SCHEME AND SYLLABUS

Department of Civil Engineering

Head of Department
Civil Engineering
Global Academy of Technology
Rajarajeshwarinagar Bangalore - 98

III -IV Semester Scheme (2022-23)

Civil Engineering

GLOBAL ACADEMY OF TECHNOLOGY

(Autonomous institution affiliated to VTU, Belagavi.

Accredited by NAAC with 'A' grade,

NBA Accredited Civil, CS, E&C, E&E, MECH and IS branches)

Ideal Homes Township,

Raja Rajeshwari Nagar, Bengaluru-560098.

Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Scheme of UG Autonomous Program – 2022 batch

(3rd Semester – Civil Engineering)

III SEMESTER

Global Academy of Technology (Autonomous Institution Affiliated to VTU) Scheme of Teaching and Examination 2022-23 Department of Civil Engineering											
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**Teaching Dept.**	**Teaching Hours/Week**			**Examination**			**CREDITS**
					L	**T**	**P**	**CIE**	**SEE**	**Total**	
1	22MAT31B	Complex Variables, Probability and Sampling Techniques	BS	MAT	2	2	0	50	50	100	3
2	22CIV32	Mechanics of Solids	PC	Civil Department	2	2	0	50	50	100	3
3	22CIV33	Mechanics of Fluids and Hydraulic Machines	IPC		2	2	2	50	50	100	4
4	22CIV34	Building Materials and Concrete Technology	PC		3	0	0	50	50	100	3
5	22CIV35	Engineering Geology and Practice	ESC		2	0	2	50	50	100	3
6	22CIV36	Planning and Designing of Buildings	AEC		2	0	2	50	50	100	3
7	22CIVL37	Material Testing and Concrete Laboratory	Lab		0	0	2	50	50	100	1
				Total				**350**	**350**	**700**	**20**

H.P. Rajashekhar Swamy
Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Scheme of UG Autonomous Program – 2022 batch

(4th Semester – Civil Engineering)

IV SEMESTER

Global Academy of Technology (Autonomous Institution Affiliated to VTU) Scheme of Teaching and Examination 2022-23 Department of Civil Engineering											
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**Teaching Dept.**	**Teaching Hours/Week**			**Examination**			**CREDITS**
					L	**T**	**P**	**CIE**	**SEE**	**Total**	
1	22MAT41B	Transform Calculus and Numerical Techniques	BS	MAT	2	2	0	50	50	100	3
2	22CIV42	Engineering Survey	IPC	Civil Department	2	2	2	50	50	100	4
3	22CIV43	Environmental Engineering	IPC		3	0	2	50	50	100	4
4	22CIV44	Structural Analysis	PC		2	2	0	50	50	100	3
5	22CIV45	Sustainable Construction	ESC		3	0	0	50	50	100	3
6	22CIV46	Design studio	AEC		2	0	2	50	50	100	3
				Total				**300**	**300**	**600**	**20**

H.P. Rajashekhar Sheregar
Dean Academic
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Rajarajeshwarinagar, Bengaluru-98

SEMESTER – III

Course: Complex Variables, Probability and Sampling Techniques

Course Code	**22MAT31B**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Course Objectives: To enable students to apply the knowledge of Mathematics in the field of Civil Engineering by making them to learn:

CLO1	Analytic functions and complex line integrals
CLO2	Probability distributions
CLO3	Stochastic process and Markov chains
CLO4	Sampling distributions and testing of hypothesis

Content	No. of Hours/ RBT levels
Module-1 Review of a function of a complex variable, Analytic functions, Cauchy-Riemann equations, construction of analytic functions using Milne Thomson method. Properties of analytic functions.	**8 Hours L2, L3**
Module 2 Conformal Transformations, Bilinear transformations. Complex line integrals, Cauchy's theorem, Cauchy's integral formula, Singularities, poles, residues, Cauchy's residue theorem.	**8 Hours L2, L3**
Module 3 Probability, Axioms of probability, Conditional probability, Bayes theorem, Discrete and continuous random variables, Binomial, Poisson, Exponential, Normal distributions.	**8 Hours L2, L3**
Module 4 Joint distributions (both discrete and continuous), Marginal and conditional distributions, Expectation and Covariance. Stochastic processes, probability vector, stochastic matrices, regular stochastic matrices, Markov chains.	**8 Hours L2, L3**
Module 5 Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, student's t-distribution, chi-square distribution as a test of goodness of fit.	**8 Hours L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22MAT31B.1	Apply Cauchy Riemann equations to study different properties of analytic functions
22MAT31B.2	Evaluate complex line integrals
22MAT31B.3	Solve problems associated with random variables using probability distributions
22MAT31B.4	Solve problems related to testing of hypothesis

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers **44th** Edition, 2017
2. T Veerarajan, Probability, Statistics and Random Processes for Engineers, Tata McGraw Hill, 3rd Edition, 2008

References:

1. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2006
2. N.P.Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications 6 th Edition, 2014
3. Richard H Williams, Probability, Statistics and Random Processes for Engineers, Cengage Learning, 1st Edition, 2003.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average marks scored in all the three is added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 2.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Assignments	10	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22MAT31B.1	3	2	1									3			
22MAT31B.2	3	2	1									3			
22MAT31B.3	3	2	1									3			
22MAT31B.4	3	2	1									3			
Average	3	2	1									3			

Low-1: Medium-2: High-3

SEMESTER – III

Course: Mechanics of Solids

Course Code	**22CIV32**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Engineering Mechanics

Course Objectives: Students will be taught:

CLO1	The basic concepts of the stresses and strains for different materials and strength of structural elements.
CLO2	The development of internal forces and resistance mechanism for one dimensional and two- dimensional structural elements.
CLO3	To analyze different internal forces and stresses induced due to representative loads on structural elements.
CLO4	To determine slope and deflections of beams.
CLO5	To evaluate the behavior of torsion members, columns and struts.

Content	**No. of Hours/ RBT levels**
Module-1 **Simple Stresses and Strain:** Introduction, Definition of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and nonferrous materials, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self-weight. Saint Venant's principle. Compound bars, Compound section subjected to temperature stresses, state of simple shear, Elastic Constants and their relationship.	**10 Hours** **L2, L3**
Module 2 **Compound Stresses:** Introduction, state of stress at a point, General two-dimensional stress system, Principal stresses and principal planes. Mohr's circle of stresses. Theory of failures: Max. Shear stress theory and Max. Principal stress theory. **Thin and Thick Cylinders:** Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders	**10 Hours** **L2, L3**

subjected to both internal and external pressure; Lame's equation, radial and hoop stress distribution.	
Module 3 **Shear Force and Bending Moment in Beams:** Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations.	**10 Hours** **L2, L3**
Module 4 **Bending and Shear Stresses in Beams:** Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section Modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections. Shear Centre. **Torsion in Circular Shaft:** Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus power transmitted by a shaft.	**10 Hours** **L2, L3**
Module 5 **Deflection of Beams:** Definition of slope, Deflection and curvature, Sign Conventions, Derivation of moment- curvature equation. Double integration method and Macaulay's method: Slope and deflection for determinate prismatic beams subjected to point loads, UDL, UVL and couple. **Columns and Struts:** Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end Conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns.	**10 Hours** **L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV32.1	**Describe** the concepts of the stresses and strains for different materials
22CIV32.2	**Determine** two- and three-dimensional stress system at a point.
22CIV32.3	**Compute** shear force and bending moment of statically beams and shafts.
22CIV32.4	**Compute** slopes, deflections in determinate beams using double integration. Method and Macaulay's method.
22CIV32.5	**Calculate** the critical load of columns subjected to compressive load with different end conditions.

Textbooks:

1. Robert D. Cook, "Advanced Mechanics of Materials", 2nd Edition, Pearson Publisher, 1998.
2. Popov, "Mechanics of Materials", Second edition, Pearson Education India, 2015

References:

1. James M. Gere and Stephen Timoshenko, "Mechanics Of Materials" ,2nd Edition, CBS Publishers , 2004
2. U. C. Jindal S, "Strength of Materials", 1st Edition, Kindle Edition, Pearson Publications, 2012
3. S Timoshenko, "Strength of Materials Part 1", 3rd edition, CBS Publishers, 2021

Web Reference:

https://archive.nptel.ac.in/courses/105/104/105104160/

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV32.1	3	3						1					1		
22CIV32.2	3	3						1						1	
22CIV32.3	3	3						1						1	
22CIV32.4	3	3						1						1	
22CIV32.5	3	3						1						1	
Average	3	3						1					1	1	

SEMESTER – III

Course: Mechanics of Fluids and Hydraulic Machines

Course Code	**22CIV33**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:2**	**SEE Marks**	**50**
No. of Credits	**4**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	Fundamental properties of fluids and its applications. Hydrostatic laws and application to solve practical problem.
CLO2	Principles of Kinematics and Hydrodynamics for practical applications
CLO3	Basic design of pipes and pipe networks considering flow, pressure and its losses.
CLO4	Design of open channels of various cross sections including design of economical sections.
CLO5	Energy concepts of fluid in open channel, Energy dissipation, Water surface profiles at different conditions.

Content	**No. of Hours/ RBT levels**
Module-1 **Fluids & Their Properties**: Concept of fluid, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Newton's law of viscosity (theory & problems), Cohesion, Adhesion, Surface tension, Pressure inside a water droplet, soap bubble and liquid jet. Numerical problems, & Capillarity. Capillary rise in a vertical tube and between two plane surfaces (theory & problems). Vapor pressure of liquid, compressibility and bulk modulus, Fluid as a continuum, **Fluid Pressure and Its Measurements**: Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure. Measurement of pressure using simple, differential & inclined Manometers (theory & problems). Introduction to Mechanical and electronic pressure measuring devices.	**10 Hours L2, L3**

Hydrostatic forces on Surfaces: Definition, Total pressure, Centre of pressure, total pressure on horizontal, vertical, and inclined plane surface, total pressure on curved surfaces, water pressure on gravity dams, Lock gates. Numerical Problems.	
Module-2 **Fundamentals of fluid flow (Kinematics):** Introduction. Methods of describing fluid motion. Velocity and Total acceleration of a fluid particle. Types of fluid flow, Description of flow pattern. Basic principles of fluid flow, three- dimensional continuity equation in Cartesian coordinate system. Derivation for Rotational and irrational motion. **Fluid Dynamics:** Introduction. Forces acting on fluid in motion. Euler's equation of motion along a Streamline and Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Modified Bernoulli's equation. Problems on applications of Bernoulli's equation (with and without losses). **Applications:** Introduction. Venturi meter, Orifice meter, Pitot tube (no derivation). Numerical Problems.	**10 Hours** **L2, L3**
Module-3 **Flow through Pipes**: Introduction. Major and minor losses in pipe flow. Darcy-Weis Bach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel, equivalent pipe-problems. Minor losses in pipe flow, equation for head loss due to sudden expansion. Numerical problems. Hydraulic gradient line, energy gradient line. Numerical problems. Pipe Networks, Hardy Cross method (No problems on pipe networks).	**10 Hours** **L2, L3**
Module-4 **Notches and Weirs**: Introduction. Classification, discharge over rectangular, triangular, trapezoidal notches, Cippoletti notch, Ogee weir, broad crested weir. Numerical problems. Ventilation of weirs, submerged weirs. **Orifice and Mouthpiece**: Introduction, classification, flow through orifice, hydraulic coefficients and Numerical problems. Mouthpiece, classification, Borda's Mouthpiece (No problems).	**10 Hours** **L2, L3**
Module-5 **Open channel flow: Uniform Flow**. Introduction Classification of flow through channels. Chezy's and Manning's equation for flow through open channel, Most economical channel sections, Uniform flow through Open channels, Numerical	

Problems. Specific Energy and Specific energy curve, Open Channel Flow Hydraulics: Uniform Flow: Introduction, critical flow and corresponding critical parameters, Numerical Problems **Non-Uniform Flow**: Hydraulic Jump, Expressions for conjugate depths and Energy loss, Numerical Problems Gradually varied flow, Equation.	**10 Hours L2, L3**

Sl. No.	Experiments	No. of Hours/ RBT levels
	Part- A	
1	Verification of Bernoulli's equation.	2hours/ L3
2	Determination of C_d for Venturi meter and Orifice meter.	2hours/ L3
3	Determination of hydraulic coefficients of small vertical orifice.	2hours/ L3
4	Determination of C_d for notches	2hours/ L3
5	Determination of Major Loss in Pipes	2hours/ L3
6	Determination of Minor losses in pipe due to sudden enlargement, sudden contraction, and bend.	2hours/ L3
7	Determination of force exerted by a jet on flat and curved vanes.	2hours/ L3
8	Determination of efficiency of Pelton wheel turbine	2hours/ L3
9	Determination of efficiency of Francis turbine / Francis Turbine/ Kaplan turbine	2hours/L3
10	Determination of efficiency of centrifugal pump	2hours/ L3

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

21CIV33.1	Possess a sound knowledge of fundamental properties of fluids and fluid Continuum. Compute and solve problems on hydrostatics, including practical applications.
21CIV33.2	Apply principles of mathematics to represent kinematic concepts related to fluid flow. Apply fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications

21CIV33.3	Apply fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications and compute the discharge through orifices and over notches and weirs
21CIV33.4	Design the open channels of various cross sections including economical channel sections and apply Energy concepts to flow in open channel sections, Calculate Energy dissipation.
21CIV33.5	Selection of turbines and pumps for the given condition, and to know their operation characteristics under different operating conditions

Textbooks:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, Standard Book House, New Delhi, 2015.
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", 11th edition, Laxmi Publications, New Delhi, 2019
3. K Subramanya, "Fluid Mechanics and Hydraulic Machines", 2nd edition, Tata McGraw Hill Publishing Co. Ltd, 2018.

References:

1. Victor L Streeter, Benjamin Wylie E and Keith W Bedford, "Fluid Mechanics", 6th edition, Tata McGraw Hill, Publishing Co Ltd., New Delhi, 2008.
2. K Subramanya, "Fluid Mechanics and Hydraulic Machines-problems and solutions", 2nd edition, Tata McGraw Hill Publishing Co. Ltd, 2018.
3. J. F. Douglas, J. M. Gasoriek, John Swaffield, Lynne Jack, "Fluid Mechanics", 5th edition, Pearson publishers, 2005.

Web Reference:

https://searchworks.stanford.edu/view/10496310
https://searchworks.stanford.edu/view/13576277
https://searchworks.stanford.edu/view/11842972

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below:

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	Semester End Examination	100	50
		Grand Total	100

Eligibility requirements: Students to secure a minimum of 40% of the marks in both the CIE for theory and lab courses (i.e., A minimum marks of 12 out of 30 in theory and 8 out of 20 in the Lab)

Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV33.1	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
22CIV33.2	2	2	2	-	-	-	-	-	-	-	-	1	1	-	-
22CIV33.3	3	2	2	1	-	1	1	-	-	-	-	1	1	-	-
22CIV33.4	3	2	2	1	-	1	1	-	-	-	-	1	1	-	-
22CIV33.5	3	2	2	1	-	1	1	-	-	-	-	1	1	-	-
Average	3	2	2	1	-	1	1	-	-	-	-	1	1	-	-

SEMESTER – III

Course: Building Materials and Concrete Technology

Course Code	**22CIV34**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	To study the properties of concrete making materials like Cement, fine aggregate, coarse aggregate, water, and admixtures
CLO2	To study the properties of concrete in fresh and hardened state which are useful in estimating the strength and durability of concrete.
CLO3	To acquire the knowledge of concrete mix design by IS 10262-2019
CLO4	To understand the types of openings as per BIS and to comprehend the concept of formwork, plastering and painting.

Content	**No. of Hours/ RBT levels**
Module-1 **Bricks:** Classification, Manufacturing of clay bricks, Requirement of good bricks. Field and laboratory tests on bricks: compressive strength, water absorption, efflorescence **Concrete Ingredients:** Cement – Cement manufacturing process chemical composition and their importance hydration of cement, types of cement Coarse aggregate: Importance of size, shape and texture. **Fine & Coarse aggregate:** Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests. Cement Concrete blocks, Autoclaved Aerated Concrete Blocks, Sizes, requirement of good blocks, Stabilized mud blocks.	**8 hours** **L2**
Module-2 **Foundations And Building Components:**	**8 hours** **L2**

Foundations: Preliminary investigation of soil, safe bearing capacity of soil, Function and requirements of good foundation, types of foundation, Introduction to spread, combined, strap, mat and pile foundation. **Plastering and Pointing**: Mortar and its types. Purpose, materials, and methods of plastering and pointing: Sand faced plastering, Stucco plastering, lathe plastering, defects in plastering. Water proofing with various thicknesses. **Damp proofing**- causes, effects, and methods. Paints- Purpose, types, technical terms, ingredients and defects, Preparation, and applications of paints to new and old plastered surfaces, wooden and steel surfaces. **Floors:** Floors: Requirement of good floor, Components of ground floor, Selection of flooring material Procedure for laying of Concrete (VDF), Mosaic, Kota, Slate, Marble, Granite, Tile flooring, Cladding of tiles	
Module 3 **Fresh Concrete:** Workability-factors affecting workability. Measurement of workability Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing **Hardened concrete:** Factor affecting strength, W/C ratio, A/c ratio, gel space ratio, Maturity concepts, and tests on hardened concrete. **Elasticity:** Relation between Modulus of Elasticity and strength, factors affecting modulus of elasticity, Poisson ratio. Creep –factors affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage.	**8 hours** **L2**
Module 4 **Durability:** Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. **Special Concretes:** RMC- manufactures its properties, advantages, and disadvantages. Self- Compacting concrete- concept, materials, tests, properties, application, and typical mix Fiber reinforced concrete - Fiber types, properties, application of FRC. Light weight concrete-material properties and types.	**8 hours** **L2**
Module 5 **Concrete Mix Proportioning:** Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262:2019.	**8 hours** **L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV34.1	Understand properties of Cement, fine aggregate, coarse aggregates and hydration properties of cement
22CIV34.2	Understand various types of masonry foundations, plastering & painting and flooring requirements.
22CIV34.3	Distinguish concrete behavior based on its fresh and hardened properties.
22CIV34.4	Select a suitable type of concrete based on specific application
22CIV34.5	Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.

Textbooks:

1. AM Nevelli, "Properties of Concrete", 5th Edition,Prentice Hall Publishers, 2012,.
2. M.S. Shetty, "Concrete Technology - Theory and Practice" 8th edition, Published by S. Chand and Company, New Delhi, 2019
3. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, "Building Construction" 11th edition, Laxmi Publications (P) ltd., New Delhi, 2016.

References:

1. S C Rangwala, "Engineering Material", 43rd edition, by, Charotar Publishing House Pvt. Ltd, 2019.
2. M.L. Gambhir, "Concrete technology theory and practice", 5th edition, McGraw Hill Education, 2014.
3. Duggal S. K., "Building Materials", 4th edition, New Age International Pvt. Ltd. 2010.
4. Sushil Kumar "Building Materials and construction", 20th edition, Standard Publishers, 2015.

Web Reference:

1. https://archive.nptel.ac.in/courses/105/102/105102012/
2. https://archive.nptel.ac.in/courses/105/102/105102088/
3. https://archive.nptel.ac.in/courses/105/106/105106206/

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from

each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 30 marks each for integrated and 40 marks for nonintegrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.
Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV34.1	3					1		1				1			
22CIV34.2	3					1		1				1			
22CIV34.3	3					1		1				1			
22CIV34.4	3					1		1				1			
22CIV34.5	3	2				1		1				2		3	
Average	3	2				1		1				1.2		3	

SEMESTER – III

Course: Engineering Geology and Practice

Course Code	**22CIV35**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:2**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	The identification of minerals & Physical properties composition & uses.
CLO2	Engineering Properties of Rocks & used for construction, foundation materials.
CLO3	Distribution of rocks in geo-tectonic setup, understand the seismic zones and natural hazards.
CLO4	Understanding the earth's interior and landform by exogene and endogene agents.

Content	No. of Hours/ RBT levels
Module 1 **Earth resources:** Introduction, Application of geology in Civil Engineering. **Minerals** – definition, classification, texture composition and industrial uses. **Rocks** – classification and types; Igneous, Sedimentary, and metamorphic. Engineering properties, texture, and composition of rocks. Rocks as construction materials –aggregates - natural sand, M-sand, road metals and railway ballast. Decorative stone facing/polishing/monumental/architectural stones.	**8 Hours** **L2**
Module 2 **Site selection for projects:** Soil formation and types of soil, prevention of soil erosion. **Fluvial process** – Erosion, transportation, and deposition; and land formed by river. Morphometric analysis of a river basin. Subsurface water and groundwater systems–Aquifers, porosity and permeability, water-bearing properties of materials, groundwater recharge and exploitation.	**8 Hours** **L3**
Module 3 **Structures in rocks** – Stress, Strain and deformation, Dip, and strike of rocks– Numerical problems.	**8 Hours** **L2**

Folds, faults, joints, and unconformities; types, causes, and effects, Engineering considerations. **Selection of site for mega structures** – Dams, reservoirs, tunnels, and Highways **Subsurface investigation** through the boreholes, problems, electrical resistivity investigations and geophysical techniques -electrical, seismic and GPR. Ground improvement techniques in the problematic area - Rock bolting, RockJointing, Grouting.	
Module 4 **Geodynamics and natural hazards:** Geodynamics, Plate tectonics, Earthquake - types, causes, seismiczones of India and Earthquake resistant structures, Tsunamis – causes, impacts. Volcano types and causes, Impacts, Landslides- causes types, preventive measures.; Tsunami warning system.	**8 Hours** **L3**
Module 5 **Mapping techniques:** Types of Maps, Toposheets, Concept of Latitude, longitude. Aerial survey – Types and application in Civil Engineering. Remote Sensing- Sensors and resolution, Satellite Image interpretation and application, GIS and GPS – Concept, component, and types. Environment, climate change and costal erosion.	**8 Hours** **L2**

Lab Component:

Sl.No	Content	No. of Hours/ RBT levels
1	Identification of rock-forming and ore-forming minerals	**4hrs/L2**
2	Identification of rocks	**2hrs/ L3**
3	Interpretation of geological maps in folded and faulted strata	**2hrs/ L2**
4	Interpretation of geological maps for tunnelling and dam construction	**2hrs/ L3**
5	Visual interpretation of toposheets and satellite images	**2hrs/ L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV35.1	Comprehend the relations between minerals and rocks based on their respective physical properties.

22CIV35.2	Understand the weathering extent and its effect on the civil engineering. structures.
22CIV35.3	Differentiate geological investigations necessary for the construction of dams, bridges, and tunnels
22CIV35.4	Explain the phenomena of the earth based on exogenous and endogenous Processes.
22CIV35.5	Understand the applications of Remote Sensing and Geographic Information Systems in Civil Engineering.

Textbooks:

1. Parthasarathy et al, "Engineering Geology", 1st Edition, Wiley Publishers, 2013.
2. Chenna Kesavulu, "A textbook of Engineering Geology", 3rd edition, Macmillan Publishers India, 1993.
3. S.K. Garg, "Physical and Engineering Geology", 7th edition, Khanna publishers, 2012.

References:

1. B. P. Verma, "Engineering Geology and Rock Mechanics" ,4th edition, Khanna publishers, 2017.
2. Krynine and Judd, "Principles of Engineering Geology and Geotechnics", CBS Publications, 2005.
3. K N Radhika & B C Prabhakar, "Text Book of Engineering Geology", 1st edition, Walnut publications, 2023.
4. KVGK Gokhale, "Principles of Engineering Geology", Revised edition, BS Publications, 2016

Web Reference:

1. https://www.youtube.com/watch?v=aTVDiRtRook&list=PLDF5162B475DD915F
2. https://www.youtube.com/watch?v=sTY-ao4RZck&list=PLDF5162B475DD915F&index=3

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

	Component	Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	Semester End Examination	100	50
		Grand Total	100

Eligibility requirements: Students to secure a minimum of 40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out of 20 in theLab)

Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV35.1	1	3	-	-	-	2	2	-	-	-	-	-	-	-	-
22CIV35.2	1	2	-	-	-	1	-	-	-	-	-	-	-	-	-
22CIV35.3	1	-	-	-	-	2	2	-	-	-	-	-	-	-	-
22CIV35.4	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-
22CIV35.5	3	2	-	-	-	2	-	-	-	-	-	-	-	-	-
Average	1.8	2.7	-	-	-	1.8	2	-	-	-	-	-	-	-	-

SEMESTER – III

Course: Planning and Designing of Buildings

Course Code	**22CIV36**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:2**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**4**

Prerequisites: Computer Aided Engineering Drawing

Course Objectives: Students will be taught:

CLO1	Principles of planning and prepare bubble diagrams and line diagrams.
CLO2	To prepare manual drawings of plan, elevation, and sectional elevations of residential and commercial buildings
CLO3	To prepare computer aided engineering drawings of plan, elevation, and sectional elevations with service drawings of residential buildings
CLO4	To prepare computer aided engineering drawings of plan, elevation, and sectional elevations with service drawings of commercial buildings

Content	**No. of Hours/ RBT levels**
Module-1 **Building Components:** **Masonry:** Definition and terms used in masonry. Brick masonry: characteristics and requirements of good brick masonry, Bonds in brick work, Header, Stretcher, English, Flemish bond **Lintels and Arches** Definition, function and classification of lintels, Balconies, chejja and canopy. Arches: Elements and Stability of an Arch.. Roofs: Elements of a pitched roof, Trussed roof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof.	**6 hours** **L2**
Module 2 **Doors, Windows, and Ventilators:** Location of doors and windows, technical terms, Materials for doors and windows: PVC, CPVC and Aluminum. Types of Doors and Windows: Paneled, Flush, Collapsible, Rolling shutter, Panceled and glazed Window, Bay Window, French window. Steel windows, **Ventilators.** Sizes as per IS recommendations.	**6 hours** **L2**

Stairs: Definitions, technical terms and types of stairs: Wood, RCC, Metal. Requirements of good stairs. Geometrical design of RCC doglegged and open-well stairs.	
Module 3 **Building Drawings:** Principles of planning, planning regulations and building byelaws, factors affecting site selection, Functional planning of residential and public buildings, recommendations of NBC. a) Prepare a bubble diagram for the given line diagrams of a residential building. b) Prepare a bubble diagram for the given line diagrams of a commercial building	**8 hours** **L2, L3**
Module 4 Drawing of Plan, elevation and sectional elevation including electrical, plumbing and sanitary services using CAD software for residential buildings: a) Single storey residential building. a) Double storeyed residential building.	**10 hours** **L2, L3**
Module 5 Drawing of Plan, elevation and sectional elevation including electrical, plumbing and sanitary services using CAD software for commercial buildings: a) Hostel building. b) Hospital building	**10 hours** **L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV36.1	Understand various types of building components, lintels, arches & roofs
22CIV36.2	Understand the concepts of doors & windows and design dog legged and open well staircase.
22CIV36.3	Understand the principles of planning and draw bubble diagrams and line diagrams
22CIV36.4	Apply the skills of AutoCAD to draw plan and elevation of residential buildings
22CIV36.5	Apply the skills of AutoCAD to draw plan and elevation of commercial buildings

Textbooks:

1. Malik R S and Meo G S, "Civil Engineering Drawing", latest edition, Asian Publishers/Compu tech Publications Pvt Ltd, 2021.

2. MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to Built Environment Drawing", Tata McGraw Hill Publishing Co. Ltd., New Delhi

References:

1. M. V. Chitawadagi, S. S. Bhavikatti, "Building planning and drawing", 1st edition , I K International Publishing House Pvt. Ltd, 2019.
2. IS: 962-1989 (Code of practice for architectural and building drawing). National Building Code, BIS, New Delhi.

Web Reference:

https://nptel.ac.in/courses/105104099

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. Total duration of the examination will be 4 hours. There will be two full questions (with a maximum of three sub questions) from each of first 3 modules carrying 20 marks theory constituting 60 marks out of 100. Module 4 and module 5 will together constitute a drawing component for 40 marks. Students are required to answer any **four full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV36.1	3					1						3			
22CIV36.2	3					1						3			
22CIV36.3	3											3			
22CIV36.4	3		1		3			1				3	1	1	
22CIV36.5	3		1		3			1				3	1	1	
Average	3		1		3	1		1				3	1	1	

SEMESTER – III

Course: Material Testing and Concrete Laboratory

Course Code	**22CIVL37**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**03**

Prerequisites:

Course Objectives:

CLO1	To conduct Tension, Compression, Bending & Shear tests on UTM and evaluate material mechanical properties of structural materials
CLO2	To carry out Torsion, Hardness & Impact tests and determine various moduli, hardness numbers and impact energy.
CLO3	Ability to use the techniques, skills, and modern engineering tools necessary for engineering.
CLO4	To understand the properties of materials used for concrete
CLO5	To determine fresh and hardened properties of concrete.

Content	No. of Hours/ RBT levels
Tension Tests using Universal Testing Machine Tension test on mild steel and HYSD bars.	**04 Hours** **L2, L3**
Compression Tests using Universal Testing Machine Compression test on mild steel, cast iron and wood. **Torsion test** Torsion test on mild steel circular sections;	**04 Hours** **L2, L3**
Bending and Double Shear Tests using Universal Testing Machine Bending test on wood under point loading; shear test on mild steel- single and double shear. **Impact Test** Impact test on mild steel (Charpy and Izod)	**04 Hours** **L2, L3**
Hardness Test Hardness test on ferrous and non- ferrous metals- Brinell's Rockwell and Vicker's.	**04 Hours** **L2, L3**
Testing of materials as per BIS specifications and codal requirements. Cement, fine and coarse aggregates; Test on bricks, Tiles	**04 Hours** **L2, L3**

Tests on Concrete: Tests on fresh concrete (slump cone, vee-bee consistometer, compaction factor test) and hardened concrete (compression strength test, flexure test and split tensile strength test) **On-site Evaluation of Concrete Strength Non-destructive testing methods:** Rebound Hammer for Concrete Strength, Ultrasonic Pulse Velocity, Profometer	**04 Hours** **L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIVL37.1	To conduct Tension, Compression, Bending & Shear tests on UTM and evaluate material properties.
22CIVL37.2	To conduct Torsion, Hardness & Impact tests and determine various moduli, hardness numbers and impact energy
22CIVL37.3	Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials.
22CIVL37.4	To understand the properties of materials used for concrete
22CIVL37.5	To understand the of fresh and hardened properties of concrete and to perform on-site evaluation using Non-destructive testing methods

Textbooks:

1. AM Nevelli, "Properties of Concrete", 5th Edition,Prentice Hall Publishers, 2012,.
2. M.S. Shetty, "Concrete Technology - Theory and Practice" 8th edition, Published by S. Chand and Company, New Delhi, 2019

References:

1. J.J. Brooks and A. M. Neville, "Concrete Technology", 2nd Edition, Pearson Publishers, 2019.
2. A.R. Santhakumar, "Concrete Technology",2nd edition , Oxford Higher education, 2018
3. M.L. Gambhir, "Concrete Technology: Theory and Practice", 5th Edition,Tata Mc Graw Hill Publishers, 2017.

Web Reference:

https://www.youtube.com/watch?v=oD0qIR6PnlQ

Scheme of Examination:

CONTINUOUS INTERNAL EVALUATION (CIE)

WEEK WISE CIE (WEEK WISE EVALUATION OF EACH EXPERIMENT)

SL.NO	ACTIVITY	MARKS
1	Record	25
2	Viva	05
	TOTAL	**30**

END OF SEMESTER CIE (INTERNAL ASSESSMENT EVALAUTION)

SL.NO	ACTIVITY	MARKS
1	Write up write up of the experiment program	20
2	Experimentation / program	40
3	Results, Graphs, Discussions	20
4	Viva Voce	20
5	TOTAL	100
	REDUCE TO	20

FINAL CIE CALCULATIONS

SL.NO	ACTIVITY	MARKS
1	Average of Weekly Entries	30
2	Internal Assessment Evaluation	20
	TOTAL	50

SEE EVALUATION OF LAB COURSES

PARTICULARS	MARKS
Write up of the experience/ Program	20
Experimentation/Program	40
Results, Graphs, Discussions	20
Viva Voce	20
TOTAL	100

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIVL37.1	3	2												2	
22CIVL37.2	3	2												2	
22CIVL37.3	3	2												2	
22CIVL37.4	3	2												2	
22CIVL37.5	3	2												2	
Average	3	2												2	

SEMESTER – IV

Course: Transform Calculus and Numerical Techniques

Course Code	**22MAT41B**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Course Objectives: To enable students to apply the knowledge of Mathematics in the field of Civil Engineering by making them to learn:

CLO1	Laplace Transforms
CLO2	Fourier series and Fourier Transforms
CLO3	Correlation and curve fitting
CLO4	Numerical methods

Content	**No. of Hours/ RBT levels**
Module-1 Laplace transforms of elementary functions, Unit-step and Dirac delta functions. Inverse Laplace Transforms, Solution of second order linear differential equations using Laplace transforms.	**8 Hours L2, L3**
Module 2 Fourier series of periodic functions, half range Fourier sine and cosine series. Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms.	**8 Hours L2, L3**
Module 3 Karl Pearson coefficient of correlation, lines of regression. Curve fitting by the method of least squares-fitting a linear curve, parabola, and geometric curves. Solution of algebraic and transcendental equations: Regula-Falsi and Newton-Raphson method.	**8 Hours L2, L3**
Module 4 Finite differences, Newton's forward, and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference formula and Lagrange's interpolation formula. Numerical integration: Simpson's 1/3rd, 3/8th, Weddle's rule (all formulae without proof).	**8 Hours L2, L3**

Module 5	
Numerical solution of ordinary differential equations of first order and first degree: Taylor's series method, Runge-Kutta method of fourth order, Milne's and Adam-Bashforth predictor and corrector methods. Numerical solution of second order ordinary differential equations: Runge-Kutta method and Milne's method..	**8 Hours L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22MAT41B.1	Determine Laplace and inverse Laplace transforms of given function and solve linear differential equations.
22MAT41B.2	Determine Fourier series and Fourier Transform of a given function.
22MAT41B.3	Apply statistical methods to study the relationship between two variables and fit a suitable mathematical model for statistical data.
22MAT41B.4	Apply numerical techniques to solve algebraic and transcendental equations.
22MAT41B.5	Apply numerical techniques for interpolation and to evaluate definite integrals.
22MAT41B.6	Solve ordinary differential equations using numerical methods

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers 44th Edition, 2017
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2006

References:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons 10th Edition, 2016
2. N.P.Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications 6 th Edition, 2014

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average marks scored in all the three is added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 2.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Assignments	10	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22MAT41B.1	3	2	1									3			
22MAT41B.2	3	2	1									3			
22MAT41B.3	3	2	1									3			
22MAT41B.4	3	2	1									3			
22MAT41B.5	3	2	1									3			
22MAT41B.6	3	2	1									3			
Average	3	2	1									3			

Low-1: Medium-2: High-3

SEMESTER – IV

Course: Engineering Survey

Course Code	**22CIV42**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:2**	**SEE Marks**	**50**
No. of Credits	**4**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	Learn linear and angular measurements to arrive at solutions to basic surveying problems.
CLO2	Apply geometric and trigonometric principles to arrive at solutions to basic surveyingproblems.
CLO3	Employ conventional surveying for data capturing and processing.
CLO4	Understand procedures carried out by a professional surveyor in field measurement
CLO5	Design proper types of curves for deviating type of alignments.

Content	**No. of Hours/ RBT levels**
Module-1 Introduction to Surveying **Introduction:** Definition of surveying, Objectives, and importance of surveying. Classification of surveys. Principles of surveying. Units of measurements, Surveying measurements and errors, types of errors, precision, and accuracy. **Measurement of Horizontal Distances:** Chain and types, Tape and types, Measurement using chain and tapes along- level ground and sloping ground. Errors and corrections in chain and tape measurements, Ranging of lines - direct and indirect methods of ranging.Obstacles in tape survey, Numerical problems. **Self-Learning Exercise:** Introduction to Map projection systems. Coordinate systems (spherical and plane).	**10 Hours L2**
Module 2 **Measurement of Directions and Angles: Compass survey** Basic definitions - meridians, bearings, magnetic and true bearings. Prismatic and surveyor's compasses, dip and declination. Quadrantal bearings, whole circle bearings,local attraction, and related problems.	**10 Hours L2, L3**

Traverse Survey and Computations - Latitudes and departures, rectangular coordinates, Traverse adjustments – Bowditch Graphical Solution, Bowditch rule and Transit rule, Numerical Problems. **Vernier theodolite**, fundamental axes, temporary adjustments, measurement of horizontal and vertical angles. **Self-Learning Exercise:** Other uses of theodolite, Sources of errors in compass and theodolite survey.	
Module 3 **Leveling:** Basic terms and definitions, Methods of leveling, Dumpy level, Auto level, digital and laser levels. Curvature and refraction corrections -Problems on horizon. Booking and reduction of levels. Differential leveling, profile leveling, fly leveling, check leveling, reciprocal leveling. **Indirect Leveling**: trigonometric leveling - heights and distances-single plane and double plane methods). **Geodetic Survey:** Principle and classification of triangulation system, selection of base line and stations, orders of triangulation, triangulation figures, reduction to center- Problems on reduction to center, selection and marking of stations, **Self-Learning Exercise**: Errors and Degree of accuracy in leveling. Methods of contouring	**10 Hours L2, L3**
Module 4: **Contouring:** Contours, Methods of contouring, Interpolation of contours, contour gradient, characteristics of contours and uses. **Plane Table Survey:** Plane table and accessories, Advantages and limitations of plane table survey, Orientation and methods of orientation, Methods of plotting – Radiation, Intersection, Traversing, Resection method, Two point and three-point problems, Solution to two-point problem by graphical method, Solution to three-point problem Bessel's graphical method, Errors in plane table survey. **Self-Learning Exercise**: Plotting a profile using plane table and identifying probable errors.	**10 Hours L2, L3**
Module 5: **Curves** – Necessity – Types, Simple curves, Elements, Designation of curves, setting out simple curves by linear methods (numerical problems), Setting out curves by Rankine's deflection angle method (numerical problems). Compound curves -	**10 Hours L2, L3**

Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two parallel straights (numerical problems on Equal radius and unequal radius). Transition curves - Characteristics, Problems on Transition Curves, Vertical curves – Types – problems on transition curves. **Self-Learning Exercise:** Volume from spot levels and contour maps.	

COURSE: Engineering Survey (Lab Part)

Sl.No	Experiments	No.of Hours/RBT levels
1	Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass. Correction of error using Bowditch and Transit rule.	2 Hours/ L3
2	Determination of reduced levels of points using dumpy level/auto level. a. Simple Levelling & Inverted levelling b. Differential Levelling c. Reciprocal Levelling and compute collimation error	2 Hours/ L3
3	Conduction of a. Profile Levelling b. Cross-sectioning and c. Block Levelling	2 Hours/ L3
4	Measurement of horizontal angle by repetition and reiteration methods and Measurement of vertical angles using theodolite.	2 Hours/ L3
5	Trigonometric levelling: a. Base of the object accessible b. Base of the object inaccessible – Single and double plane method	2 Hours/ L3
6	To determine distance and elevation using tachometric surveying with horizontal and inclined line of sight.	2 Hours/ L3
7	To locate the points using Radiation and Intersection method of Plane table surveying.	2 Hours/ L3
8	To solve three-point problem in plane table using Bessel's graphical solution.	2 Hours/ L3
9	Curve Setting: Using chain, tape and accessories.	2 Hours/ L3
10	Total Station Survey: (to include data transfer and plotting using suitable software) a. Conduction of block levelling using total station (Should include station change) b. Curve setting – Rankine's deflection angle method. c. Base of the object inaccessible - Single plane and double plane method.	2 Hours/ L3
11	Transfer of points to ground from CSV file using total station.	2 Hours/ L3
12	Demo Class: Chain Survey	2 Hours/ L2

	a) Measurements of distances using tape along with horizontal planes and slopes, direct ranging. b) Setting out perpendiculars. Use of cross staff, optical square. c) Obstacles in chain survey.	

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV42.1	Describe the fundamental principles of Geodetics.
22CIV42.2	Construct solutions to basic surveying problems by measurement of distances and angles along horizontal and vertical plane.
22CIV42.3	Apply knowledge of geometric principles to arrive at surveying problems.
22CIV42.4	Design and implement the different types of curves for deviating type of alignments.
22CIV42.5	Comprehend effectively field procedures required for a professional surveyor.
22CIV42.6	Use techniques, skills, and conventional surveying instruments necessary for engineering practice.

Textbooks:

1. B. C. Punmia, "Surveying & levelling Vol. I & Vol.II', 17th edition, Laxmi Publications, 2016.
2. S. K. Duggal, 'Surveying Vol.I & Vol II', 4th edition, McGraw Hill Education, 2017.
3. T P Kanetkar and S V Kulakarni,"Surveying and Leveling Vol I & Vol II, Pune Pidyarthi Griha Prakashan, Pune, 2008.

References:

1. James M Anderson and Adward M Mikhail, "Surveying theory and practice", 7th Edition, Tata McGraw Hill Publication, 1998.
2. R. Subramanian, "Surveying and Leveling", 2nd edition, Oxford University Press, 2012.
3. David Clerk, Plane and Geodetic Surveying Vol I and Vol 2', CBS publishers.

Web Reference:

https://archive.nptel.ac.in/courses/105/104/105104101/

Scheme of Examination:

Semester End Examination (SEE):

See question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module. The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	30	**50**
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	**20**	
SEE	**Semester End Examination**	**100**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of 40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out of 20 in the Lab)

Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

Typical Evaluation pattern is shown in Table 1.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV42.1	2														
22CIV42.2	2	2													
22CIV42.3	3	3													
22CIV42.4	2	2	2											1	
22CIV42.5	2	2	1		1				1	1		1			
22CIV42.6	2	2	1		2				1	1		1			
Average	**2**	**2**	**1.33**		**2**				**1**	**1**		**1**		**1**	

SEMESTER – IV

Course: Environmental Engineering

Course Code	**22CIV43**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
No. of Credits	**4**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	To analyze the variation of water demand and to estimate water requirement for a community
CLO2	Understand the foundational principles of water and wastewater treatment the operations and design of the units.
CLO3	Understand the importance of sanitation, dry and wet weather flow, sewer materials, appurtenances and the aspects involved in the design of sewerage system.
CLO4	Understand and design the various hydraulic elements of circular sewers.
CLO5	Understand the self-purification capacity of water bodies and estimate the same
CLO6	To enable students to conduct experiments and determine the physical, chemical, and biological characteristics of water and wastewater.

Content	**No. of Hours/ RBT levels**
Module-1 **Introduction:** Water: Need for protected water supply, Demand of Water: Types of water demands - domestic demand, industrial, institutional and commercial demand, public use and fire demand estimation, factors affecting per capita demand, Variations in demand of water, Peak factor. **Design period** and factors governing design period. Methods of population forecasting and numerical problems. Physical and chemical characteristics of water Sampling. **Water Treatment**: Objectives, Unit flow diagrams – Significance of each unit, Aeration process Limitations and types.	**10 hours L2, L3**

Module 2 Screens, Sedimentation, Filtration and Disinfection Screens: types, disposal. Grit chamber, oil and grease removal. **Sedimentation** - Theory, settling tanks, types and design with numerical, Coagulation and flocculation, types of coagulants. **Filtration:** Mechanism, theory of filtration, types of filters: slow sand, rapid sand and pressure filters. Operation and cleaning. Design of slow and rapid sand filter without under drainage system, Numerical. **Disinfection:** Methods of disinfection with merits and demerits. Breakpoint chlorination, **Softening**: Lime soda and Zeolite process.	**10 hours** **L2**
Module 3 **Collection and Conveyance of water**: Types of pumps with working principles and numerical Problems. Design of the economical diameter for the rising main. **Distribution system**: Methods: Gravity, Pumping and Combined gravity and pumping system. Types of Distribution system. Service reservoirs and their capacity determination plant units and distribution system with population forecasting for the given city.	**10 hours** **L2**
Module 4 **Wastewater** **Introduction:** Need for sanitation, methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors affecting dry and wet weather flow on the design of sewerage system, estimation of storm water flow, time of concentration flow, numerical. **Wastewater characteristics**: sampling, significance and techniques, physical, chemical, and biological characteristics, flow diagram for municipal wastewater treatment unit operations and process. **Design of sewers:** Hydraulic formula to determine velocity and discharge. Self-cleansing and non-scouring velocity. Design of hydraulic elements for circular sewers for full flow and half flow conditions. Numerical.	**10 hours** **L2, L3**
Module 5 **Disposal of effluents**: Dilution, self-purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents. Streeter-Phelps's equation. **Biological Treatment Process**: Estimation and significance of BOD. Numerical on BOD. **Suspended growth system** - conventional activated sludge process and its modifications.	**10 hours** **L2, L3**

Attached growth system – trickling filter, bio-towers and rotating biological contactors.	

Sl. No.	Experiments	No. of Hours/ RBT levels
1	Determination of pH, Conductivity, TDS, and Turbidity.	2 hours / L3
2	Determination of Acidity and Alkalinity	2 hours / L3
3	Determination of Calcium, Magnesium, and Total Hardness	2 hours / L3
4	Determination of Dissolved Oxygen	2 hours / L3
5	Determination of BOD	2 hours / L3
6	Determination of Chlorides	2 hours / L3
7	Determination of percentage of available chlorine in bleaching powder sample, Determination of Residual Chlorine and chlorine demand.	2 hours / L3
8	Determination of Solids in Sewage a. Total Solids, b. Suspended Solids, c. Dissolved Solids, d. Volatile solids, fixed solids e. Settleable solids	2 hours / L3
9	Determination of Optimum Dosage of Alum using Jar test apparatus	2 hours / L3
10	Determination of Fluorides and Iron by spectrophotometer.	2 hours / L3
11	Determination of sodium and potassium using flame photometer	2 hours / L3
12	Determination of COD	2 hours / L3

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV43.1	Determine appropriate water quantity and quality requirement for a community.
22CIV43.2	Design various water treatment units using the underlying scientific principles of treatment.
22CIV43.3	Design water treatment and distribution system to purify and distribute water to the required quality standards.
22CIV43.4	Determine the hydraulic elements of circular sewers using rational and empirical formula
22CIV43.5	Analyse the self-purification phenomenon of water bodies and oxygen sag curve using Streeter-Phelps Equation

Textbooks:

1. S. K. Garg, "Environmental Engineering Volume-I, Water supply Engineering", 35th edition, – M/s Khanna Publishers, New Delhi, 2010
2. B.C. Punmia and Ashok Jain, "Environmental Engineering I-Water Supply Engineering", 2nd edition, Laxmi Publications (P) Ltd., New Delhi 2016.
3. S.K.Garg, "Environmental Engineering vol-II, Water supply Engineering", 28th edition Khanna Publishers, – New Delhi 2017

References:

1. Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering", Indian edition, Tata McGraw Hill, New York, 2013
2. Karia G.L., and Christian R.A, "Wastewater Treatment Concepts and Design Approach", 3rd edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2017.
3. B C Punmia, "Environmental Engineering volume-II", 2nd edition, Laxmi Publications 2016

Web Reference:

Conveyance and pumping https://youtu.be/iqweoehujtc
Water sources and availability https://youtu.be/k4vty0cmybi
Water supply key issues and concerns https://youtu.be/jueygpbsflw
Treated water storage https://youtu.be/buz48afjd04
Placement, design and construction of storage reservoirs https://youtu.be/nqczbxabb1o

Scheme of Examination:

Semester End Examination (SEE):
See question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	**Semester End Examination**	100	50
Grand Total			100

Eligibility requirements: Students to secure a minimum of 40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out of 20 in the Lab)

Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV43.1	2	2					2						2	2	
22CIV43.2	2	2	3			2	2						2	2	
22CIV43.3	2	2	3			2	2						2	2	
22CIV43.4	2	3	3			2	2						2	2	
22CIV43.5	2	3		3		2	2					1	3	3	
Average	2	2.4	3			2	2					1	2.2	2.2	

SEMESTER – IV

Course: Structural Analysis

Course Code	**22CIV44**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Engineering Mechanics, Mechanics of solids

Course Objectives: Students will be taught:

CLO1	Static and kinematic indeterminacies of pin and rigid jointed structures
CLO2	The concept of ILD and moving loads.
CLO3	To determine slopes and deflections of beams using moment area and conjugate beam method
CLO4	The analysis of arches and cables
CLO5	To calculate slope, deflection, bending moment and shear force using slope deflection and moment distribution method

Content	**No. of Hours/ RBT levels**
Module-1 Static and kinematic indeterminacies of structural systems. **Influence lines for statically determinate structures:** Influence lines for cantilever, simply supported beam, overhanging beam and pin jointed trusses, criteria for maximum shear force and bending moment under moving loads for simply supported beams, absolute maximum bending moment	**10 Hours L3**
Module 2 **Deflection of statically determinate structures:** Deflection of determinate beams by Moment area and Conjugate beam methods, Principle of virtual work (unit load method)	**10 Hours L3**
Module 3 **Arches and Cable Structures:** Three hinged parabolic and circular arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.	**10 Hours L3**

Module 4 **Slope Deflection Method:** Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤ 3.	**10 Hours L3**
Module 5 **Moment Distribution Method:** Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤3.	**10 Hours L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV44.1	Calculate the static and kinematic indeterminacies of pin and rigid jointed structures
22CIV44.2	Construct ILD for the determinate beams subjected to moving loads
22CIV44.3	Determine the slopes and deflections in determinate beams using moment area and conjugate beam method
22CIV44.4	Compute the shear force, bending moment in indeterminate beams and frames using slope defection method
22CIV44.5	Calculate the shear force, bending moment in indeterminate beams and frames using moment distribution method
22CIV44.6	Solve the stress resultants in arches and cables.

Textbooks:

1. David Marca, Clement Mcgowan "Structural Analysis and Design Structures (Mcgraw Hill Software Engineering Series)" Mcgraw-Hill Education / India Publisher, 1987.
2. Devdas Menon, "Structural Analysis Volume – I", Narosa Publication, 2007
3. Muthu K U. et al, "Basic Structural Analysis", 2nd edition, IK International Pvt. Ltd., New Delhi, 2015.

References:

1. C S Reddy, "Basic Structural Analysis", 3rd edition McGraw Hill Education; McGraw Hill Education (India) Private Limited; 2017.
2. Stephen P. Timoshenko, Donovan H. Young, "Theory of Structures", 2nd edition, McGraw Hill Higher Education; 1965

3. B G Neal, "Structural theorems and their application", Pergamon, 2013.
4. Bhavikatti, "Structural Analysis Volume – I", 3rd edition, Vikas Publishers, 2010.

Web Reference:

https://nptel.ac.in/courses/105101085
https://nptel.ac.in/courses/105105166

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	40	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV44.1	3	1	-	-	-	-	-	-	-	-	-	-	1	-	-
22CIV44.2	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-
22CIV44.3	3	1	-	-	-	-	-	-	-	-	-	-	1	-	-
22CIV44.4	3	1	-	-	-	-	-	-	-	-	-	-	2	-	-
22CIV44.5	3	1	-	-	-	-	-	-	-	-	-	-	2	-	-
22CIV44.6	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
Average	**2.83**	**1.16**	-	-	-	-	-	-	-	-	-	-	**1.33**	-	-

SEMESTER – IV

Course: Sustainable Construction

Course Code	**22CIV45**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Building materials and construction technology

Course Objectives: Students will be taught:

CLO1	To understand the Definition, Concept & Objectives of the terms cost effective construction and green building.
CLO2	To apply cost effective techniques in construction.
CLO3	To understand the Problems due to Global Warming
CLO4	To state the Concept of Green Building
CLO5	To understand Green Buildings

Content	No. of Hours/ RBT levels
Module-1 **Introduction to the concept of cost effective construction**: Uses of different types of materials and their availability -Stone and Laterite blocks- Burned Bricks- Concrete Blocks- Stabilized Mud Blocks- Lime Pozzolana Cement- Gypsum Board- Light Weight Beams- Fiber Reinforced Cement Components- Fiber Reinforced Polymer Composite- Bamboo- Availability of different materials- Recycling of building materials – Brick- Concrete- Steel- Plastics - Environmental issues related to quarrying of building materials.	**8 Hours L2**
Module 2 **Environment friendly and cost effective Building Technologies** : Different substitute for wall construction Flemish Bond - Rat Trap Bond – Arches – Panels - Cavity Wall - Ferro Cement and Ferro Concrete constructions – different pre cast members using these materials - Wall and Roof Panels – Beams – columns - Door and Window frames - Water tanks - Septic Tanks - Alternate roofing systems - Filler Slab - Composite Beam and Panel Roof -Pre-engineered and ready to use building elements - wood products - steel and plastic - Contributions of agencies – Cost ford - Nirmithi Kendra - Habitat	**8 Hours L2**

Module 3 **Global Warming** – Definition - Causes and Effects - Contribution of Buildings towards Global Warming - Carbon Footprint – Global Efforts to reduce carbon Emissions Green Buildings – Definition - Features- Necessity – Environmental benefit - Economical benefits - Health and Social benefits - Major Energy efficient areas for buildings – Embodied Energy in Materials Green Materials - Comparison of Initial cost of Green V/s Conventional Building - Life cycle cost of Buildings.	**8 Hours** **L2**
Module 4 **Green Building rating Systems**- BREEAM – LEED - GREEN STAR -GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings – Purpose - Key highlights - Point System with Differential weight age. Green Design – Definition - Principles of sustainable development in Building Design - Characteristics of Sustainable Buildings – Sustainably managed Materials - Integrated Lifecycle design of Materials and Structures (Concepts only)	**8 Hours** **L3**
Module 5 **Utility of Solar Energy in Buildings:** Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. LowEnergy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. **Green Composites for Buildings:** Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. UrbanEnvironment and Green Buildings. Green Cover and Built Environment.	**8 Hours** **L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV45.1	Select different building materials for construction
22CIV45.2	Apply effective environmentally friendly building technology
22CIV45.3	Analyze global warming due to different materials in construction
22CIV45.4	Analyze buildings for green rating
22CIV45.5	Use alternate source of energy and effective use water

Textbooks:

1. Harharalyer G, "Green Building Fundamentals", 1st edition, Notion Press, 2022.
2. Dr. Adv. HarshulSavla, "Green Building: Principles & Practices", Notion Press Media Pvt Ltd, 2021
3. Allen. D.T and Shonnard, D.R Paul L Bishop, "Sustainability Engineering: Concepts, Design and Case studies -Prentice Hill

References:

1. Bradley A.S, Adebayo A.O, Maria, "Engineering applications in sustainable design and development", -Cengage Learning
2. Mackenthun.K.M, "Basic Concepts in Environmental Management" Lewis Publication London 1998.
3. New Delhi Bureau of Energy Efficiency: Griha Rating System -Rating System Teri Publications -ECBC Code 2007.

Web Reference:

https://www.youtube.com/watch?v=THgQF8zHBW8
https://www.youtube.com/watch?v=DRO_rIkywxQ

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV45.1	2	2				3	3					2			
22CIV45.2	2	2				2	3					2			
22CIV45.3	2	2				2	2					2			
22CIV45.4	2	2				2	2					2			
22CIV45.5	2	2				2	2					2			
Average	**2**	**2**				**2.2**	**2.4**					**2**			

SEMESTER – IV

Course: Design Studio

Course Code	**22CIV46**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:2**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Computer Aided Engineering Drawing; Planning and designing of buildings; Structural Analysis

Course Objectives: Students will be taught:

CLO1	Analysis of indeterminate structures using Kani's method
CLO2	Modelling and analysis of elements and structures in Staad Pro
CLO3	Basics of modelling and tools in Autodesk Revit
CLO4	Develop plan and elevation of given residential and commercial building using architectural softwares
CLO5	Develop plan and cross section of various types of footings, staircases using architectural softwares

Content	No. of Hours/ RBT levels
Module 1 **Kani's Method:** Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway. **Introduction to Staad Pro:** Analysis of plane truss, continuous beams, and portal frames. Static analysis of Multistoried RCC and Steel framed structures	**20 hours** **L2, L3**
Module 2 **Building Drawings using Architectural Software:** Principles of planning, Planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, recommendations of NBC. 1. Prepare plan and elevation for the given line diagrams of a residential building. 2. Prepare plan and elevation for the given line diagrams of a commercial building	**15 hours** **L2, L3**

3. Drawing of Plan, elevation and sectional elevation including electrical, plumbing and sanitary services using software for: a. Single storey residential building b. Double storeyed residential building. c. Hostel building. d. Hospital building. e. School building 4. Drawings Related to different building elements: Following drawings are to be prepared for the data given using Software; a) Cross section of Foundation, masonry wall, RCC columns with isolated &combined footings. Different types of staircases–Doglegged, Openwell.	
Module 3 **Introduction to BIM Software:** Fundamentals of Autodesk Revit, Basics of modelling, use of Autodesk Revit for drawings.3D Modelling of Residential Unit; Modelling of floors and walls; Parametric modelling of basic components; Annotation styles and drafting methods.	**15 hours** **L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV46.1	Apply Kani's method to analyze the indeterminate structures
22CIV46.2	Apply the tools of Staad Pro to analyze structural elements and multi storey structures.
22CIV46.3	Use Auto desk Revit to plan and model the structures
22CIV46.4	Sketch the plan and elevation of given residential and commercial building and cross section of various types of footings, staircases using architectural softwares

Textbooks:

1. Malik R S and Meo G S, "Civil Engineering Drawing", Asian Publishers/Computech Publications Pvt Ltd.
2. "Mastering Autodesk Revit" Series by James Vandezande, Eddy Krygiel, and Phil Read
3. "Introducing Autodesk Revit Architecture" by Patrick Davis, Charlie Busa, and Beau Turner
4. "Structural Analysis" by R.C. Hibbeler

References:

1. "Revit Architecture 2023" by Munir M. Hamad
2. Fink A, "Conducting research literature reviews: From the Internet to Paper", SAGE publications, 2009.
3. "Autodesk Revit 2023 Architecture: Fundamentals" by Elise Moss
4. "Structural Analysis and Design of Tall Buildings: Steel and Composite Construction" by Bungale S. Taranath
5. "STAAD.Pro V8i for Beginners" by T.S. Sarma
6. Structural Analysis" by Aslam Kassimali

Web Reference:

- https://help.autodesk.com/view/rvt/2021/enu/?guid=guid-9e9688a2-0645-4f8e-9d96-f1b76291a6c6
- https://www.udemy.com/course/staadpro-cs/
- https://archive.nptel.ac.in/courses/121/106/121106007/ https://www.youtube.com/watch?v=cdhoJPlJNSg&list=PLLy_2iUCG87AuIWZ3qnjA1GriD-IGF3Za&index=10&t=5s
- https://onlinecourses.nptel.ac.in/noc22_ge23/preview

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions including theory and software component from module 1 for 25 marks each, comprising a total of 50 marks from module 1. There will be two full questions from module 2 and module 3 carrying 25 marks each. Students are required to answer any three full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

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Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	05	
	Quiz 2/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV46.1	3	3	1					2				3			
22CIV46.2	3	3	1		3			2				3		2	
22CIV46.3	3	2	1		3			2				3		2	
22CIV46.4	3	2	1		3			2				3		2	
Average	3	2.5	1		3			2				3		**2**	

Head of Department
Civil Engineering
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H. M. Rajashekar Swamy
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SCHEME AND SYLLABUS

Department of Civil Engineering

Head of Department
Civil Engineering
Global Academy of Technology,
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V - VI Semester Scheme (2022-23)

Civil Engineering

GLOBAL ACADEMY OF TECHNOLOGY
(Autonomous institution affiliated to VTU, Belagavi.
Accredited by NAAC with 'A' grade,
NBA Accredited Civil, CS, E&C, E&E, MECH and IS branches)
Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098.

Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Scheme of UG Autonomous Program – 2022 batch
(5th Semester – Civil Engineering)

V SEMESTER

Global Academy of Technology
(Autonomous Institution Affiliated to VTU)
Scheme of Teaching and Examination 2022-23
Department of Civil Engineering

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	22CIV51	Construction Management	PC	Civil Department	2	2	0	50	50	100	3
2	22CIV52	Design and Drawing of RCC Elements	IPC		2	2	2	50	50	100	4
3	22CIV53	Basic Geotechnical Engineering	IPC		3	0	2	50	50	100	4
4	22CIV54	Hydrology and Irrigation Engineering	PC		2	2	0	50	50	100	3
5	22CIV55X	Program Elective 1	PEC		3	0	0	50	50	100	3
6	22CIV56	Extensive Survey	AEC		0	0	4	50	50	100	2
7	22CIV57/66	Environmental Science	HSM	Civil	1	0	0	50	50	100	1
	22UHV57/66	Universal Human Values	BS	Respective Department							
				Total				**350**	**350**	**700**	**20**

Program Elective 1*			
22CIV551	Advanced Mechanics of Solids	**22CIV553**	Ground Water Hydrology
22CIV552	Environmental Impact Assessment	**22CIV554**	Modern Construction Materials and Technology

Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Scheme of UG Autonomous Program – 2022 batch
(6th Semester – Civil Engineering)

VI SEMESTER

Global Academy of Technology
(Autonomous Institution Affiliated to VTU)
Scheme of Teaching and Examination 2022-23
Department of Civil Engineering

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1.	22CIV61	Estimation, Costing and Engineering Economics	PC	Civil Department	2	2	0	50	50	100	3
2.	22CIV62	Advanced Geotechnical Engineering	PC		2	2	0	50	50	100	3
3.	22CIV63	Transportation Engineering	IPC		3	0	2	50	50	100	4
4.	22CIV64X	Program Elective 2	PEC		3	0	0	50	50	100	3
5.	22CIV65X	Open Elective 1	OEC	Offering Department	3	0	0	50	50	100	3
6.	22CIV57/66	Environmental Science	HSM	Civil	1	0	0	50	50	100	1
	22UHV57/66	Universal Human Values	BS	Respective Department							
7.	22CIVMP67	Mini Project	MP	Civil Department	Two Contact hours per week			50	50	100	2
8.	22CIVL68	Project management software laboratory	Lab		0	0	2	50	50	100	1
				Total				**400**	**400**	**800**	**20**

Program Elective 2*			
22CIV641	Structural Dynamics and Earthquake Engineering	**22CIV643**	Water Resources Engineering
22CIV642	Ground Improvement Techniques	**22CIV644**	Geospatial Surveying
Open Elective 1 (Offered to other branch students)			
22CIV651	Environmental Pollution and Control	**22CIV653**	Occupational Health and Safety
22CIV652	Smart Cities and Digital Infrastructure	**22CIV654**	Cyber-Physical Systems for Infrastructure

GLOBAL ACADEMY OF TECHNOLOGY

(An Autonomous Institute under VTU, Belgaum)

DEPARTMENT OF CIVIL ENGINEERING

SEMESTER – V

Course: Construction Management

Course Code	22CIV51	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: -

Course Objectives: Students will be taught:

CLO1	Understand the concept of planning, scheduling, cost and quality control, organization, and use of project information necessary for construction project.
CLO2	Efficient acquisition, utilization, and distribution of finance.
CLO3	Inculcate entreprencurial vision and will.
CLO4	Keep up ethical conduct and discharge professional duties.

Content	No. of Hours/ RBT levels
Module-1 – Construction Management and Scheduling **Management** - Characteristics of management, functions of management, Importance and purpose of planning process, types of plans. **Construction Project Formulation:** Introduction to construction management, project organization, management functions, management styles. **Construction Planning and Scheduling:** Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path-critical path method, PERT method – Problems. Concept of activity on arrow and activity on node.	**8 Hours L2**
Module 2 - Resource Management **Resource Management:** Basic concepts of resource management, class of lab our, Wages & statutory requirement, Labor Production rate or Productivity, Factors affecting labor output or productivity. **Construction Equipment:** classification of construction equipment, estimation of productivity for- excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipment. Selection of construction equipment and basic concept on equipment maintenance Materials- material management functions, inventory management.	**8 Hours L2, L3**

Module 3- Construction Quality, safety, and Human Values: Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management HSE: Introduction to concepts of HSE as applicable to Construction. Importance of safety in construction, Safety measures to be taken during Excavation, Explosives, drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances. **Ethics** - Morals, values and ethics, integrity, trustworthiness, work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.	**8 Hours L2, L3**
Module 4 – Entrepreneurship **Introduction to Entrepreneurship** – Learn how entrepreneurship has changed the world. Identify six entrepreneurial myths and uncover the true facts. Explore E-cells on Campus. **Listen to Some Success Stories:** - Global legends Understand how ordinary people become successful global entrepreneurs, their journeys, their challenges, and their success stories. Understand how ordinary people from their own countries have become successful entrepreneurs. **Characteristics of a Successful Entrepreneur** Understand the entrepreneurial journey and learn the concept of different entrepreneurial styles. Identify your own entrepreneurship style based on your personality traits, strengths, and weaknesses. Learn about the 5M Model, each of the five entrepreneurial styles in the model, and how they differ from each other. Communicate Effectively: Learn how incorrect assumptions and limiting our opinions about people can negatively impact our communication. Identify the barriers which cause communication breakdown, such as miscommunication and poor listening, and learn how to overcome them. **Business Planning Process:** Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities, entry into international business, exporting, direct foreign investment, venture capital.	**8 Hours L2**
Module 5 – Economy in Construction **Introduction:** Principles of Engineering Economy, Engineering Decision- Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy. Interest and Interest Factors: Interest rate, Simple interest, Compound interest, Cash- flow diagrams, Exercises and Discussion.	**8 Hours L2, L3**

Comparison of alternatives: Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break-even analysis. **Replacement Analysis:** Replacement studies, replacement due to deterioration, obsolescence, inadequacy, economic life for cyclic replacements, Exercises, Problems. Break- Even Analysis: Basic concepts, Linear Break- Even analysis, Exercises, Problems. **Depreciation:** Causes of Depreciation, Basic methods of computing depreciation charges, Exercises, Problems	

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV51.1	Discuss the importance of management and its approaches.
22CIV51.2	Classify planning and resources required in a construction project.
22CIV51.3	Understand the importance of quality control and safety concept in construction industry.
22CIV51.4	Summarize entrepreneurship types, characteristics, schemes, and policies.
22CIV51.5	Evaluate alternatives to develop capital budget in different scenarios.

Textbooks:

1. P C Tripathi and P N Reddy, "Principles of Management", 6th edition, Tata McGraw-Hill Education, 2017.
2. Poornima M. Charantimath, "Entrepreneurship Development and Small Business Enterprise", 3rd edition, Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education, 2018.
3. Bureau of Indian standards – IS 7272 (Part-1)- 1974: Recommendations for labour output constant for building works
4. Peurifoy R L, "Construction Planning, Equipment and Methods", 7th edition, Mc Graw Hill, 2010.

References:

1. Harold Koontz, Heinz Weihrich, "Essentials of Management: An International, Innovation, and Leadership perspective", 10th edition, T.M.H. Edition, New Delhi, 2012.
2. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, "Modern Construction Management", 7th edition, Wiley-Blackwell, 2018.

3. Mike Martin, Roland Schinzinger, "Ethics in Engineering", 4th edition, McGraw-Hill. Education, 2004
4. Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders", Prentice Hall,Pitsburgh, 1988.

Web Reference:
https://archive.nptel.ac.in/courses/105/104/105104161/

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e., A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV51.1						1		1	2	2	3				
22CIV51.2									1	1	1	2			
22CIV51.3											2	1			
22CIV51.4		1				1		1	2	2		2			
22CIV51.5		1	1			1		1	1			1	1		
Average		**1**	**1**			**1**		**1**	**1.5**	**1.67**	**2**	**1.5**	**1**		

SEMESTER – V

Course: Design and Drawing of RCC Elements

Course Code	**22CIV52**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:2**	**SEE Marks**	**50**
No. of Credits	**4**	**Examination Hours**	**3**

Prerequisites: Strength of Materials, Structural Analysis

Course Objectives: Students will be taught:

CLO1	To describe the concepts of RCC, Materials, Philosophy, and principles of RCC, Methods of Design, Load Construction and relevant codal Provisions (L2)
CLO2	To estimate load on structural elements namely slabs, beams, columns, footing and staircase, analyse to obtain BM & SF and Draw SFD and BMD(L3)
CLO3	To design Various Structural elements and apply checks for safety (L3)
CLO4	To prepare Reinforcement drawings/detailing of structural elements (L3)

Content	**No. of Hours/ RBT levels**
Module-1 **General features of Reinforced Concrete:** Introduction, design loads, materials for reinforced concrete, code requirements of reinforcements, moment of resistance of section, balanced, under reinforced and over reinforced sections. **Principles of Limit State Design:** Philosophy of limit state design, principles of limit states, factor of safety, characteristic and design loads, characteristic and design strength, Analysis of sections for flexure and shear.	**10 Hours L2, L3**
Module 2 **Flexure and serviceability limit states:** General Specification for flexure design of beams-practical requirements, size of beam, and cover to reinforcement spacing of bars. General aspects of Serviceability-Deflection limits in IS: 456 – 2018-Calculation of deflection and crack width. **Design of Beams**: Design procedures of critical sections for moment and shear. Anchorage value, development length, steel requirements, and lateral stability of beam, Design examples for simply supported, Cantilever beams, continuous beams and T-Beam with rectangular sections. **Practice:** Use AUTOCAD for detailed drawings of above designed numerical.	**10 Hours L2, L3**

Module 3 **Design of slabs:** General consideration of design of slabs, (one way and Two-way slab), for various boundary conditions. Design examples of simply supported cantilever and continuous slabs as per code. **Practice:** Use AUTOCAD for detailed drawings of above designed numerical.	**10 Hours L2, L3**
Module 4 **Design of columns:** General aspects, effective length, loads, slenderness ratio, Minimum eccentricity. Concept of long and short columns and Design of short columns subjected to axial load, Uniaxial and biaxial bending moment using SP – 16 charts. **Design of footings:** Introduction, load consideration. Design of isolated rectangular footing for axial load, Uniaxial and biaxial moments. **Practice:** Use AUTOCAD for detailed drawings of above designed numerical.	**10 Hours L2, L3**
Module 5 **Design of staircases:** Design of staircases with waist slabs (Dog legged and Open well) as per IS code provisions. **Design of Water Tanks:** Design of rectangular water tanks resting on ground. As per IS: 3370. **Practice:** Use AUTOCAD for detailed drawings of above designed numerical.	**10 Hours L2, L3**

Learning Assignments (Not for SEE)

Details of Drawing sheets to be prepared and submitted.

i) Longitudinal Section and Cross Section at prominent point (at mid span and support section) with flexure and shear details

1) Beam- Plan, L/S and C/S showing reinforcement details
   - i) Simply Supported beam
   - ii)Continuous beam
   - iii) Cantilever beam
   - iv) T-Beam

2)Slab- Plan, L/S and C/S showing reinforcement details
   - i) One way slab
   - ii)Two-way slab
   - iii) One-way continuous slab

3) Column with Footing- Plan, L/S and showing reinforcement details
   - i) Rectangular or Square Column
   - ii)Circular Column

4)Staircase-Plan, L/S and C/S showing reinforcement details
   - i) Dog legged Staircase
   - ii)Open well Staircase

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV52.1	Describe the concepts of design philosophies, stress block parameters and limit state criterion
22CIV52.2	Design of RC Beams for Strength, serviceability requirements such as deflection and crack width.
22CIV52.3	Design of RC Slabs for Strength and serviceability requirements under various boundary conditions.
22CIV52.4	Calculate the axial and bending moment to design columns and footings.
22CIV52.5	Design of Footing and water tank as per codal provisions.

Textbooks:

1. Unnikrishnan Pillai and Devdas Menon, " Reinforced Concrete Design" , 3rd edition, McGraw Hill, New Delhi, 2017.
2. Subramanian, " Design of Concrete Structures" , 1st edition, Oxford university Press, 2013.
3. H J Shah, "Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)", 11th edition, Charotar Publishing House Pvt. Ltd, 2016.

References:

1. P C Varghese, "Limit State design of reinforced concrete", 2nd edition, PHI, New Delhi, 2008.
2. Kong and Evans, "Reinforced and Pre-Stressed Concrete", Springer Publications.
3. A W Beeby and Narayan R S, "Introduction to Design for Civil Engineers", CRC Press
4. Robert Park and Thomas Paulay, "Reinforced Concrete Structures", 1st edition, John Wiley & Sons, Inc, 1975.
5. IS 456-2018 (Reaffirmed 2011, 2016) plain and reinforced concrete -code of practice (Fourth Revision)
6. SP:34(S&T)-1987- Handbook on concrete Reinforcement and Detailing
7. SP16:1980, Design Aids for Reinforced Concrete to IS: 456-1978, Bureau of Indian Standards, New Delhi, 1992

Web Reference:

NPTEL Course: https://onlinecourses.nptel.ac.in/noc18_ce24/preview

Introduction to Design of RCC Elements	https://youtu.be/pIdaC_I6H_M
Design of Beams	https://youtu.be/zVKf6hZfrhA https://youtu.be/DjT5G6KlfIM https://youtu.be/0fTvE8aSsiE https://youtu.be/JwiHgkC-6Ic https://youtu.be/WaAWYM6HDWs
Design for Torsion	https://youtu.be/AyRgeA65oI0 https://youtu.be/aTGeCoGkh3M
Design for shear	https://youtu.be/AfHmpWlcqq4
Design of Slabs	https://youtu.be/PDJPcQq3PZE
Design of Columns	https://youtu.be/wJWt0dcgafs
Design of Footings	https://youtu.be/8ATp13mOhvg
Design of Staircases	https://youtu.be/hxakW1miEcM

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below.

Table 1: Distribution of weightage for CIE & SEE of Regular courses:

Component		Marks	Total Marks
CIE	CIE Test-1	30	**50**
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	**20**	
SEE	**Semester End Examination**	**100**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV52.1	3	3			2									3	
22CIV52.2	3	3			2							1		3	
22CIV52.3	3	3			2							1		3	
22CIV52.4	3	3			2							1		3	
22CIV52.5	3	3			2							1		3	
Average	**3**	**3**			**2**							1		**3**	

SEMESTER – V

Course: Basic Geotechnical Engineering

Course Code	**22CIV53**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
No. of Credits	**4**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	Understand the importance of soil and its properties in Civil Engineering applications
CLO2	Understand the Index properties and engineering properties of different soils and Soil Structure
CLO3	Understand the geotechnical engineering problems such as, flow of water through soil medium and terminologies associated with geotechnical engineering.
CLO4	Understand the improvement in mechanical behavior by densification of soil deposits using compaction and Measure consolidation and shear strength properties
CLO5	To enable students to conduct experiments and determine Index and engineering properties of soil

Content	**No. of Hours/ RBT levels**
Module-1 **Introduction:** Origin and formation of soil, regional soil deposits in India, Phase Diagram, phase relationships, definitions, and their interrelationships. Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis (sieve and Hydrometer analysis) Atterberg's Limits, consistency indices. Activity of clay, Field identification tests.	**10 Hours L2, L3**
Module 2 **Soil Structure and Clay Mineralogy** Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering. BIS soil classification (IS: 1498-1970), Unified classification, Plasticity chart.	**10 Hours L2, L3**

Module 3 **Permeability:** Darcy"s law- assumption, coefficient of permeability and its determination in laboratory, factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation Effective Stress Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena.	**10 Hours L2, L3**
Module 4 **Compaction:** Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties. **Consolidation:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption, Consolidation characteristics of soil (Cc, av, mv and Cv). Laboratory one dimensional consolidation test, characteristics of e-log (σ') curve, Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio.	**10 Hours L2, L3**
Module 5 **Shear Strength of Soil:** Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotropy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions.	**10 Hours L2, L3**

Geotechnical Engineering Laboratory

Content	Content No. of Hours/ RBT levels
1. Specific gravity test i. Pycnometer ii. Density bottle method	**2 Hours L2, L3**
2.Water content determination i. Oven drying. ii. Pycnometer method. iii. Rapid moisture meter method.	**2 Hours L2, L3**
3. Grain size analysis	**2 Hours**

i. Sieve analysis ii. Hydro meter analysis	**L2, L3**
4. In-situ density tests i. Core-cutter method ii. Sand replacement method	**2 Hours** **L2, L3**
5. Consistency limits i. Liquid limit test (by Casagrande's and cone penetration method) ii. Plastic limit test iii. Shrinkage limit test	**2 Hours** **L2, L3**
6.Compaction test i. Light compaction ii. Heavy compaction	**2 Hours** **L2, L3**
7. Co-efficient of permeability test Constant head test Variable head test	**2 Hours** **L2, L3**
8. Shear strength tests (undrained conditions) i. Unconfined compression test ii. Direct shear test iii. Triaxial test (unconsolidated undrained test only **iv.** Laboratory vane shear test	**2 Hours** **L2, L3**
9. Consolidation test: To determine pre consolidation pressure only (half an hour per loading-test)	**2 Hours** **L2, L3**
10. Demonstration Experiments: Field identification of soil, Hydrometer analysis, Rapid moisture meter method, Swell pressure test, Standard penetration test and boring equipment	**2 Hours** **L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV53.1	Describe the properties, inter relationships of soil and classify based on its index properties
22CIV53.2	Explain the concepts of clay mineralogy and soil structures and their applications
22CIV53.3	Explain the concepts of permeability, seepage flow of soil, effective stress based on assumptions and validity of Darcy's law
22CIV53.4	Determine the characteristics of compaction and consolidation of soil by principle of compressibility.
22CIV53.5	Apply the Mohr-Coulomb failure concepts to determine the shear strength parameters from various laboratory shear tests under different drainage conditions
22CIV53.6	Conduct experiments and determine Index, engineering properties of soil

Textbooks:

1. Braja, M. Das, "Principles of Geotechnical Engineering" 9th Edition, Cengage India Private Limited, New Delhi, 2017
2. Gopal Ranjan and Rao A.S.R., "Basic and Applied Soil Mechanics", 4th Edition, New Age International Pvt Ltd., New Delhi,2022
3. Punmia B C, "Soil Mechanics and Foundation Engineering", 17th Edition, Laxmi Publications, New Delhi, 2021

References:

1. Murthy V.N.S.," Principles of Soil Mechanics and Foundation Engineering", CBS Publishers and Distributors, New Delhi, 2018
2. C. Venkatramaiah., Geotechnical Engineering", 6th Edition, New Age International, New Delhi,2018

Web Reference:

https://nptel.ac.in/courses/105101201
https://nptel.ac.in/courses/105105168

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below.

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	CIE Test-3	30	
	Laboratory	**20**	
SEE	**Semester End Examination**	**100**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
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22CIV53.1	3	2	2	1										2	
22CIV53.2	3	2	2	1										2	
22CIV53.3	3	2	2	1										2	
22CIV53.4	3	2	2	1										2	
22CIV53.5	3	2	2	1										2	
22CIV53.6	3	2	2	1										2	
Average	3	2	2	1										2	

SEMESTER – V

Course: Hydrology and Irrigation Engineering

Course Code	**22CIV54**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	To understand the concept of hydrology and components of hydrologic cycle.
CLO2	To quantify runoff and use the concept of unit hydrograph.
CLO3	To understand the different methods of irrigation, methods of application of water and irrigation procedure.
CLO4	To design canals and canal network based on the water requirement of various crops
CLO5	To determine the reservoir capacity

Content	**No. of Hours/ RBT levels**
Module-1 **Hydrology:** Introduction, Importance of hydrology, Global distribution of water and Indian water availability, Practical application of hydrology, Hydrologic cycle (Horton's) qualitative and engineering representation. **Precipitation:** Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs. **Case history** – Modern techniques for measurement of precipitation.	**8 Hours L2**
Module 2 **Losses: Evaporation:** Introduction, Process, factors affecting evaporation, measurement using IS class-A Pan, estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control. **Evapotranspiration:** Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation. **Infiltration:** Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.	**8 Hours L3**

Case history – Modern techniques used for the measurement and monitoring of losses.	
Module 3 **Runoff:** Definition, the concept of the catchment, factors affecting runoff, rainfall-runoff relationship using regression analysis. **Hydrographs:** Definition, components of the hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations. Case history – Measurement of runoff in urban and rural areas.	**8 Hours** **L3**
Module 4: **Irrigation:** Definition. Benefits and ill effects of irrigation. System of irrigation: surface and groundwater, flow irrigation, lift irrigation, Bandhara irrigation. **Case history:** Irrigation practice in India **Water Requirements of Crops:** Duty, delta and base period, the relationship between them, actors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.	**8 Hours** **L3**
Module 5: **Canals:** Types of canals. Alignment of canals. Definition of gross command area, cultural command area, the intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method. **Reservoirs:** Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, the economical height of the dam.	**8 Hours** **L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV54.1	Understand the importance of hydrology and its components.
22CIV54.2	Measure precipitation and analyze the data and losses in precipitation
22CIV54.3	Estimate runoff and develop unit hydrographs.
22CIV54.4	Estimate the benefits and ill-effects of irrigation and the water requirement of crops.
22CIV54.5	Estimate the canal capacity, design the canal, and compute reservoir capacity.

Textbooks:

1. K. C. Patra "Hydrology And Water Resources Engineering" 2nd Edition, Alpha Science International Ltd Publisher, 2008.
2. Subramanya, K. (2013). Engineering Hydrology, 4th Edition, Tata McGraw Hill Education (India) Pvt. Ltd., New Delhi, India, 2017.
3. Jayarami Reddy, "A Text Book of Hydrology", 3rd edition, Lakshmi Publications, New Delhi, 2016.

References:

1. Punmia and LalPandey, "Irrigation and Water Power Engineering", 16th edition, Lakshmi Publications, New Delhi, 2009.
2. Sharma R.K., "Irrigation Engineering and Hydraulics", Oxford & IBH Publishing Co., New Delhi.
3. Modi P.N, "Water Resources and Water Power Engineering", 11th edition, Standard book house, Delhi, 2019.
4. Garg S.K, "Irrigation Engineering and Hydraulic Structures", 38th edition, Khanna publications, New Delhi, 1976.

Web Reference:

https://onlinecourses.nptel.ac.in/noc22_ce19/preview#:~:text=Sreeja%20Pekkat,-IIT%20Guwahati&text

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of three test marks will be added to test component and loboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes/Alternate Assessment Tools(AAT's). some possible AAT's:

Seminar/ assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	05	
	Quiz 2/AAT	05	
SEE	**Semester End Examination**	**100**	50
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV54.1	3	2	1												
22CIV54.2	3	2	1	1									2		
22CIV54.3	3	2											1		
22CIV54.4	3	2		1			1						1		
22CIV54.5	3	2		1			1						1		
Average	3	2	1	1			1						1.25		

SEMESTER – V

Course: Advanced Mechanics of solids

Course Code	**22CIV551**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Engineering Mechanics, Mechanics of solids, Structural Analysis

Course Objectives: Students will be taught:

CLO1	To develop differential equations for beams on elastic foundation
CLO2	To construct differential equations for beam-column for different loads with various end conditions
CLO3	To determine the buckling load for prismatic and non-prismatic columns
CLO4	To find stresses, deflections and shear center in symmetric and unsymmetrical sections.
CLO5	To compute buckling load on plates using energy and finite difference method

Content	**No. of Hours/ RBT levels**
Module-1 **Beams on elastic foundations:** Differential equations of elastic line interpretation of constants of integration, infinite beam with concentrated load, moment and UDL and problems related to infinite beams. Semi-infinite beams with concentrated load, moment and UDL, semi-infinite beam with fixed and hinged conditions, problems on semi-infinite beams.	**8 Hours L3**
Module 2 **Beam-Column:** Governing differential equation for axial and lateral loads, analysis of beam columns subjected to axial and concentrated loads, axial and UDL, beam column with different end conditions.	**8 Hours L3**
Module 3 **Buckling of Columns:** Assumptions, Euler's theory of buckling governing differential equation, prismatic columns with different end conditions, obtaining the characteristic equation for the critical load for non- prismatic columns, buckling of frames.	**8 Hours L3**
Module 4	**8 Hours L3**

Unsymmetrical bending of beams: Introduction, stresses in beams, deflections of beams subjected to unsymmetrical bending, problems related to unsymmetrical bending. **Shear Centre:** introduction, shear center for symmetrical and unsymmetrical sections, problems related to shear center.	
Module 5 **Buckling of plates** – Differential equation of plate buckling – critical load on plates for various boundary conditions – Energy method – Finite difference method.	**8 Hours** **L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV551.1	**Construct** differential equations for beams on elastic foundation
22CIV551.2	**Construct** differential equations for beam-column for different loads with various end conditions
22CIV551.3	**Calculate** the critical load for prismatic and non-prismatic columns
22CIV551.4	**Compute** stresses, deflections, and shear center in symmetric and unsymmetrical sections.
22CIV551.5	**Determine** buckling load on plates using energy and finite difference method

Textbooks:

1. Ashwini Kumar, "Stability Theory of Structures", Allied publishers Ltd., New Delhi, 2003.
2. Gambhir, "Stability Analysis and Design of Structures", 1st edition, springer, New York, 2004.
3. N. Krishna Raju, and D.R. Guru raja, "Advanced Mechanics of solids and structures", Narosa Publishing House, New Delhi,1997.
4. Timoshenko.S.P, and Gere.J.M, "Theory of Elastic Stability", McGraw Hill Book Company,1963

References:

1. Boresi A.P., and Sidebottom O.M, "Advanced Mechanics of Materials", John Wiley and Sons in N.Y, 1985.
2. Simitser.G.I and Hodges D.H, "Fundamentals of Structural Stability", Elsevier Ltd., 2006.
3. Chajes, A. "Principles of Structures Stability Theory", Prentice Hall, 1974.

Web Reference:
https://onlinecourses.nptel.ac.in/noc22_ce91/preview

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes/Alternate Assessment Tools(AAT's). some possible AAT's: Seminar/ assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.
Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	05	
	Quiz 1/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV551.1	3	2	-	-	-	-	-	-	-	-	-	1	1	-	-
22CIV551.2	3	3	1	-	-	-	-	-	-	-	-	1	1	-	-
22CIV551.3	2	3	2	-	-	-	-	-	-	-	-	1	1	-	-
22CIV551.4	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
22CIV551.5	2	2	1	-	-	-	-	-	-	-	-	1	1	-	-
Average	**2.4**	**2.4**	**1.25**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**

SEMESTER – V

Course: Environmental Impact Assessment

Course Code	**22CIV552**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Environmental Engineering

Course Objectives: Students will be taught:

CLO1	To study the importance of EIA
CLO2	To know the role of public in EIA studies
CLO3	Understand phenomena of impacts in the environment
CLO4	Know the impact quantification of various projects on the environment

Content	**No. of Hours/ RBT levels**
Module 1 **Environmental Impact Assessment:** Introduction, definition of EIA, need for EIA, EIS, FONSI, REIA, CEIA, Utility of EIA, Scope of EIA, Step-by-step procedure for conducting EIA, limitations of EIA, Framework of EIA, EIA guidelines for developmental projects.	**8 Hours L2**
Module 2 **Developmental Projects:** Description of affected environment with factors and indices, methodologies of EIA – Adhoc method, Checklist method, Matrices method, Network method and Overlay method. EIA guidelines for Development Projects	**8 Hours L2**
Module 3 **Assessment and Prediction of Impacts on Attributes:** Air, Water, Noise, Land Ecology, Soil, Cultural and Socio-economic Environment. Public Participation in Environmental Decision making.	**8 Hours L2**
Module 4 **Salient Features of the Project Activity:** Environmental Parameter Activity Relationships- Matrices. Practical Considerations in preparing Environmental Impact Assessment and Statements.	**8 Hours L2**
Module 5 **EIA for Projects:** Water resource developmental projects, Highway projects:	

Nuclear Power plant projects, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities.	**8 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV552.1	Describe the fundamental concepts of EIA.
22CIV552.2	Identify various attributes and methods of EIA
22CIV552.3	Apply prediction and assessment methods to EIA of air, water, land and noise environment.
22CIV552.4	Understand the Environmental Parameter Activity Relationships in preparing EIA and Settlement.
22CIV552.5	Apply suitable method of EIA for developmental projects.

Textbooks:

1. Jain, R.K., Urban, L.V., Stracy, G.S., "Environmental Impact Analysis", Van Nostrand Reinhold Co., New York, 1991.
2. Rau, J.G. and Wooten, D.C., "Environmental Impact Assessment", McGraw Hill Pub. Co., New York, 1996.

References:

1. Guidelines for EIA of developmental Projects Ministry of Environment and Forests, GOI.
2. Larry W. Canter, "Environment Impact Assessment",McGraw Hill Publication, 2014.
3. "Environmental pollution & Control in Chemical process Industries by S.C. Bhatia "Khanna Publishers", Delhi

Web Reference:

http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv104-Page1.htm

nptel.ac.in/courses/105101084/https://ay14-15

moodle.wisc.edu/prod/course/view.php?id=499

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes/Alternate Assessment Tools (AAT's). some possible AAT's: Seminar/ assignments/ mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	05	
	Quiz 1/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV552.1	1	1	2							1		1			
22CIV552.2	1	1	2							1		1			
22CIV552.3	1	1	2							1		1			
22CIV552.4	1	1	2							1		1			
22CIV552.5	1	1	2							1		1			
Average	1	1	2							1		1			

SEMESTER – V

Course: Groundwater Hydrology

Course Code	22CIV553	**CIE Marks**	50
Hours/Week (L: T: P)	3:0:0	**SEE Marks**	50
No. of Credits	3	**Examination Hours**	3

Prerequisites: Hydrology and Water Supply Engineering

Course Objectives: Students will be taught:

CLO1	Understand the water-bearing strata and determination the aquifer parameters.
CLO2	Study of Ground Water flow phenomenon in steady & unsteady strata
CLO3	Application of Geophysics for determination of Ground Water Resources.
CLO4	Understanding the subsurface groundwater modeling.

Content	No. of Hours/ RBT levels
Module-1 Vertical distribution of subsurface water. Types of water-bearing formation. Aquifer and its types. Aquifer parameters, specific yield, specific retention, porosity, storage coefficient, land subsidence due to withdrawal of groundwater, Groundwater movement - Darcy's law, intrinsic permeability, Hydraulic conductivity, Transmissivity, permeability determination	**08 Hours L1, L2**
Module 2 Well Hydraulics. Steady unidirectional flows in confined aquifers, unconfined aquifers- Dupit's equation, Baseflow to a stream, Steady Radial flow to well – Confined aquifer, unconfined aquifer with uniform recharge. Unsteady radial flow in a confined aquifer – non-equilibrium pumping equation, Theis method, Cooper-Jacob method and Chow method, unsteady radial flow in an unconfined aquifer, Image well theory	**08 Hours L2**
Module 3 Groundwater prospecting. –Remote Sensing methods, geophysical investigation: Electrical Resistivity method, Seismic refraction method, Ground-penetrating Radar. Well design- design of diameter, depth, spacing, and casing. Well losses. Groundwater modelling: Finite difference and finite element models, Applications of groundwater models. Regional groundwater flow modelling.	**08 Hours L2**

Module 4 Groundwater contamination and remediation: Sources Attenuation of pollution (Filtration, Sorption, Dilution) Mass transport of pollution - Fick's law. Advection-Dispersion equation in Saturated porous media. Monitoring of groundwater quality and methods of remediation. Saline Water Intrusion in Aquifers: Ghyben-Herzberg relation between fresh & saline waters, shape & structure of the fresh & saline water interface, upcoming of saline water, saline water intrusion control.	**08 Hours L2**
Module 5 Groundwater management – Concept of basin management, Conjunctive use of surface water and groundwater, Groundwater management techniques. Managed aquifer recharge – Objectives, purpose, and methods. Groundwater provinces and resources of India. Impacts of climate change on groundwater – Hydrological components affecting the groundwater, direct and indirect impacts of climate change on groundwater. Climate change impacts on the water availability in an aquifer.	**08 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV553.1	Describe the concepts of the groundwater flow phenomenon.
22CIV553.2	Understand the different flow conditions and problems associated with groundwater pollution.
22CIV553.3	Understanding the subsurface using geophysical techniques.
22CIV553.4	Apply the concepts and techniques necessary to determine aquifer parameters.
22CIV553.5	Analyze the various aspects of groundwater assessment, development, and management

Textbooks:

1. Todd, D. and Mays, L. "Groundwater Hydrology" 3rd Edition, John Wiley and Sons, Inc., Hoboken, 2005.
2. K. R. Karanth, "Hydrogeology", Tata McGraw Hill Publishing Company, 2017.
3. Fetter, C W., Applied Hydrogeology, 2nd edition, CBS Publishers and Distributors,2007.

References:

1. Freeze and Cherry, "Ground Water", Pearson Publications, 1979.
2. Raghunath H.M., "Ground Water Hydrology", Wiley Eastern Ltd., Second reprint, 2000.
3. Bear J., "Hydraulics of Groundwater", Vol 5, McGraw-Hill International, 1979.

4. Willis, R. and W.W.G. Yeh, "Groundwater Systems Planning and Management", Prentice-Hall, 1987.
5. S.P. Garg, "Groundwater and Tube Wells", Oxford & IBH Publishing Co., 1993

Web Reference:
https://archive.nptel.ac.in/courses/105/101/105101214/

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e., A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV553.1	2	3				2	2						1		
22CIV553.2	2	2				1							1		
22CIV553.3	2					2	2						1		
22CIV553.4	2					2			2				1		
22CIV553.5	2	2				2			2				1		
Average	2	2.7	---			1.8	2		2				1		

SEMESTER – V

Course: Modern Construction Materials and Technology

Course Code	**22CIV554**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Concrete Technology, Building material planning and drawing

Course Objectives: Students will be taught:

CLO1	Various equipment's and fundamentals for earth work operation
CLO2	The concept of shuttering and bar bending
CLO3	Various equipment's used for shoring and soil stabilization
CLO4	Methods to improve acoustics and thermal insulation in a building

Content	**No. of Hours/ RBT levels**
Module-1 **Thermal insulation**- Types of materials, Heat transfer and basic definition, methods of thermal insulations for roof, exposed walls, doors and windows in building construction. **Acoustics**- Types of materials for improvement of acoustics in building construction, audible sound, behaviour of sound, reflection of sound, reverberation and absorption, sound insulation and acoustic design of hall.	**8 Hours L1, L2**
Module 2 **Smart Materials**: concept and types, sensing technology-types of sensors -physical measurement using piezoelectric strain measurement, piezoelectric and electro strictive material - magneto structure material, shape memory alloys, electro rheological fluids	**8 Hours L2, L3**
Module 3 **Shuttering and bar bending:** Scaffolding & formwork - Definitions of common technical terms used in Scaffolding, formwork. Types & applications Different materials used in formwork. Methods and tools used for formwork. Safety precautions to be observed in scaffolding and formwork Defects in formwork Shuttering /removal of formwork. Maintenance & repair of formwork Type of rebar, size of rebar, cover to reinforcement, spacing, Insertion and fixing	**8 Hours L2, L3**

sequence for different types of R.C.C structures (Slab, Beam, Column, Footing, Wall, Staircase), Computation of cutting length of rebars,	
Module 4 **Equipment's:** Dozers, Scrapers, Excavators, Finishing equipment's, Trucks, Forklifts and related equipment - Portable Material Bins – Conveyors – Hauling Equipment. Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders, Earth Movers.	**8 Hours L2, L3**
Module 5 **Soil stabilization technique:** Geotechnical materials, Compaction and stabilization, Machine power, Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting - Equipment for Compaction - Erection Equipment - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Foundation and Pile Driving Equipment – Equipment for Demolition	**8 Hours L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV554.1	Understand fundamentals and Various equipment's used for Earth work operations
22CIV554.2	Understand Maintenance & repair of formworks
22CIV554.3	Describe various equipment's used for shoring and soil stabilization
22CIV554.4	Infer modern Construction techniques in repairing and rehabilitation of structures
22CIV554.5	Understand various smart materials used in construction technology

Textbooks:

1. Shan Somayaji, "Civil Engineering Materials", 2nd Edition, Prentice Hall Inc., 2001
2. Santhakumar A.R., "Concrete Technology", Oxford University Press, New Delhi. 2007
3. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, "Building Construction", 11th edition, Laxmi Publications (P) ltd., New Delhi, 2016.

References:

1. S. K. Duggal, "Building Materials", (Fourth Edition) New Age International (P) Limited, 2016
2. P C Vergese, "Building Materials", PHI Learning Pvt.Ltd Building Materials and Components, CBRI, 1990
3. Ranga Wala S. C. "Engineering Materials", Charter Publishing House, Anand, India.

Web Reference:

https://nptel.ac.in/courses/105102088

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	05	
	Quiz 2/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV554.1	3					1		1				2			
22CIV554.2	3					1		1				2			
22CIV554.3	3					1		1				2			
22CIV554.4	3					1		1				2			
22CIV554.5	3					1		1				2			
Average	3					1		1				2			

SEMESTER – V

Course: Extensive Survey

Course Code	**22CIV56**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:4**	**SEE Marks**	**50**
No. of Credits	**2**	**Examination Hours**	**3**

Prerequisites: Engineering Survey, Building Materials, Hydraulics, Environmental Engineering, Highway Engineering.

Course Objectives: Students will be taught:

CLO1	Understand the practical applications of Survey and survey tools for civil engineering projects.
CLO2	Evaluation and interpretation of field data to develop solution to meet societal needs
CLO3	Work in teams and learn time management, communication, and presentation skills

Content	**No. of Hours/ RBT levels**
NEW TANK PROJECT The work shall consist of: a. Reconnaissance survey for selection of site and conceptualization of project. b. Alignment of centerline of the proposed bund, Longitudinal and cross-sections of the centerline. c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement. d. Design and preparation of drawing with report. e. Design to raise the bund height and to increase the capacity of an existing old tank.	**8 Hours L3**
WATER SUPPLY AND SANITARY PROJECT The work shall consist of. a. Reconnaissance survey for selection of site and conceptualization of project. b. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population. c. Preparation of village map by using total station. d. Survey work required for laying of water supply and UGD. e. Location of sites for water tank. Selection of type of water tank to be provided.	**8 Hours L3**

(Ground level, overhead and underground) f. Design of all elements and preparation of drawing with report.	
HIGHWAY PROJECT: The work shall consist of. a. Reconnaissance survey for selection of site and conceptualization of project. b. Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using total station. c. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed. d. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.	**8 Hours L3**
TOWN/HOUSING / LAYOUT PLANNING: The work shall consist of. a. Reconnaissance survey for selection of site and conceptualization of project. b. Detailed survey required for project execution like contour surveys. c. Preparation of layout plans as per regulations. d. Design of all elements and preparation of drawing with report as per regulations.	**8 Hours L3**
CENTRE LINE MARKING: The work shall consist of: a. Plan a commercial building of G+4 story. b. Centerline marking transfer of centerlines from plan to ground using total station. c. Drawings shall include blueprint of the commercial building. d. Developing plan from the measurements of an existing building.	**8 Hours L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV56.1	Understand the type of survey to be carried out for various civil works.
22CIV56.2	Use appropriate surveying equipment to carry out required survey work.
22CIV56.3	Analyze the field data and prepare required drawings.
22CIV56.4	Design required civil engineering work as per the procured data and drawings.

Note: To be conducted between 4th & 5th Semester for a period of 2 weeks including training on total station.

Use of Total Station is compulsory for minimum of TWO projects.

- The student shall submit a project report consisting of designs and drawings.
- Drawings should be done using CAD and survey work using total station.
- Students should learn data download from total station, generation of contours, block levelling, longitudinal and cross-sectional diagrams, and capacity volume calculation by using relevant software.
- The course coordinators should give exposure and simulate activities to achieve the course outcomes.

References:

1. Training Manuals and User Manuals

Web Reference:

https://www.youtube.com/watch?v=wQBWh75lG1E&t=487s

Scheme of Examination:

Semester End Examination (SEE):

- Viva voce conducted along with 5th semester exams.
- An extensive project preparation training involving investigation, collection of data is to be conducted.

Continuous Internal Evaluation (CIE):

- Presentation on all the projects.

Component		Marks	Total Marks
CIE	Presentation	**50**	**50**
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e., A miffimum marks öf 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV56.1	3	3	3	2	3	2	2	1	2	1	1	1	1	1	1
22CIV56.2	3	3	3	2	3	2	2	1	2	1	1	1	1	1	1
22CIV56.3	3	3	3	2	3	2	2	1	2	1	1	1	1	1	1
22CIV56.4	3	3	3	2	3	2	2	1	2	1	1	1	1	1	1
Average	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**

SEMESTER – V

Course: Environmental Science

Course Code	**22CIV57/66**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:0**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**1**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	The fundamentals of environmental science.
CLO2	The types of natural resources
CLO3	The various global environmental concerns.
CLO4	The types of wastes generated and their handling at a basic level
CLO5	The area of environmental law and policies with a few important acts in the field

Content	No. of Hours/ RBT levels
Module 1 **Environment:** • Definition, scope & importance • Components of Environment Ecosystem: Structure and function of various types of ecosystems • Human Activities – Food, Shelter, and Economic & Social Security. • Population - Growth, variation among nations – population explosion and impact on environment **Biodiversity:** • Types, Value; Hot spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.	**4 Hours L2**
Module 2 **Natural Resources**: Forest, Water, Mineral, Food, Energy, Land Environmental **Pollution** - Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards	**4 Hours L2**

Module 3 **Global Environmental Concerns** (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.	**4 Hours L2**
Module 4 **Sources:** Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Solid Waste Management Rules in India Sources and management of E – Waste, Biomedical Waste, Hazardous waste, and construction waste at individual and community level. Socio-economic aspect of waste management Environmental Toxicology.	**4 Hours L2**
Module 5 **Latest Developments in Environmental Pollution Mitigation Tools** (Concept and Applications): Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship, NGOs.	**4 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV57.1/66.1	Understand holistically the key concepts "Environment", and "Biodiversity".
22CIV57.2/66.2	Classify the types of natural resources available and the effects of anthropogenic interventions.
22CIV57.3/66.3	Express the gravity of various global environmental concerns.
22CIV57.4/66.4	Categorize the types of wastes generated and their handling at a basic level.
22CIV57.5/66.5	Understand the importance of environmental law and policies.

Textbooks:

1. Environmental studies, Benny Joseph, Tata Mcgraw-Hill 2nd edition 2012
2. Environmental studies, S M Prakash, pristine publishing house, Mangalore 3rd edition-2018
3. Gilbert M.Masters, _Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

References:

1. Benny Joseph, Environmental studies, Tata Mcgraw-Hill 2nd edition 2009
2. M.Ayi Reddy Textbook of environmental science and Technology, BS publications 2007
3. Dr. B.S Chauhan, Environmental studies, university of science press 1st edition

Web Reference:

https://www.hzu.edu.in/bed/E%20V%20S.pdf
https://onlinecourses.nptel.ac.in/noc23_hs155/preview
https://onlinecourses.swayam2.ac.in/cec19_bt03/preview

Scheme of Examination:
Semester End Examination (SEE): SEE Question paper is to be set for 50 marks with multiple choice questions of 1 mark each covering all aspects of the syllabus.

Continuous Internal Evaluation (CIE): Three Tests are to be conducted for 50 marks each. The average of the three tests are taken for computation of CIE. Question paper for each of the CIE is to be of the multiple-choice type with 50 question each.
Typical Evaluation pattern for regular courses is shown in Table.

Table 1: Distribution of weightage for CIE & SEE for 1 credit course

	Component	Marks	Total Marks
CIE	CIE Test-1	**50**	**50**
	CIE Test-2	**50**	
	CIE Test-3	**50**	
SEE	Semester End Examination	**50**	**50**
		Grand Total	**100**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV57.1/66.1	2						3						1		
22CIV57.2/66.2	2	1					3					1	1		1
22CIV57.3/66.3	2		2			2	3	1				1	1		1
22CIV57.4/66.4	2	2				2	3								1
22CIV57.5/66.5	2					2	3							1	1
Average	**2**	**1.5**	**2**			**2**	**3**	**1**				**1**	**1**	**1**	**1**

SEMESTER – V

Course: Universal Human Values

Course Code	22UHV57/66	CIE Marks	50
Hours/Week (L: T: P)	1:0:0	SEE Marks	50
No. of Credits	1	Examination Hours	1

Prerequisites:

Course Objectives: Students will be taught:

CLO1	To create an awareness on Engineering Ethics and Human Values.
CLO2	To understand social responsibility of an engineer.
CLO3	To appreciate ethical dilemma while discharging duties in professional life.

Content	No. of Hours/ RBT levels
Module 1 **Introduction to Value Education.** • Value Education, Definition, Concept and Need for Value Education. • The Content and Process of Value Education. • Basic Guidelines for Value Education. • Self-exploration as a means of Value Education. • Happiness and Prosperity as parts of Value Education.	5 Hours L2
Module 2 **Harmony in the Human Being** • Human Being is more than just the Body. • Harmony of the Self ('I') with the Body. • Understanding Myself as Co-existence of the Self and the Body. • Understanding Needs of the Self and the needs of the Body. • Understanding the activities in the Self and the activities in the Body.	5 Hours L2
Module 3 **Harmony in the Family and Society and Harmony in the Nature** • Family as a basic unit of Human Interaction and Values in Relationships. • The Basics for Respect and today's Crisis: Affection, e, Guidance, Reverence, Glory, Gratitude and Love.	5 Hours L2

• Comprehensive Human Goal: The Five Dimensions of Human Endeavour. • Harmony in Nature: The Four Orders in Nature. • The Holistic Perception of Harmony in Existence.	
Module 4 **Social Ethics** • The Basics for Ethical Human Conduct. • Defects in Ethical Human Conduct. • Holistic Alternative and Universal Order. • Universal Human Order and Ethical Conduct. • Human Rights violation and Social Disparities.	**5 Hours** **L2**
Module 5 **Professional Ethics** • Value based Life and Profession, Professional Ethics and Right Understanding. • Competence in Professional Ethics. • Issues in Professional Ethics – The Current Scenario. • Vision for Holistic Technologies, • Production System and Management Models.	**5 Hours** **L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22UHV57.1/66.1	Understand the significance of value inputs in a classroom and start applying them in their life and profession.
22UHV57.2/66.2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
22UHV57.3/66.3	Understand the role of a human being in ensuring harmony in society and nature.
22UHV57.4/66.4	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.

Textbooks:

1. A.N Tripathy, New Age International Publishers, 2003.
2. Bajpai. B. L, New Royal Book Co, Lucknow, Reprinted, 2004 3.Bertrand Russell Human Society in Ethics & Politics

References:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Corliss Lamont, Philosophy of Humanism.
4. Gaur. R.R. , Sangal. R, Bagari G.P, A Foundation Course in Value Education, Excel Books,2009.
5. Gaur. R.R. , Sangal R , Bagaria G.P, Teachers Manual, Excel Books, 2009.
6. I.C. Sharma, Ethical Philosophy of India, Nagin & co, Julundhar
7. William Lilly- Introduction to Ethics -Allied Publisher

Scheme of Examination:
Semester End Examination (SEE): SEE Question paper is to be set for 50 marks with multiple choice questions of 1 mark each covering all aspects of the syllabus.

Continuous Internal Evaluation (CIE): Three Tests are to be conducted for 50 marks each. The average of the three tests are taken for computation of CIE. Question paper for each of the CIE is to be of the multiple-choice type with 50 question each.
Typical Evaluation pattern for regular courses is shown in Table.

Table 1: Distribution of weightage for CIE & SEE for 1 credit course

	Component	Marks	Total Marks
CIE	CIE Test-1	50	50
	CIE Test-2	50	
	CIE Test-3	50	
SEE	Semester End Examination	50	50
		Grand Total	100

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22UHV57.1/66.1								2				1			
22UHV57.2/66.2								2				1			
22UHV57.3/66.3								2				1			
22UHV57.4/66.4								2				1			
Average								2				1			

SEMESTER – VI

Course: Estimation, Costing and Engineering Economics

Course Code	**22CIV61**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Engineering Survey, Building Materials, Environmental Engineering, Hydraulics, Irrigation Engineering

Course Objectives: Students will be taught:

CLO1	Estimation of the quantities of various items of Civil Engineering works, prepare the abstract for the estimated cost of civil engineering project.
CLO2	Standard procedure of writing specification and the method of analysis of rate for various civil engineering items.
CLO3	Efficient acquisition, utilization, and distribution of finance.
CLO4	Create the tender and contract documents.

Content	No. of Hours/ RBT levels
Module – 1 Quantity Estimation for Building- Study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates. Estimation of building by short wall and long wall method – center line method. Estimate of RCC structures including Slab, beam, column, footings.	**8 Hours L3**
Module – 2 Estimate of Steel truss, manhole and septic tanks, and culvert. **Quantity Estimation for Roads:** Computation of volume of earthwork fully in banking cutting and partly Filling by mid-section, trapezoidal and Prismoidal Methods.	**8 Hours L3**
Module – 3 **Specification for civil Engineering Works:** Objective of writing specifications essentials in specifications, general and details specifications of different items of works in buildings and roads. **Analysis of Rates;** Factors affecting Cost of Civil Works, Concept of Direct Cost, Indirect Cost and Project Cost. Rate analysis and preparation of bills, Data analysis of rates for various items of	**8 Hours L2**

Works, Sub – structure components, Rate analysis for RCC slabs, columns, and beams.	
Module – 4 **Tender and its Process:** Invitation to tender, Prequalification, administrative approval, and technical sanction. Bid submission and Evaluation process. **Contract Formulation:** Letter of intent, 'Award of contract, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PAD/CPWD)	**8 Hours L2**
Module 5 **Engineering Economy** **Introduction to engineering economy:** Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision-making. **Interest and time value of money:** concept of simple and compound interest, interesf formula for: single payment, equal payment, and uniform gradient series. Nominal and effective interest rates, deferred annuities, capitalized cost. **Comparison of alternatives:** Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break-even analysis.	**8 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV61.1	Compute quantities, cost and prepare abstract for building components
22CIV61.2	Compute quantities, cost and prepare abstract for various structural works: water supply, Sanitary and road works.
22CIV61.3	Prepare specifications and rate of analysis for various items of work.
22CIV61.4	Assess Contract and tender documents for various construction works.
22CIV61.5	Demonstrate role and importance of finance function.

Textbooks:

1. Datta B.N "Estimation and Costing", 28th edition, UBSPD Publishing house, New Delhi, 2021
2. B S Patil, "Civil Engineering contracts and Estimates", 4th edition, Universities press, 2015.
3. M Chakraborthi; "Estimation, costing and specifications", 29th edition, Lakshmi publications, 2006.
4. MORTH Specifications for Roads and Bridge works – IRC New Delhi.

References:

1. Rangwala C "Estimating, Costing and valuation", 17th edition, Charotar Publishing House Pvt Ltd, 2017.
2. Martin Books, "Estimation and Tendering for Construction Work", 5th edition, A Butterworth – Heinemann publishers, 2017
3. P W D Data Book, CPWD Schedule of Rate (SoR) and NH SoR – Karnataka FIDIC Contract forms.
4. B S Ramaswamy "Contracts and their Management",5th edition Lexis Nexis (a division of Reed Elsevier India Pvt Ltd), 2016.

Web Reference:

https://www.youtube.com/watch?v=IcmigyqQcEw&list=PLZmv_MNQCMBi7gXQe_bGAFPlrfM7qIX47

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e., A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV61.1	3	2	1								1			3	
22CIV61.2	3	2	1			1					1			3	
22CIV61.3	3	2												2	
22CIV61.4	3	2						1			1			1	
22CIV61.5											2	1			
Average	**3**	**2**	**1**			1		1			**1.25**	**1**		**2.25**	

SEMESTER – VI

Course: Advanced Geotechnical Engineering

Course Code	22CIV62	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Geotechnical Engineering

Course Objectives: Students will be taught:

CLO1	Prepare a detailed site investigation report based on geotechnical data.
CLO2	Estimate internal stresses in the soil mass and estimate the Probable settlement of foundation.
CLO3	Study about assessing stability of slopes and earth pressure on rigid retaining structures
CLO4	Conceptually learn various theories related to bearing capacity of soil and their application in the design of shallow and Deep foundation.
CLO5	Study about the classification of pile and estimate load carrying capacity of single and group of piles.

Content	No. of Hours/ RBT levels
Module 1 **Soil Exploration:** Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed, and representative samples, Geophysical exploration and Bore hole log. **Drainage and Dewatering** methods, estimation of depth of GWT (Hvorslev's method). Design of dewatering system.	8Hours L2, L3
Module 2 **Stress in Soils:** Introduction, Boussinesq's theory on concentrated load, line load and uniformly distributed loads, Newmark's Chart, Contact Pressure, Pressure bulbs. **Foundation Settlement:** Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1). Factors influence the settlement of foundation.	8Hours L2, L3
Module 3 **Lateral Earth Pressure:** Active, Passive and earth pressure at rest, Rankine's	8Hours L2, L3

theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and Culmann's graphical construction. Geotechnical design of gravity and cantilever retaining walls. **Stability of Slopes:** Assumptions, infinite and finite slopes, factor of safety, Swedish slip circle method for C and C-ø (Method of slices) soils, Fellineous method for critical slip circle, use of Taylor's stability charts, Bishop's rigours analysis And Numerical Problems.	
Module 4 **Bearing Capacity of Shallow Foundation:** Types of foundations, Determination of bearing capacity by Terzaghi's, Meyerhof's, Brinch Hansen's and BIS method (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and/or eccentricity on bearing capacity of soil, field methods of determining bearing capacity of soil: SPT and plate load test.	**8Hours L2, L3**
Module 5 **Pile Foundations:** 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, Settlement of piles, under reamed piles (only introductory concepts – no derivation).	**8Hours L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV62.1	Plan and execute geotechnical site investigation program for different civil engineering projects
22CIV62.2	Understanding stress distribution in soil and estimate the settlement beneath loaded footings on soils.
22CIV62.3	Analyze the factor of safety against failure of slopes and compute lateral pressure distribution behind earth retaining structures.
22CIV62.4	Determine bearing capacity of soil and study the effect of ground water table on bearing capacity of soil.
22CIV62.5	Classify types of piles and Estimate the load carrying capacity of single and group of piles.

Textbooks:

1. Punmia B C, "Soil Mechanics and Foundation Engineering", 16th edition, Laxmi Publications co., New Delhi. B.C. 2005.
2. Murthy V.N.S., "Principles of Soil Mechanics and Foundation Engineering", UBS Publishers and Distributors, New Delhi, 2018.
3. Gopal Ranjan and Rao.A.S.R.,"Basic and Applied Soil Mechanics", 4th edition, New Age International (P) Ltd., New-Delhi, 2022.

References:

1. P C Varghese, "Foundation Engineering", PHI India Learning Private Limited, New Delhi, 2005.
2. Bowles J E , "Foundation analysis and design", McGraw- Hill Publications,2017
3. T.W. Lambe and R.V. Whitman, "Soil Mechanics" -, 1st edition, John Wiley & Sons, 1969.
4. Donald P Coduto, "Geotechnical Engineering"- Phi Learning Private Limited, New Delhi
5. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes

Web Reference:

https://nptel.ac.in/courses/105105176
https://nptel.ac.in/courses/105101201
https://nptel.ac.in/courses/105105168

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately Reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). Some possible AATs: seminar / assignments / miniprojects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	05	
	Quiz 1/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV62.1	3	3	1										1		
22CIV62.2	3	3	1											2	
22CIV62.3	3	3	1												
22CIV62.4	3	3	1										1	2	
22CIV62.5	3	2	1											2	
Average	3	2.75	1										1	**2**	

SEMESTER – VI

Course: Transportation Engineering

Course Code	**22CIV63**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
No. of Credits	**4**	**Examination Hours**	**3**

Prerequisites: Surveying

Course Objectives: Students will be taught:

CLO1	Understand the importance of transportation and the present scenario of road development
CLO2	Understand the different aspects of geometric elements and to design geometric elements of a highway network.
CLO3	Understand the different aspects of elements in Railway engineering
CLO4	Understand the different aspects of airport layout, design facilities required for runway, taxiway and impart knowledge about visual aids
CLO5	Understand pavement materials properties and its tests.

Content	**No. of Hours/ RBT levels**
Module-1 **Importance of transportation:** Different modes of transportation and comparison, Ideal Alignment, Factors affecting the alignment, Engineering surveys- Map study, Reconnaissance, Preliminary and Final location & detailed survey, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL), IRC and Road development plan - vision 2023.	**8 Hours L2**
Module 2 **Highway Geometric Design:** Cross sectional elements, Sight distances–SSD, OSD, ISD, Radius of curve, Transition curve, Design of horizontal and vertical alignment– curves, super-elevation, widening, gradients, summit and valley curves. Highway Drainage: Significance and requirements, Surface drainage system	**8 Hours L2, L3**
Module 3 **Railway Engineering:** Elements of Permanent way - Rails, Sleepers, Ballast, Rail fixtures and fastenings, Track Stress, Coning of wheels, Creep in rails, Defects in rails - Geometric Design of Railways, gradient, super elevation, widening of gauge on curves – Points and crossings, turnouts.	**8 Hours L2, L3**

Module 4 **Airport Planning and Design**: Air transport characteristics, airport classification, airport planning, criteria for airport site selection, Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Elements of Taxiway Design, Runway and Taxiway Markings and lighting.	**8 Hours L2, L3**
Module 5 **Pavement Materials**: Sub grade soil, Determination of CBR and modulus of sub grade reaction, Road Aggregates - Desirable properties and Tests Bituminous materials - Desirable properties - Explanation on Tar, Bitumen, Cutback and Emulsion	**8 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV63.1	Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data..
22CIV63.2	Design road geometrics, structural components of pavement and drainage
22CIV63.3	Acquires capability of geometric design aspects of railway system
22CIV63.4	Acquire the capability of airport runway orientation with design aspects and to identify required type of visual and/or navigational aids for the same.
22CIV63.5	Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction

Content	**No.of Hours/ RBTlevels**
Tests on Soil: CBR test	**2 Hours L2**
Tests on aggregates: 1. Shape tests 2. Aggregate impact value and Crushing test. 3. Los Angeles abrasion value test 4. Specific gravity & Water absorption test	**4 Hours L2**

Tests on bitumen: 1. Penetration test 2. Viscosity test 3. Specific gravity test 4. Flash and fire point test 5. Ductility test 6. Softening point test	**4 Hours L2**
Tests on bituminous mixes 1. Proportioning of materials by Rothfutch's method and Mix design by Marshall Method.	**4 Hours L2**

Textbooks:

1. S.K. Khanna, C.E.G. Justo and Veeraraghavan A "Highway Engineering", 10th Edition, Nem Chand & Bros, 2013.
2. S.C.Saxena and S.P. Arora, A Text book of Railway Engineering,8th Ed Dhanpat Rai Publications, Delhi.2015.
3. Khanna S K, Arora M G and Jain S S,Airport Planning and Design, 4th Edition Nem Chand & Bros 1990

References:

1. Relevant IRC Codes. IRC002 1968, IRC003 1983 , IRC005 2015, IRC035 2015, IRC 038 1988, IRC086-1983, ITC092-1985, IRCSP023-1993., IRCSP99 2013.Publisher Indian Roads Congress, New Delhi
2. Specifications for Roads and Bridges-MoR T&H, IRC2013, New Delhi.
3. C. Jotin Khisty, B. Kent Lall, "Transportation Engineering", 3rd Ed., Pearson Prentice-Hall, India (2008).
4. Khanna and Justo, S.K. Khanna, C.E.G. Justo and Veeraraghavan A "Highway Materials Testing"- NemChand &Bros,2013.

Web Reference:

https://nptel.ac.in/courses/105105107

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module

carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below.

Table 1: Distribution of weightage for CIE & SEE of Regular courses:

Component		Marks	Total Marks
CIE	CIE Test-1	30	**50**
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	**20**	
SEE	**Semester End Examination**	**100**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV63.1	2	2												2	
22CIV63.2	2	2	2											2	
22CIV63.3	2	2	2											2	
22CIV63.4	2	2												2	
22CIV63.5	2	2												2	
Average	2	2	2											2	

SEMESTER – VI

Course: Structural Dynamics and Earthquake Engineering

Course Code	22CIV641	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Engineering Mechanics, Structural Analysis

Course Objectives: Students will be taught:

CLO1	Formulate the equation of motion for SDOF system
CLO2	Understand the response of SDOF system to harmonic loading
CLO3	Analyze the behavior of multi degree of freedom systems subjected to free and forced vibrations
CLO4	Understand the basic concepts of earthquake engineering
CLO5	Computation of seismic forces in multistoried buildings as per IS-1893

Content	No. of Hours/ RBT levels
Module-1 **Introduction:** Introduction to Dynamic problems in Civil Engineering, Concept of degrees of freedom, D'Alembert's principle, Dynamics of Single degree-of-freedom systems: Mathematical models of Single-degree-of-freedom systems, Free vibration response of damped and undamped systems.	**8 Hours L3**
Module 2 Response of Single-degree-of-freedom systems to harmonic loading including support motion, vibration isolation, transmissibility. Numerical methods applied to Single-degree-of-freedom systems – Duhamel integral. Principle of vibration measuring instruments–seismometer and accelerometer.	**8 Hours L3**
Module 3 **Dynamics of Multi-degree freedom systems:** Free vibration of undamped multi-degree-of freedom systems – Natural frequencies and mode shapes –Orthogonality of modes. Response of Shear buildings for harmonic loading with and without damping using normal mode approach.	**8 Hours L3**

Module 4 **Introduction to Engineering Seismology**: Geological and tectonic features of India, Origin and propagation of seismic waves, characteristics of earthquake and its quantification – Magnitude and Intensity scales, Earthquake Hazards in India, Earthquake Risk Evaluation and Mitigation. Structural behavior under gravity and seismic loads, Lateral load resisting structural systems, damping devises, base isolation systems	**8 Hours** **L3**
Module 5 Structural Configuration for earthquake resistant design, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Design provisions for these in IS-1893. Computation of seismic forces in multi-storeyed buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS-1893	**8 Hours** **L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV641.1	**Construct** mathematical model for free vibration of SDOF systems under damped and undamped conditions.
22CIV641.2	**Compute** the response of single degree of freedom systems for various types of excitations.
22CIV641.3	**Determine** natural frequencies and mode shapes of multi degree of freedom systems under free and forced vibration conditions.
22CIV641.4	**Understand** the causes of earthquakes, its risk and mitigation methods
22CIV641.5	**Compute** seismic forces in multistoried buildings as per IS-1893

Textbooks:

1. John Biggs, "Introduction to Structural Dynamics" McGraw-Hill Education Publisher, 1964
2. Madhujit Mukophadhyay, "Structural Dynamics: Vibrations and Systems", Publisher: ANE Books, 2008
3. Roy R. Craig. "Fundamentals of Structural Dynamics" 2nd Edition, ohn Wiley & Sons Inc Publisher, 2006.
4. Dr. Vinod Hosur, "Earthquake-Resistant Design of Building Structures", Wiley India Pvt Ltd, 2012

References:

1. Mario Paz, "Structural Dynamics: Theory and Computation", 2nd Edition, , CBS Publisher, 2004.
2. Anil K. Chopra, "Dynamics of Structures: "Theory and Application to Earthquake Engineering"- 2nd edition.,Pearson Education, 2007.
3. R,W.Clough and J.Penzien, "Dynamics of Structures", 2nd edition, McGraw– Hill Education, 1993.
4. William Thomson, "Theory of vibration with applications", 4th edition, CRC Press, 1996.
5. S.R.Damodarasamy and S.Kavitha, Phi, "Basics of Structural Dynamics and Aseismic Design", Learning Private Ltd, 2009

Web Reference:

https://eerc.iiit.ac.in/
https://www.nicee.org/
https://isr.gujarat.gov.in/
https://www.eri.u-tokyo.ac.jp/en/

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV641.1	3	2	3												
22CIV641.2	2	3	1												
22CIV641.3	2	3	2									1	2		
22CIV641.4	2	3	2			1						1	2		
22CIV641.5	1	2	1											1	
Average	**2**	**2.6**	**1.8**			**1**						**1**	**2**	**1**	

SEMESTER – VI

Course: Ground Improvement Techniques

Course Code	**22CIV642**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Geotechnical Engineering, Foundation Engineering

Course Objectives: Students will be taught:

CLO1	The fundamental concepts of ground improvement techniques
CLO2	Modification of ground required for construction of civil engineering structures.
CLO3	The concepts of chemical compaction, grouting, and other miscellaneous methods
CLO4	Geo synthetics, vibration, grouting, and Injection.

Content	No. of Hours/ RBT levels
Module-1 **Introduction:** Definition, Objectives of soil improvement, classification of ground improvement techniques, factors to be considered in the selection of suitable soil improvement technique. **Compaction:** Introduction, compaction mechanics, Field procedure, surface compaction, Dynamic Compaction, selection of field compaction procedures, compaction quality control.	**8 Hours L2**
Module 2 **Drainage Methods:** Introduction, Seepage, filter requirements, ground water and seepage control, methods of dewatering systems, Design of dewatering system including pipeline effects of dewatering. Drains, different types of drains. **Pre-compression and Vertical Drains:** Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading.	**8 Hours L2**
Module 3 **Chemical Modification-I:** 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. Stabilization using Fly ash. **Chemical Modification-II:** Lime stabilization – suitability, process, criteria for	**8 Hours L2**

lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.	
Module 4 **Vibration Methods:** Introduction, Vibro compaction – blasting, vibratory probe, Vibro displacement compaction – displacement piles, vibro flotation, sand compaction piles, stone columns, heavy tamping **Grouting and Injection**: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting.	**8 Hours** **L2**
Module 5 **Geosynthetics:** Introduction, Geo-synthetic types, properties of Geosynthetics – materials and fiber properties, Geometrical aspects, mechanical properties, Hydraulic properties, Durability; Applications of Geosynthetics - Separation, Filtration and Fluid Transmission, Reinforcement, **Miscellaneous Methods (Only Concepts & Uses):** Soil reinforcement, Thermal methods, Ground improvement by confinement – Crib walls, Gabions and Mattresses, Anchors, Rock bolts and soil nailing, Micro piles.	**8 Hours** **L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV642.1	Explain the objectives of ground improvement and various methods, compaction mechanics and methods.
22CIV642.2	Describe dewatering and methods, pre-compression, vertical drains
22CIV642.3	Understand methods of chemical stabilization using cement, lime, fly-ash, and other chemicals.
22CIV642.4	Illuminate vibration and grouting techniques, procedures, and applications.
22CIV642.5	Explain the applications of Geosynthetics and miscellaneous methods of ground improvement techniques.

Textbooks:

1. Purushothama Raj P, "Ground Improvement Techniques", 2nd edition, Laxmi Publications, New Delhi, 2016.
2. Koerner R.M, "Construction and Geotechnical Method in Foundation Engineering", McGraw Hill Pub. Co.

References:

1. Manfred Hausmann , "Engineering principles of ground modification", McGraw Hill Pub. Co.,1989
2. Ingles, C.G and Metcalf.J.B., "Soil Stabilization; Principles and Practice", Butterworths, London
3. Bell, F.G., "Methods of treatment of unstable ground", Butterworths, London

Web Reference:

https://nptel.ac.in/courses/105108075
https://nptel.ac.in/courses/105105210

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV642.1	3				1									2	
22CIV642.2	3	2			1										
22CIV642.3	3				1										
22CIV642.4	3	2			1										
22CIV642.5	3				1								1		
Average	3	2			1								1	2	

SEMESTER – VI

Course: Water Resources Engineering

Course Code	**22CIV643**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Hydrology and Irrigation Engineering

Course Objectives: Students will be taught:

CLO1	Analyze various components of the hydrologic cycle and world water budget
CLO2	Estimate surface runoff using hydrographs.
CLO3	Classify the various uses of water and estimation of yield from reservoir.
CLO4	Identifying various aspects of flood and storm water control.

Content	No. of Hours/ RBT levels
Module-1 Hydrologic cycle, atmospheric and ocean circulation. Water use data: classification of uses water for energy. Water for agriculture: irrigation trends and needs, irrigation infrastructures, irrigation system selection and performance, water requirement for irrigation, impacts of irrigation	**8 Hours L2**
Module 2 **Drought Management** - Options, severity, and economic aspects of water storage. Analysis of surface water supply: surface water reservoir systems, storage firm yield analysis for water supply reservoir simulation. Types of droughts and its measurement.	**8 Hours L2**
Module 3 **Floods** - Flood plain management, flood plain definition, hydrologic and hydraulic analysis of floods, storm water management. Flood control alternatives: structural and non-structural measures. Flood damage and net benefit estimation: damage relationships, expected damages, risk-based analysis. Operation of reservoir systems for flood control	**8 Hours L2**
Module 4 **Urban Floods:** Basic approaches to urban drainage – runoff quantity and quality – wastewater and storm water reuse – major and minor systems. Elements of drainage systems – open channel – underground drains – appurtenances – pumping – source	**8 Hours**

control. Storm water Analysis Calculation of runoff and peak – Design of storm water network systems	**L2, L3**
Module 5 **Statistics for Water resources studies** - Probabilistic and statistical methods for hydrologic data, Fitting probability distribution. Probability distributions for hydrologic variables, Frequency analysis, and Extreme value distributions. Correlation, simple regression, and trend analysis. Risk and reliability analysis	**8 Hours** **L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV643.1	Analyze components of the hydrological cycle and uses of water
22CIV643.2	Estimate the extent of drought and its management.
22CIV643.3	Estimate floods and its management
22CIV643.4	Identify different aspects of urban flood and storm water control.
22CIV643.5	Analyze water resource data through statistical techniques.

Textbooks:

1. Ralph A Wurbs, Wesley P. James, "Water Resources Engineering", Old Edition, Pearson Publishers, New Delhi.,2022.
2. Larry W. Mays, John Wiley & sons, "Water Resources Engineering", Wiley Publishers, New Delhi.,2019.

References:

1. Sathya Narayana Murthy Challa, "Water Resources Engineering: Principles and Practice",2nd Edition, New Age International Publishers, New Delhi,2020
2. Water resources engineering, lecture notes, IIT Kharagpur.
3. David A.Chin, "Water Resources- Engineering" International 3rd Edition, Pearson Publishers,2013

Web Reference:

https://nptel.ac.in/courses/105105110
https://nptel.ac.in/courses/105105110
NOC | Water Economics and Governance (nptel.ac.in)

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e., A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab)
Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV643.1	3	2				2							1		
22CIV643.2	3	2	1			2							1		
22CIV643.3	3	2	1			2							1		
22CIV643.4	3	2				2							1		
22CIV643.5	3	2	1			2							1		
Average	3	2	1			2							1		

SEMESTER – VI

Course: Geo Spatial Engineering

Course Code	22CIV644	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	3

Prerequisites: Engineering Survey

Course Objectives: Students will be taught:

CLO1	Basic components, and working principles of remote sensing and GIS
CLO2	To understand the objective and procedure of image enhancement and image processing.
CLO3	Practical application of image enhancement and processing

Content	No. of Hours/ RBT levels
Module 1 **Remote sensing:** Introduction, basic principle – Electromagnetic radiation, electromagnetic spectrum, different bands and their applications in remote sensing - Stages / components of remote sensing, ideal remote sensing system and real remote sensing system – Source of EMR – Energy interaction with the atmosphere and the surface features, reflection, absorption, scattering, atmospheric window, albedo, spectral reflectance curve - Types of remote sensing, classification based on platforms, energy sources, wavelength regions, number of bands – Satellite orbits, geosynchronous, near polar and sun synchronous orbits, swath, inclination, orbital period, repeat cycle, revisit period – Image format – Resolutions in remote sensing – Remote sensing applications – Characteristics of Indian Remote Sensing Satellites , sources of remote sensing data	**8 Hours L2**
Module 2 **Image rectification and enhancement:** Image geometric corrections, Ground control points, atmospheric corrections, color composites, Digital Image analysis, Image enhancement.	**8 Hours L2**
Module 3 **Image classification:** Classification methods, vegetation indices, band combinations, Users accuracy, producer accuracy and overall accuracy.	**8 Hours L2**

Module 4 **Geographic information system:** Definitions, components, functions of GIS, Spatial and attribute data, Data models: raster and vector data, topology, Sources of data and data structures, Geodatabase and metadata, Errors in GIS, GIS applications, link with remote sensing, introduction to web GIS, free and open source GIS tools.	**8 Hours** **L2**
Module 5 **Maps:** Introduction to maps, components of maps, map projections and coordinate reference system. Introduction to drone survey. **Spatial analysis:** Introduction to spatial analysis, raster and vector operations, neighborhood analysis, spatial interpolation, DEM, generation of contours.	**8 Hours** **L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV644.1	Understand the principles and components of remote sensing.
22CIV644.2	Understand the principles and components of GIS.
22CIV644.3	Apply principles of image enhancement and digital image processing.
22CIV644.4	Understand the practical application of remote sensing and GIS to real world scenarios.

Textbooks:

1. Lillesand TM, Keifer RW, Chipman JW, "Remote sensing and image interpretation " Wiley Publications, 7th edition, 2015.
2. B Bhatta, "Remote Sensing and GIS" , Oxford Publications, 3rd edition, 2021.
3. M Anji Reddy, "Remote Sensing and GIS" , BS Publications, 4th edition, 2012.

References:

1. Paul R Wolf, "Elements of Photogrammetry", McGraw International, Indian Edition, 2013.
2. Peter A Burrough, "Principles of GIS" , Oxford Publications, 3rd edition, 2016.
3. Bemhardsen, " Geographic Information Systems – an Introduction", Wiley Publications, 3rd edition, 2002.
4. Gibson P.J, Routledge, "Introductory Remote Sensing- Principles and Concepts" Routledge, 1st edition, 2000.

Web Reference:

NPTEL Lectures:
Modern Surveying Techniques by Prof. Onkar Dikshit, IIT Kanpur
http://nptel.ac.in/courses/Webcourse-

contents/IITKANPUR/ModernSurveyingTech/ui/TOC1.htm

NPTEL Lectures:
Remote Sensing by Prof. D Nagesh Kumar, IISc Bangalore
http://www.nptel.ac.in/syllabus/105108077/

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of three test marks will be added to test component and loboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes/Alternate Assessment Tools(AAT's). some possible AAT's: Seminar/ assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Component		Marks	Total Marks
CIE	CIE Test 1	40	50
	CIE Test 2	40	
	CIE Test 3	40	
	Average of CIE	40	
	Quiz 1/AAT	05	
	Quiz 2/AAT	05	
SEE	Semester End Examination	50	50
Grand Total			100

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV644.1	3				1								1		
22CIV644.2	3				1								1		
22CIV644.3	3	2		1	1										
22CIV644.4	3	1	1	1	2				1				2		
Average	**3**	**1.5**	**1**	1	**1.25**				**1**				1.33		

SEMESTER – VI

Course: Environmental Pollution and Control

Course Code	**22CIV651**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Environmental Science

Course Objectives: Students will be taught:

CLO1	The aspects of air pollution & control and noise pollution
CLO2	Concepts of treatment of wastewater from industrial source.
CLO3	Differentiate the solid and hazardous waste based on characterization
CLO4	The Concept of Soil pollution
CLO5	Provide basic knowledge on sustainable development.

Content	No. of Hours/ RBT levels
Module 1 **Air pollution:** Introduction to the different aspects of air pollution, Sources and effects of particulate and gaseous air pollutants, Photochemical reactions, Air pollution sampling and measurement Air pollution Control Methods: Particulate control devices –Methods of Controlling Gaseous Emissions –Air quality standards. (NAAQ) Noise Pollution: Noise standards, Measurement, and control methods –Reducing residential and industrial noise –ISO:14000.	**10Hours L2**
Module 2 **Water pollution:** Introduction to various aspects of water pollution and water quality standards **Industrial wastewater:** Management: Strategies for pollution control –Volume and Strength reduction –Neutralization –Equalization –Proportioning –Common Effluent Treatment Plants –Recirculation of industrial wastes –Effluent standards	**8Hours L2**
Module 3 **Solid Waste Management:** Characteristics of solid waste, Overview of solid waste generation and management techniques, Hazardous wastes; definition and	**8Hours L2**

classification, Hazardous waste management techniques, Treatment and management of hazardous waste-Disposal and Control methods.	
Module 4 **Soil Pollution:** Introduction, soil Contamination, soil pollution and types, causes and effects of soil pollution. Remedial measures and Control methods.	**6Hours L2**
Module 5 **Sustainable Development:** Sustainable Development: Definition-elements of sustainable developments-Indicators of sustainable development-Sustainability Strategies-Barriers to Sustainability–Industrialization and sustainable development –Cleaner production in achieving sustainability-sustainable development.	**8Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV651.1	Identify the air pollutant control devices and have knowledge on the NAAQ standards and Noise pollution standards.
22CIV651.2	Describe the source of water pollution and differentiate the treatment techniques used for sewage and industrial wastewater treatment
22CIV651.3	Understand the fundamentals of solid waste management, practices adopting in town or village and its importance in keeping the health of the city
22CIV651.4	Describe the soil contamination methods and Identify various Remediation Techniques.
22CIV651.5	Appreciate the importance of sustainable development while planning a project or executing an activity.

Textbooks:

1. Peavy, H. S., Rowe, D.R, Tchobanoglous, "Environmental Engineering", Indian edition, G.Mc-Graw Hill International Editions, New York 1985.
2. J. G. Henry and G.W. Heinke, "Environmental Science and Engineering", 2nd edition, Pearson Education, 1988.
3. .M. N. Rao and H. V. N. Rao, "Air pollution", 1st edition, Tata Mc.Graw Hill Company, 2017.

References:

1. K. V. S. G. Murali Krishna, "Air Pollution and Control"by, Kousal & Co. Publications, New Delhi.
2. LaGrega, M. D., Buckingham, P. L. and Evans, J. C. - Hazardous Waste Management, New York: McGraw-Hill, 2001.

3. G. L. Karia and R.A. Christian, "Waste water treatment-concepts and design approach", Prentice Hall of India

Web Reference:

https://www.sciencedirect.com/book/9780750698993/environmental-pollution-and-control
https://cpcb.nic.in/env-protection-act/
https://archive.nptel.ac.in/courses/123/105/123105001/
https://archive.nptel.ac.in/courses/105/107/105107213/

Scheme of Examination:

Semester End Examination (SEE):

Semester End Examination (SEE): SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). Some possible AATs: seminar / assignments / miniprojects/ concept videos/ partial reproduction of research work/ group activity/ any other.
Typical Evaluation pattern for integrated courses is shown in the Table1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	05	
	Quiz 1/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV651.1	2	2	2							1		1	1		
22CIV651.2	2	2	2							1		1	1		
22CIV651.3	2	2	2			1				1		1	1		
22CIV651.4	2	2	2							1		1	1		
22CIV651.5	2	2	2				1			1		1	1		
Average	2	2	2	1		1	1			1		1	1		

SEMESTER – VI

Course: Smart Cities and Digital Infrastructures

Course Code	**22CIV652**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: -

Course Objectives: Students will be taught:

CLO1	The planning of urban infrastructure and different feasibility studies in infrastructure projects.
CLO2	The concept of sustainable development with changing pattern of urban growth and different strategies for sustainable development.
CLO3	The concept of IOT (Internet of Things), its applications in planning of smart cities.
CLO4	The concept of smart transportation with different concepts of urban mobility.
CLO5	The fundamentals of E governance and suitability for implementation of smart cities

Content	No. of Hours/ RBT levels
Module-1 Understanding Smart Cities Introduction to smart cities- Definition, dimensions, scope Smart Cities –Global Standards and Performance Benchmarks, Practice Code. India "100 Smart Cities" Policy and Mission. Planning for Urban Infrastructure Urban Infrastructure, Role of Planner in the provision of urban networks and services, feasibility studies for infrastructure projects, planning for major infrastructure projects, Various Infrastructure Programs and policies by MOUD, PPP (DBOOT, BOOT, etc.) in infrastructure projects	**8 Hours L2**
Module 2 Introduction to Sustainable Development Concepts History, definitions, and perspectives on Sustainability Theory and Background to Sustainability Planning Changing patterns of urban growth, Quality of life in the city. Efficiencies and inefficiencies in cities; challenges and opportunities. Eco challenges in the contemporary cities; Principles of green and smart cities, international initiatives including UN and EU level; Corporate social and environmental strategies in cities; The Three E's: Environment, Economics, ethics, and ecology of sustainable Green	**8 Hours L2**

technologies in cities,	
Module 3 Internet of Things (IoT) in Smart Cities IOT fundamentals, protocols, design and development, data analytics and supporting services, Surveillance Systems, Smart Street Lighting, ICCC platforms, Command Control Center,Sensors/ Devices, Connectivity, Data Processing, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.	**8 Hours L2**
Module 4 Introduction to smart transport, Intelligent transportation system (ITS) components, Introduction to traffic sensors GIS and GPS positioning Navigation and Identification system, Smart Automobiles smart pedestrian walkways and cycle tracks, solar roads, electronic fee payment technology, electronic speed determination technology, smart signaling technology. Types of Public Mass transport: Mass Rapid Transit System (MRTS), BRTS, LRT, RRTS and its role in the transport system.	**8 Hours L2**
Module 5 E- GOVERNANCE Smart Governance Introduction to smart E-governance, Smart E-governance for citizen services, Smart E-governance within Government agencies, Smart E-governance for industries and commerce, Emerging trends in Smart Egovernance, Implementation models for E-Governance, Regulatory guidelines for E-Governance.	**8 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV652.1	Adopt different urban infrastructures policies and programmes for development of smart cities.
22CIV652.2	Acquire knowledge and understanding of the current trends in Urban Planning with introduction of Sustainability and various strategies regarding environmental concerns.
22CIV652.3	Adopt the fundamentals of IOT in planning of smart cities.
22CIV652.4	Adopt different utilities of urban mobility and implementation of smart transport in development of smart cities.
22CIV652.5	Adopt E governance through the emerging trends to provide a platform for digital infrastructure as an integral part of smart cities.

Textbooks:

1. Choudury M A and Sadek A, "Fundamentals of Intelligent Transportation Systems Planning" Artech House, 2003.
2. AMDA, 1999, Urban Governance and Management of Urban Environment. New Delhi.
3. T.N. Chaturvedi (ed.), 2000, Urban Governance, IIPA, New Delhi.
4. CSR Prabhu, 2013, E-Governance- Concepts and Case Studies, PHI Learning Pvt. Ltd.
5. Institute of Transportation Engineers, 1982, Transportation and Traffic Engineering Handbook, Prentice-Hall. Inc., New Jersey.

References:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 1 st Edition, Pearson Education.
2. Steve Austakalnis, "Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR, Addison"- Wesley Professional, 2016.
3. HMSO, Roads in Urban Areas, HMSO London.
4. Khanna S K. and CEG Justo, 1987, Highway Engineering, Nemichand and Bros., Roorkee, 2018.
5. Timothy and Kristy Manning, "The Ecology of Place: Planning for Environment, Economy, and Community", Washington, D.C. Island Press, 1997.

Web Reference:

https://www.coursera.org/learn/smart-cities
www.smartcitiescouncil.com

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	05	
	Quiz 1/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV652.1	2													1	
22CIV652.2	2	2	1				2							1	
22CIV652.3	2	2	1	1	2	2			1	2		2			
22CIV652.4	2	2	1	1			2		1						
22CIV652.5	2	2		1	1	2									
Average	2	2	1	2		2	2		1	2		2			

SEMESTER – VI

Course: Occupational Health and Safety

Course Code	**22CIV653**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: -

Course Objectives: Students will be taught:

CLO1	Gain an historical, economic, and organizational perspective of occupational safety and health
CLO2	Investigate current occupational safety and health problems and solutions
CLO3	Identify the forces that influence occupational safety and health
CLO4	Demonstrate the knowledge and skills needed to identify workplace problems and safe work practice

Content	**No. of Hours/ RBT levels**
Module-1 Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation	**8 Hours L2**
Module 2 Ergonomics at Workplace: Ergonomics Task analysis, Preventing Ergonomic Hazards, Workspace Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis, Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations	**8 Hours L2**
Module 3 Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers. Electrical Safety, Product Safety: Technical Requirements of Product safety	**8 Hours L2**

Module 4 Health Considerations at Workplace: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) -- types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability	**8 Hours L2**
Module 5 Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors	**8 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV653.1	Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
22CIV653.2	Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
22CIV653.3	Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation
22CIV653.4	Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors
22CIV653.5	Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

Textbooks:

1. Goetsch D.L., "Occupational Safety and Health for Technologists, Engineers and Managers", 9th Edition, Pearson Publications.2018
2. Heinrich H.W., "Industrial Accident Prevention - A Scientific Approach", McGraw-Hill Book Company, US,2018
3. National Safety Council and Associate (Data) Publishers Pvt. Ltd., "Industrial Safety and Pollution Control Handbook,1991

References:

1. Colling D.A., "Industrial Safety Management and Technology", Prentice Hall, New Delhi, 1990.
2. Della D.E., and Giustina, "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc, 1996.

Web Reference:

https://nptel.ac.in/courses/114106017
https://www.youtube.com/watch?v=8nbOI-0U9Co
https://www.youtube.com/watch?v=Be9inw8xlw8
https://www.youtube.com/watch?v=n7oUOUCIblg
https://www.youtube.com/watch?v=gzgNLvHTrfY
https://www.slideshare.net/engkhanmsh/introduction-to-osha-50289682

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks **each.** Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	05	
	Quiz 1/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV653.1	2	2				2	1						1		
22CIV653.2	2	2				2	1						1		
22CIV653.3	2	2				2	1						1	1	
22CIV653.4	2	2				2	1			1			1		
22CIV653.5	2	2				2	1						1		
Average	2	2				2	1			1			1	**1**	

SEMESTER – VI

Course: Cyber-Physical Systems for Infrastructure

Course Code	**22CIV654**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: - None

Course Objectives: Students will be taught:

CLO1	Cyber-physical systems (CPS) in civil and infrastructure engineering
CLO2	Basic aspects of instrumentation and wireless communications.
CLO3	To apply cyber-physical system principles to civil engineering applications

Content	No. of Hours/ RBT levels
Module-1 **Introduction to Cyber-Physical Systems in Civil Engineering:** Overview of Cyber-Physical Systems (CPS) and their Importance in Civil Engineering, Applications of CPS in Infrastructure: Smart Cities, Building Automation, Case Study: Role of CPS in Enhancing Infrastructure Efficiency.	**8 hours L2**
Module 2 **Sensing Technologies and Data Acquisition:** Types of Sensors used in Civil Engineering and Infrastructure. Data Collection Techniques: Remote Sensing, GPS, and GIS. Wireless Sensor Networks for Real-time Monitoring.	**8 hours L2**
Module 3 **Communication and Networking for CPS in Civil Engineering:** Communication Protocols and Standards for CPS, Introduction to Internet of Things (IoT) in Infrastructure, Ensuring Cybersecurity in CPS: Challenges and Solutions	**8 hours L2**

Module 4 **Control Systems and Automation in Infrastructure:** Basics of Control Systems and Automation, Smart Transportation Systems: Traffic Control and Management, Building Automation and Energy Efficiency	**8 hours** L2
Module 5 **Advanced Applications and Future Trends:** Role of Artificial Intelligence and Machine Learning in CPS, Robotics in Construction and Infrastructure Maintenance, Ethical Considerations and Societal Impact of CPS in Civil Engineering.	**8 hours** L2

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV654.1	Realize the need of CPS, sensors, and instrumentation in civil engineering.
22CIV654.2	Utilize the concepts of wireless communications in major infrastructure planning
22CIV654.3	Adopt various structural control systems
22CIV654.4	Find innovative CPS based solutions for various civil engineering applications.

Textbooks:

1. Rajeev A, "Principles of cyber-physical systems", 1st edition, The MIT Press, 2016.
2. Lee,E.A., & Seshia, S.A, "Introduction to embedded systems:A cyber physical systems approach", 2nd edition, The MIT Press, 2017.
3. "Smart Cities: Applications, Technologies, Standards, and Driving Factors" edited by Casimiro Antonio Rodrigues and Paulo Pereira.

References:

1. "Wireless Sensor Networks for Civil Infrastructure Monitoring: A Best Practice Guide" by Neil Hoult and Robert J. Piechocki
2. "Infrastructure Monitoring with Fiber Optic Sensors" by Branko Glisic and Kai Wang

Web Reference:

https://inl.gov/secure-and-resilient-cyber-physical-systems/

https://digitaltwinhub.co.uk/forums/topic/571-cyber-physical-infrastructure-vision-launch/

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	40	
	Quiz 1/AAT	05	
	Quiz 1/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
22CIV654.1	3		1		1							1			
22CIV654.2	3	2	1		1							1			
22CIV654.3	3	2	1		1	2						1			
22CIV654.4	3	2	1		1	2						1			
Average	3	2	1		1	2						1			

SEMESTER – VI

Course: Environmental Science

Course Code	22CIV57/66	CIE Marks	50
Hours/Week (L: T: P)	1:0:0	SEE Marks	50
No. of Credits	1	Examination Hours	1

Prerequisites:

Course Objectives: Students will be taught:

CLO1	The fundamentals of environmental science.
CLO2	The types of natural resources
CLO3	The various global environmental concerns.
CLO4	The types of wastes generated and their handling at a basic level
CLO5	The area of environmental law and policies with a few important acts in the field

Content	No. of Hours/ RBT levels
Module 1 **Environment:** • Definition, scope & importance • Components of Environment Ecosystem: Structure and function of various types of ecosystems • Human Activities – Food, Shelter, and Economic & Social Security. • Population - Growth, variation among nations – population explosion and impact on environment **Biodiversity:** • Types, Value; Hot spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.	**4 Hours L2**
Module 2 **Natural Resources**: Forest, Water, Mineral, Food, Energy, Land Environmental Pollution - Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards	**4 Hours L2**

Module 3 **Global Environmental Concerns** (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.	**4 Hours L2**
Module 4 **Sources:** Sources of Solid waste; Types of solid waste, Physical and Chemical composition of municipal solid waste. Solid Waste Management Rules in India Sources and management of E – Waste, Biomedical Waste, Hazardous waste, and construction waste at individual and community level. Socio-economic aspect of waste management Environmental Toxicology.	**4 Hours L2**
Module 5 **Latest Developments in Environmental Pollution Mitigation Tools** (Concept and Applications): Environment Impact Assessment; Environmental Management Systems, ISO14001; Environmental Stewardship, NGOs.	**4 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV57.1/66.1	Understand holistically the key concepts "Environment", and "Biodiversity".
22CIV57.2/66.2	Classify the types of natural resources available and the effects of anthropogenic interventions.
22CIV57.3/66.3	Express the gravity of various global environmental concerns.
22CIV57.4/66.4	Categorize the types of wastes generated and their handling at a basic level.
22CIV57.5/66.5	Understand the importance of environmental law and policies.

Textbooks:

1. Environmental studies, Benny Joseph, Tata Mcgraw-Hill 2nd edition 2012
2. Environmental studies, S M Prakash, pristine publishing house, Mangalore 3rd edition-2018
3. Gilbert M.Masters, _Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

References:

1. Benny Joseph, Environmental studies, Tata Mcgraw-Hill 2nd edition 2009
2. M.Ayi Reddy Textbook of environmental science and Technology, BS publications 2007
3. Dr. B.S Chauhan, Environmental studies, university of science press 1st edition

Web Reference:

https://www.hzu.edu.in/bed/E%20V%20S.pdf
https://onlinecourses.nptel.ac.in/noc23_hs155/preview
https://onlinecourses.swayam2.ac.in/cec19_bt03/preview

Scheme of Examination:
Semester End Examination (SEE): SEE Question paper is to be set for 50 marks with multiple choice questions of 1 mark each covering all aspects of the syllabus.

Continuous Internal Evaluation (CIE): Three Tests are to be conducted for 50 marks each. The average of the three tests are taken for computation of CIE. Question paper for each of the CIE is to be of the multiple-choice type with 50 question each.
Typical Evaluation pattern for regular courses is shown in Table.

Table 1: Distribution of weightage for CIE & SEE for 1 credit course

	Component	Marks	Total Marks
CIE	CIE Test-1	50	50
	CIE Test-2	50	
	CIE Test-3	50	
SEE	Semester End Examination	50	50
		Grand Total	100

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV57.1/66.1	2						3						1		
22CIV57.2/66.2	2	1					3					1	1		1
22CIV57.3/66.3	2		2			2	3	1				1	1		1
22CIV57.4/66.4	2	2				2	3								1
22CIV57.5/66.5	2					2	3							1	1
Average	2	1.5	2			2	3	1				1	1	1	1

SEMESTER – VI

Course: Universal Human Values

Course Code	**22UHV57/66**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:0**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**1**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	To create an awareness on Engineering Ethics and Human Values.
CLO2	To understand social responsibility of an engineer.
CLO3	To appreciate ethical dilemma while discharging duties in professional life.

Content	No. of Hours/ RBT levels
Module 1 **Introduction to Value Education.** • Value Education, Definition, Concept and Need for Value Education. • The Content and Process of Value Education. • Basic Guidelines for Value Education. • Self-exploration as a means of Value Education. • Happiness and Prosperity as parts of Value Education.	**5 Hours L2**
Module 2 **Harmony in the Human Being** • Human Being is more than just the Body. • Harmony of the Self ('I') with the Body. • Understanding Myself as Co-existence of the Self and the Body. • Understanding Needs of the Self and the needs of the Body. • Understanding the activities in the Self and the activities in the Body.	**5 Hours L2**
Module 3 **Harmony in the Family and Society and Harmony in the Nature** • Family as a basic unit of Human Interaction and Values in Relationships. • The Basics for Respect and today's Crisis: Affection, e, Guidance, Reverence, Glory, Gratitude and Love. • Comprehensive Human Goal: The Five Dimensions of Human Endeavour.	**5 Hours L2**

• Harmony in Nature: The Four Orders in Nature. • The Holistic Perception of Harmony in Existence.	
Module 4 **Social Ethics** • The Basics for Ethical Human Conduct. • Defects in Ethical Human Conduct. • Holistic Alternative and Universal Order. • Universal Human Order and Ethical Conduct. • Human Rights violation and Social Disparities.	**5 Hours** **L2**
Module 5 **Professional Ethics** • Value based Life and Profession, Professional Ethics and Right Understanding. • Competence in Professional Ethics. • Issues in Professional Ethics – The Current Scenario. • Vision for Holistic Technologies, • Production System and Management Models.	**53 Hours** **L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22UHV57.1/66.1	Understand the significance of value inputs in a classroom and start applying them in their life and profession.
22UHV57.2/66.2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
22UHV57.3/66.3	Understand the role of a human being in ensuring harmony in society and nature.
22UHV57.4/66.4	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.

Textbooks:

1. A.N Tripathy, New Age International Publishers, 2003.
2. Bajpai. B. L, New Royal Book Co, Lucknow, Reprinted, 2004 3.Bertrand Russell Human Society in Ethics & Politics

References:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Corliss Lamont, Philosophy of Humanism.
4. Gaur. R.R. , Sangal. R, Bagari G.P, A Foundation Course in Value Education, Excel Books,2009.
5. Gaur. R.R. , Sangal R , Bagaria G.P, Teachers Manual, Excel Books, 2009.
6. I.C. Sharma, Ethical Philosophy of India, Nagin & co, Julundhar
7. William Lilly- Introduction to Ethics -Allied Publisher

Scheme of Examination:
Semester End Examination (SEE): SEE Question paper is to be set for 50 marks with multiple choice questions of 1 mark each covering all aspects of the syllabus.

Continuous Internal Evaluation (CIE): Three Tests are to be conducted for 50 marks each. The average of the three tests are taken for computation of CIE. Question paper for each of the CIE is to be of the multiple-choice type with 50 question each.
Typical Evaluation pattern for regular courses is shown in Table.

Table 1: Distribution of weightage for CIE & SEE for 1 credit course

	Component	Marks	Total Marks
CIE	CIE Test-1	50	**50**
	CIE Test-2	50	
	CIE Test-3	50	
SEE	Semester End Examination	50	**50**
		Grand Total	**100**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22UHV57.1/66.1								2				1			
22UHV57.2/66.2								2				1			
22UHV57.3/66.3								2				1			
22UHV57.4/66.4								2				1			
Average -								2				1			

SEMESTER – VI

Course: Mini Project

Course Code	22CIVMP67	CIE Marks	50
Hours/Week (L: T: P)	0:0:4	SEE Marks	50
No. of Credits	2	Examination Hours	2

Mini-project work:

Students are required to undertake innovative and research oriented project under the direct supervision of a faculty member of the department. The mini project should not only to reflect their knowledge gained in the previous semesters but also to acquire additional knowledge and skill of their own effort.

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini-project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-Project:

i. **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio **50:25:25.** The marks awarded for the project report shall be the same for all the batch mates.

ii. **Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini-Project shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio **50:25:25.** The marks awarded for the project report shall be the same for all the batch mates.

SEE for Mini-Project:

i. **Single discipline:** Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.

ii. **Interdisciplinary:** Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to

Typical Evaluation pattern for regular courses is shown in Table 2

Table 2: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	Review - 1	50	**50**
	Review – 2	50	
SEE	Semester End Examination	50	**50**
		Grand Total	**100**

SEMESTER – VI

Course: Project Management Software Laboratory

Course Code	**22CIVL68**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**3**

Prerequisites: -

Course Objectives: Students will be taught:

CLO1	To learn project planning and scheduling with Microsoft Project.
CLO2	Understand the critical path method using work breakdown structure.
CLO3	To add and assign resources and costs to the project
CLO4	Compare between different PMP software.

Content	No. of Hours/ RBT levels
Module 1 **Introduction:** Project structure in MS Project, Interface backstage view, Interface options, tabs, customized ribbon and quick access	4 Hours L2
Module 2 **Project Creation:** Project creation, WBS and tasks, different types of relationship, CPM, task constraints	2 Hours L2
Module 3 **Resources:** create and assign – resources and cost, resource leveling	2 Hours L2
Module 4 Project progress, Reporting and Exporting	6 Hours L2
Module 5 Comparison between different PMP software. (Demo)	2 Hours L2

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIVL68.1	Describe a project life cycle, and skillfully map each stage in the cycle.
22CIVL68.2	Understand project management terminologies
22CIVL68.3	Identify the resources needed for each stage, stakeholders, tools and supplementary

	materials.
22CIVL68.4	Provide internal stakeholders with information regarding project costs by considering estimated cost, variances and profits
22CIVL68.5	Develop a project scope while considering factors like customer requirements and goals

Textbooks:

1. Verzuh, E, "The fast forward MBA in project management", 4th edition, New York: J. Wiley., 2011.
2. Adrinne Watt, "Project Management", BC campus, 2014.

References:

1. Scott Berkun, "Making Things Happen: Mastering Project Management (Theory and Practice), O'Reilly
2. Carl Chatfield, "Microsoft Project 2016 Step by Step", Microsoft Press.

Web Reference:

https://www.coursera.org/learn/smart-cities
www.smartcitiescouncil.com

Scheme of Examination:

Continuous Internal Evaluation (CIE):

WEEK WISE CIE (WEEK WISE EVALUATION OF EACH EXPERIMENT)

SL.NO	ACTIVITY	MARKS
1	Record	25
2	Viva	05
TOTAL		30

END OF SEMESTER CIE (INTERNAL ASSESSMENT EVALUATION)

SL.NO	ACTIVITY	MARKS
1	Writeup	20
2	Conduction	40
3	Results, graphs, discussions	20
4	Viva-voce	20
Total		100
Reduced to		20

FINAL CIE CALCULATIONS

SL.NO	ACTIVITY	MARKS
1	Average of weekly entries	30
2	Internal Assessment Evaluation	20
Total		50

SEE EVALUATION OF LAB COURSES

PARTICULARS	MARKS
Writeup	20
Experimentation program	40
Results/Graphs/Discussions	20
Viva-voce	20
Total	100

Complete project report to be prepared for the following cases:

1. Residential building – G+3 floors with Lift and parking facility included.
2. Commercial complex.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIVL68.1	2	1			3				1		3	1	1		1
22CIVL68.2	2											1			
22CIVL68.3		1			3				1		2				1
22CIVL68.4	1				3				1		3			1	
22CIVL68.5	1	1			2				2	2	2				
Average	1.5	1			2.75				1.25	2	2.5	1	1	1	1

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Rajarajeshwarinagar, Bengaluru-98

Head of Department
Civil Engineering
Global Academy of Technology
Rajarajeshwarinagar, Bangalore-98

SCHEME AND SYLLABUS

Department of Civil Engineering

Head of Department
Civil Engineering
Global Academy of Technology,
Rajarajeshwarinagar, Bangalore - 98

VII - VIII Semester Scheme (2022-23)

Civil Engineering

GLOBAL ACADEMY OF TECHNOLOGY

**(Autonomous institution affiliated to VTU, Belagavi.
Accredited by NAAC with 'A' grade,
NBA Accredited Civil, CS, E&C, E&E, MECH and IS branches)
Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098.**

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Scheme of UG Autonomous Program – 2022batch
(7th Semester – Civil Engineering)

VII SEMESTER

Global Academy of Technology
(Autonomous Institution Affiliated to VTU)
Scheme of Teaching and Examination 2022-23
Department of Civil Engineering

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	22CIV71	Finite Element Method	PC	Civil Department	2	2	0	50	50	100	3
2	22CIV72	Design and Drawing of Steel Structural Elements	IPC		2	2	2	50	50	100	4
3	22CIV73	Design & Drawing of Irrigation and Bridge Structures	IPC		2	2	2	50	50	100	4
4	22CIV74X	Program Elective 3	PEC		3	0	0	50	50	100	3
5	22CIV75X	Open Elective 2	OEC	Offering Department	3	0	0	50	50	100	3
6	22CIVP76	Project Phase 1	MP	Two Contact hours per week				100	-	100	2
TOTAL								**350**	**250**	**600**	**19**

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Program Elective 3*			
22CIV741	Advanced Design of RCC Structures	**22CIV743**	Pavement Design and Maintenance
22CIV742	Advanced Foundation Engineering	**22CIV744**	Integrated Water Resources Management
Open Elective 2 (Offered to other branch students)			
22CIV751	AI/ML in Infrastructure Engineering	**22CIV753**	Engineering Economics
22CIV752	Disaster Mitigation and Management	**22CIV754**	Sensor Technologies for Infrastructure

***NPTEL for Credit transfer**: Students can take 12 weeks NPTEL course as an equivalent to Program elective. The NPTEL courses of duration less than 12 weeks will not be considered for credit transfer. The courses (only technical) taken are as per the recommendation of BOS of respective department. The similarity of the contents as offered by NPTEL should not exceed a maximum of 40% of the courses being registered by the student. The NPTEL course need to be completed before the registration of the elective. Any certificate obtained after the registration of elective would not be considered. The validity of NPTEL certificate is for two years and it cannot be used more than once to avail the benefit. The student is eligible to transfer a maximum of nine credits in the entire duration of the program. The grades will be awarded as equivalent to the grades obtained in the NPTEL course.

Scheme of UG Autonomous Program – 2022batch
(8th Semester – Civil Engineering)

VIII SEMESTER

Global Academy of Technology (Autonomous Institution Affiliated to VTU) Scheme of Teaching and Examination 2022-23 Department of Civil Engineering											
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**Teaching Dept.**	**Teaching Hours/Week**			**Examination**			**CREDITS**
					L	**T**	**P**	**CIE**	**SEE**	**Total**	
1	22CIV81	Design and Drawing of RCC and Steel Structures	PC	Civil Department	2	2	2	50	50	100	4
2	22CIV82X	Program Elective 4	PEC		3	0	0	50	50	100	3
3	22CIV83X	Program Elective 5	PEC		3	0	0	50	50	100	3
4	22CIV84	Project work phase – II	MP	Two Contact hours per week				100	100	200	8
5	22CIVS85	Technical Seminar	MP	One Contact hour per week				100	--	100	1
6	22INT86	Internship	INT	Completed during the intervening period of VI and VII Semester				100	--	100	2
TOTAL								**450**	**250**	**700**	**21**

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Program Elective 4*			
22CIV821	Design of PSC and RCC bridges	**22CIV823**	Solid Waste Management
22CIV822	Urban Transport and Intelligent Transportation Systems	**22CIV824**	Deep Foundations
Program Elective 5*			
22CIV831	Advanced Design Steel Structures	**22CIV833**	Economic Evaluation and DPR
22CIV832	Pavement Construction, Maintenance & Management	**22CIV834**	Geo-Environmental Engineering

***NPTEL for Credit transfer**: Students can take 12 weeks NPTEL course as an equivalent to Program elective. The NPTEL courses of duration less than 12 weeks will not be considered for credit transfer. The courses (only technical) taken are as per the recommendation of BOS of respective department. The similarity of the contents as offered by NPTEL should not exceed a maximum of 40% of the courses being registered by the student. The NPTEL course need to be completed before the registration of the elective. Any certificate obtained after the registration of elective would not be considered. The validity of NPTEL certificate is for two years and it cannot be used more than once to avail the benefit. The student is eligible to transfer a maximum of nine credits in the entire duration of the program. The grades will be awarded as equivalent to the grades obtained in the NPTEL course.

SEMESTER – VII

Course: Finite Element Method

Course Code	**22CIV71**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Structural Analysis

Course Objectives: Students will be taught:

CLO1	To learn basic principles of finite element analysis procedure
CLO2	To understand discretisation and shape functions for beam and truss problems
CLO3	To determine element stiffness matrix for finite elements
CLO4	To apply numerical integration techniques to various dimensional structures
CLO5	To learn solution techniques for geometric and material nonlinearity problems

Content	No. of Hours/ RBT levels
Module-1 Basic concepts of elasticity, Energy principles, Rayleigh - Ritz Method, Galerkin method, Difference between Finite Difference Method and Finite Element Method, Steps in finite element analysis, advantages & disadvantages, displacement approach, stiffness matrix and boundary conditions.	**8 Hours L3**
Module 2 Discretisation; finite representation of infinite bodies and discretisation of very large bodies, Element aspect ratio – mesh refinement vs. higher order elements. Natural Coordinates, Shape functions; polynomial, Lagrange and Serendipity, one dimensional formulation; beam and truss with numerical examples.	**8 Hours L3**
Module 3 2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 nodded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, Static Condensation of nodes, Degradation technique, Axisymmetric element.	**8 Hours L3**
Module 4 Isoperimetric concepts; isoperimetric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isoperimetric	**8 Hours L3**

Elements, Numerical integration by Gaussian quadrature rule for one, two- and three-dimensional problems.	
Module 5 Techniques to solve nonlinearities in structural systems; material, geometric and combined nonlinearity, incremental and iterative techniques. Structure of computer program for FEM analysis, description of different modules, exposure to FEM software.	**8 Hours** **L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV71.1	**Understand** the basic concepts of finite element analysis
22CIV71.2	**Construct** mesh and shape functions for beam and truss problems
22CIV71.3	**Compute** element stiffness matrix for various types of finite elements
22CIV71.4	**Apply** Gaussian quadrature rule for one, two and three dimensional problems.
22CIV71.5	**Explain** the solution techniques for geometric and material non linearity problems

Textbooks:

1. Krishnamoorthy C.S., "Finite Element analysis" 2nd edition - Tata McGraw Hill, 2017.
2. S Rajashekharan, "Finite Element Analysis", S Chand, S Chand & Company, 2006

References:

1. Desai C & Abel J F.," Introduction to Finite Element Method", East West Press Pvt. Ltd.

Web Reference:

1. https://ocw.mit.edu/courses/res-2-002-finite-element-procedures-for-solids-and-structures-spring-2010/
2. https://www.coursera.org/projects/finite-element-analysis-convergence-and-mesh-independence-study-mw7ah
3. https://www.coursera.org/projects/finite-element-method-linear-nonlinear-analysis-post-processing
4. https://nptel.ac.in/courses/112104193
5. https://onlinecourses.nptel.ac.in/noc22_me43/preview

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced

to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of 40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV71.1	3	1											1		
22CIV71.2	3	2			2							1	1		1
22CIV71.3	2	3	3		1							1	1		1
22CIV71.4	2	2											1		
22CIV71.5	3	3	3		2							1	1		1
Average	**2.6**	**2.2**	**3**		**1.67**							**1**	**1**		**1**

SEMESTER – VII

Course: Design and Drawing of Steel Structural Elements

Course Code	**22CIV72**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:2**	**SEE Marks**	**50**
No. of Credits	**4**	**Examination Hours**	**3**

Prerequisites: Engineering Mechanics, Mechanics of Solids.

Course Objectives: Students will be taught:

CLO1	Analysis the Plastic behavior of structural steel.
CLO2	Design Bolted connections and Welded connections.
CLO3	Design of Compression members, Built-up columns and Column Splices.
CLO4	Design of Tension members, Simple Slab Base and Gusseted Base.
CLO5	Design of Laterally supported and Un-supported steel beams.

Content	**No. of Hours/ RBT levels**
Module-1 **Introduction:** Limit state method, Loading and load combinations, IS code provisions, Specifications, and section classification. **Bolted Connections:** Introduction, Design of High Strength Friction Grip (HSFG) bolts, Design of simple Bolted connections- Lap and Butt joints and Bracket connections. **Welded Connections:** Introduction, Simple welded joints for truss member and bracket connections. **Practice:** Use AUTOCAD for detailed drawings of above designed numerical.	**10 Hours L3**
Module 2 **Design of Compression members:** Introduction, Failure modes, Behaviour of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened Systems. **Practice:** Use AUTOCAD for detailed drawings of above designed numerical.	**10 Hours L3**
Module 3 **Design of Tension members:** Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension	**10 Hours L3**

members, Design of tension members and Lug angles, Shear lag effect on tension members, Splices, Gussets. **Design of Column Bases:** Design of Simple Slab Base and Gusseted Base. **Practice:** Use AUTOCAD for detailed drawings of above designed numerical.	
Module 4 **Design of Beams:** Introduction, Types of Beams, Lateral stability of Beams, Factors affecting lateral stability, Behavior of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally Unsupported Beams, Shear Strength of Steel Beams. Beam to Beam Connections, Beam to Column Connection and Column Splices. **Practice:** Use AUTOCAD for detailed drawings of above designed numerical.	**10 Hours** **L3**
Module 5 **Plastic Behaviour of Structural Steel:** Introduction, Plastic theory, Plastic hinge concept, Length of plastic hinge, Plastic collapse load, Load factor, Shape factor, Theorems of plastic collapse. Methods of Plastic analysis, Plastic analysis of Continuous Beams, Portal frames. **Practice:** Use SAP2000 for above numerical.	**10 Hours** **L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV72.1	Evaluate the collapse load, plastic moment for continuous beams and portal frames subjected to various types of loads.
22CIV72.2	Estimate number of bolts, welded strength properties for bolted and welded connections in steel structures.
22CIV72.3	Design of Compression members, built-up columns, laced and battened systems as per IS:800 codal provisions.
22CIV72.4	Design of tension members, lug angles, splices and gusseted base as per IS:800 codal provisions.
22CIV72.5	Determine the Strength of laterally supported and unsupported steel beams.

Textbooks:

1. N. Subramanian, "Design of Steel Structures" ,1st Edition, Oxford University press, New Delhi,2016.
2. Duggal S.K, "Limit State Method of Design of Steel Structures", 3rd Edition , Tata Mc Graw Hill, New Delhi,2019.
3. M.L Gambhir, "Fundamentals of Structural Steel Design" 1st Edition, Mc Graw Hill, New Delhi, 2017.

References:

1. Dayarathnam P, "Design of Steel Structures" Reprint Edition, S Chand Publisher, 2020.
2. Kazim S M A and Jindal R S, "Design of Steel Structures", 2nd Edition (International Edition), Prentice Hall of India, New Delhi, 1990.
3. M Bil Wong,"Plastic Analysis and Design of Steel Structures", Butterworth-Heinemann Publications, 2011.
4. IS 800-2007: General Construction in Steel Code Practice (Third Revision) , Bureau of Indian Standards, New Delhi.

Web Reference:

https://archive.nptel.ac.in/courses/105/106/105106216/
https://www.steel-insdag.org/

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below.

Table 1: Distribution of weightage for CIE & SEE of Regular courses:

Component		Marks	Total Marks
CIE	CIE Test-1	30	**50**
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	**20**	
SEE	**Semester End Examination**	**100**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV72.1	2	3	2		2							1		3	
22CIV72.2	2	3	3		2							1		3	
22CIV72.3	2	3	3		2							1		3	
22CIV72.4	1	2	2		2							1		3	
22CIV72.5	3	2	2		3							1		3	
Average	**2**	**2.6**	**2.4**		**2.2**							**1**		**3**	

SEMESTER – VII

Course: Design & Drawing of Irrigation and Bridge Structures

Course Code	**22CIV73**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:2**	**SEE Marks**	**50**
No. of Credits	**4**	**Examination Hours**	**4**

Prerequisites: Fluid Mechanics, Hydrology and Irrigation Engineering and Design and Drawing of RC structural Elements,

Course Objectives: Students will be taught:

CLO1	Apply principles of Hydraulics and Empirical formula for design and drawings of hydraulic structures associated with irrigation.
CLO2	Analyze and design slab culvert, box culvert and pipe culvert as per IRC specifications

Content	No. of Hours/ RBT levels
Module-1 **Design and drawing of the following hydraulic structures.** i. Surplus Weir ii. Tank sluice with tower head iii. Canal drop iv. Canal Regulator	**25 Hours L3**
Module 2 **Design Principles of Transportation Sub-Structures** i. General-features, piers and Abutments-materials, types, forces, design of piers. ii. Design of Reinforced cement concrete slab culvert, box culvert and pipe culvert.	**25 Hours L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV73.1	**Design** of Tank sluice, Canal drop, Canal regulator and Direct sluice for Strength and serviceability requirements.
22CIV73.2	**Design** of Slab culvert, Box, Pipe culvert, Piers and Abutments for Strength and serviceability requirements.

Textbooks:

1. C Satyanarayana Murthy "water Resources Engineering: Principles and Practice"- 2nd edition, New age International Publishers-2000
2. N Krishna Raju, "Design of Bridges", 5th edition, Oxford & IBH Publishing Co New Delhi, 2019.
3. T R Jagadeesh and M A Jayaram, "Design of Bridge Structures", 2nd Edition, Eastern Economy Edition, 2009.
4. D Johnson Victor, "Essentials of Bridge Engineering", 6th edition, Oxford & IBH Publishing Co New Delhi, 2019.

References:

1. Arora KR "Irrigation Water Power & Water Resources Engineering"- Standard Publishers Distributors-2010
2. P.N Modi, "Irrigation Water Power & Water Resources Engineering"- Standard book houseDistributors-2010
3. C.Punima and PandeLal, "Irrigation Water Power & Water Resources Engineering"- Lakshmi Publications, New Delhi-2009.
4. Ponnuswamy. S, "Bridge Engineering", 3rd edition, Tata McGraw Hill, 2017.
5. IRC 6 – 1966 "Standard Specifications and Code of Practice for Road Bridges"- Section II Loads and Stresses, the Indian Road Congress New Delhi
6. IRC 21 – 1966 "Standard Specifications and Code of Practice for Road Bridges"-Section III Cement Concrete (Plain and reinforced) The Indian Road Congress New Delhi
7. IS 456 – 2018 "Indian Standard Plain and Reinforced Concrete Code of Practice"- (Fourth Revision) BIS New Delhi

Web Reference:

Design of Beams	www.youtube.com/watch?v=RXWImcb73Y&list=PLXKZsEFKU__HHtsCMaAIPB3tr5Ht2Bdge&index=12 www.youtube.com/watch?v=Llg1rYoZMfU&list=PLXKZsEFKU__HHtsCMaAIPB3tr5Ht2Bdge&index=13 www.youtube.com/watch?v=3UBrBrpW-uY&list=PLXKZsEFKU__HHtsCMaAIPB3tr5Ht2Bdge&index=14 www.youtube.com/watch?v=7HXF3oGWRIA&list=PLXKZsEFKU__HHtsCMa AIPB3tr5Ht2Bdge&index=15
Design of Box culvert	www.youtube.com/watch?v=tVrp4M9HoxY
Design of Abutment and Piers	www.youtube.com/watch?v=VHlaD0lEMhQ

Scheme of Examination:
Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. Two questions shall be asked with one question from each module. There can be a maximum of three subdivisions in each question, if necessary. One full question should be answered from each module. Each question carries 50 marks.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks reduced to 20 marks each. Average of three test marks will be added to test component. CIE is executed by way of Lab Assessment Tools (AATs)

Some possible AATs: seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern for integrated courses is shown in the Table below

Table 1: Distribution of weightage for CIE & SEE of Regular courses:

Component		Marks	Total Marks
CIE	CIE Test-1	20	**50**
	CIE Test-2	20	
	CIE Test-3	20	
	Laboratory	**30**	
SEE	**Semester End Examination**	**100**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV73.1	3	2			2			1				2		3	
22CIV73.2	3	2			2			1				2		3	
Average	**3**	**2**			**2**			1				**2**		**3**	

SEMESTER – VII

Course: Advanced Design of RCC Structures

Course Code	**22CIV741**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Design and drawing of RC structural Elements

Course Objectives: Students will be taught:

CLO1	Analyze and design retaining walls and water retaining structures
CLO2	Analyze and design flat slabs
CLO3	Analyze and design special RC elements
CLO4	Analyze and design Silos (circular) and bunkers
CLO5	Understand Nonlinear behavior and design of joints

Content	No. of Hours/ RBT levels
Module-1 Yield Line Analysis: Design of slabs of various shapes and having various support conditions using yield line analysis approach. Retaining Walls: Design of cantilever Retaining wall and counter fort retaining wall. Water retaining structures: Design and detailing of rectangular and circular underground sump tanks (Rigid and Flexible base).	**08 Hours L3**
Module 2 Flat slabs: Elements of flat slabs, Codal procedure for design of flat slabs, Behavior of flat slab in shear, one way and two way shear, Equivalent Frame Method, Openings in flat slabs, Effect of pattern loading in flat slabs.	**08Hours L3**
Module 3 Design of special RC elements Design of slender columns -Concentrically loaded slender columns, eccentrically loaded slender columns, slender columns subjected to axial and transverse loads, Structural behavior of columns in braced and unbraced frames, Codal procedure for design of slender columns Design of RC walls--ordinary and shear walls- design of corbels Deep Beams: General features, Parameter influencing design, Flexural bending and	**08 Hours L3**

shear stresses in deep beams. Design provisions of IS-456, Checking for local failures, Strut and tie analysis of deep beams, Detailing of reinforcement in deep beams.	
Module 4 Design for Serviceability: Calculation of deflection and crack width in RC members. Silos (circular) and bunkers: analysis, design and detailing of side walls, hopper bottoms.	**08 Hours L3**
Module 5 Nonlinear behavior and design of joints - Nonlinear behavior of concrete –concrete confined by reinforcement–provision of ties in reinforced concrete slab –Frame system–Design of cast-in-situ joints in frames- Design of grid floors - Design loads other than earthquake loads	**08 Hours L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV741.1	Apply principles of RCC to design walls
22CIV741.2	Apply principles of RCC to design slabs
22CIV741.3	Apply principles of RCC to design special RC elements
22CIV741.4	Design RCC walls and slabs subjected to various loading combinations.
22CIV741.5	Estimate the loads to assess critical bending moments, shear forces and torsion

Textbooks:

1. Krishnam Raju, "Structural Design and drawing (RCC and steel)" Universites. Press, New Delhi
2. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, "R.C.C Designs (Reinforced concrete Structures)", 10th edition, Laxmi Publications, New Delhi, 2015.
3. Varghese, "Advanced RCC", 2nd edition, PHI Publications, New Delhi.
4. M.L.Gambhir "Design of RCC structures",P.H.I. Publications, New Delhi.

References:

1. Varghese P.C, "Advanced Reinforced Concrete", 2nd edition, Prentice Hall of India, New Delhi, 2001
2. Varghese P.C, "Limit state design of Reinforced Concrete", 2nd edition, Prentice Hall of India, New Delhi, 1997
3. Unnikrishnan Pillai S and Menon D., "Reinforced concrete Design", 3rd edition, Tata

McGraw Hill Book Co., NewDelhi,1998.
4. N.C.Sinha and S. K.Roy, Fundamentals of Reinforced concrete, S.Chand & Co Ltd., 2007

Web Reference:

https://onlinecourses.nptel.ac.in/noc23_ce109/preview

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	05	
	Quiz 2/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV741.1	2	2	2		2									3	
22CIV741.2	2	2	2		2									3	
22CIV741.3	2	2	2		2									3	
22CIV741.4	2	2	2		2									3	
22CIV741.5	2	2	2		2									3	
Average	2	2	2		2									3	

SEMESTER – VII

Course: Advanced Foundation Engineering

Course Code	**22CIV742**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Geotechnical Engineering, Foundation Engineering

Course Objectives: Students will be taught:

CLO1	Understanding geotechnical site investigation program for different civil engineering projects
CLO2	Ability to determine bearing capacity of soil by different methods
CLO3	Understanding of shallow and deep foundation analyses
CLO4	Understanding of choice of foundation design parameters

Content	**No. of Hours/ RBT levels**
Module-1 **Introduction**: Importance of soil investigations, Subsoil exploration, Types of samples (undisturbed, disturbed, representative and non-representative samples, Types of Samplers (Standard split spoon sampler, Shell by tubes, Thin-walled samplers, and Piston sampler), Design features affecting sample disturbance (area ratio, Recovery ratio, inside and outside clearances), Typical bore log. Number and depth of borings for various Civil engineering structures, Soil exploration report, In-situ testing of soils Classification of foundations systems. General requirement of foundations, Selection of foundations.	**8 Hours L2, L3**
Module 2 **Modes of shear failure**: Concept of soil shear strength parameters, Terzaghi's and IS: 6403 and 1981 method, Shallow foundations in clay, sand & C-Φ soils, Settlement analysis of footings, Design for Eccentric or Moment Loads, Footings on layered soils and sloping ground.	**8 Hours L2, L3**
Module 3 **Shallow foundations**: Proportion of shallow foundation for equal settlement, Computation of design loads, design of combined footings (rectangular and trapezoidal), strap footings and strip footings, Types of rafts, bearing capacity and	**8 Hours L2, L3**

settlements of raft foundation, Rigid methods, Flexible methods, coefficient of sub grade reaction.	
Module 4 **Deep Foundations**, Types of Deep Foundations, Ultimate bearing capacity of different types of piles, laterally loaded piles, tension piles & batter piles, Pile groups: Bearing capacity, settlement, uplift capacity, load distribution between piles. Negative skin friction, Pile load Test.	**8 Hours L2, L3**
Module 5 **Types of caissons**: Analysis of well foundations, Design principles, well construction and sinking. Foundations in special cases: Foundations for tower structures: Introduction, Forces on tower foundations, Selection of foundation type, Stability, and design considerations, Foundation on expansive soils, under reamed pile foundation.	**8 Hours L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV742.1	Understand the principles of subsoil exploration and concepts of Settlement analysis
22CIV742.2	Classify the different types of foundation and their suitability for particular site and structures.
22CIV742.3	Evaluate the soil shear strength parameters and bearing capacity for various sub-soil profile
22CIV742.4	Analyse shallow foundation, deep foundations and special foundations depending on the type of soil.

Textbooks:

1. Braja, M. Das, "Principles of Geotechnical Engineering",8th edition, Cengage Learning, India, 2013.
2. SwamiSaran, "Analysis & Design of Substructures", Oxford & IBHPub. Co.Pvt.Ltd, 2006.
3. J.E.Bowles, "Foundation Analysis and Design", 5th edition, McGraw-Hill Int. Editions, 2001.

References:

1. W.C. Teng, "Foundation Design", Prentice Hall of India Pvt. Ltd, 2003.
2. R.B. Peck, W.E. Hanson & T.H. Thornburn, "Foundation Engineering", 2nd Edition, Wiley Eastern Ltd, 1984.

3. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

Web Reference:

https://nptel.ac.in/courses/105105207
https://nptel.ac.in/courses/105105185

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	05	
	Quiz 2/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV742.1	2	3	2		2							1		3	
22CIV742.2	2	3	3		2							1		3	
22CIV742.3	2	3	3		2							1		3	
22CIV742.4	1	2	2		2							1		3	
Average	**1.75**	**2.75**	**2.5**		**2**							**1**		**3**	

SEMESTER – VII

Course: Pavement Design and Maintenance

Course Code	**22CIV743**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Transportation engineering

Course Objectives: Students will be taught:

CLO1	To understand components of pavement and factors affecting pavement design and performance
CLO2	To understand stresses & deflection in flexible pavements under the action of wheel loads and various design methods of flexible pavement.
CLO3	To understand stresses & deflection in rigid pavements under the action of wheel loads and various design methods of rigid pavement.
CLO4	To understand different flexible pavement failures and methods of evaluation and maintenance
CLO5	To understand different rigid pavement failures and methods of evaluation and maintenance

Content	**No. of Hours/ RBT levels**
Module-1 **Introduction:** Desirable characteristics of pavement, Comparison of Flexible and Rigid Pavements, Components and Functions of pavement layers. **Fundamentals of design of pavements:** Pavement design factors, loads, Design life, Traffic factors, climatic factors, Evaluation of Subgrade soil strength	**8 Hours L2**
Module 2 **Stresses in flexible pavement** Stresses and deflections, Boussinesq's Elastic Theory – principle, Assumptions – Limitations, Burmister two-layer Elastic theory and Problems using vertical stress charts and deflection charts. **Flexible pavement design:** Assumptions, Mcleod Method, Kansas method, CSA method using IRC-37-2001, problems on above. , Plate load Test, CBR Test, (Numericals). Outline of other common design methods such as AASHTO and Asphalt Institute methods.	**8 Hours L3**
Module 3	**8 Hours**

Stresses in rigid pavement: Design factors, Analysis of stresses, Assumptions, Westergaard's Analysis, Critical stress Locations, Wheel load stresses, Temperature stress, combined stresses (using chart / equations) – Problems. **Design of rigid pavement:** Design of C.C. Pavement by IRC: 58 – 2015 for dual loads (Problems) , Concept of White topping.	**L3**
Module 4 **Flexible pavement failures, maintenance and evaluation**: Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by unevenness measurements, Structural evaluation by Merlin, Benkleman beam deflection method(problems), Bump integrator, Falling weight deflectometer, GPR method	**8 Hours L2,L3**
Module 5 **Rigid pavement failures, maintenance, and evaluation**: Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by unevenness measurements, VFD, Wheel load and its repetition, properties of subgrade, properties of concrete.	**8 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV743.1	Analyze the components and factors considered in fundamental design of pavements.
22CIV743.2	Design the thickness of flexible pavements by different methods and compute the stresses and deflection under the action of wheel load.
22CIV743.3	Design the thickness of concrete pavements and joints associated with CC pavements in addition to the computation of stresses in CC pavements.
22CIV743.4	Analyze the types of flexible pavement failures and propose suitable remedies.
22CIV743.5	Analyze the types of rigid pavement failures and propose suitable remedies.

Textbooks:

1. Yoder and Witczak, "Principles of Pavement Design", 2nd edition, John Wiley and sons 1975.
2. Yang Huang, "Pavement Analysis and Design",2nd Edition, Pearson, 2004.
3. S.K. Khanna, C.E.G. Justo and Veeraraghavan A, "Highway Engineering", 10th Edition, Nem Chand & Bros, 2013.
4. Haas, R., W.R. Hudson and J.P. Zaniewski., "Modern Pavement Management", Krieger Publishing Company, Florida, USA, 1994

References:

1. Nai C. Yang, "Design of Functional Pavements", McGraw-Hill Book Company, New York, USA, 1972.
2. "Hand Book on Cement Concrete Roads"- Cement Manufacturers Association, New Delhi.
3. MoRTH "Specifications for Roads and Bridge Works"- 2001, fourth revision, Indian Roads Congress.
4. MoRTH "Manual for Construction and Supervision of Bituminous Works"- 2001, Indian Roads Congress.
5. MoRTH "Manual for Maintenance of Roads"- 1989, Indian Roads Congress.
6. IRC 37-2001, IRC 81-1997, IRC 58 – 2002, IRC 59 – 1976, IRC 101-1988, Indian Roads Congress

Web Reference:

https://nptel.ac.in/courses/105104098

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	05	
	Quiz 2/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e., A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab)
Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV743.1	2	2													
22CIV743.2	2	2						2					2		
22CIV743.3	2	2	1					2					2		
22CIV743.4	2	2	1												
22CIV743.5	2	2	1												
Average	2	2	1					2					2		

SEMESTER – VII

Course: Integrated Water Resources Management

Course Code	**22CIV744**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	To develop the ability among students to synthesize data and technical concepts for application in Integrated Water Resources Management.
CLO2	To provide a basic knowledge of contemporary problems in integrated management of water.
CLO3	To provide practical experience in using water management modelling tools.
CLO4	To provide an understanding of the role of Geographic Information System (GIS) in water resources management

Content	**No. of Hours/ RBT levels**
Module-1 Introduction to Integrated Water Resources Management (IWRM): IWRM - Definition – Objectives – Principles - Evolution of IWRM - IWRM relevance in water resources management Water Sustainability: Concept of sustainable water uses; The Dublin statement; Sustainable water management with economical, engineering, ecological and social viewpoints; Emerging Issues - Drinking water management in the context of climate change - IWRM and irrigation - Flood – Drought – Pollution – Linkages between water, health and poverty	**08 Hours L1, L2**
Module 2 Watershed: Planning and Management: Watershed concepts: Watershed-Topographic divide, Groundwater divide, Stream patterns, Soil erosion- Problems, Types, Conservation Technology, Watershed approach; Watershed Management, Factors influencing watershed operations, Watershed characteristics, Deterioration of watershed, Watershed delineation, Prioritizing watersheds, Coding of the	**08Hours L2**

watershed, Morphometric analysis of watershed-Linear, Areal and Relief aspects, Channel networks, Hypsometric analysis. River Basin – Concept	
Module 3 IWRM and water resources development in India: Rural Development - Ecological sustainability- -Watershed development and conservation - Ecosystem regeneration – Wastewater reuse - Sustainable livelihood - Food security. Problems and policy issues - Solutions for effective integrated water management - Case studies	**08 Hours L2**
Module 4 Modelling and Decision Support Systems (DSS) in IWRM: Introduction, Types of models – hydrological, hydrodynamic, water quality, DSS. Case studies – IWRM in urban areas, lakes, rivers, Interlinking of rivers, Desalination	**08 Hours L2**
Module 5 Geoinformatics for IWRM: Basics of Geoinformatics – Use of GIS and image processing software's, Preparation of thematic layers required for water resources modelling. Introduction to WEAP (Water Evaluation and Planning system): Basic Tools, Inputs, Scenarios. Introduction to Open Data for Water resources management – Understanding open data for processing and accessing. Case studies on the implementation of WEAP model – Policy, management, and financial aspects of implementation	**08 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV744.1	Understand water management system components, their characteristics and functioning of such systems
22CIV744.2	Analyse integrated water management scenarios and implementation
22CIV744.3	Utilize the Geographic Information System (GIS) in water resources management
22CIV744.4	Apply appropriately the water management modelling software.

Textbooks:

1. David A. Chin. "Water-Resources Engineering" 3rd Edition, Pearson Publisher, 2013.
2. Mollinga P. et al. "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.
3. Cech Thomas V., "Principles of Water Resources: History, Development, Management and Polic", 3rd edition, John Wiley and Sons Inc., New York. 2003.
4. Murthy, J.V.S., "Watershed Management in India", Wiley Eastern Ltd., New York, 1995.

References:

1. Heathcote, I. W. "Integrated Watershed Management: Principles and Practice", John Wiley and Sons, Inc., New York, 1988
2. Koudstaal R., and al, "Water and Sustainable Development", Proc. Int. Conf. On Water and the Environment. Dublin, 1992

Web Reference:

1. https://www.weap21.org/index.asp?action=213
2. https://www.gwptoolbox.org/learn/iwrm-tools
3. https://archive.nptel.ac.in/courses/105/101/105101214/

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab)

Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV744.1	2	2				1	1					1	1		
22CIV744.2	2	2				1	1					1	1		
22CIV744.3	2	2				1	1					1	1		
22CIV744.4	2	2				1	1					1	1		
Average	2	2				1	1					1	1		

SEMESTER – VII

Course: AI&ML in Infrastructure Engineering

Course Code	**22CIV751**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: -

Course Objectives: Students will be taught:

CLO1	The fundamental concepts and working principle of machine learning in civil & infrastructure engineering
CLO2	Concepts of machine learning algorithms in civil & infrastructure engineering
CLO3	Application of artificial intelligence in civil engineering

Content	**No. of Hours/ RBT levels**
Module-1 **Introduction:** Definitions and scope of AI and ML, Historical overview and key concepts, fundamental concepts and working principle of ANN; network training models; Types of Machine Learning (Supervised, Unsupervised, Reinforcement); Data preprocessing and feature engineering	**8 hours L2**
Module 2 **Data Collection for Infrastructure Projects:** Sensors and data sources in infrastructure engineering; Data quality assurance and integrity; Data acquisition and storage **Data Preprocessing and Feature Engineering:** Data cleaning and outlier detection; Feature selection and dimensionality reduction; Data normalization and transformation	**8 hours L2**
Module 3 **Overview of Deep networks:** Building deep networks for classification: Stacked autoencoders, liner decoders with autoencoders, liner decoder, feature extraction using convolution, CNN, pooling, classification layer.	**8 hours L2**

Module 4 **Applications in civil & infrastructure engineering:** Scope of applications in structural engineering, water resource engineering, geotechnical engineering, transportation engineering, construction engineering etc. Examples for application of AI/ML in material modelling, traffic management and safety, foundation settlement.	**8 hours** **L2**
Module 5 **Other applications:** Examples for application of AI/ML in structural control system identification, structural health monitoring, damage assessment, surrogate modelling, uncertainty quantification etc	**8 hours** **L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV751.1	Understand the concepts of deep networks and data collection
22CIV751.2	Understand machine learning algorithms in civil & infrastructure engineering
22CIV751.3	Analyze problems in deterministic and random environments
22CIV751.4	Understand applications of AI & ML in infrastructure engineering

Textbooks:

1. J.A.Goulet "Probabilistic machine learning for civil engineers", the MIT Press, 2020
2. P.C.Deka , "A primer on machine learning applications in civil engineering", CRC Press, 2020.

References:

1. C.M. Bishop, Pattern recognition and machine learning, Springer, 2006.
2. By Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep learning", MIT Press, 2016.

Web Reference:

https://www.viktor.ai/blog/40/artificial-intelligence-machine-learning-engineering-construction

https://www.arup.com/services/digital/artificial-intelligence-and-machine-learning

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV751.1	3	2	2		3							3	1		
22CIV751.2	3	2	3	2	3							3	1		
22CIV751.3	3	2	3	2	3							3	1		
22CIV751.4	3	2	3	2	3							3	1		
Average	3	2	2.75	2	3							3	1		

SEMESTER – VII

Course: Disaster Mitigation and Management

Course Code	**22CIV752**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	Basic concepts in Disaster Management
CLO2	Types and categories of disasters
CLO3	The role of individual and various organization during and after disaster
CLO4	Challenges posed by Disaster
CLO5	Impacts of Disasters Key Skills

Content	**No. of Hours/ RBT levels**
Module-1 **Introduction -** Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change.	**8 Hours L2**
Module 2 **Natural Disaster and Manmade disasters:** Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion **Manmade Disasters:** Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.	**8 Hours L2**
Module 3 **Disaster Management, Policy and Administration-** Disaster management: meaning, concept, importance, objective of disaster management policy, disaster risks in India, Paradigm shift in disaster management. Policy and administration: Importance and principles of disaster management policies, command and coordination of in disaster management, rescue operations-how to start with and 06	**8 Hours L2**

how to proceed in due course of time, study of flowchart showing the entire process.	
Module 4 **Institutional Framework for Disaster Management in India:** Importance of public awareness, Preparation and execution of emergency management programme. Scope and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India. Methods and measures to avoid disasters, Management of casualties, set up of emergency facilities, importance of effective communication amongst different agencies in such situations. Use of Internet and software for effective disaster management. Applications of GIS, Remote sensing and GPS in this regard	**8 Hours L2**
Module 5 **Preventive and Mitigation Measures**- Pre-disaster, during disaster and post-disaster measures in some events in general Structural mapping: Risk mapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication Non Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans. Do's and Don'ts in case of disasters and effective implementation of relief aids	**8 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV752.1	Explain the application of Disaster Concepts to Management
22CIV752.2	Identify extent and damaging capacity of a disaster
22CIV752.3	Understand the means of losses and methods to overcome /minimize it.
22CIV752.4	Describe role of individual and various organization during and after disaster
22CIV752.5	Understand the emergency government response structures before, during and after disaster

Textbooks:

1. Coppola D P, "Introduction to International Disaster Management", 4th edition, Elsevier Science (B/H), London, 2021.
2. O S Dagur, "Disaster Management: An Appraisal of Institutional Mechanisms in India", new edition, 2011
3. Jack Pinkowski, "Disaster Management Handbook", 1st edition, CRC Press Taylor and Francis group, 2008

References:

1. Dr Ravikant Pagnis, "Disaster Management and Mitigation measures", 1st edition, TechKnowledge Publications, Pune, 2023.
2. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
3. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)

Web Reference:

https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	50
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV752.1	2	1	1		3	3	2			2			1		
22CIV752.2	2	1	1		3	3	2			2			1		
22CIV752.3	2	1	1		3	3	2						1		
22CIV752.4	2	1	1	1	3	3	2						1		
22CIV752.5		1	1	1	3	3	2						1		
Average	1.6	1	1	1	3	3	2			1			1		

SEMESTER – VII

Course: Engineering Economics

Course Code	**22CIV753**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	The role of economics in engineering.
CLO2	To compare between alternatives.
CLO3	To learn how to construct and interpret a breakeven graph.

Content	No. of Hours/ RBT levels
Module 1 **Economic Decisions Making** – Overview, Problems, Role, Decision making process. **Engineering Costs & Estimation** – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring and Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits. Case Study - Price and Income Elasticity of Demand in the real world	**8 Hours L2**
Module 2 **Time value of money:** Simple and compound interest, Time value equivalence, Compound interest factors, Cash flow diagrams, Calculation, Calculation of time – value equivalences. Present worth comparisons, Comparisons of assets with equal, unequal and infinite lives, comparison of deferred investments, Future worth comparison, pay back period comparison.	**8 Hours L2**
Module 3 Comparison of alternatives using equivalent annual worth method, Comparison of assets of equal and unequal life. Rate of return, Internal rate of return, comparison of IIR with other methods, IRR misconceptions. Analysis of public Projects: Benefit/ Cost analysis, quantification of project, cost and benefits, benefit/ cost	**8 Hours L2**

applications, Cost –effectiveness analysis.	
Module 4 Depreciation, Computing depreciation charges, after tax economic comparison, Break-even analysis; linear and non-linear models. Sensitivity analysis: single and multiple parameter sensitivity	**8 Hours L2**
Module 5 Fixed and variable cost, Product and Process Costing, Standard Costing, Cost estimation, Relevant Cost for decision making, Cost estimation, Cost control and Cost reduction techniques.	**8 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV753.1	Describe the principles of economics that govern the operation of any organization under diverse market conditions.
22CIV753.2	Comprehend macroeconomic principles and decision making in diverse business set up
22CIV753.3	Explain the inflation and price change as well as present worth analysis.
22CIV753.4	Apply the principles of economics through various case studies.

Textbooks:

1. Horn green, C.T., "Cost Accounting",16th edition, Prentice Hall of India, 2017.
2. Sullivan and Wicks: "Engineering Economy", 17th edition, Pearson, 2019.

References:

1. James L.Riggs,David D. Bedworth, Sabah U. Randhawa, "Economics for Engineers", 4th edition, Tata McGraw-Hill, 1996.
2. Donald Newnan, Ted Eschembach, Jerome Lavelle, "Engineering Economics Analysis", 12th edition, Oxford University Press, 2013.
3. John A. White, Kenneth E.Case,David B.Pratt, "Principle of Engineering Economic Analysis", 6th edition, John Wiley, 2012.
4. R.Paneer Seelvan, "Engineering Economics", PHI, 13th edition, 2012.
5. Michael R Lindeburg, "Engineering Economics Analysis", Professional Pub, 1993.

Web Reference:

www.finmin.nic.in ,
www.rbi.org.in ,
www.planningcommission.nic.in

Scheme of Examination:

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). Some possible AATs: seminar / assignments / miniprojects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test 1	**40**	**50**
	CIE Test 2	**40**	
	CIE Test 3	**40**	
	Average of CIE	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV753.1	2										1		1		
22CIV753.2	2	1													
22CIV753.3	2														
22CIV753.4	2							1			1				
Average	2							1			1		1		

SEMESTER – VII

Course: Sensor Technologies for Infrastructure

Course Code	**22CIV754**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Structural Analysis, Smart Materials

Course Objectives: Students will be taught:

CLO1	To learn basic principles of sensor technologies
CLO2	To understand instruments and sensors for Structural Health Monitoring
CLO3	To understand the different methods of Structural Health Monitoring
CLO4	To apply sensing solutions to various civil engineering facilities

Content	No. of Hours/ RBT levels
Module-1 Sensor data acquisition systems and architectures, Commonly used sensors for civil infrastructures and their associated algorithms, Piezoelectric transducers for assessing and monitoring civil infrastructures, Fiber optic sensors for assessing and monitoring civil infrastructures, Acoustic emission sensors for assessing and monitoring civil infrastructures, Electromagnetic sensors for assessing and monitoring civil infrastructures, Corrosion sensing for assessing and monitoring civil infrastructures	**8 Hours L3**
Module 2 **Instrumentations & Sensors for SHM:** Basics of Instrumentations & Measurements, Classifications, Input-Output Configurations of Instruments, Static & Dynamic Characteristics, Functions. Various Types of Electromechanical, Electronics & Digital Instruments for SHM. Data Acquisition Systems-Types, Hardware & It's Components. Basics of Sensors, Transducers & Actuators, Classification of Sensors, Characteristics & Working Principles of Various Types of Sensors like Strain Gauges, LVDT, Accelerometers etc. Concept of Smart Materials & Smart Structures with SHM, Basics of Smart Materials like Piezoelectric, Shape Memory Alloys, ER & MR Fluids etc.	**8 Hours L3**

Module 3 **Methods of SHM:** Methodologies and Monitoring Principles, Local & Global Techniques for SHM, Static & Dynamic Field Testing, Short & Long-Term Monitoring, Active & Passive Monitoring. Vibration Based SHM Techniques - Use & Demonstration of Dynamic Properties of Structures for Damage Detection & SHM, Ambient Vibration Test, Acoustic Emission Technique, Electromechanical Impedance Technique, Wave Propagation Based Techniques, Fibre Optics Based Techniques, Remote & Wireless SHM Techniques, IoT Application in SHM, Artificial Intelligence & Machine Learning in SHM.	**8 Hours L3**
Module 4 **Sensing Solutions:** Sensing solutions for assessing and monitoring of bridges, Sensing solutions for assessing and monitoring supertall structures, Seismic monitoring solutions for buildings, Sensing solutions for assessing and monitoring dams, Sensing solutions for assessing and monitoring tunnels	**8 Hours L3**
Module 5 Mapping subsurface utilities with mobile electromagnetic geophysical sensor arrays, Sensing solutions for assessing the stability of levees, sinkholes and landslides, Sensing solutions for assessing and monitoring pipeline systems, Sensing solutions for assessing and monitoring roads, Sensing solutions for assessing and monitoring high-speed railroads, Sensing solutions for assessing and monitoring underwater systems, Sensor solutions for assessing and monitoring offshore structures	**8 Hours L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV754.1	**Understand** the basic concepts of sensor data acquisition systems
22CIV754.2	**Apply** instruments and sensors for structural health monitoring
22CIV754.3	**Explain** various methods of structural health monitoring
22CIV754.4	**Apply** sensing solutions to various civil engineering facilities

Textbooks:

1. M.L. Wang, J.P. Lynch and H. Sohn, "Sensor Technologies for civil infrastructures",2nd edition, Springer, 2022
2. Gandhi and Thompson, "Smart Materials and Structures", Springer, 1992.

References:

1. Fu Ko Chang, "Structural Health Monitoring: Current Status and Perspectives", 1st edition,

CRC Press, 1998.
2. Journal Papers on this subject

Web Reference:

1. https://nptel.ac.in/courses/114106046
2. https://www.serc.res.in/structural-health-monitoring-life-extension-research-areas

Scheme of Examination:

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). Some possible AATs: seminar / assignments / Mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test 1	**40**	**50**
	CIE Test 2	**40**	
	CIE Test 3	**40**	
	Average of CIE	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV754.1	3	1			1								1		
22CIV754.2	3	2			1								1		1
22CIV754.3	2	3			1								1		1
22CIV754.4	2	2			1								1		1
Average	**2.5**	**2.0**			**1**								**1**		**1**

SEMESTER – VII

Course: Project work Phase 1

Course Code	22CIV76	CIE Marks	100
Hours/Week (L: T: P)	0:0:2	SEE Marks	-
No. of Credits	2	Examination Hours	-

Course Learning Objective (CLOs): Major Project work phase-I is carried out under the guidance of a faculty. In this course, the students will finalize the project title, collect the data required by indirect and direct methods and carry out literature review and formulate the methodology.

The project report shall be presented in the following for

1) Definition of the problem.
2) Exhaustive literature survey.
3) State of Project work.
4) References.

SEMESTER – VIII

Course: Design and Drawing of RCC and Steel Structures

Course Code	**22CIV81**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:2**	**SEE Marks**	**50**
No. of Credits	**4**	**Examination Hours**	**3**

Prerequisites: Design and Drawing of RCC Elements, Design and Drawing of Steel Elements.

Course Objectives: Students will be taught:

CLO1	Concept of Design and Steel structures.
CLO2	Solve Engineering problems in RC and Steel Structures.
CLO3	Design a Retaining wall, Footing, Water tanks, Portal frames as per the specifications of IS Codal Provisions.
CLO4	Design a Roof Truss, Plate Girder and Gantry Girder as per the specifications of IS Codal Provisions.

Content	**No. of Hours/ RBT levels**
Module-1 **Footings:** Design of rectangular slab, slab-beam type combined footing. **Retaining Walls:** 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 portal frames with fixed and hinged based supports.	**25 Hours L3**
Module 2 **Roof Truss:** Design of roof truss for different cases of loading, forces in members to given. **Plate Girder:** Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks. **Gantry Girder:** Design of gantry girder with all necessary checks.	**25 Hours L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV81.1	Design of combined footing, retaining wall, Portal frame and water tank for Strength and serviceability requirements.
22CIV81.2	Design of Roof Truss, Plate Girder and Gantry Girder for Strength and serviceability requirements.

Textbooks:

1. N Krishna Raju, "Structural Design and Drawing of Reinforced Concrete and Steel", 3rd edition, University Press, 2021.
2. Subramanian N, "Design of Steel Structures", Oxford University Press, New Delhi, 2008
3. K S Duggal, "Design of Steel Structures" 3rd Edition, Tata McGraw Hill, New Delhi, 2019.

References:

1. Charles E Salman, Johnson & Mathas, "Steel Structure Design and Behavior",Pearson Publications
2. Nether Cot, et.al, "Behavior and Design of Steel Structures to EC-III" 4th Edition, CRC Press, 2007
3. P C Verghese, "Limit State Design of Reinforced Concrete", 2nd Edition, PHI Publications, New Delhi, 2008
4. S N Sinha, "Reinforced Concrete Design" 3rd Edition, McGraw Hill Publication, 2017.

IS Codes

1. IS:456-2000 – Plain and Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi.
2. IS:800-2007- General Construction in Steel- Code of Practice, Bureau of Indian Standards, New Delhi.
3. SP-6 – Steel Tables
4. IS:3370 (part-4) – Code of Practice for Concrete Structures for the storage of liquids, Bureau of Indian Standards, New Delhi.

Web Reference:

https://archive.nptel.ac.in/courses/105/106/105106112/

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. Two questions shall be asked with one question from each module. There can be a maximum of three subdivisions in each question, if necessary. One full question should be answered from each module. Each question carries 50 marks.

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below.

Table 1: Distribution of weightage for CIE & SEE of Regular courses:

Component		Marks	Total Marks
CIE	CIE Test-1	30	**50**
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	**20**	
SEE	**Semester End Examination**	**100**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV81.1	3	3	2		2									3	
22CIV82.2	3	3	2		2									3	
Average	**3**	**3**	**2**		**2**									**3**	

SEMESTER – VIII

Course: Design of PSC and RCC Bridges

Course Code	**22CIV821**	**CIE Marks**	50
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	50
No. of Credits	3	**Examination Hours**	3

Prerequisites: Advanced Design of RCC Structures

Course Objectives: Students will be taught:

CLO1	Design of slab culvert as per IRC Specifications.
CLO2	Design of box culvert as per IRC Specifications.
CLO3	Design of T Beam and PSC Bridge as per IRC Specifications.
CLO4	Design of Balanced cantilever bridge as per IRC Specifications.

Content	No. of Hours/ RBT levels
Module-1 **Introduction & Design of Slab Culvert:** Bridge Engineering and its development in past, Ideal site selection for Bridges, Bridge classifications, Forces acting on Bridge. Analysis for maximum BM and SF at critical sections for Dead and Live load as per IRC class A, B, AA tracked and wheeled vehicles. Structural design of slab culvert using limit state method with reinforcement details	**08 Hours L3**
Module 2 **Box Culvert:** Introduction to box culvert, advantage of structural continuity, Analysis for maximum BM and SF at critical sections using moment distribution method for various load combinations such as Dead, Surcharge, Soil, Water and Live load as per IRC class A, B, AA tracked and wheeled vehicles. Structural design of box culvert using limit state method with reinforcement details.	**08 Hours L3**
Module 3 **T Beam Bridge Slab Design:** Proportioning of Components Analysis of interior Slab & Cantilever Slab Using IRC Class AA Tracked, Wheeled Class A Loading, Structural Design of Slab, with Reinforcement Detail. T Beam Bridge Cross Girder Design: Analysis of Cross Girder for Dead Load & Live Load Using IRC Class AA Tracked, Wheeled Class A Loading A Loads, Structural Design of beam with Reinforcement Detail using Courbon's Method.	**08 Hours L3**
Module 4 **PSC Bridge:** Introduction to Pre-& Post Tensioning, Proportioning of	**08 Hours L3**

Components, Analysis & Structural Design of Slab, Analysis of Main Girder Using Courbon's Method for IRC Class AA, tracked vehicle, Calculations of Prestressing Force, Calculations of Stresses, Cable profile, Design of End Block, Detailing of Main Girder.	
Module 5 **Balanced Cantilever Bridge:** Introduction & Proportioning of Components, Analysis of Main Girder Using Courbon's Method for IRC Class AA, tracked vehicle Design of Simply Supported Portion, Cantilever Portion, Articulation, using limit state method with reinforcement details.	**08 Hours L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV821.1	Understand the concepts of bridges, IRC loadings and distribution theory as per IRC standards.
22CIV821.2	Design slab culvert and box culvert subjected to various loading combinations and IRC standards.
22CIV821.3	Analyse the maximum bending moment and shear force for T Beam bridge and PSC bridge as per COURBON'S method.
22CIV821.4	Evaluate the maximum bending moment and shear force for Balanced Cantilever bridge as per IRC Codal provisions.

Textbooks:

1. N Krishna Raju, "Design of Bridges"- Oxford & IBH Publishing Co New Delhi-2013
2. Raina V.K., "Concrete Bridge Practice"- Tata McGraw Hill 200
3. D Johnson Victor "Essentials of Bridge Engineering"-, Oxford & IBH Publishing Co New Delhi 199

References:

1. N. Rajagopalan, Bridge Superstructure, Narosa Publishing House, 2006.
2. Ponnu Swamy. S, "Bridge Engineering"- Tata McGraw Hill 200
3. W. F. Chen and L. Duan, Bridge Engineering Handbook, CRC press, 2003

IS Code Books:

1. IS 456-2018 (Reaffirmed 2011, 2016) Plain and Reinforced Concrete -Code of Practice (4th Edition)

2. SP:34(S&T)-1987- Handbook on concrete Reinforcement and Detailing
3. SP16:1980, Design Aids for Reinforced Concrete to IS: 456-1978, Bureau of Indian Standards, New Delhi, 1992
4. IRC6,18,21,112-2015 (Code of Practice for Concrete Road Bridges)

Web Reference:

Introduction to Bridge Engineering IRC Loadings	• www.youtube.com/watch?v=RB2k5hSYO3U&list=PLXKZsEFKU__HHtsCMaAIPB3tr5Ht2Bdge&index=2 • www.youtube.com/watch?v=U4a0q4hYUWw&list=PLXKZsEFKU__HHtsCMaAIPB3tr5Ht2Bdge&index=6
Design of Beams	• www.youtube.com/watch?v=RXWImcb73Y&list=PLXKZsEFKU__HHtsCMaAIPB3tr5Ht2Bdge&index=12 • www.youtube.com/watch?v=Llg1rYoZMfU&list=PLXKZsEFKU__HHtsCMaAIPB3tr5Ht2Bdge&index=13 • www.youtube.com/watch?v=3UBrBrpW-uY&list=PLXKZsEFKU__HHtsCMaAIPB3tr5Ht2Bdge&index=14 • www.youtube.com/watch?v=7HXF3oGWRlA&list=PLXKZsEFKU__HHtsCMa • AIPB3tr5Ht2Bdge&index=15
Design T-Beam Bridge	• www.youtube.com/watch?v=TDuvNevZwp0&list=PLXKZsEFKU__HHtsCMaAIPB3tr5Ht2Bdge&index=17 • www.youtube.com/watch?v=xh876dxfLnE&list=PLXKZsEFKU__HHtsCMaAIPB3tr5Ht2Bdge&index=18 • www.youtube.com/watch?v=BllNVVo2HnM&list=PLXKZsEFKU__HHtsCMaAIPB3tr5Ht2Bdge&index=19 • www.youtube.com/watch?v=KDXVQ3TMTlo&list=PLXKZsEFKU__HHtsCMaAIPB3tr5Ht2Bdge&index=22

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non integrated

subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). Some possible AATs: seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test 1	**40**	**50**
	CIE Test 2	**40**	
	CIE Test 3	**40**	
	Average of CIE	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum marks of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV821.1	3	3			2									3	
22CIV821.2	3	3			2							1		3	
22CIV821.3	3	3			2							1		3	
22CIV821.4	3	3			2							1		3	
Average	**3**	**3**			**2**							**1**		**3**	

SEMESTER – VIII

Course: Urban Transport and Intelligent Transportation Systems

Course Code	**22CIV822**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Highway Engineering

Course Objectives: Students will be taught:

CLO1	Understand and apply basic concepts and methods of urban transportation planning, methods of designing, conducting, and administering surveys to provide the data required for transportation planning
CLO2	Understand the process of developing an organized mathematical modelling approach to solve select urban transportation planning problem
CLO3	Excel in use of various types of models used for travel forecasting, prediction of future travel patterns
CLO4	Have an awareness and scope of transport issues, such as, traffic safety, public transport, advanced vehicle management and control
CLO5	What Intelligent transport systems (ITS) involve the application of information technology and telecommunications to control traffic.

Content	**No. of Hours/ RBT levels**
Module-1 **Urban transport planning:** Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination	**8Hours L2**
Module 2 **Data Collection and Inventories:** Collection of data – Organization of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources,	**8Hours L2,L3**

Economic data – Income – Population – Employment – Vehicle Owner Ship	
Module 3 **Trip Generation, Distribution & Traffic Assignment:** UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution by Growth Factor Methods. Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling: gravity model, opportunity models, Desire line diagram. Modal split analysis. Problems on above. Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Introduction to land use planning models, land use and transportation interaction.	**8Hours L2,L3**
Module 4 **Introduction to ITS:** Basic elements of intelligent transportation systems (ITS), focusing on technological, systems and institutional aspects. Benefits of ITS -ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection Advanced traveler information systems; transportation network operations; commercial vehicle operations and intermodal freight	**8Hours L2,L3**
Module 5 **Public transportation applications,** ITS and regional strategic transportation planning, including regional architectures. ITS and changing transportation institutions, ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS and sustainable mobility. Travel demand management, electronic toll collection, and ITS and road-pricing. Automated Highway SystemsVehicles in Platoons –ITS in World – Overview of ITS Implementations in developed countries, ITS in developing countries	**8Hours L2,L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV822.1	Design, conduct and administer surveys to provide the data required for transportation planning.
22CIV822.2	Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
22CIV822.3	Develop and calibrate modal split, trip generation rates for specific types of land use developments and adopt the steps that are necessary to complete a long-term transportation plan.

22CIV822.4	Suggest the appropriate system/s in various functional areas of transportation. Would be able to amalgamate the various systems, plan and implement the applications of ITS.
22CIV822.5	Understand the application of information technology and telecommunication to control traffic and also provide advance information to the travelers, automatic handling of emergencies and to improve safety.

Textbooks:

1. Kadiyali. L. R., "Traffic Engineering and Transportation Planning", Classic Edition, Khanna Publishers, New Delhi,1999
2. Khisty C.J., "Transportation Engineering – An Introduction", 3rd Edition, Pearson Education,2017
3. Papacostas, "Fundamentals of Transportation Planning", Prentice Hall,1987
4. Choudury M A and Sadek A, "Fundamentals of Intelligent Transportation Systems Planning" Artech House, 2003

References:

1. Mayer M and Miller E, "Urban Transportation Planning: A decision oriented Approach", McGraw Hill, 2001
2. Bruton M.J., "Introduction to Transportation Planning", Hutchinson of London,2001
3. Dicky, J.W., "Metropolitan Transportation Planning", 2nd Edition, Tata McGraw Hill. 2108
4. Sussman, J. M., "Perspective on ITS", Artech House Publishers, 2005
5. Turban. E and Aronson. J. E, "Decision Support Systems and Intelligent Systems", 6th Edition,Pearson Publishers, 2000.
6. Kan Paul Chen, John Miles, "Recommendations for World Road Association (PIARC)" ITS Hand Book, 2000.
7. US Department of Transportation, "National ITS Architecture Documentation", 2007 (CDROM).

Web Reference:

1. https://archive.nptel.ac.in/courses/105/107/105107067/
2. https://archive.nptel.ac.in/courses/105/105/105105208/
3. https://nptel.ac.in/courses/105107210
4. https://www.civil.iitb.ac.in/tvm/nptel/591_ITS_1/web/web.html

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum mark of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV822.1	2	2	2										2		
22CIV822.2	2	2	2										2		
22CIV822.3	2	2	2										2		
22CIV822.4	2	2	2										2		
22CIV822.5	2	2	2										2		
Average	2	2	2										2		

SEMESTER – VIII

Course: Solid Waste Management

Course Code	**22CIV823**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	To study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules
CLO2	To understand and different elements of solid waste management from generation of solid waste to disposal.
CLO3	To analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.
CLO4	To evaluate landfill site and to study the sanitary landfill reactions

Content	**No. of Hours/ RBT levels**
Module-1 **Introduction;** - Functional elements of municipal solid waste (MSW) management system, Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems. Environmental implications of open dumping of MSW, Construction debris – management & handling. Rag pickers and their role, Solid waste management 2000 rules with 2016 amendments	**8 Hours L2**
Module 2 **Collection:** Collection of solid waste- services and systems Haul and stationary container system numericals, equipment's, Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization.	**8 Hours L2**
Module 3 **Treatment / Processing Techniques:** Components separation, volume reduction, size reduction, chemical reduction and biological processing problems. **Composting:** Aerobic and anaerobic composting, factors affecting composting, Indore and Bangalore processes, mechanical and semi mechanical composting processes. Vermicomposting	**8 Hours L2**

Module 4 **Sanitary Land Filling:** Different types, trench area, Ramp and pitmethod, site selection, basic steps involved, cell design, prevention of site pollution, leachate & gas collection and control methods, geosynthetic fabrics in sanitary land fills. **Incineration:** Process – 3 T's, factors affecting incineration process,incinerators – types, prevention of air pollution, pyrolsis, design criteria for incineration.	**8 Hours** **L2**
Module 5 **Sources, Collection, Treatment and Disposal: -** Biomedical waste and E-waste, **Recycle and Reuse**: Material and energy recovery operations, reusein other industries, plastic wastes, environmental significance and reuse.	**8 Hours** **L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV823.1	Identify improper practices of solid waste disposal and their environmental implications. Know the basic engineering principles of solid waste management
22CIV823.2	Describe the need for economics in collection and transportation of solid waste and clearly discuss various types of collection systems and analyse system dynamics
22CIV823.3	Understand the management concepts, define 4 R approach, apply PPP model and community involvement for effective management of solid waste
22CIV823.4	Develop a concise idea on various conventional and advanced treatment options for solid waste
22CIV823.5	Conceive the design aspects of engineered disposal options and apply the gained knowledge

Textbooks:

1. George Tchobanoglous, Hilary Theisen , Samuel A Vigil, "Integrated Solid Waste Management : Engineering principles and management issues", 2nd edition, M/c Graw hill Education . Indian edition, 1993.
2. Howard S Peavy, Donald R Rowe and George Tchobanoglous, "Environmental Engineering", Tata Mcgraw Hill Publishing Co ltd, 1984.
3. Mantell C.L.,"Solid Waste Management", John Wiley, 1975.

References:

1. Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment – 1357(E) – 08-04-2016
2. Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health and Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India.
3. Handbook of Solid waste management, second edition, George Tchobanoglous, Frank Kreith, published by M/c Graw hill Education, 2002, ISBN-13 978-0071356237 ISBN -10 0071356231

Web Reference:

1. https://onlinecourses.nptel.ac.in/noc23_ce66/preview
2. https://archive.nptel.ac.in/courses/105/103/105103205/
3. https://nptel.ac.in/courses/105103205

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum mark of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV823.1	3	2				1									
22CIV823.2	3	2				1	2								
22CIV823.3	3	2			1	2	1					1			
22CIV823.4	3	2			1	2						1	1		
22CIV823.5	3	2			1	1	2					1			
Average	3	2			1	1.4	1.7					1	1		

SEMESTER – VIII

Course: Deep Foundations

Course Code	**22CIV824**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Foundation Engineering

Course Objectives: Students will be taught:

CLO1	Understand the basics and concepts associated with different types of pile foundations
CLO2	The course enables the students to understand the concepts in the analysis of single pile by static and dynamic analysis
CLO3	Apply the concepts and solve deep foundation problems in different soil conditions using theoretical and field studies
CLO4	The course imparts students to understand the methodology to solve problems of deep foundations subjected to uplift and lateral loads
CLO5	Apply the concepts, analyse and evaluate the design of caisson elements.

Content	**No. of Hours/ RBT levels**
Module-1 **Single pile – Static Analysis:** Introduction, Timber, Concrete, Steel piles, Corrosion of steel piles, Soil properties for static pile capacity, Ultimate bearing capacity of a pile, use of SPT and SCPT data Skin resistance, Static load capacity using Load – transfer, Pile load test – progressive and cyclic, Negative skin friction in piles	**8Hours L2 L3**
Module 2 **Single pile – Dynamic analysis:** Dynamic analysis, Pile driving, rational pile formula, other Dynamic formulae and general considerations. Reliability of dynamic pile driving formulae. The wave equation, pile load tests, Pile driving stresses, General comments on pile driving.	**8Hours L2 L3**
Module 3 **Pile Groups:** Single pile Vs Pile group, Pile group considerations, efficiency of pile groups, stresses on underlying strata from piles, Bearing capacity of a pile group, settlements of pile groups, Negative skin friction, Pile caps..	**8Hours L2 L3**
Module 4	**8Hours**

Tension Piles & Laterally loaded piles: Piles for resisting uplift, Uplift capacity of pile group, Lateral load resistance of a pile group Pile group subjected to eccentric loading, Batter piles under lateral loads, Buckling of fully and partially embedded piles and poles	**L2 L3**
Module 5 **Caissons:** Types of Caissons, Bearing capacity, stress distribution and settlement, Design of drilled caissons elements, forces in drilled Caissons, design of elements of Caissons, Constructional aspects of a drilled caissons, Construction of Caissons, problems associated with installation, advantages and disadvantages of Caisson foundation, Comparison of Caisson types.	**8Hours L2 L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV824.1	Able to understand the basic knowledge deep foundations and evaluate the capacity by different method.
22CIV824.2	Formulations and solutions of engineering problems with respect to single pile and pile groups and extend the approach to solve practical problems
22CIV824.3	Apply and solve engineering problems with respect to laterally loaded piles
22CIV824.4	Analyse and evaluate pile foundations subjected to uplift loads in stratified soil deposits
22CIV824.5	Apply skills to evaluate and develop solutions to engineering problems during the infrastructure developments

Textbooks:

1. Joseph.E. Bowles, "Foundation analysis and Design", McGraw Hill, International edition, 2017.
2. S.P. Brahma, "Foundation Engineering", Tata McGraw Hill publishing company Ltd, New Delhi
3. Purushotham Raj, "Geotechnical Engineering", 1st edition, Tata McGraw Hill publishing company Ltd, New Delhi, 1999
4. Swamy Saran, "Analysis and Design of Substructures", 2nd edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 2018.

References:

1. H.G. Poulos, and E.H.Davis, "Pile Foundation Analysis and Design", John Wiley and Sons,New York, 1980

2. N.P. Kurien, "Design of Foundation Systems: Principles & Practices", 3rd edition,, Alpha Science International Ltd, 2005.
3. Foundation Engineering Hand Book (1990), H. F. Winterkorn and H Y Fang Galgotia Booksource.

Web Reference:

1. https://nptel.ac.in/courses/105105039
2. https://archive.nptel.ac.in/courses/105/105/105105207/
3. https://www.youtube.com/watch?v=ymMSz3qTfJU

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum mark of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV824.1	1	2	3										2		
22CIV824.2		2	3										2	2	
22CIV824.3	1	2	3										2	2	
22CIV824.4	1	2	3										2	2	
22CIV824.5	1	2	3										2	2	
Average	1	2	3										2	2	

SEMESTER – VIII

Course: Advanced Design of Steel Structures

Course Code	**22CIV831**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	Analyze unstrained beams and beam column behavior in frames
CLO2	Design steel beams with web openings and Vierendeel girders.
CLO3	Evaluate the behavior of Light gauge steel members.
CLO4	Design steel structures subjected to fire resistance.

Content	No. of Hours/ RBT levels
Module-1 **Laterally Unrestrained Beams:** Lateral Buckling of Beams, Factors affecting lateral stability, IS 800 code provisions, Design Approach. Lateral buckling strength of Cantilever beams, continuous beams, beams with continuous and discrete lateral restraints, Mono-symmetric and non- uniform beams – Design Examples. Concepts of-Shear Center, Warping, Uniform and Non-Uniform torsion.	**10 Hours L3**
Module 2 **Beam- Columns in Frames:** Behaviour of Short and Long Beam - Columns, Effects of Slenderness Ratio and Axial Force on Modes of Failure, Biaxial bending, Strength of Beam Columns, Sway and Non-Sway Frames, Strength and Stability of rigid jointed frames, Effective Length of Columns-, Methods in IS 800	**10 Hours L3**
Module 3 **Steel Beams with Web Openings**: Shape of the web openings, practical guidelines, and Force distribution and failure patterns. Analysis of beams with perforated thin and thick webs, Design of laterally restrained castellated beams for given sectional properties. Vierendeel girders (design for given analysis results)	**10 Hours L3**
Module 4 **Cold formed steel sections:** Techniques and properties, Advantages, Typical profiles, Stiffened and unstiffened elements, Local buckling effects, effective	**10 Hours L3**

section properties, IS 801& 811 code provisions numerical examples, beam design, column design.	
Module 5 Fire resistance: Fire resistance level, Period of Structural Adequacy, Properties of steel with temperature, Limiting Steel temperature, Protected and unprotected members, Methods of fire protection, Fire resistance Ratings. Numerical Examples	**10 Hours** **L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV831.1	Analyze unrestrained beams and beam column behavior in frames as per IS:800 codal provisions
22CIV831.2	Design steel beams with web openings and Vierendeel girders.
22CIV831.3	Evaluate the behavior of Light gauge steel members.
22CIV831.4	Design steel structures subjected to fire resistance.

Textbooks:

1. N. Subramanian, "Design of Steel Structures", Oxford, IBH.
2. Duggal,S.K. "Design of Steel Structures", 3rd edition, Tata McGraw-Hill, 2017..
3. IS 800: 2007, IS 801-2010 , IS 811-1987 4. BS5950 Part- 8, SP 6 (5)-1980

References:

1. Srinivasan Chandrasekaran, "Advanced Design of Steel Structures", 1st edition, CRC Press-2019.

Web Reference:

INSDAG Teaching Resource Chapter 11 to 20:www.steel-insdag.org

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non-integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). **Some possible AATs:** seminar / assignments / mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum mark of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV831.1	2	2	2		2									3	
22CIV831.2	2	2	2		2									3	
22CIV831.3	2	2	2		2									3	
22CIV831.4	2	2	2		2									3	
Average	**2**	**2**	**2**		**2**									**3**	

SEMESTER – VIII

Course: Pavement Construction, Maintenance & Management

Course Code	**22CIV832**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Transportation Engineering, Pavement design and maintenance.

Course Objectives: Students will be taught:

CLO1	To understand the drainage system for different components of road and pavement structure.
CLO2	To understand characteristics of different types of bituminous layers and design of bituminous surfacing along with safety aspects needed for roads.
CLO3	To understand the characteristics of different types of CC pavements and design of along with safety aspects needed for CC pavements.
CLO4	To understand different equipment's used for preparation of subgrade in cutting or filling and also the preparation steps for base and sub base layers.
CLO5	To understand Components and framework of Pavement Management Systems

Content	**No. of Hours/ RBT levels**
Module-1 Components of road and pavement structure including subgrade, drainage system, functions, requirements and sequence of construction operations. Drainage – Assessment of drainage requirements for the road and design of various components, drainage materials, Construction of surface and subsurface drainage system and design of filter materials for roads. Drainage of urban roads, problems.	**8 Hours L2**
Module 2 Different types of granular base course – WMM, CRM, WBM, specifications, construction method and quality control tests. Different types of bituminous layers for binder and surface courses, their specifications (as per IRC and MORTH), construction method and quality control tests. Special structural courses like stone matrix asphalt and mastic asphalt and construction of porous asphalt.	**8 Hours L2**
Module 3 Different types of sub-base and base course for cement concrete (CC) pavement and construction method. Construction of cement concrete (PQC) pavements and joints, quality control during construction. Construction of special Cement concrete	**8 Hours L2**

pavements like interlocking concrete block pavements (ICBP), Continuously reinforced cement concrete pavements (CRCP), Fiber reinforced cement concrete pavements (FRCP), General Aspects: Quality assurance, statistical approach, quality system for road construction. Safety aspects during road construction and maintenance works. Installation of various traffic safety devices and information system	
Module 4 Road construction equipment – different types of excavators, graders, soil compactors / rollers, pavers and other equipment for construction of different pavement layers – their uses and choice Problem on equipment usage charges. Specifications and steps for the construction of road formation in embankment and cut, construction steps for subgrade (preparation of subgrade) in cutting, filling and at grade. Construction of subgrade in marshy areas and weak / expansive soils and water- logged - areas.	**8 Hours L2**
Module 5 Introduction: Definition - Components of Pavement Management Systems, Essential features. Pavement Management Levels and functions: Ideal PMS-Network and Project levels of PMS-Influence Levels- PMS Functions- Function of Pavement evaluation. Introduction to HDM : Objectives & Principles.	**8 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV832.1	Design the drainage requirements for different components of the road structure and maintenance with suitable remedies.
22CIV832.2	Design bituminous surfacing and other layers along with safety aspects needed during construction.
22CIV832.3	Design CC pavements with appropriate base course thickness and along with safety aspects needed during construction.
22CIV832.4	Select suitable equipment for preparation of subgrade in cutting or filling and also the preparation steps for base and subbase layers.
22CIV832.5	Compute the framework of Pavement Management Systems and pavement evaluation through HDM.

Textbooks:

1. S.K. Khanna, C.E.G. Justo and Veeraraghavan A "Highway Engineering", 10th Edition, Nem Chand & Bros, 2013.

2. Sharma S.C., "Construction Equipment and its Management",5th Edition, Khanna Publishers,2008.
3. Ralph Hass, Ronald Hudson and Zanieswki, "Modern Pavement management"-Krieger Publications.

References:

1. Freddy L Roberts, Prithvi S Kandhal et al, "Hot Mix Asphalt Materials, mixture design and construction"- (2nd Edition), National Asphalt Pavement Association Research and Education Foundation, Maryland, USA.
2. S.K. Khanna, C.E.G. Justo and Veeraraghavan A "Highway Materials Testing"- New Chand &Bros,2013
3. MoRTH 'Specifications for Roads and Bridges Works'- Indian Roads Congress
4. State of art, special report 3 – "compaction of earthwork and subgrade"- IRC, HRB, 1999
5. Highway Hand Book by FAW, Publication from NUS, Singapore.
6. "Guidelines for use of Geotextiles in Road Pavements and Associated works"- 2002, Indian Roads Congress
7. "Soil Mechanics for Road Engineers"- HMSO Publication
8. "Bituminous materials in Road Construction"- HMSO Publication.
9. IS 73, revised 2006, IS 2720, IS 2386, IS 1201 to 1220, IS 8887- 1995, IS 217- 1986.
10. IRC: 51-1992, 63-1976, 74 –1979, 88-1984, "Indian Roads Congress".
11. IRC SP : 53 – 2002, IRC SP: 58 – 2000, "Indian Roads Congress".

Web Reference:

https://onlinecourses.nptel.ac.in/noc22_ce93/preview

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). Some possible AATs: seminar / assignments / miniprojects/

concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern is shown in Table 1.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum mark of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV832.1	3	2												2	
22CIV832.2	3	2												2	
22CIV832.3	3	2												2	
22CIV832.4	3	2												2	
22CIV832.1	3	-												2	
Average	3	2												**2**	

SEMESTER – VIII

Course: Economic Evaluation and DPR

Course Code	**22CIV833**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	Develop and interpret cash flow diagrams and discuss their applications in effective financial management of projects
CLO2	Evaluate the opportunities and pitfalls of alternative engineering investments from an economic point of view by reducing them to a common platform
CLO3	Analyze, interpret and present accounting information in order to assist management in the process of decision making, creation of policy and day to day operation of a project/ organization
CLO4	Derive compound interest factors and their corresponding formulae to determine unknown amounts from known values of varying cash flows
CLO5	Understand the need of a detailed project report.

Content	**No. of Hours/ RBT levels**
Module 1	
Definition and scope of economics, fundamental concepts in business economics. **Basics of Microeconomics**: Demand and supply analysis, elasticity of demand, theory of production, cost analysis, market structure, perfect competition, monopoly, monopolistic competition and oligopoly market. **Basics of Macroeconomics:** National economy, national income accounting, business cycle, monetary policy, fiscal policy, inflation, employment, price indices- wholesale price index- consumer price index. **Economics of Development**: Causes and characteristics of underdevelopment, general theories of development, five - year planning and social development. **The Construction Industry**: Nature, characteristics, size and structure; Role in	**8 Hours L2**

economic development and employment generation, input industries, clients, contractors, consultants and workers and their organizations; Economics of ecology and environment, local material selection, form and functional designs. **Economics of Infrastructure in India:** Roads and buildings, transportation and communications, irrigation and power, ports and aviation, health and education services; Economics of Civil and Social infrastructure, building service, facilities and services, urban infrastructure in India, Issues in developing, funding and managing infrastructure; International and national constraints and incentives, unique features of this business and their impact on savings, investments and other economic phenomena; Support matters of economy as related to top Engineering, choice of technology, quality control and quality production, audit in economic law of returns.	
Module 2 **Types of finance-** long term and short-term finance, leasing, equity financing, internal generation of funds, external commercial borrowings, assistance from government budgeting support, international finance corporations, investment financing decision, financial control, job control and centralized management. **Funds management-** working capital management, inventory valuation, mortgage financing, international finance management, foreign currency management, budgeting and budgetary control, performance budgeting	**8 Hours L2**
Module 3 **Time value of money:** Nominal and effective interest, formulation of interest computation, single payment, equal payments and unequal payments, cash flow analysis. **Comparing the Alternatives:** Present worth comparison, future worth comparison, annual cost and return method, rate of return method, incremental rate of return, discounted cash flow, net present value, profitability index, ratio analysis, replacement analysis, break-even analysis.	**8 Hours L2**
Module 4 **Evaluating** Alternative Investments: Real estate, work pricing, contract bidding and award, revision due to unforeseen causes, depreciation and amortization, taxation and inflation, escalation, risks and uncertainties and management decision in capital budgeting, turnkey activities, project appraisal and project yield **Management Accounting:** Basic financial and accounting concepts and methods, the company as an economic unit, project as a profit center; Basic concepts:- capital and revenue, financial accounting, cost accounting, management accounting; Accounting process: General Accepted Accounting Principles, double entry system, ten point Programme in book keeping; Journal, ledger, cash book, trial balance, final balance, depreciation accounting provisions and reserves; Preparation of profit	**8 Hours L2**

and loss account, balance sheet, income statement, cash flow and fund flow statements.	
Module 5 **Budget:** Types of budgets, procedure for master budget, budgetary control system, budget as a system of management control and corporate growth; Balance sheet reading, understanding health of an enterprise by study of its balance sheet; Interpretation of financial statements, balance sheet, Profit and Loss account, balance sheet as a valuation statement. **Lending to Contractors:** Loans to contractors, interim construction financing, security and risk aspects. **Detailed Project Report: Need and significance of project report,** Contents of DPR, Project Formulation, Case Study of sample DPR.	**8 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV833.1	Discuss the basics of Micro and macroeconomics in the economic development of a country
22CIV833.2	Understand types of funds associated with finance management.
22CIV833.3	Compare the various alternatives and selection criteria.
22CIV833.4	Understand different accounting in finance management
22CIV833.5	Formulate detailed project report.

Textbooks:

1. D.M.Mithani, " Managerial Economics, Himalaya Publishing House, 7th edition, 2013.
2. R.Winfrey, "Economic Analysis for Highway", International Textbook Co., Pennsylvania. USA,1969

References:

1. IRC– 30, Manual on Economic Evaluation of Highways In India.
2. Fair and Williams, Economics of Transportation, Harper and Brothers, Publishers, New York, 1959.
3. G.Harrl Clell, A Manual for the Economic Appraisal of Transport Projects, World.Bank Report, Washington D.C.1980.

Web References:

https://especia.co.in/post/what-is-dpr/
https://hppwd.hp.gov.in/sites/default/files/documents/ES.PDF

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). Some possible AATs: seminar / assignments / miniprojects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern is shown in Table 1.

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	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum mark of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV833.1	1														
22CIV833.2	1														
22CIV833.3	1														
22CIV833.4	1													1	
22CIV833.5	1													1	
Average	**1**													**1**	

SEMESTER – VIII

Course: Geo-Environmental Engineering

Course Code	**22CIV834**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Environmental Engineering, Geotechnical Engineering

Course Objectives: Students will be taught:

CLO1	The importance Geo-environmental Engineering
CLO2	Understand the environmental Concerns with waste management strategies.
CLO3	Understand phenomena of Contaminant Transport in landfill site.
CLO4	The objectives and methods of site Remediation,

Content	No. of Hours/ RBT levels
Module 1 **Sources and Site Characterization**: Scope of Geo-environmental Engineering, Various Sources of Contaminations, Need for contaminated site characterization; and Characterization methods.	**8Hours L2**
Module 2 Solid and Hazardous Waste Management: Classification of waste, Characterization solid wastes, Environmental Concerns with waste, waste management strategies.	**8Hours L2**
Module 3 **Contaminant Transport:** Transport process, Mass-transfer process, Modeling, Bioremediation, Phytoremediation.	**8Hours L2**
Module 4 **Remediation Techniques**: Objectives of site remediation, various active and passive methods, remediation NAPL sites, Emerging Remediation Technologies.	**8Hours L2**
Module 5 **Landfills:** Types of landfills, Site Selection, Waste Containment Liners, Leachate collection system, Cover system, Gas collection system.	**8Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIV834.1	Identify various Sources of Contaminations.
22CIV834.2	Describe the Characterization solid wastes with respect to waste management strategies.
22CIV834.3	Understand the contaminant transport process like Bioremediation, Phytoremediation.
22CIV834.4	Identify various active and passive methods of Remediation Techniques.
22CIV834.5	Understand the concept of Landfills.

Textbooks:

1. Phillip B. Bedient, Refai, H. S. & Newell C. J, "Ground Water Contamination" - Prentice Hall Publications, 4th Edition, 2008.
2. Sharma, H. D. and Reddy, K. R, "Geoenvironmental Engineering", John Wiley & Sons, 2004.
3. Rowe, R. K, "Geotechnical & Geoenvironmental Engineering Handbook", Kluwer Academic, 2001.

References:

1. Reddi, L. N. and Inyang, H. I. - Geoenvironmental Engineering Principles and Applications, Marcel. Dekker, Inc., New York, 2000.
2. LaGrega, M. D., Buckingham, P. L. and Evans, J. C. - Hazardous Waste Management, New York: McGraw-Hill, 2001.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 30 marks each for integrated and 40 marks for non integrated subjects. Average of three test marks will be added to test component and laboratory assessment to be finalized for 10 marks for integrated subjects. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs). Some possible AATs: seminar / assignments / miniprojects/

concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern is shown in Table 1.

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Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz/AAT	05	
	Quiz/AAT	05	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**

Eligibility requirements: Students to secure a minimum of40% of the marks in both the CIE for theory and lab courses (i.e. A minimum mark of 12 out of 30 in theory and 8 out 20 in the Lab) Students not scoring the minimum as stipulated above both in theory and laboratory would be termed as NSSR for that course and be awarded a grade of "NE" for that course alone.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIV834.1	2	1	2							1					
22CIV834.2	2	1	2				1			1					
22CIV834.3	2	1	2							1					
22CIV834.4	2	1	2	1						1					
22CIV834.5	2	1	2							1					
Average	2	1	2	1			1			1					

SEMESTER – VIII

Course: Project work Phase -II

Course Code	**22CIV84**	**CIE Marks**	**100**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**100**
No. of Credits	**8**	**Examination Hours**	**3**

Course Learning Objective (CLOs): Project work Phase-II is carried out under the guidance of a faculty. In this course, the students will analyze the data collected, interpret the results, draw conclusions, design project components, evaluate/ assess the project and redesign if necessary, following relevant codes/ standards of practice, if applicable. The evaluation will be carried out through presentation and viva-voce.

Major project phase-2 is the continuation from phase –I. The same project team formed for phase –I will continue the work under the guidance of the same faculty member. A committee consisting of minimum 3 faculty members of which guide is a member shall evaluate at the end for CIE. There is a viva voce examination which shall be examined by two examiners one internal and one external to the college appointed by COE based on the suggestions by the respective HOD.

SEMESTER – VIII

Course: Technical Seminar

Course Code	22CIVS85	CIE Marks	100
Hours/Week (L: T: P)	0:0:1	SEE Marks	-
No. of Credits	1	Examination Hours	3

The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion, and present and exchange ideas. Each student, under the guidance of a faculty, is required to choose, preferably, a recent topic of his/her interest relevant to the course of specialization.

Carryout literature survey; organize the Course topics in a systematic order.

1) Conduct literature survey in the domain area to find appropriate topic.
2) Prepare the synopsis report with own sentences in a standard format.
3) Learn to use MS word, MS power point, MS equation and Drawing tools or any such facilities in the preparation of report and presentation.
4) Present the seminar topic orally and/or through power point slides.
5) Communicate effectively to answer the queries and involve in debate/discussion.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation Procedure:

1) As per COE guidelines.
2) The Internal Assessment marks for the seminar shall be awarded based on the relevance of the seminar topic, quality of the report, presentation skills, participation in the question and answer, and attendance in the seminar classes/sessions.

SEMESTER – VIII

Course: Internship

Course Code	22INT86	CIE Marks	100
Hours/Week (L: T: P)	0:0:2	SEE Marks	-
No. of Credits	2	Examination Hours	3

Purpose to provide practical exposure in civil engineering related organizations instructional objectives.

1. Students have to undergo four-week practical training in Civil Engineering related organizations so that they become aware of the practical applications of theoretical concepts studied in the classrooms.
2. Students have to undergo four-week practical training in Civil Engineering related organizations of their choice but with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.

   Assessment process

   This course is mandatory, and a student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

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