi,India.

CIE- Continuous Internal Evaluation/Semester End Examination (50 Marks) / (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	5	-	-	10
Understand	5	5	5	10
Apply	10	5	5	20
Analyze	5	5	-	10
Evaluate	-	-	-	-
Create	-	-	-	-

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	05	10	15	15
Understand	15	10	25	25
Apply	20	20	40	40
Analyze	10	10	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

GROUND IMPROVEMENT TECHNIQUES

Course Code: 20 CIV643 **Credits: 03**

L: T: P: S : 3:0:0:0 **CIE Mark: 50**

Exam Hours: 3 Hours **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Analyze the field data and assess the requirement for improving the locally available soils.
CO2	Understand dewatering techniques and design for simple cases.
CO3	Apply the knowledge on in-situ treatment of cohesion less and cohesive soils.
CO4	Understand the concepts of cement stabilization, sandwich technique and other miscellaneous methods.
CO5	Apply the grouting and sand column techniques with respect to field conditions.
CO6	Understand the concept of earth reinforcement and analyze the stability of earth retaining wall.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Ground improvement:** Definition, Objectives of ground improvement, Classification of ground improvement techniques, Factors to be considered in the selection of the best soil improvement technique. **Drainage & preloading:** Importance, Vertical drains, Sand drains, Electro kinetic dewatering, Preloading.	09	CO1 & CO2
2	**Compaction:** Effect of grain size distribution on compaction for various soil types like lateritic soil, coarse-grained soil. Effect of compaction on engineering behavior like compressibility, swelling and shrinkage, permeability, relative density, liquefaction potential. **Field compaction**: static, dynamic, impact and vibratory type. Specification of compaction. Shallow and deep compaction, Dynamic Compaction, Vibrofloatation.	09	CO3
3	**Cement stabilization:** Definition, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization **Lime and Bitumen stabilization:** Lime stabilization – suitability, process, criteria for lime stabilization. Bitumen stabilization in brief.	09	CO4
4	**Grouting:** Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting. **Stone Column:** Function, Design principles, load carrying capacity, construction techniques, settlement of stone column.	09	CO5
5	**Earth reinforcement:** Concept of reinforced earth, Reinforcing materials, Backfill, Construction of reinforced earth wall. Stability analysis of reinforced earth retaining wall- external stability analysis, internal stability analysis(Brief mention about the methods only), application areas of reinforced earth structures **Geosynthetics:** Soil reinforcement with, geogrids, geotextiles, classification, concepts, geogrid and geotextiles as separators, filters, and drainage media, damage and durability of geotextile	09	CO6

TEXT BOOKS:

1. Ground Improvement Techniques**,** Purushothama Raj P, ,(ISBN: 978-8131805947), Laxmi Publications New Delhi, 3rdEdition,2016.
2. An Introduction to Soil Reinforcement & Geosynthetics, G L Sivakumar Babu, Universities Press, (ISBN: 978-8173714818), 2nd Edition,2005.
3. Raj P P "Ground Improvement Techniques" Tata McGraw Hill, New Delhi.

REFERENCE BOOKS:

1. "Engineering principles of ground modification", Manfred Hausmann, McGraw Hill Pub. Co., New York, (ISBN-13: 978-0070272798),1990.
2. "Ground Improvement", Moseley M.P., Blackie Academic and Professional, ChapmanandHall, Glasgow, (ISBN-13: 978-0415274555), 2004."Earth Reinforcement and Soil Structure", Jones J.E.P, Butterworths,

CIE- Continuous Internal Evaluation/Semester End Examination (50 Marks) / (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	-	-	-	-
Understand	10	5	5	20
Apply	10	5	5	20
Analyze	5	5	-	10
Evaluate	-	-	-	-
Create	-	-	-	-

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	-	-	-	-
Understand	20	20	40	40
Apply	20	20	40	40
Analyze	10	10	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	50	50	100	100

MECHANIZATION IN CONSTRUCTION

Course Code: 20CIV644 **Credits: 03**

L: T: P: S : 3:0:0:0 **CIE Marks: 50**

Exam Hours: 3 Hours **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the concept of Mechanization in construction
CO2	Analyze the effective utilization of equipment's used in earthwork activities.
CO3	Apply equipments used to manufacture construction material and to handle concrete.
CO4	Apply Mechanization through Various methods and technologies used in construction
CO5	Analyze the effective utilization of equipments used in pile driving
CO6	Analyze the effective utilization of equipments used in drilling.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Introduction to mechanization**: Definition, advantages and limitations of mechanization, Indian scenario and Global scenario, Safety and Environmental issues in mechanization **Mechanization Through Construction**: formwork and scaffolding types and materials	9	CO1
2	**Mechanization through construction equipment:** Equipment cost, Machine Power, Production cycle - Dozers, scrapers, Excavators, Finishing equipment, Trucks and Hauling equipment, Hoisting equipment, Draglines and Clamshells	9	CO2
3	**Mechanization in construction material production**: Mechanization in aggregate manufacturing: Natural aggregates and recycled aggregates, Mechanization in rebar fabrication, Concrete production and handling	9	CO3
4	**Mechanization through construction methods/technologies:** Segmental construction of bridges/flyovers, box pushing technology for tunneling, trench-less technology. **Pile Driving Equipment:** Pile hammers, selecting a pile hammer, loss of energy due to impact, Energy losses due to causes other than impact.	9	CO4 & CO5
5	**Mechanization through construction methods of drilling**: Blasting and Tunneling equipment: Definition of terms, bits, Jackhammers, Drifters, wagon drills, chisel drills, piston drills, blast hole drills, shot drills, diamond drills, tunneling equipment, selecting the drilling method equipment; selecting drilling pattern.	9	CO6

TEXT BOOKS:

1. B.Satyanarayana and S.C.Saxena., "**Construction, Planning and Equipements**", Standard Publishers Distributors, Reprint Edition, New Delhi. 2014.
2. Sharma S.C., "**Construction Equipment and Management**", Khanna Publishers , First Edition, Delhi, 2019
3. Peurifoy R L, Ledbetter, W.B. and Schexnayder, C "**Construction Planning, Equipment and Methods**", Mc Graw Hill, 5th Edition, Singapore, 1995

REFERENCE BOOKS:

1. Deodhar, S.V., "**Construction Equipment and Job Planning**", Khanna Publishers, 4th Edition, New Delhi, 1974
2. Mahesh Varma., "**Construction Equipment and its Planning and Applications**", Metropolitan Book Co.(P) Ltd., New Delhi. India.1975
3. "**Construction Review**" Published by Civil Engineering and Construction Review,New Delhi, 1991.

CIE- Continuous Internal Evaluation/Semester End Examination (50 Marks) / (50 Marks)

Bloom's Category	Test	Assignment	Quizzes	Exam
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	5	5	5	15
Understand	15	10	5	25
Apply	5	-	-	10
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Percentage Evaluation of Various Blooms levels

Bloom's	CIE	SEE	TOTAL	%
Remember	15	15	30	30
Understand	30	25	55	55
Apply	5	10	15	15
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

STRUCTURAL DYNAMICS

Course Code: 20CIV651 **Credits: 03**
L: T: P: S : 3:0:0:0 **CIE Mark: 50**
Exam Hours: 3 Hours **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Comprehend the fundamental concepts of Structural Dynamics.
CO2	Analyze SDOF systems, with and without damping.
CO3	Analyze SDOF systems, with free or forced vibration.
CO4	Analyze free and forced vibration using Duhamel's Integral.
CO5	Compute the natural frequencies and normal modes of multi-degree freedom System.
CO6	Compute the response of shear buildings to base motion, harmonic and forced excited motion.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	Introduction to structural dynamics, basic definitions, Principle of Virtual displacement and energy, vibration of single degree of freedom system-Simple numerical problems. Mathematical models of Undamped & damped free vibrations of SDOF, logarithmic decrement- Simple numerical problems.	09	CO1 & CO2
2	Forced vibrations of single degree freedom system, response of undamped and damped systems subjected to harmonic loading- Simple numerical problems. Rotation unbalance, reciprocating balance, support motion.- Simple numerical problems.	09	CO2 & CO3
3	Duhamel's integral, response due to general system of loading, dynamic load factor, Response spectrum- Simple numerical problems. Response of SDOF subjected to harmonic excitation, Vibration isolation- Simple numerical problems.	09	CO4
4	Free vibration of two and three degree of freedom systems, natural frequencies- Simple numerical problems. Normal modes, orthogonality property of natural modes, Eigen values- Simple numerical problems.	09	CO3 & CO5
5	Layout of water supply pipes in buildings. Distribution Systems: System of supply, service reservoirs and their capacity determination, methods of layout of distribution systems. Introduction to Solid Waste management and Air Pollution –Types of solid waste, Sources and properties, Solid waste management. Air pollution, effects, classification of pollutants and air quality management concepts.	09	CO6

TEXT BOOKS:

1. Mario Paz, "Structural Dynamics", CBS Publishers, (ISBN: 9780442275358), 2nd Edition, 1997.

2. M Mukhopadhyay, "Structural Dynamics", CRC Press, (ISBN:9788180520907), 1st Edition, 2010.

REFERENCE BOOKS:

1. Anil K. Chopra "Dynamics of Structures", Prentice Hall of India,(ISBN :9780132858038), 4th Edition 2012
2. S.K. Duggal, "Earthquake Resistant Design of Structures", (ISBN:9780195688177) Oxford University Press, 2007
3. Pankaj Agarwal, Manish Shrikande, "Earthquake Resistant Design of structures", (ISBN: 8120328922), PHI India, 2007
4. IS4326, IS13920, IS1893.

CIE- Continuous Internal Evaluation/Semester End Examination (50 Marks) / (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	3	2	2	5
Understand	5	2	3	10
Apply	7	5	3	20
Analyze	10	6	2	15
Evaluate	-	-	-	-
Create	-	-	-	-

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	7	5	12	12
Understand	10	10	20	20
Apply	15	20	35	35
Analyze	18	15	33	33
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

PREFABRICATED STRUCTURES

Course Code: 20CIV652 **Credits: 03**
L: T: P: S : 3:0:0:0 **CIE Mark: 50**
Exam Hours: 3 Hours **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Comprehend the fundamentals of prefabricated structures and materials.
CO2	Design Simple prefabricated structural elements using design principles and understand joints for structural connection.
CO3	Comprehend the production and storage technology of Prefabricated structural components.
CO4	Understand the hoisting technology of Prefabricated structural components.
CO5	Design and detail precast unit for factory structures.
CO6	Design single storey buildings for abnormal loads.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Introduction:** Comparison with monolithic construction, need for prefabrication, Principles, Materials – Types of prefabrication – site and plant prefabrication – Economy of prefabrication, Modular coordination– Standardization–Systems- Planning for Components of prefabricated structures– Disuniting of structures. **Prefabricated components:** Design of simple rectangular beams and I beams– Handling and erection stresses, Elimination of erection stresses – Beams, columns - Symmetrical frames.	09	CO1 & CO2
2	**Prefabricated components:** Roof and floor slabs, ribbed floor panels – wall panels, footings, shear walls. **Joints for different structural connections:** Joints for different structural connections, Dimensions and detailing–Effective sealing of joints for water proofing – Provisions for non-structural fastenings – Expansion joints in pre-cast construction.	09	CO2
3	**Production technology methods:** Choice of production setup – Manufacturing methods – Stationary and mobile production – Planning of production setup. **Storage technology:** Storage of precast elements – Dimensional tolerances– Acceleration of concrete hardening.	09	CO4
4	**Hoisting technology:** Equipments for hoisting and erection – Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns– Vacuum lifting pads. Designing and detailing of precast unit for factory structures – Purlins, Principal rafters, roof trusses, lattice girders, Cable frames.	09	CO4 & CO5
5	Concepts of Single span single storeyed frames– Single storeyed buildings– slabs, beams and columns. **Design for abnormal loads:** Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., Importance of avoidance of progressive collapse.	09	CO6

TEXT BOOKS:

1. "Prefabricated Concrete for Industrial and Public Structures", L. Mokk, Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.
2. "Knowledge based process planning forconstruction and manufacturing", GerostizaC.Z., Hendrikson C. and Rehat D.R, Academic Press Inc., (ISBN – 9780127819006), 2007.
3. I. T. Koncz, "Manual of Precast Concrete Construction", Vol. I, II, III & IV, Berlin, 1971

REFERENCE BOOKS:

1. CBRI, "Building materials and components", India, 1990.
2. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland BetorVerlag, 2009.
3. "Prefabricated Concrete for Industrial and PublicSectors",LassloMokk, AkademiaiKiado, Budapest, 1964

CIE- Continuous Internal Evaluation/Semester End Examination (50 Marks) / (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	5	2	2	10
Understand	5	5	3	15
Apply	10	5	3	15
Analyze	5	3	2	10
Evaluate	-	-	-	-
Create	-	-	-	-

Percentage Evaluation of Various Blooms levels

Bloom's Category	**CIE**	**SEE**	**TOTAL**	**%**
Remember	9	10	20	20
Understand	13	15	30	30
Apply	18	15	30	30
Analyze	10	10	20	20
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	50	50	100	100

DESIGN OF PRE-STRESSED CONCRETE STRUCTURES

Course Code: 20CIV653 **Credits: 03**
L: T: P: S : 3:0:0:0 **CIE Mark: 50**
Exam Hours: 3 Hours **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the fundamental concepts of stress analysis.
CO2	Analyze pre stressed members
CO3	Analyze different losses encountered in pre stressed system and end block design.
CO4	Analyze flanged & rectangular pre stressed members/sections for flexure and shear.
CO5	Analyze pre-stress members for deflection under transfer loads and due to different cable profiles.
CO6	Design the simple rectangular pre stressed concrete flexural members for different load conditions.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**Introduction materials:** High strength concrete and high strength steel. Stress-Strain characteristics and properties, advantages of pre-stressed concrete. Pre-tensioning and post-tensioning systems, tensioning methods and end anchorages. Pre-stressing systems Fressinet System, Gifford – Udall & Magne- lBlatan System, Tensioning devices, is anchoring devices. **Analysis of rectangular sections for flexure:** Analysis of pre-stress rectangular members, assumptions, Stresses in concrete due to pre-stress and concentric and eccentric loads.	**09**	**CO1 & CO2**
2	**Analysis of flange sections for flexure:** Analysis of pre-stress flange members, assumptions, Stresses in concrete due to pre-stress and concentric and eccentric loads. **Load balancing concept and pressure line:** Load balancing concept, Stress concept and Centre of Thrust. Analysis Thrust line concept or pressure line, load balancing concept, cable profile, as per IS 1343.	**09**	**CO2**
3	**Losses of pre-stress:** Various losses encountered in pre-tensioning and post tensioning methods, determination of jacking force. Elastic shortening, loss due to shrinkage, creep, friction, curvature etc. I.S. code provisions. **Design of end blocks:** Transmission of pre-stress in pre-tensioned members, transmission length, Anchorage stress in post-tensioned members. Bearing stress and bursting tensile force-stresses in end blocks-Methods, I.S. Code, provision for the design of end block reinforcement.	**09**	**CO3**
4	**Limit state of collapse:** Ultimate flexural strength of prestressed member as per IS 1343 Code recommendations –Ultimate flexural strength of sections. **Limit state of collapse:** Shear - IS Code Recommendations, shear resistance of sections, shear reinforcement.	**09**	**CO4**
5	**Deflections:** Effect of tendon profile on deflections – Factors influencing deflections– Calculation of Short term and long-term deflections of simply supported flexural members, Elastic deflections under transfer loads and due to different cable profiles **Design of pre-tensioned & posttensioned beams:** Design of simple rectangular pre & post tensioned flexural members	**09**	**CO5 & CO6**

TEXT BOOKS:

1. N. Krishna Raju., "Pre-stressed Concrete", Tata McGraw Publishers, 5th Edition, 2012.
2. P. Dayarathnam., "Pre-stressed Concrete", Oxford and IBH Publishing Co. 2016.
3. Praveen Nagarajan., "Pre-stressed Concrete design", Pearson India, 1st Edition January 2013.

REFERENCE BOOKS:

1. T.Y. Lin and Ned H Burns "Design of pre-stressed concrete structures", Wiley India Private Limited, 3rd Edition, 2010.
2. N.C. Sinha & S.K. Roy "Fundamentals of pre-stressed concrete", S Chand Publishers, New Delhi, 3rd Edition, 2011.
3. Rajagopalan, "Pre-stressed Concrete", Narosa Publishing House, 2nd Edition, 2015
4. IS-1343-2012, "Design of Prestress concrete structures".

CIE- Continuous Internal Evaluation/Semester End Examination (50 Marks) / (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	5	2	2	5
Understand	5	3	3	8
Apply	-	-	-	-
Analyze	15	10	5	37
Evaluate	-	-	-	-
Create	-	-	-	-

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	9	5	14	14
Understand	11	8	19	19
Apply	-	-		
Analyze	30	37	67	67
Evaluate	-	-	-	-
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

PAVEMENT MATERIALS & CONSTRUCTION

Course Code: 20CIV654 **Credits: 3**

L: T: P: S : 3:0:0:0 **CIE Marks: 50**

Exam Hours: 03 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the various properties of aggregate in construction of pavements.
CO2	Understand the various properties of bitumen in construction of pavements.
CO3	Identify the various bitumen mixes
CO4	Design the suitable bitumen mixes for different layers of pavements
CO5	Identify the equipments used in road construction.
CO6	Understand the importance of specifications and quality control in road construction.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**AGGREGATES:** Origin, classification, requirements, properties and tests on road aggregates. **AGGREGATE GRADATION:** concepts of size and gradation – design gradation, maximum aggregate size, aggregate blending by different methods to meet specification.	9	CO1
2	**BITUMEN AND TAR:** Origin, preparation, Properties and chemical constitution of bituminous road binders, requirements. Basic tests on bitumen. **BITUMEN, EMULSION AND CUTBACKS:** Preparation, characteristics, uses Basic tests. Adhesion of Bituminous Binders to Road Aggregates. Adhesion failure, mechanism of stripping, tests and methods of improving	9	CO2
3	**BITUMINOUS MIXES:** Mechanical properties, dense and open textured mixes, flexibility and brittleness, without Hveem Stabilometer & Hubbar – Field Tests. **MIX DEISGN:** Types of bituminous mix, design methods using Rothfuch's Method only and specification, Marshal mixed design criteria- voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen.	9	CO3 & CO4
4	**EQUIPMENT IN HIGHWAYCONSTRUCTION:** Various types of equipment for excavation, grading and compaction – their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction. **SUBGRADE:** Earthwork grading and construction of embankments and cuts for roads. Preparation of subgrade, quality control tests	9	CO5 & CO6
5	**FLEXIBLE PAVEMENTS:** Specifications of materials, construction method and field control checks for various types of flexible pavement layers. **CEMENT CONCRETE PAVEMENTS:** Specifications and method of cement concrete pavement construction (PQC Importance of providing DLC as sub-base and polythene thin layer between PQC and sub-base), Quality control tests, Construction of various types of joints.	9	CO6

TEXTBOOKS:

1. S.K.Khanna, C.E.G.Justo, A.Veeraragavan, "Highway Engineering", Nem Chand Bros, 10th edition Roorkee, 2015.
2. L.R.Kadiyali "Principles and Practices of Highway Engineering", Khanna Publishers, 4th edition, New Delhi, 2005.
3. Prithvi Singh Kandhal "Bituminous Road construction in India", PHI Learning 1st edition, New Delhi, 2016.

REFERENCEBOOKS:

1. "Soil mechanics for Road Engineers", , RRLDSIR, HMSO Publications 1st edition 1952,New Delhi.
2. "Bituminous Materials in Road Construction", , RRLDSIR, HMSO Publications 1st edition 1962.
3. Specifications for Roads and Bridge works, MORT&H-5th revision, New-Delhi, 2013.
4. Paving Bitumen-specification,IS:73-2013,BIS,4th revision, New Delhi, 2013.

CIE/ SEE - Continuous Internal Evaluation/Semester End Examination-(50 Marks) / (50 Marks)

Bloom's Category	**Test**	**Assignment**	**Quizzes**	**Exam**
Marks (out of 50)	**25**	**15**	**10**	**50**
Remember	5	5	-	10
Understand	10	5	5	20
Apply	5	5	5	15
Analyze	-	-	-	-
Evaluate	5	-	-	5
Create	-	-	-	

Percentage Evaluation of Various Blooms levels

Bloom's	**CIE**	**SEE**	**TOTAL**	**%**
Remember	10	10	20	20
Understand	20	20	40	40
Apply	15	15	30	30
Analyze	-	-	-	-
Evaluate	5	5	10	10
Create	-	-	-	-
TOTAL	**50**	**50**	**100**	**100**

ENVIRONMENTAL ENGINEERING LAB

Course Code: 20 CIV66 **Credits: 1.5**

L: T: P: S : 0:0:1.5:0 **CIE Mark: 25**

Exam Hours: 3 Hours **SEE Marks: 25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Estimate the physical, chemical and biological parameters of the water quality
CO2	Implement safety of drinking water by proper disinfection.
CO3	Compare the experimental results with standards and deliberate based on the purpose of analysis
CO4	Understand the environmental significance and application in environmental engineering practice

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Sl no:	Name of the experiment	Hrs	COs
1	Determination of Alkalinity, Acidity and pH	**3**	**CO1,3,4**
2	Determination of Electrical conductivity	**3**	**CO1,3,4**
3	Determination of Chlorides.	**3**	**CO1,3,4**
4	Determination of Calcium, Magnesium and Total Hardness.	**3**	**CO1,3,4**
5	Determination of Dissolved Oxygen.	**3**	**CO1,3,4**
6	Determination of BOD& COD	**3**	**CO1,3,4**
7	Determination of sodium and potassium by flame photometer	**3**	**CO1,3,4**
8	Jar Test for Optimum Dosage of Alum	**3**	**CO1,3,4**
9	Determination of Residual Chlorine	**3**	**CO2,3,4**
10	Determination of percentage of available chlorine in bleaching powder	**3**	**CO2,3,4**
11	Determination of MPN index of given water sample	**3**	**CO1,3,4**
12	Determination of Solids in Sewage: Total Solids, Suspended Solids,Dissolved Solids, Volatile Solids, Fixed Solids, Settleable Solids.	**3**	**CO1,3,4**

TEXT BOOKS:

1. Standard Methods for examination of Water and Wastewater, APHA, AWWA and WPCF, 20th Edition.
2. Punmia B C & Ashok Jain., "Environmental Engineering I", Laxmi Publications, , 2nd edition. ISBN: 10: 9788131807033.
3. Birdie, G S & Birdie J S., "Water supply & Sanitary engineering", DhanpatRai Publishing company,8th edition, 2012. ISBN-10: 8187433795

REFERENCE BOOKS:

1. KVSG Muralikrishna (1997), "Chemical analysis of water and soil - a laboratory manual", Environmental Protection Society. National Institute of Ecology and Environment, Kakinada, India, 1997.
2. Manual on Water supply and treatment 1999, –CPHEEO manual, Ministry of Housing and Urban affairs, New Delhi.
3. S.K.Garg"Water supply Engineering", Khanna Publishers, 33 rd edition, ISBN: 9788174091208

CIE- Continuous Internal Evaluation/Semester End Examination (25 Marks) / (25 Marks)

Bloom's Category	Test	Exam
Remember	5	5
Understand	10	10
Apply	10	10
Analyze	-	-
Evaluate	-	-
Create	-	-

Percentage Evaluation of Various Blooms levels (25+25)

	THEORY		
Bloom's	**CIE**	**SEE**	**TOTAL**
Remember	5	5	10
Understand	10	10	20
Apply	10	10	20
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-

MINI PROJECT –III (Analysis & Design of RC Structural Elements Lab)

Course Code: 20CIV67 **Credits: 1.5**
L: T: P: S : 0:0:1.5:0 **CIE Mark: 25**
Exam Hours: 3 Hours **SEE Marks: 25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Apply IS provisions and computational tool in structural design & detailing.
CO2	Prepare detailed drawings and bar bending schedule of column and Isolated footing
CO3	Prepare detailed drawings and bar bending schedule of beams and slab
CO4	Prepare detailed drawings and bar bending schedule of staircases

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Exercise No	Description	Hrs	COs
01.	Drawing a plan of a residential building. [Framed structure, G+1, minimum of 1200sft]. Drawing beam layout of plinth, ground floor and first floor.	**3**	**CO1**
02.	Drawing column layout for the above plan. [Use of proper gridlines with proper column numbering.]	**3**	**CO1**
03.	Modeling the above structure using STAAD PRO/CYPECAD. [Modeling only].	**3**	**CO1**
04.	Analysis of above model. [Applying appropriate analysis techniques, Exporting column reactions for foundation design.]	**3**	**CO1**
05	Design and Detailing of Isolated footing. [Column and Footing grouping, Design one typical isolated footing, & foundation layout.]	**3**	**CO2**
06	Detailed drawing of Column & foundation. Preparing bar bending schedule.	**3**	**CO2**
07	Detailed drawing of Plinth beam. Preparing bar bending schedule.	**3**	**CO3**
08	Detailed drawing of ground floor beam. Preparing bar bending schedule.	**3**	**CO3**
09	Detailed drawing of ground floor slab. Preparing bar bending schedule.	**3**	**CO3**
10.	Detailed drawing of ground floor slab. Preparing bar bending schedule.	**3**	**CO3**

11.	Design and Detailing of first floor beam and slab. Preparing bar bending schedule.	**3**	**CO3**
12.	Design and Detailing of dog legged stair case and landing beam. Preparing bar bending schedule.	**3**	**CO4**

Note: Submissions:-

1. All the drawings should be drawn using AUTOCAD drafting software.
2. Bar bending schedule be done in A4 sheets.
3. A consolidated report on overall analysis, design, detailing and bar bending schedule of G+1 residential structure should be submitted.
4. Project Report should contain all the required drawings taken in A3 sized printout and its respective bar bending schedule in A4 sized sheets.

TEXT BOOKS:

4. Staad Pro/CYPE CAD Design manual.
5. N. Krishnaraju .,"Structural Design & Drawing: Reinforced Concrete & Steel", University Press , 2nd edition,Bangaluru, 2005
6. . B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain , "R.C.C. Designs (Reinforced Concrete Structures)", Laxmi Publications, 10th edition, New Delhi 2012.
7. N. Subramanian, "Design of Reinforced Concrete Structures", Oxford University Press, 1st edition, New Delhi, 2013.

REFERENCE BOOKS:

1. **SP 34** - 1987 Handbook on Concrete Reinforcement and Detailing.
2. Krishnamurthy., "Elementary Structural Design and Drawing",CBS publishers,1st edition, 2006, (Concrete Structures), CBS publishers, New Delhi. 1999.
3. S.N.Sinha., "Reinforced Concrete Design",McGrawHill Education, 3rdedition, New Delhi,2014.
4. Ghosh Karuna Moy, "Practical Design of Reinforced Concrete Structures", PHI Learning, 1st edition, New Delhi, 2010.

CIE- Continuous Internal Evaluation/Semester End Examination (25 Marks) / (25 Marks)

Bloom's Category	Test	Exam
Remember	25	25
Understand		
Apply	5	5
Analyze	10	10
Evaluate	10	10
Create	-	

Percentage Evaluation of Various Blooms levels (25+25)

	THEORY		
Bloom's	**CIE**	**SEE**	**TOTAL**
Remember	-	-	-
Understand	5	5	10
Apply	10	10	20
Analyze	10	10	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	**25**	**25**	**50**

MINI PROJECT-IV (EXTENSIVE SURVEY PROJECT)

Course Code: 20CIV68 **Credits: 02**
L: T: P: S : 0:0:2:0 **CIE Mark: 25**
Exam Hours: 3 Hours **SEE Marks: 25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Apply the concepts of surveying in the construction sites
CO2	Design a new reservoir and enhance the capacity of the exiting one
CO3	Geometrically design the stretch of road and its pavement as per IRC provision
CO4	Prepare a layout for the township and design water supply and sanitary facility

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

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

Module No	Content of Module	Hrs	COs
1	**INTRODUCTION:** Importance of project works, Reconnaissance of the sites and setting up of bench marks. **NEW TANK PROJECT:** Alignment of center line of the proposed bund, Longitudinal and cross sections of the bund. Capacity Contour survey, block leveling at Waste weir and sluice points and canal alignment	**09**	**CO1 & CO2**
2	**WATER SUPPLY AND SANITARY PROJECT:** Identifying the proper water supply source, Calculation of water requirement based on present and future population, Preparation of village map by using plane table surveying, block leveling at waste weir and overhead tanks, underground drainage system surveys for laying the sewers	**09**	**CO1 & CO4**
3	**HIGHWAY PROJECT:** Preliminary and detailed investigations to align a new road. The investigations shall consist of topographic surveying of strip of land for considering alternate routes for final alignment. Longitudinal and cross sections of the proposed road and its pavement design	**09**	**CO1 & CO3**
4	**OLD TANK PROJECTS:** Longitudinal and cross sections of the center line of the existing bund. Capacity Contour survey of existing bund, block leveling at existing Waste weir and sluice points.	**09**	**CO1 & CO2**
5	T**OWN/HOUSING / LAYOUT PLANNING:** Reconnaissance survey for selection of site and conceptualization of project. Detailed survey required for project execution like contour surveys. Preparation of layout plans for township development as per regulations. Centerline marking. Preparation of drawing along with report as per regulations.	**09**	**CO1 & CO4**

NOTE: Students shall submit

1. Report consisting of all the design aspects of each project work along with necessary drawings in Auto-CAD

TEXT BOOKS:

1. B.C. Punmia , Er. Ashok Kr. Jain, Dr.Arun Kumar Jain., **"Surveying** Vol 2 and Vol 3", Laxmi Publications, Edition: 16th (2016), New Delhi.

2. A. M. Chandra., **"Plane surveying"**– New age international (P) Ltd, 3rd Edition (Reprint 2015).

3. A. M. Chandra., **"Higher surveying"**– New age international (P) Ltd, 3rd Edition (Reprint 2015).

REFERENCE BOOKS:

1. Milton O. Schmidt – Wong, Thomson Learning., **"**Fundamentals of Surveying''.

2. S.K. Roy., **"**Fundamentals of Surveying**''** –– Prentice Hall of India.

3. S.K. Duggal., **"**Surveying Vol. I**''**, Tata McGraw Hill - Publishing Co. Ltd., New Delhi.

CIE- Continuous Internal Evaluation/Semester End Examination (25 Marks) / (25Marks)

Bloom's Category	**Test**	**Exam**
Remember	**-**	-
Understand	05	05
Apply	10	10
Analyze	10	10
Evaluate	-	-
Create	-	-

Percentage Evaluation of Various Blooms levels (25+25)

	THEORY		
Bloom's	**CIE**	**SEE**	**TOTAL**
Remember	-	-	-
Understand	05	05	10
Apply	10	10	20
Analyze	10	10	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	**25**	**25**	**50**

APPENDIX A

Outcome Based Education

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

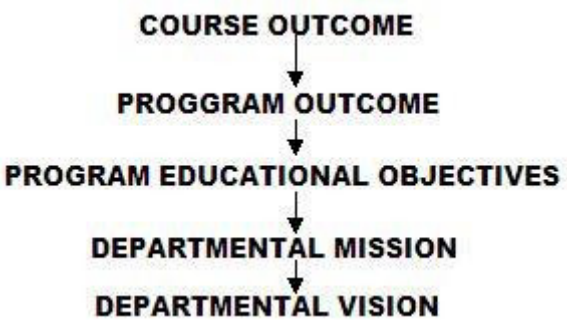
There are three educational Outcomes as defined by the National Board of Accredition:

Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes

Mapping of Outcomes



APPENDIX B

The Graduate Attributes of NBA

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

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

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.

Conduct investigations of complex problems: The problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement (like: cost, power requirement, durability, product life, etc.) which need to be defined (modeled) within appropriate mathematical framework that often require use of modern computational concepts and tools.

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

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.

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.

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

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

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.

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.

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

APPENDIX C

BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.

[eduglosarry.org]