SCHEME AND SYLLABUS

Department of Civil Engineering

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

III - IV Semester Scheme (2023-24)

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- 2023 batch (3rd to 4th Semester)

III SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	MAT23301B	Complex Variables, Probability and Sampling Techniques	BS	MAT	2	2	0	50	50	100	3
2	CIV23302	Mechanics of Solids	PC	Civil	2	2	0	50	50	100	3
3	CIV23303	Mechanics of Fluids	PC		2	2	0	50	50	100	3
4	CIV23304	Building Materials and Concrete Technology	PC		3	0	0	50	50	100	3
5	CIV23305X	Engineering Science Course	ESC		3	0	0	50	50	100	3
6	SCK23306	Social Connect and Responsibility	Any Department		0	0	2	100	---	100	1
7	CIV23307X	Ability Enhancement Course	AEC		1	0	2	50	50	100	2
8	NSK23308	National Service Scheme (NSS)	MC	NSS coordinator	0	0	2	100	---	100	0
	PEK23308	Physical Education (PE) (Sports and Athletics)		Physical Education Director							
	YOK23308	Yoga		Yoga Teacher							
9	CIVL23309	Mechanics of Fluids Laboratory	Laboratory	Civil	0	0	2	50	50	100	1
10	CIVL23310	Material testing and Concrete Laboratory	Laboratory	Civil	0	0	2	50	50	100	1
								600	**400**	**1000**	**20**

Engineering Science Course (ESC/ETC/PLC)			
CIV23305A	Rural, Urban Planning and Architecture	CIV23305C	Sustainable Design Concept for Building Services
CIV23305B	Geospatial Techniques in Practice	CIV23305D	Fire Safety in Buildings
CIV23305E	Engineering Geology & practice		
Ability Enhancement Course – I			
CIV23307A	Data analytics with Excel	CIV23307C	Problem Solving with PYTHON
CIV23307B	Smart Urban Infrastructure	CIV23307D	Personality Development for Civil Engineers
CIV23307E	Planning and Designing of Building		

IV SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	MAT23401B	Transform Calculus and Numerical Techniques	BS	MAT	2	2	0	50	50	100	3
2	CIV23402	Engineering Survey	PC	Civil	2	2	0	50	50	100	3
3	CIV23403	Environmental Engineering	PC		3	0	0	50	50	100	3
4	CIV23404	Structural Analysis	PC		2	2	0	50	50	100	3
5	CIV23405X	Engineering Science Course	ESC		3	0	0	50	50	100	3
6	CIV23406X	Ability Enhancement Course	AEC		2	0	2	50	50	100	3
7	NSK23407	National Service Scheme (NSS)	MC	NSS coordinator	0	0	2	100	---	100	0
	PEK23407	Physical Education (PE) (Sports and Athletics)		Physical Education Director							
	YOK23407	Yoga		Yoga Teacher							
8	CIVL23408	Engineering Survey Laboratory	Lab	Civil	0	0	2	50	50	100	1
9	CIVL23409	Environmental Engineering Laboratory	Lab	Civil	0	0	2	50	50	100	1
								500	**400**	**900**	**20**

Engineering Science Course (ESC/ETC/PLC)			
CIV23405A	Building Information Modelling in Civil Engineering – Basics	CIV23405C	Electronic Waste Management - Issues and Challenges
CIV23405B	GIS with Quantum GIS	CIV23405D	Technical Writing Skills
CIV23405E	Fundamental approach to Sustainable Development		
Ability Enhancement Course – II			
CIV23406A	Finance for Professionals	CIV23406C	Concreting Techniques & Practices
CIV23406B	Construction Equipment, Plants and Machinery	CIV23406D	Watershed Management
CIV23406E	Design Studio		

Semester: III

Course: Complex Variables, Probability and Sampling Techniques

Course Code	**MAT23301B**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**03**	**Examination Hours**	**03**

Prerequisites: -

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.	**08 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.	**08 Hours L2, L3**
Module 3 Probability, Conditional probability, Bayes theorem. Discrete and continuous random variables, Binomial, Poisson, Uniform, Exponential, Normal distributions.	**08 Hours L2, L3**
Module 4 Joint probability of two discrete random variables, Marginal distributions, Expectation and Covariance. Stochastic processes, probability vector, stochastic matrices, regular stochastic matrices, Markov chains.	**08 Hours L2, L3**
Module 5 Karl Pearson coefficient of correlation. 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.	**08 Hours L2, L3**

COURSE OUTCOMES:

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

MAT23301B.1	• Apply Cauchy Riemann equations in Cartesian as well as in polar coordinates to study properties of analytic functions • Apply the Milne-Thomson method to construct analytic functions
MAT23301B.2	• Define conformal and bilinear transformation and discuss their properties • Apply Cauchy's theorem and Cauchy's integral formula to solve problems in complex analysis Apply the residue theorem to evaluate complex line integrals
MAT23301B.3	• Describe the properties and characteristics of random variables, including their probability distributions, probability mass/density functions, and cumulative distribution functions. Solve problems using binomial, Poisson, exponential and normal distributions
MAT23301B.4	• Compute joint probabilities, marginal probabilities, and expectations and covariance using joint distributions. • Describe the key characteristics and properties of stochastic processes, including their state space, time parameter, and the role of probability. • Define and work with stochastic matrices, which represent transition probabilities between states. Compute and interpret transition probabilities in Markov chains.
MAT23301B.5	• Determine the appropriate test statistic (z-test or t-test), Conduct hypothesis tests for population means and proportions, and interpret the results. Conduct chi-square tests of goodness of fit and interpret the results

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

Reference books:

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.

Web Reference:

B.E. 2023-24 Syllabus (III – IV Sem)

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 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **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**

Semester: III

Course: Mechanics of Solids

Course Code	**CIV23302**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**03**	**Examination Hours**	**03**

Prerequisites: Engineering Mechanics

Course Objectives: Students will be taught to

CLO1	Understand the Fundamental principles of stress and strain for various materials and strength of structural components.
CLO2	Understand the concept of development of internal forces and resistance mechanism for one dimensional and two- dimensional structural elements.
CLO3	Analyse different internal forces and stresses induced due to representative loads on structural elements
CLO4	Determine slope and deflections of beams.
CLO5	Evaluate the behaviour 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 subjected to both internal and external pressure; Lame's equation, radial and hoop stress distribution.	**10 Hours L2, L3**
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:

CIV23302.1	**Describe** the concepts of the stresses and strains for different materials.
CIV23302.2	**Determine** two- and three-dimensional stress system at a point.
CIV23302.3	**Compute** shear force and bending moment of statically determinate beams and shafts.
CIV23302.4	**Compute** slopes, deflections in determinate beams using double integration method and Macaulay's method.
CIV23302.5	**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 1998 pearson publisher
2. Popov, "Mechanics of Materials 'second edition pearson Education India,2015

Reference books:

1. J.Gere & Timeshenko , Mechanics of Materials, 2nd edition, 2004, CBS, ISBN-13 : 978-8123908946
2. S.Timshenko- D, Strength of Materials, 3rd edition, 2002, VAN NOSTRAND Company- PHI Publishers, ISBN-13 : 978-8123910772
3. U.C.Jindal S,"Strength of Materials "2nd edition 2017,Pearson Publications

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):

Two Tests are to be conducted for 40 marks each. Average of two test marks will be added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and two tests. **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 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
CIV23302.1	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CIV23302.2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CIV23302.3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CIV23302.4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CIV23302.5	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

SEMESTER – III

Course: Mechanics of Fluids

Course Code	**CIV23303**	**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 to:

CLO1	Understand the Fundamental properties of fluids and their applications.
CLO2	Understand Hydrostatic laws and its practical applications.
CLO3	Understand the Principles of Kinematics and Hydrodynamics for practical applications
CLO4	Understand the Basic design of pipes and pipe networks considering flow, pressure and its losses.
CLO5	Design of open channels of various cross sections including economical sections.
CLO6	Energy concepts of fluid in open channel, Energy dissipation, Water surface profiles at different conditions.

Content	**No. of Hours/ RBT levels**
Module-1 **Basics:** Introduction, types of fluid, - viscosity, surface tension, capillarity, vapor pressure & cavitation, Numerical problems. (No derivations). **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.	**8 Hours L2, L3**
Module-2 **Hydrostatic forces on Surfaces:** Definition, Total pressure, Centre of pressure, total pressure on horizontal, vertical, and inclined plane surface, water pressure on gravity dams, Lock gates. Numerical Problems. **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.	**8 Hours L2, L3**

Module-3 **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. **Applications:** Introduction. Venturi meter, Orifice meter, Pitot tube (no derivation). Numerical Problems.	**8 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).	**8 Hours** **L2, L3**
Module-5 **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).	**8 Hours** **L2, L3**

COURSE OUTCOMES:

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

CIV23303.1	Possess a sound knowledge of fundamental properties of fluids and fluid Continuum.
CIV23303.2	Solve problems on hydrostatics, including practical applications
CIV23303.3	Apply principles of mathematics to represent kinematic concepts related to fluid flow.
CIV23303.4	Apply fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications.
CIV23303.5	Compute discharge through orifices, notches and weirs

Textbooks:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi ISBN-13:978-81-89401-26-9
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi
3. K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co. Ltd

Reference books:

1. Victor L Streeter, Benjamin Wylie E and Keith W Bedford, "Fluid Mechanics", Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008(Ed)
2. K Subramanya, "Fluid Mechanics and Hydraulic Machines-problems and solutions", 2nd editionTata McGraw Hill Publishing Co. Ltd.
3. J. F. Douglas, J. M. Gasoriek, John Swaffield, Lynne Jack, "Fluid Mechanics", Pearson, Fifth Edition,2005.

Web Reference:

1. https://searchworks.stanford.edu/view/10496310
2. https://searchworks.stanford.edu/view/13576277
3. 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 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):

Two Tests are to be conducted for 40 marks each. Average of two test marks will be added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and two tests. **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	
	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 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CIV23303.1	3	2	-	-	-	1	1	1	-	-	-	-	2	2	-
CIV23303.2	3	2	-	-	-	1	1	1	-	-	-	-	2	2	-
CIV23303.3	3	2	-	-	-	1	1	1	-	-	-	-	2	2	-
CIV23303.4	3	2	-	-	-	1	1	1	-	-	-	-	2	2	-
CIV23303.5	3	2	-	-	-	1	1	1	-	-	-	-	2	2	-
Average	**3**	**2**	**-**	**-**	**-**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

SEMESTER – III

Course: Building Materials and Concrete Technology

Course Code	**CIV23304**	**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.	**12 hours L1, L2**
Module 2 **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. Creep –factors affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. **Durability:** Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing	**10 hours L1,L2**

and thawing.	
Module 3 **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**
Module 4 **Foundations And Building Components:** **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. **Building Components:** Types of masonry, English and Flemish bonds, rubble and ashlars masonry, types of walls. Lintels; arches; pitched, flat and curved roofs, lean-to roof, coupled roofs, trussed roofs, king and queen post trusses; RCC roofs	**6 hours L1, L2**
Module 5 **Doors, Windows and Ventilators:** Materials for Doors, Windows and Ventilators, size as per IS recommendations. **Formwork:** Introduction to form work, scaffolding, shoring, under pinning. **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.	**4 hours L1, L2**

COURSE OUTCOMES:

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

CIV23304.1	Understand properties of Cement, fine aggregate, coarse aggregates and hydration properties of cement
CIV23304.2	Distinguish concrete behavior based on its fresh and hardened properties.
CIV23304.3	Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.
CIV23304.4	Understand various types of Bricks, masonry foundations, lintels and arches
CIV23304.5	Exhibit the knowledge of building finishes and form work requirements.

Textbooks:

1. M.S. Shetty, Concrete Technology - Theory and Practice 8th edition Published by S. Chand and Company, New Delhi, 2019
2. Dr. B. C. Punmia, Ashok kumar Jain, Arun Kumar Jain, "Building Construction ,Eleventh edition,2017 Laxmi Publications (P) ltd., New Delhi.
3. A.M Nevelli,"Properties of Concrete",5th Edition prentice Hall publishers by S.Chand and

Company,New Delhi,2019

Reference books:

1. Engineering Materials 43rd Edition 2019 by S C Rangwala
2. Concrete Technology: Theory and Practice, M.L. Gambhir, Tata Mc Graw Hill Publishers, 2017, 5th Edition.
3. Sushil Kumar "Building Materials and construction", 20th edition, reprint 2015, Standard Publishers
4. Duggal S.K, "Building Materials*", 5th edition, New Age International Pvt. Lid. 2019.

Web Reference:

1. http://nptel.ac.in
2. https://www.youtube.com/watch?v=nMIl3krK-GI
3. https://www.youtube.com/watch?v=6OAHO9zgeXM

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
CIV23304.1	3														
CIV23304.2	3														
CIV23304.3	3													1	
CIV23304.4	3														
CIV23304.5	3														
Average	3													**1**	

SEMESTER – III

Course: Rural, Urban Planning and Architecture

Course Code	**CIV23305A**	**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 make the student understand about the past and present architecture of different parts of the world
CLO2	Rural and urban planning and growth and circulation of patterns and effect of increase in urbanization
CLO3	The basic planning required for urban and rural centres with respect to physical and social aspects
CLO4	Students to visit the different place of architecture monuments to understand the concept different types of architecture and planning

Content	**No. of Hours/ RBT levels**
Module-1 Introduction: Aim and importance of Architecture, Architecture as a fine art. Role of an architect and an engineer. Essential principles and qualities of architecture with examples Factors of architecture: Mass, Form, Colour, Solids, and Voids, Uniformity, Balance and Symmetry, Painting with examples.	**12 hours, L2**
Module 2 Architectural influence of the following: Association, Tradition, Climate, Materials, Topography, Religion social customs and aspiration of time. Architectural characteristics of the following architecture with examples. 1. Egyptian, 2. Greek, 3. Roman, 4. Buddhist, 5. Hindu, 6. Jain, 7. Chalukyan, 8. Modern architecture Factors that have influence present day Modern Architecture, Aesthetic difference between the past and present Architecture. Students are advised for a technical tour related Architecture and town planning to gain additional knowledge in this subject	**10 hours L2**
Module 3 Human settlements, Rural and urban pattern of growth, Factors that promote growth and development of Rural and urban areas Ancient Town Planning in India: Principles of town planning and circulation pattern with examples	**8 hours L2,L3**
Module 4 Industrialisation: Impact on town planning, Urbanisation causes, its effect on town and cities, remedial measures both in urban and rural planning Circulation pattern in cities: Urban roads and streets, their fuctional classification, traffic survey data and its use in town planning	**6 hours L1, L2**

Contemporary objectives and methods of planning of town: Development plans for cities, objectives and stages involved in their preparation and implementation, space standards for planning.	

COURSE OUTCOMES:

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

CIV23305A.1	Understand importance of architecture in rural and urban planning
CIV23305A.2	Understand Influence of architecture
CIV23305A.3	Design infrastructure for rural and urban region
CIV23305A.4	Plan and design rural and urban roads

Textbooks:

1. History of Architecture – Fletcher
2. Urban pattern – Galliaon
3. Urbanization and Urban Syatems in India, Ramachandran R, Oxford University Press, New Delhi.

Reference books:

1. Town planning – Rangwala, Charothar Publication
2. Principle of town and country planning – Lewis Keeble
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 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
CIV23305A.1	3														
CIV23305A.2	3														
CIV23305A.3	3													1	
CIV23305A.4	3														
Average	3													**1**	

SEMESTER – III

Course: Geospatial Techniques in Practice

Course Code	**CIV23305B**	**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	Introduce the concept of various geospatial technologies used in the industry
CLO2	Help to acquire basic idea about the processing and mapping with modern surveying equipment.
CLO3	Elaborate proven concepts, business practices and applications of geospatial technology
CLO4	Explain learners understand how geospatial concepts are leveraged in handling real world business challenges of engineering and construction industry.

Content	**No. of Hours/ RBT levels**
Module-1 Need of Geospatial technology in Industry: Geospatial in Day to Day Life, Spatial thinking, Evolution of location technology and importance of geography and maps. Need for spatial information, Terminologies, logic, language and formats of spatial technology. Location perspective of construction industry, Overview of Geospatial technology in tenders, Design and execution and Construction lifecycle management. Fundamentals and components of Geospatial Engineering, Surveying and Conventional survey equipment Vs Modern surveying equipment Components. Digital Land Surveying Needs.	**12 hours** **L1, L2**
Module 2 Total Station and Global Navigation Satellite System (GNSS): Basics of Surveying, Introduction to Survey and Mapping, Geospatial Surveying Equipment, Demo of Total Station Equipment, Setting out and mapping, Advanced geospatial solutions, GNSS Overview of components, working and signal structure of Global navigation System.	**10 hours** **L1,L2**
Module 3 Geospatial Engineering and technology: Remote Sensing Technologies, Types of remote sensing, Sensors and its types, Application of sensors & platforms, Image Acquisition, Applications of Remote Sensing. 3D scanning, Principles and the science behind photogrammetry, LiDAR, RADAR and SONAR. Introduction to Platforms and working.	**8 hours** **L2,L3**

Module 4 Geographical Information System: Basics of GIS, Vector & Raster data models, Types and components of a Map. Hardware for GIS, DEM and TIN Data products, Attribute Data Types. Basic GIS data conversions, conversions from non-spatial formats to spatial formats. Demo of Conversion of Excel to GIS, Demo of Conversion of CAD TO GIS, Demo of Downloading and Geo-referencing Topo sheets and Raster files.	**6 hours L1, L2**
Module 5 Applications and Future trends of Geospatial Technologies: Application of GIS - Spatial Analysis, Catchment Area delineation, Overlay Analysis, Cluster Analysis, Hotspot Analysis and View shed Analysis. Future Trends of Geospatial Technologies. Case Study 1 -Benefit Realization - Case Study 2 Advancements in Modern Survey & Mapping Technologies, Advancements in Spatial Analytics – Geo Intelligence, Future Trends, Geospatial Technology - Way Forward.	**6 hours L1, L2**

COURSE OUTCOMES:

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

CIV23305B.1	Comprehend different geospatial techniques in the Construction Industry.
CIV23305B.2	Understand the application of geospatial equipment like Total Station, GNSS, LIDAR, UAV (Drones), etc.,
CIV23305B.3	Evaluate the various spatial analysis operations by using GIS Environment
CIV23305B.4	Create a map layout with all essential cartographic elements in GIS Environment.
CIV23305B.5	Illustrate the various geospatial emerging trends of GIS in Industry

Textbooks:

1. T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2010, 24th edition.
2. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, McGraw Hill 2001

Reference books:

1. Satheesh Gopi, R. Sathikumar, N. Madhu, — Advanced Surveying, Total Station GPS and Remote Sensing — Pearson education, 2nd Edition,2017
2. George Joseph and C. Jeganathan, Fundamentals of Remote Sensing, Third Edition Universities Press (India) Private limited, Hyderabad, 2018
3. M. Anij Reddy. Textbook of Remote Sensing and Geographical Information systems. BS Publications, 2012.

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
CIV23305B.1	3														
CIV23305B.2	3														
CIV23305B.3	3													1	
CIV23305B.4	3														
CIV23305B.5															
Average	3													**1**	

SEMESTER – III

Course: Sustainable Design Concept for Building Services

Course Code	**CIV23305C**	**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 facilitate learners to understand sustainable building designs and its parameters such as energy and water efficiency, Comfort in buildings, and waste management.
CLO2	To expose the learners to shading systems, thermal and visual comfort.
CLO3	To impart fundamental knowledge on Life cycle assessment and Green ratings and certifications.

Content	**No. of Hours / RBT levels**
Module-1 Introduction to Sustainability and Climatology: Overview of Sustainability – Global energy scenario, carbon footprint and climate action, Net zero in carbon offsetting, Water neutral, Sustainable construction and resource management. Green buildings - Selection of site – preservation and planning, Influence of climate on buildings, Basics of climatology, Earth – Sun relationship, Solar angles and sun path diagram, Design of shading systems.	**12 hours L** **L2**
Module 2 Comfort in Buildings: Thermal comfort – Basics of Thermodynamics, Convection/radiation heat transfer, Heat gain through various elements of a building, Thermal comfort models and case studies Acoustics – Building acoustics, measures, defects and prevention of sound transmission Indoor Air Quality – Effects, design consideration and integrated approach for IAQ management Visual comfort – Enhancement strategies for Daylighting and Artificial	**10 hours** **L1,L2**
Module 3 Energy, water efficiency and waste management in buildings: Energy efficiency – Energy efficiency in building envelope and energy efficient HVAC and Lighting as per Energy conservation building code (ECBC) 2017, Energy simulation, Energy management system – Renewable energy and Energy Audit. Water Efficiency – Planning and design of water management system, Rain water harvesting, Water efficient design and fixtures, Treatment and	**8 hours** **L2,L3**

reuse and Water efficient landscape system. Waste management – Types of waste and its treatment methods, Construction and demolition waste management, Waste management in residential, commercial buildings, healthcare facilities.	
Module 4 Life Cycle Assessment of Buildings and Green project management: Materials – Green product certifications, features of sustainable building materials and sustainable alternatives for structural, envelope and finishing materials. Low carbon cement, Zero emission bricks and lean construction practices. Life cycle assessment and its types – Modelling and Analysis, Greenhouse gas emission. Different phases of Green building project management.	**6 hours** **L1, L2**
Module 5 Sustainable rating systems: Green building rating systems- LEED, BREEAM and others, Indian Green building rating systems – IGBC & GRIHA. IGBC criteria for certification -site selection credits, pre-design credits, detailed design credits, pre-construction credits, construction credits, post construction credits.	**6 hours** **L1, L2**

COURSE OUTCOMES:

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

CIV23305C.1	Comprehend sustainable design, climatology, shading system and analyze heat transfer mechanism in buildings.
CIV23305C.2	Assess the design considerations and parameters for thermal comfort, visual comfort, indoor air quality and acoustics.
CIV23305C.3	Develop solutions for energy efficiency, water efficiency and waste management in buildings
CIV23305C.4	Adopt green project management methodology and evaluate building life cycle assessment.
CIV23305C.5	Implement green practices during construction and operation phase of the buildings for achieving green rating.

Textbooks:

1. HarharaIyer G, Green Building Fundamentals, Notion Press
2. Dr. Adv. HarshulSavla, Green Building: Principles & Practices
3. IGBC Green new building rating system - version 3.0 - Abridged reference guide

Reference books:

1. The Sustainable Habitat Handbook (6 Volume Set), GRIHA Version 2019
2. National Building Code – 2016, Volume 1&2, Bureau of Indian Standards

3. Energy Conservation Building Code – 2017 (with amendments up to 2020), Bureau of Energy Efficiency

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
CIV23305C.1	3														
CIV23305C.2	3														
CIV23305C.3	3													1	
CIV23305C.4	3														
CIV23305C.5															

Average	3													**1**	

SEMESTER – III

Course: Fire Safety in Buildings

Course Code	**CIV23305D**	**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 understand the importance fire safety
CLO2	To learn various techniques involved in fire safety
CLO3	To design fire resistant buildings using proper materials and methods

Content	**No. of Hours/ RBT levels**
Module-1 Fire: Introduction, Basic concepts of fire protection, Fire as a process of combustion, planning for fire protection, fire resistance Ventilation and fuel controlled fire, process of combustion: flashover condition, effect of fire on construction material, design of fire resistance steel structure, concrete structure	**12 hours L1, L2**
Module 2 Fire safety: urban planning, escape and refuge, internal planning, detection and suppression Introduction to lift design, design of lift system, expected stop and floor of reversal, different cases, simulation, arrangements and escalators	**10 hours L1,L2**
Module 3 Introduction to flow system: water supply, constant demand, variable demand and diversity factor, control systems Flow in pipe networks and fixture units, design of water supply distribution system, flow in waste water pipes	**8 hours L2,L3**
Module 4 Introduction to HVAC: governing equations to HVAC process, numerical problem on HVAC system, psychometric chart, equation based approach Electrical systems: design of electrical systems, intelligent building, life cycle cost and basics of building maintenance, stages of maintenance management, planning for building maintenance, periodicity of maintenance management, estimation of repair cycle, cost profile of maintenance, lamp replacement, building inspection, planned and Ad-hoc maintenance	**6 hours L1, L2**

Module 5	
Condition survey and health evaluation of buildings, diagnosis of building by visual survey, case studies of visual survey, effect of corrosion and alkali aggregate reaction, sampling and choice of test location Non-destructive testing, core strength test, carbonation and chloride measurement, electrical method of progress measurement Repair, rehabilitation, retrofit, periodicity and economics of condition survey, interpretation of test results	**6 hours** **L1, L2**

COURSE OUTCOMES:

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

CIV23305D.1	Understand types of fire, combustion process and fire resistance
CIV23305D.2	Plan for fire safety and design of lifts
CIV23305D.3	Design flow network in buildings
CIV23305D.4	Design of electrical systems and maintenance
CIV23305D.5	Perform health evaluation of buildings and suggest remedies

Textbooks:

1. J A Purkiss, Fire Safety Engineering: Design of Structures, ISBN 13 978-8131220085, Elsevier, 2009
2. V K Jain, Fire Safety in Buildings, ISBN-13 978-938980219, New Age International Private Limited; Third edition, 2020
3. Fire protection, services and maintenance management of building, NPTEL video lecture, IIT, Delhi

Reference books:

1. Bureau of Indian Standards, " HAND BOOK OF FUNCTIONAL REQUIREMENTS OF BUILDINGS, (SP-41 & SP-32)", BIS 1987 and 1989
2. Croome,J.D .& Roberts,B.M.,"AIR CONDITIONING AND VENTILATION OF BUILDINGS, VOL-1".Pergamon press.

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
CIV23305D.1	3														
CIV23305D.2	3														
CIV23305D.3	3													1	
CIV23305D.4	3														
CIV23305D.5															
Average	3													**1**	

SEMESTER – III

Course: Engineering Geology and Practice

Course Code	**CIV23305E**	**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	To identify the minerals & and their Physical properties, composition & uses.
CLO2	To understand the Engineering Properties of Rocks & uses in construction industry.
CLO3	To understand the Distribution of rocks in geo-tectonic setup, seismic zones and natural hazards.
CLO4	To understand the earth's interior and landform by exogene and endogene agents.
CLO5	To understand the applications of Remote Sensing and Geographic Information Systems in Civil Engineering.

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.	**7 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.	**5 Hours L3**
Module 3 **Structures in rocks –** Stress, Strain and deformation, Dip, and strike of rocks– Numerical problems. 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, electricalresistivity investigations and geophysical techniques -electrical, seismic and GPR. Ground improvement techniques in the problematic area - Rock bolting, Rock Jointing, Grouting.	**6 Hours L2**
Module 4 **Geodynamics and natural hazards:** Geodynamics, Plate tectonics, Earthquake - types, causes, seismic zones of India and Earthquake resistant structures, Tsunamis – causes, impacts. Volcano types and causes, Impacts, Landslides- cause, types, preventive measures. Tsunami warning system.	**6 Hours L3**
Module 5 **Mapping techniques: +5** Types of Maps, Topo sheets 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.	**4 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:

CIV23305E.1	**Comprehend** the relations between minerals and rocks based on their respective physical properties
CIV23305E.2	**Understand** the weathering extent and its effect on civil engineering structures
CIV23305E.3	**Differentiate** geological investigations necessary for the construction of dams, bridges, and tunnels
CIV23305E.4	**Explain** the phenomena of the earth based on exogenous and endogenous Processes.
CIV23305E.5	**Understand** the applications of Remote Sensing and Geographic Information Systems in Civil Engineering.

Textbooks:

1. Engineering Geology, by Parthasarathy et al, Wiley, 1st Edition, 2013
2. Engineering Geology by Chenna Kesavulu, Macmillan Publishers India, 1993, ISBN-10: 0333927079
3. S.K. Garg, "Physical and Engincering Geology", 7* edition, Khama publishers, 2012.

References:

1. Engineering Geology and Rock Mechanics B. P. Verma,4th edition, Khanna publishers, ISBN: 978-93-87394-15-5
2. Principles of Engineering Geology and Geotechnics,1 January 2005, Krynine and Judd, CBS Publications, ISBN-13 : 978-8123906034
3. Principles of Engineering Geology, by KVGK Gokhale, BS Publications, 1 December 2016 ISBN-13 : 978-9352300655
4. Text Book of Engineering Geology by K N Radhika & B C Prabhakar , Walnut publication

Web Reference:

1. https://www.youtube.com/watch?v=aTVDiRtRook&list=PLDF5162B475DD915F
2. https://www.youtube.com/watch?v=EBiLLJAxBuU&index=2&list=PLDF5162B475DD 915F
3. https://www.youtube.com/watch?v=sTY-ao4RZck&list=PLDF5162B475DD915F&index=3
   https://nptel.ac.in/courses
4. https://youtu.be/fvoYHzAhvVM
5. https://youtu.be/aTVDiRtRook

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.

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
CIV23305E.1	1	2	-	-	-	2	2	-	-	-	-	-	-	-	-
CIV23305E.2	-	2	-	-	-	1	-	-	-	-	-	-	-	-	-
CIV23305E.3	-	1	-	2	-	2	2	-	-	-	-	-	-	-	-
CIV23305E.4	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-
CIV23305E.5	3	2	-	-	2	2	-	-	-	-	-	2	-	-	-
Average	2.33	1.75	-	2	2	1.8	2	-	-	-	-	2	-	-	-

SEMESTER – III

Course: Data analytics with Excel

Course Code	**CIV23307A**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:2**	**SEE Marks**	**50**
No. of Credits	**2**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	Understand the use of Spreadsheet for data collection and analysis..
CLO2	Evaluate the equations using Excel functions
CLO3	Learn the data quality and consistency of data

Sl.no.	Content	No. of Hours
1	Introduction to Data Analysis Using Spreadsheets: Fundamentals of spreadsheet applications, Excel interface, and learn how to navigate around a worksheet and workbook.	3 hours
2	Using Excel Spreadsheets: Perform basic spreadsheet tasks, such as viewing, entering and editing data, and moving, copying and filling data. Learn about the fundamentals of formulas, and learn about the most common functions used by a data analyst. Finally, you will learn how to reference data in formulas.	4 hours
3	Cleaning & Wrangling Data Using Spreadsheets: Importance of data quality, how to import file data in to Excel, fundamentals of data privacy, remove duplicate and inaccurate data, and how to remove empty rows in your data..	4 hours
4	How to deal with inconsistencies in your data and how to use the Flash Fill and Text to Columns features to help you manipulate and standardize your data.	3 hours
5	Analyzing Data Using Spreadsheets: Fundamentals of analyzing data using a spreadsheet, and learn how to filter and sort data. Learn how to use some of the most useful functions for a data analyst	4 hours
6	How to use the VLOOKUP and HLOOKUP reference functions. In addition, learn how to create pivot tables in Excel, and use several pivot table features	4 hours
7	Final Project: In this final module, you will be introduced to a hands-on lab where you will complete a graded assignment for cleaning and preparing data, and then analyzing data using an Excel spreadsheet.	4 hours
8	Submission of report for final assessment	4 hours

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

CIV23307A.1	Prepare the data sets and perform the analysis.
CIV23307A.2	Analyze and perform repetitive calculations using several functions
CIV23307A.3	Design and apply solutions to verify the data sets

Suggested Learning Resources:

1. https://www.coursera.org/learn/excel-basics-data-analysis-ibm
2. Any online platform with the above course content like YouTube videos and NPTEL courses

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.

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
CIV23307A.1	3														
CIV23307A.2	3														
CIV23307A.3	3													1	
Average	3													**1**	

SEMESTER – III

Course: Smart Urban Infrastructure

Course Code	**CIV23307B**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:0**	**SEE Marks**	**50**
No. of Credits	**2**	**Examination Hours**	**3**

Prerequisites: -

Course Objectives: Students will be taught:

CLO1	about Urban Infrastructure Systems & their Management
CLO2	about Smart Cities Key Concepts
CLO3	the Transport and Energy Smart Urban Infrastructure and Services
CLO4	Feasibility Studies for Smart City Services
CLO5	Understand the Global Context of Smart Cities

Content	**No. of Hours/ RBT levels**
Module-1 Introduction to Smart Urban Infrastructures and Smart Cities: Introduction to smart city, Basic concept of developing smart city, Global standards to create smart city. Different conceptual approaches to Smart Cities and discussing the pros and cons of each approach. Smart urban Infrastructure: List of infrastructure facilities, advantages and disadvantages.	**8 Hours/ L1, L2**
Module 2 Smart Urban Energy Systems: Introduction to Smart Energy Systems, Government policy and technology. Energy sector to explore some of the most important managerial considerations in the transition phase and operation of Smart Urban Energy Systems.	**8 Hours/ L1, L2**
Module 3 Smart Transportation Technologies: Introduction to smart transportation system, Mode of transport systems for smart city, data collection to arrive at best transport facility. Significant opportunities and threads for legacy urban transportation systems. Managerial considerations to facilitate the transition phase, and operation of Smart Urban Transportation Systems	**8 Hours/ L1, L2**
Module 4 Towards Smart Cities: Important factors in the transition phase of legacy cities to Smart cities and their managerial implications.	**8 Hours/ L1, L2**
Module 5 Towards Smart Cities: Management of Smart Cities calls for different approaches from conventional urban management approaches. The role of city government in the network of actors who play an important role in management of Smart Cities.	**8 Hours/ L1, L2**

COURSE OUTCOMES:

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

CIV23307B.1	Understand the concept of smart city
CIV23307B.2	Play the role of a civil engineer in providing smart infrastructure.
CIV23307B.3	Design efficient energy system for smart city
CIV23307B.4	Analyze and design efficient transport system

Textbooks:

1. Infrastructure for Smart Cities, Dr. R P Rathaliya, Shree Hari Publications, 2021
2. Building Smart Cities, ISBN-13 978-1032340128, by Carol L. Stimmel, 2022
3. Smart Cities for Sustainable Development, Ram Kumar Mishra, Ch Lakshmi Kumari, Sandeep Chachra, P.S. Janaki Krishna, Springer, ISBN-13 978-9811674099, 2022

Web Reference:

https://www.youtube.com/watch? app=desktop&v=E6TE9u1XgAg
https://www.youtube.com/watch?v=rX6XfCMRYU0
https://www.coursera.org/learn/smart-cities

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 / 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
CIV23307B.1	2	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CIV23307B.2	2	-	-	-	1	-	1	-	-	-	-	1	-	1	-
CIV23307B.3	2	1	2	-	1	-	1	-	-	-	-	1	-	1	-
CIV23307B.4	2	1	2	-	1	-	1	-	-	-	-	1	-	1	-
Average	2	1	2	-	1	-	1	-	-	-	-	1	-	**1**	-

SEMESTER – III

Course: Problem Solving with PYTHON

Course Code	**CIV23307C**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:2**	**SEE Marks**	**50**
No. of Credits	**2**	**Examination Hours**	**3**

Prerequisites: -

Course Objectives: Students will be taught:

CLO1	To understand why Python is a useful scripting language for developers
CLO2	To read and write simple Python programs
CLO3	To learn how to identify Python object types.
CLO4	To learn how to write functions and pass arguments in Python

Content	**No. of Hours/ RBT levels**
Module-1 Introduction to Python: Installing Python and Python packages, Managing virtual environments with venv module Introduction to NumPy arrays:Array creation, indexing, data types, broadcasting, copies and views, universal functions, I/O with NumPy	**8 Hours/** **L1, L2**
Module 2 Introduction to NumPy and SciPy:NumPy subpackages– linalg, fft, random, polynomials, SciPy subpackages– linalg, fatback, integrate, interpolate, optimize Introduction to Matplotlib: Plotting 2D graphs with Matplotlib, annotations, legend, saving plots to file, bar and pie charts, line plots	**8 Hours/** **L1, L2**
Module 3 Linear algebra using NumPy and SciPy:Solving linear simultaneous equations using NumPy and SciPy using numpy.linalg and scipy.linalg – solve, inverse, determinant, least square solution, Linear algebra using NumPy and SciPy (continued): Decomposition using lu and cholesky. Solving eigenvalue problems using NumPy and SciPy:Using numpy.linalg and scipy.linalg – eig, eigvals.	**8 Hours/** **L1, L2**
Module 4 Solving initial value problems for ODE systems using scipy.integrate subpackage – solve_ivp, RK45, LSODA. Numerical integration of functions using SciPy:Using scipy.integratesubpackage– Definite integral using Gaussian quadrature – quad and quadrature Numerical integration of fixed samples using scipy.integratesubpackage– Trapezoidal rule trapezoid, Simpson's 1/3 rule using Simpson, Romberg integration romb	**8 Hours/** **L1, L2**

Module 5	
Determining roots of equations using SciPyusing scipy.optimizesubpackage– Bisection method bisect, Brent's method brentq, Newton-Raphson method newton. Symbolic computing using SymPy and solving civil engineering problems using SymPy: Introduction, defining symbols, derivatives, integrals, limits, expression evaluation, expression simplification, solving equations, solving differential equations	**8 Hours/** **L1, L2**

COURSE OUTCOMES:

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

CIV23307C.1	Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
CIV23307C.2	Demonstrate proficiency in handling Strings and File Systems
CIV23307C.3	Represent compound data using Python lists, tuples, Strings, dictionaries.
CIV23307C.4	Read and write data from/to files in Python Programs

Text Books:

1. R. Nageswara Rao, "Core Python Programming", dreamtech
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson 22.07.2023 22.07.2023 TEMPLATE for AEC (if the course is a theory) Annexure-IV 33.
3. Python Programming , Reema theraja, OXFORD publication

Web links and Video Lectures (e-Resources):

1. NumPy documentation at https://numpy.org/doc/
2. SciPy documentation at https://docs.scipy.org/doc/scipy/
3. Matplotlib documentation at https://matplotlib.org/stable/users/index
4. SymPy documentation at https://docs.sympy.org/latest/index.html.

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 / 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
CIV23307C.1	2	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CIV23307C.2	2	-	-	-	1	-	1	-	-	-	-	1	-	1	-
CIV23307C.3	2	1	2	-	1	-	1	-	-	-	-	1	-	1	-
CIV23307C.4	2	1	2	-	1	-	1	-	-	-	-	1	-	1	-
Average	2	1	2	-	1	-	1	-	-	-	-	1	-	**1**	-

SEMESTER – III

Course: Personality Development for Civil Engineers

Course Code	**CIV23307D**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:0**	**SEE Marks**	**50**
No. of Credits	**2**	**Examination Hours**	**3**

Prerequisites: -

Course Objectives: Students will be taught:

CLO1	To offer placement focused guidance across interview best practices, formal communication, and business etiquette
CLO2	To give learners a comprehensive understanding of job skills and knowledge that are essential for adapting to changes in workplace

Content	**No. of Hours/ RBT levels**
Module-1 LSRW and Personality Development: Importance of LSRW Skills: Art of listeningListening comprehension – Art of Speaking – Art of Reading – Reading comprehension – Art of Writing – email writing Personality Development: Emotional Intelligence – Self Awareness – Self Management – Personal SWOT – Manners & Etiquette – Positive Attitude – Confidence building Interpersonal Skills: Active Listening – Motivation – Flexibility – Patience – Dependability – Adaptability – Interpersonal & Intrapersonal skills – Body Language	**8 Hours/ L1, L2**
Module 2 NVC, Presentation and Teamwork: Non – Verbal Communication: Body language – Gestures – Postures – Eye contact – Hand Shake – First impression – Proxemics – Facial Expressions Presentation Skills: 4P's of Presentation – Communicating with Credibility – Audience analysis and Building Rapport – Usage of Figures, diagrams & Charts – Presenting with Confidence – Body Language in Presentation Teamwork: What is a Team - Stages of a Team – Benefits of Team work & Collaboration – Group vs Team – Types of Teams – Roles of the Team	**8 Hours/ L1, L2**
Module 3 Etiquette and Management: Critical Thinking & Problem Solving: Core Skills – Uses & Importance of Critical Thinking – Principles of Critical Thinking – Facts about Problem Solving – Skills to use in Problem Solving - Problem Solving Process – Barriers to Problem Solving Time Management: Managing your time – Time wasters – Analyzing your Strengths	**8 Hours/ L1, L2**

and weakness – Goal Setting – Why Goal Setting is important - SMART Goals – Types of Goals Business Etiquette: Types of Etiquette – Importance of Etiquette – Meeting Etiquette – Office Etiquette – Phone and email Etiquette – Work Place Etiquette	
Module 4 Leadership: Leadership Skills: What makes an effective Leader – Relationship Building – Leader vs Boss – Decision Making Skills – Innovation & Motivation – Dependability Business Writing – How to improve your Business writing skills – Importance of Business writing – how to write effectively – 5C's of Business writing – 4 types of Business writing Conflict Management: Strategies of Conflict Management – Best practices for Conflict Resolution – 22.07.2023 22.07.2023 @#16032024 2 Stress Management – Learn to say No – Importance of Conflict Management at Work Place	**8 Hours/** **L1, L2**
Module 5 V GD, Creativity and Psychometry: Group Discussion: Types of GD – Attitude & being Proactive – Time management & how to stick to it – Importance of Listening - Do's & Don'ts Creativity & Innovation: What is Creativity – What is Innovation – Difference between Creativity & Innovation – Categories and misconception of Creativity Psychometric Analysis: What is Psychometric Analysis – Cognitive Skills – Importance of Personality Tests – Personality Profiling	**8 Hours/** **L1, L2**

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

CIV23307D.1	Use English as a medium of communication in interviews and in any professional working environment proficiently.
CIV23307D.2	Develop necessary skills to Answer common interview questions, express confidence in body language and present with clarity

Textbooks:

1. Personality Development And Soft Skills, Barun K Mitra, 2nd edition, Oxford University Press, 2016
2. Power of Positive thinking, Norman Vincent Peale, ISBN-13 978-0091906382, RHUK, 2016
3. Magic of thinking Big, David J Schwartz, ISBN-13 978-1785040474, Vermilion, 2016

Web Reference:

NPTEL videos.

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 / 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
CIV23307D.1	2	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CIV23307D.2	2	-	-	-	1	-	1	-	-	-	-	1	-	1	-
Average	2	1	2	-	1	-	1	-	-	-	-	1	-	**1**	**-**

SEMESTER – III

Course: Planning and Designing of Buildings

Course Code	**CIV23307E**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:2**	**SEE Marks**	**50**
No. of Credits	**2**	**Examination Hours**	**3**

Pre-requisite: Building Constructions

Course Objectives: Students will be taught:

CLO1	To understand the scales, signs and symbols used in given civil engineering drawings.
CLO2	To know the principles of planning and building by laws.
CLO3	To draw the plan elevation and cross sections of residential and public buildings
CLO4	To draw the the Stairs and water supply sanitary and electrical layouts.

Content	**No. of Hours/ RBT levels**
Module-1 **Drawing Basics:** **Selection of scales** for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962.1989 **Symbols** for different materials such as earthwork, brickwork, stonework, concrete, woodwork and glass used in civil engineering. Construction, Graphical symbols for door and window, Abbreviations, symbols for sanitary and electrical installations **Types of lines**- visible lines, centre line, hidden line, section line, dimension line, extension line, pointers, arrowhead or dots. Appropriate size of lettering and numerals for Titles, subtitles, notes and dimensions.	**8 Hours /L1,L2**
Module 2 **Planning of Building** 1. Principles of planning of Residential and Public Building-Aspect, Prospect, Orientation, Grouping, Privacy, Elegance, Flexibility. Roominess, Circulation, Furniture requirements, Sanitation. Economy. 2. Space requirement and norms for minimum dimension of different. 3. Rules and byelaws of sanctioning authorities for construction work. 4. Plot area built up area, super built up area, plinth area, carpet area, floor area and FAR (Floor Area Ratio) / FSI.	**8 Hours /L1,L2**

Module 3 **Foundation and Residential Building Drawing** Isolated footing drawing with all detailing, Line diagram, Plan, Elevation and Cross section for residential building of minimum two rooms including w/c, bath and staircase as per principles of planning.	**8 Hours /L2**
Module **Water supply, Sanitation and Electrical layouts for residential buildings and Stairs case drawings** Draw a water supply and sanitary layout for residential buildings from street pipeline. Draw a Detail electrical layout for a residential building with the necessary fittings. Stairs: Drawing of dog legged and open well staircase.	**8 Hours /L2**
Module 5 **Commercial/Public Building Drawing** Line diagram, Plan, Elevation and Cross section for public building-school building, primary health centre, bank, post office, hostel and Library.	**8 Hours /L2**

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

CIV23307E.1	Interpret the symbols, signs and conventions from the given drawing.
CIV23307E.2	Understand the principles of planning, Floor area and building by laws of sanctioning authorities for construction work
CIV23307E.3	Draw the Foundation, plans, elevation and cross section of residential buildings using principles of planning.
CIV23307E.4	Prepare the water supply sanitary and electrical layout of buildings and draw the stairs of a buildings.
CIV23307E.5	Draw the plans, elevation and cross section of Commercial and Public buildings using principles of planning.

Textbooks:

1. Shah. M.G., Kale C.M., Patki S.Y., "Building Drawing" , Mcgraw Hill Publishing company Ltd. New Delhi 2002 ISBN: 9780074638767
2. Dr. Swamy Kumara N; Rao Kameshwara A ." Building Planning and Drawing" Charotar Publication, ANAND ISBN : 978- 93-85039-12-6 (Ed.2015)
3. Mantri Sandip "A to Z Building Construction" Satya Prakashan; 2nd edition (2015), New Delhi, ISBN: 978-8176849692

References:

1.Malik R.S., Meo G.S" Civil Engineering Drawing" Computech Publication Ltd New Asian Publishers, 2009, New Delhi ISBN:978- 8173180026
2. IS: 962-1989 (Code of practice for architectural and building drawing).
3. National Building Code, BIS, New Delhi.

Web Reference:

https://www.youtube.com/watch? app=desktop&v=E6TE9u1XgAg
https://www.youtube.com/watch?v=rX6XfCMRYU0

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 module 3 carrying 50 and module 4& 5 carries 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): One Test is to be conducted for 100 marks at the end of the semester that reduced to 40 marks and 10 marks for submission of auto CADD drawing sheets with sketch book.
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	
	Periodic evaluation of Manual & Drawing Sheets	10	
Total CIE		**50**	**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
23CIV23307E.1	2	-	-	-	-	-	1	-	-	-	-	-	-	-	-
23CIV23307E .2	2	-	-	-	1	-	1	-	-	-	-	-	-	1	-
23CIV23307E .3	2	1	2	-	1	-	1	-	-	-	-	-	-	1	-
23CIV23307E .4	2	1	2	-	1	-	1	-	-	-	-	-	-	1	-
23CIV23307E .5	2	1	2	-	-	-	1	-	-	-	-	-	-	1	-
Average	2	1	2	-	1	-	1	-	-	-	-	-	-	**1**	-

SEMESTER – III

Course: Fluid Mechanics Laboratory

Course Code	**CIVL23309**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**03**

Prerequisites:

Course Objectives: students will be taught to:

CLO1	Calibrate flow measuring devices.
CLO2	Measure discharge and head losses in pipes
CLO3	Determine the force exerted by jet of water on vanes
CLO4	Efficiency test on Turbines and pumps.

Content	No. of Hours/ RBT levels
Part A	
Verification of Bernoulli's equation.	2hours/ L3
Determination of C_d for Venturi meter and Orifice meter.	2hours/ L3
Determination of hydraulic coefficients of small vertical orifice.	2hours/ L3
Determination of C_d for notches	2hours/ L3
Determination of C_d for Ogee and broad crested weir	2hours/L3
Determination of C_d for Venturi flume	2hours/L3
Determination of Major Loss in Pipes	2hours/ L3
Determination of Minor losses in pipe due to sudden enlargement, sudden contraction, and bend.	2hours/ L3
Part B	
Determination of force exerted by a jet on flat and curved vanes.	2hours/ L3
Determination of efficiency of Pelton wheel turbine	2hours/ L3
Determination of efficiency of Francis turbine	2hours/L3
Determination of efficiency of Kaplan turbine	2hours/L3
Determination of efficiency of centrifugal pump	2hours/ L3

COURSE OUTCOMES:

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

CIVL23309.1	Determine constant coefficients for various flow measuring devices
CIVL23309.2	Determine the major & minor losses in pipe flow
CIVL23309.3	Performance evaluation of different types of turbines
CIVL23309.4	Performance evaluation of Centrifugal pump

Textbooks:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi

Reference books:

1. P N Modi & Dr. S.M. Seth, "Hydraulics and Fluid Mechanics", 2009, Standard Book House – New Delhi,

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):

Two Tests are to be conducted for 50 marks each. Marks scored in each test is reduced to 20 and added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and two tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

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 Evalaution	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
CIVL23309.1	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CIVL23309.2	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CIVL23309.3	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CIVL23309.4	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
Average	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-

SEMESTER – III

Course: Material Testing and Concrete Laboratory

Course Code	**CIVL23310**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**03**

Prerequisites:

Building materials for Construction, Concrete Technology

Course Objectives: Students will be taught to:

CLO1	Evaluate mechanical properties – Tension, compression, bending and shear of structural materials.
CLO2	Determine various moduli-Torsion test, hardness numbers-Hardness test and impact energy-Impact testing.
CLO3	Understand the properties of concrete materials.
CLO4	Understand the application of Non-destructive testing for structural members.

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.	**04Hours** **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 test) and hardened concrete (compression 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:

CIVL23310.1	Analyse the mechanical properties for various construction material used in structural members.
CIVL23310.2	Determine various moduli, hardness numbers and impact energy of construction materials.
CIVL23310.3	Evaluate the properties of concrete in green and hardened state.
CIVL23310.4	Evaluate the properties of concrete by non-destructive methods.

Textbooks:

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

Reference books:

1. J. Brooks and A. M. Neville, "Concrete Technology", 2nd Edition, Pearson Publishers, 2019.
2. A.R. Santhakumar, "Concrete Technulogy", 2' edition, Oxford Higher education, 2018
3. M.L. Gambhir, "Concrete Technology: 'Theary and Practice", Sth Edition, Tata Me Graw Hill Publishers, 2017.

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

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):

Two Tests are to be conducted for 50 marks each. Marks scored in each test is reduced to 20 and added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and two tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

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

COURSE OUTCOMES:

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

CIVL23310.1	Analyse the mechanical properties for various construction material used in structural members.
CIVL23310.2	Determine various moduli, hardness numbers and impact energy of construction materials.
CIVL23310.3	Evaluate the properties of concrete in green and hardened state.
CIVL23310.4	Evaluate the properties of concrete by non-destructive methods.

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CIVL23310.1	2	2	1	-	2	-	-	-	2	1	-	-	2	2	-
CIVL23310.2	2	2	1	-	2	-	-	-	2	1	-	-	2	2	-
CIVL23310.3	2	2	-	-	2	-	1	1	1	1	-	-	2	2	-
CIVL23310.4	2	2	-	-	3	-	1	1	-	-	-	-	2	2	-
Average	2	1	1	-	2.25	-	1	1	1.67	1	-	-	2	2	-

SEMESTER – IV

Course: Transform Calculus and Numerical Techniques

Course Code	**MAT23401B**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites:

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
CLO5	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.	**08 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.	**08 Hours** **L2, L3**
Module 3 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.	**08 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).	**08 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.	**08 Hours**

COURSE OUTCOMES:

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

MAT23401B.1	• Derive the Laplace transforms of elementary functions, unit step function and dirac delta function • Establish the relationship between the Laplace transform of a function and the Laplace transform of its derivative. • Develop techniques for finding the inverse Laplace transform Solve linear differential equations using Laplace transform
MAT23401B.2	• Determine the Fourier series of a given periodic functions • Solve problems involving the representation of functions using half-range Fourier series • Solve problems using Fourier transform and its inverse transform Solve problems using Fourier sine and cosine transform
MAT23401B.3	• Apply the correlation coefficient to measure the strength and direction of the linear relationship between two variables. • Learn the method of least squares as a technique for fitting various types of curves to a dataset. Solve algebraic and transcendental equations using Regula-Falsi and Newton Raphson methods.
MAT23401B.4	• Apply numerical techniques for interpolation of data Evaluate definite integrals using numerical techniques.
MAT23401B.5	Solve ordinary differential equations of first and second order using single step and multistep 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

Reference books:

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

Web Reference:

1. https://surveyofindia.gov.in/
2. https://gsi.gov.in/
3. https://usgs.gov/

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 Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

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	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**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
MAT23401B.1	3	2	1	-	-	-	-	-	-	-	-	3	-	-	-
MAT23401B.2	3	2	1	-	-	-	-	-	-	-	-	3	-	-	-
MAT23401B.3	3	2	1	-	-	-	-	-	-	-	-	3	-	-	-
MAT23401B.4	3	2	1	-	-	-	-	-	-	-	-	3	-	-	-
MAT23401B.5	3	2	1	-	-	-	-	-	-	-	-	3	-	-	-
Average	3	2	1	-	-	-	-	-	-	-	-	3	-	-	-

SEMESTER – IV

Course: Engineering Survey

Course Code	**CIV23402**	**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 to:

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 surveying problems.
CLO3	Employ conventional surveying for data collection and processing.
CLO4	Design suitable 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).	**8 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. **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	**8 Hours** **L2, L3**

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). **Self-Learning Exercise**: Errors and Degree of accuracy in leveling. Methods of contouring	**8 Hours** **L2, L3**
Module 4: **Contouring:** Contours, Methods of contouring, Interpolation of contours,contour gradient, characteristics of contours and uses. **Areas and Volume:** Measurement of area – by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpson's one third rule, area from co-ordinates. Measurement of Volumes-trapezoidal and Prismoidal formula, volume of contours. **Plane Table Survey:** Plane table and accessories, Advantages and limitations ofplane 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 tothree-point problem Bessel's graphical method, Errors in plane table survey. **Self-Learning Exercise**: Plotting a profile using plane table and identifying probable errors.	**8 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 - 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. **Geodetic Survey:** Principle and classification of triangulation system, selection of base line and stations, orders of triangulation, triangulation figures, reduction to centre- Problems on reduction to centre, selection and marking of stations, **Self-Learning Exercise:** Volume from spot levels and contour maps	**8 Hours L2, L3**

COURSE OUTCOMES:

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

CIV23402.1	**Describe** the fundamental principles of Geodetics.
CIV23402.2	**Construct** solutions to basic surveying problems by measurement of distances and angles along horizontal plane.
CIV23402.3	**Illustrate** the applications of levelling and theodolite.
CIV23402.4	**Understand** the working of plane table survey
CIV23402.5	**Design and implement** the different types of curves for deviating type of alignments.

Textbooks:

1. B. C. Punmia, Surveying & levelling Vol. I, Laxmi Publications; seventeenth edition,2016.
2. S. K. Duggal, Surveying Vol.I', McGraw Hill Education; Fourth edition, 2017.
3. T P Kanetkar and S V Kulakari, "Surveying and Leveling" Vol 1 & Vol 11, Pune Pidyarthi Griha Prakashan, Pune, 2008.

Reference books:

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

Web Reference:

1. https://surveyofindia.gov.in/
2. https://gsi.gov.in/
3. https://usgs.gov/

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.

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 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
CIV23402.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CIV23402.2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CIV23402.3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CIV23402.4	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CIV23402.5	2	2	2	-	-	-	-	-	-	-	-	-	1	-	-
Average	**2.4**	**2.5**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

SEMESTER – IV

Course: Environmental Engineering

Course Code	**CIV23403**	**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	Estimate water requirement for a community on varied water demand.
CLO2	Design the various units for the treatment of domestic and wastewater.
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	Estimate the self-purification capacity of the water bodies.

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.	**8hours/ 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.	**8hours / L2, L3**

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.	
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.	**8hours / L2, L3**
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.	**8hours / 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. **Attached growth system** – trickling filter, bio-towers and rotating biological contactors	**8hours/L2, L3**

COURSE OUTCOMES:

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

CIV23403.1	Determine water quantity and quality requirement as per IS standards for a community.
CIV23403.2	Design various water treatment units and distribution systems using the underlying scientific principles of potable water treatment to the required quality standards.

CIV23403.3	Determine the hydraulic elements of circular sewers using rational and empirical Formula.
CIV23403.4	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 – M/s Khanna Publishers, New Delhi2010
2. B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi2010.
3. S.K.Garg, "Environmental Engineering vol-II, Water supply Engineering", Khanna Publishers, – New Delhi, 28th edition and 2017

Reference books:

1. Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering" - Tata McGraw Hill, New York, Indian Edition, 2017
2. Karia G.L., and Christian R.A, "Wastewater Treatment Concepts and Design Approach" , Prentice Hall of India Pvt. Ltd., New Delhi. 3rd, Edition, 2017
3. B C Punmia, "Environmental Engineering volume-II", Laxmi Publications 2nd, 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 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/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 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
CIV23403.1	2	2	-	-	-	2	2	1	-	-	-	1	2	2	-
CIV23403.2	2	2	3	-	-	2	2	1	-	-	-	-	2	2	-
CIV23403.3	2	2	3	-	-	2	-	-	-	-	-	-	2	2	-
CIV23403.4	2	2	3	-	-	2	-	-	-	-	-	-	2	2	-
Average	**2**	**2**	**3**	**-**	**-**	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**2**	**2**	**-**

SEMESTER – IV

Course: Structural Analysis

Course Code	**CIV23404**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Engineering Mechanics, Strength of Materials

Course Objectives: Students will be taught:

CLO1	To understand the Static and kinematic indeterminacies of pin and rigid jointed structures
CLO2	To understand the concept of ILD and moving loads.
CLO3	To determine slopes and deflections of beams using moment area and conjugate beam method
CLO4	To analyze 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)	**8 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.	**8 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:

CIV23404.1	Calculate the static and kinematic indeterminacies of pin and rigid jointed structures
CIV23404.2	Construct ILD for the determinate beams subjected to moving loads
CIV23404.3	Determine the slopes and deflections in determinate beams using moment area and conjugate beam method
CIV23404.4	Compute the shear force, bending moment in indeterminate beams and frames using slope defection method
CIV23404.5	Calculate the shear force, bending moment in indeterminate beams and frames using moment distribution method
CIV23404.6	Solve the stress resultants in arches and cables.

Textbooks:

1. Structural Analysis Volume – I , Devdas Menon, 3rd edition 2010, Narosa Publication
2. Muthu K U. et al, Basic Structural Analysis, 2nd edition, IK International Pvt. Ltd., New Delhi, 2015
3. David Marca, Clement Mcgowan "Structural Analysis and Design Structures (Megraw Hill Software Engineering Series)" Mcgraw-Hill Education / India Publisher, 1987

Reference books:

1. Basic Structural Analysis, C S Reddy, 3rd edition,2017 Tata McGraw Hill
2. Theory of Structures, Timoshenko & Young, 2nd edition 1965 Tata McGraw Hill
3. Structural theorems and their application,2013, B G Neal, Pergamon Press.
4. Bhavikatti,"Structural Analysis Volume-1"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.

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
CIV23404.1	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CIV23404.2	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CIV23404.3	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CIV23404.4	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CIV23404.5	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CIV23404.6	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
Average	**2.83**	**1.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.33**	**-**	**-**

SEMESTER – IV

Course: Building Information Modelling in Civil Engineering - Basic

Pre-requisite: NA

Course Code	**CIV23405A**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:2:4**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	To understand the concepts of Sustainable Development.
CLO2	To understand the Economic, Socio-political and Ecological aspects of Sustainable Development
CLO3	To understand the concept and importance of natural resources with respect to sustainable development
CLO4	To understand the Sustainable strategies of various firms.

Sl.no.	Content
1.	Introduction Building Information Modelling
2.	Revit Projects: Project Templates, Revit File Types Working with Revit Elements and Families Exploring the User Interface Starting a Project
3.	Setting Up Levels and Grids (Datum Planes) Setting up Levels & Modifying Creating Grids
4.	Modelling Walls Creating Walls Modify wall types
5.	Working with Doors and Windows Loading Door and Window Types from the Library Creating Additional Door and Window Sizes
6.	Using Editing Tools & Working with Views: Using Editing Commands Setting the view display Visibility Graphics, Duplicate Views Elevations & Sections, Adding Callout Views Creating and Modifying 3D Views
7.	Modelling Floors Creating and Modifying Floors
8.	Modelling Stairs, Railings, and Ramps Creating & Modifying Stairs Working with Railings Sketching Custom Stairs Creating Ramps
9.	Modelling Roofs Creating Roofs by Footprint Using Join & unjoin roof

COURSE OUTCOMES:

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

CIV23405A.1	Prepare, read and interpret the drawings in a professional set up.
CIV23405A.2	Know the procedures of submission of drawings and Develop working and submission drawings for building
CIV23405A.3	Plan of residential or public building as per the given requirements with details

Textbooks:

1. BIM Handbook – Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston
2. ISO 19650 - Building Information Modelling (BIM)

Web Reference:

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. Average of three test marks will be added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and two tests. 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
CIV23405A.1	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23405A.2	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23405A.3	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
Average	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**1**	**1**	**1**	**-**	**2**	**-**	**-**	**2**

SEMESTER – IV

Course: GIS with Quantum GIS

Course Code	**CIV23405B**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Engineering Mechanics, Strength of Materials

Course Objectives: Students will be taught:

CLO1	Learning the open source QGIS software for Civil Engineering applications
CLO2	Understand raster and vector data
CLO3	Creation of base map and thematic maps for specific application

Content	No. of Hours/ RBT levels
Module-1 QGIS Introduction: Definition of GIS and its use. Introduction to a free and open source desktop geographic information system software. Types of data (vector and raster formats), web services, useful commands and utilities for geo-processing, extending its capabilities to digital satellite image processing and analysis	**10 Hours** **L3**
Module 2 INTRODUCTION IN QGIS About QGIS Characteristics of QGIS Start using QGIS. QGIS TOOLS QGIS Configuration, General tools, Working with projections QGIS Browser. WORKING WITH RASTER DATA Introduction, Display raster data, Raster calculator, Working with images, Practical exercises: Working with raster data and operations with	**8 Hours** **L3**
Module 3 QGIS PLUGINS Additional modules of QGIS or "plugins" Description of Plugins incorporated in QGIS Operations through "plugins" Practical exercises: Different QGIS "plugins" and their applications: GDAL library tool, georeferencing, coordinate capture, format converter.	**8 Hours** **L3**
Module 4 CREATE MAPS AND RELATED PRODUCTS: Creation tools, Graphic elements, Atlases generation, and Graphic output creations. Practical exercises: Map creation with QGIS.	**10 Hours** **L3**
Module 5 RELATIONAL DATABASE MANAGEMENT SYSTEMS AND SPATIAL DATA. Database design, Database connections, Table joins Spatial joins, generate new statistics and new data using table and spatial data information. Practical exercises: Creation of thematic maps like population data of taluk, Watershed map with drainage and water bodies, Highway with other 2 road intersection details	**10 Hours** **L3**

COURSE OUTCOMES:

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

CIV23405B.1	Use open-source software for civil engineering applications
CIV23405B.2	Various tools in QGIS software
CIV23405B.3	Create thematic layers with attribute data
CIV23405B.4	Generate maps for decision making

Textbooks:

1. Geographic Information System-An Introduction, Tor Bernharadsen, 2009, 3rd Edition, Wiley India Pvt. Ltd. New Delhi, ISBN - 9788126511389.
2. Principles of Remote sensing and Image Interpretation, Lillesand and Kiefer, 2011, 6th Edition, John Wiley Publishers, New Delhi, ISBN – 8126532238.

Web Reference:

YouTube videos
https://docs.qgis.org/3.16/pdf/en/QGIS-3.16-DesktopUserGuide-en.pdf for QGIS manual NPTEL Lectures.

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.

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
CIV23405B.1	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CIV23405B.2	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CIV23405B.3	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CIV23405B.4	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
Average	**2.83**	**1.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.33**	**-**	**-**

SEMESTER – IV

Course: Electronic Waste Management - Issues and Challenges

Course Code	**CIV23405C**	**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 provide students with a comprehensive understanding of e-waste and its impact on the environment.
CLO2	To familiarize students with the generation, composition, and hazardous components of e-waste.
CLO3	To highlight the health and environmental risks associated with improper e-waste management
CLO4	To introduce students to various methods of e-waste collection, recycling, and disposal.
CLO5	To develop an understanding of the relevant policies and regulations governing e-waste management in India

Content	**No. of Hours/ RBT levels**
Module-1 Introduction to E-Waste Management, Overview of e-waste and its impact on the environment,	**8 Hours** **L3**
Module 2 E-Waste Generation and Composition, Types of e-waste and their components	**8 Hours** **L3**
Module 3 E-Waste Hazards and Environmental Impacts, Health and environmental risks associated with e-waste	**8 Hours** **L3**
Module 4 E-Waste Collection and Recycling, Methods of e-waste collection, recycling, and disposal	**8 Hours** **L3**
Module 5 E-Waste Management Policies and Regulations, Relevant laws, policies, and regulations in India	**8 Hours** **L3**

COURSE OUTCOMES:

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

CIV23405C.1	Explain the concept of e-waste and its significance in the context of environmental sustainability.
CIV23405C.2	Identify and classify different types of e-waste and describe their components.
CIV23405C.3	Recognize the potential health and environmental hazards associated with improper e-waste management.
CIV23405C.4	Evaluate and apply appropriate methods for the collection, recycling, and disposal of e-waste.
CIV23405C.5	Demonstrate knowledge of the existing policies, regulations, and frameworks for e-waste management in India

Textbooks:

1. "E-Waste Management: From Waste to Resource" by R. K. Rathore and H. N. Chanakya, TERI Press, 2019
2. E-Waste in India: An Emerging Crisis" by Sangeeta Sharma, Cambridge Scholars Publishing, 2019.

Reference books:

1. E-Waste Management: Research, Technology, and Applications" , Majeti Narasimha Vara Prasad, CRC Press, 2016
2. "Electronic Waste Management and Treatment Technology" by Rezaul Begg, R. M. Sarcar, and R. V. R. Singh, Springer, 2018
3. E-Waste Management: From Waste to Resource" by Florin-Constantin Mihai, Academic Press, 2018

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.

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
CIV23405C.1	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CIV23405C.2	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CIV23405C.3	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CIV23405C.4	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CIV23405C.5	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
Average	**2.83**	**1.5**	-	-	-	-	-	-	-	-	-	-	**1.33**	-	-

SEMESTER – IV

Course: Technical Writing Skills

Pre-requisite: NA

Course Code	**CIV23405D**	**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	Achieve better Technical writing and Presentation skills for employment.
CLO2	Develop adequate knowledge of paragraph writing and precise writing techniques
CLO3	Write business proposals and reports.
CLO4	Write conference papers and prepare gist of published papers.
CLO5	Develop efficiency in drafting social media posts and blogs.

Content	**No. of Hours/ RBT levels**
Module-1 Technical Report Writing: Introduction to Technical writing process, Understanding of writing process, Introduction to various Technical Report writing.	**10 hours** **L1, L2**
Module 2 Art of condensation and Paragraph Writing: Introduction and importance, Types and principles of condensation. Importance of paragraph writing, Features and its construction styles.	**10 hours** **L1, L2**
Module 3 Business Report Writing: Introduction, Definition and Salient features of Business reports. Significance and types of report writing. (Formal and Informal). Resume building and Types of resumes. (samples of resumes)	**10 hours** **L1, L2**
Module 4 Technical Articles and Proposals: Nature and significance, Types of technical Articles Journal articles and conference papers. Elements of technical articles .Introduction to technical proposal writing, Purpose, importance, structure and types of technical proposals	**10 hours** **L1, L2**
Module 5 Social media posts and Blog Writing: Ethics and practices of social media posts, Principles and fundamentals, Guiding principles for composition of articles, some common pitfalls. Maintaining common etiquette. Blogs and Blog writings strategies.	**10 hours** **L1, L2**

COURSE OUTCOMES:

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

CIV23405D.1	Effectively communicate in technical matters.
CIV23405D.2	Practice preparation of gist, abstract and notes from a technical article.
CIV23405D.3	Prepare a business proposals and reports.
CIV23405D.4	Write and respond in social media and write blogs.

Textbooks:

1. Sanjay Kumar and Pushpalata, 'Communication Skills', Oxford University Press. 2018.
2. M. Ashraf Rizvi, 'Effective Technical Communication', McGraw Hill, 2018.

References:

1. Gajendra Singh Chauhan and et.al. 'Technical Communication', Cengage Publication, 2018.
2. Meenakshi Raman and Sangeeta Sharma, Technical Communication Principles and Practice, Oxford University Press, 2018.

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. Average of three test marks will be added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and two tests. 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
CIV23405D.1	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23405D.2	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23405D.3	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23405D.4	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
Average	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**1**	**1**	**1**	**-**	**2**	**-**	**-**	**2**

SEMESTER – IV

Course: Fundamental approach to Sustainable development

Pre-requisite: NA

Course Code	**CIV23405E**	**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 understand the concepts of Sustainable Development.
CLO2	To understand the Economic, Socio-political and Ecological aspects of Sustainable Development
CLO3	To understand the concept and importance of natural resources with respect to sustainable development
CLO4	To understand the Sustainable strategies of various firms.

Content	**No. of Hours/ RBT levels**
Module-1 Introduction to Sustainable Development: Meaning, Definition, Brief Historical background of Sustainable Development, Features and Principles of Sustainable Development, Sustainable Development Goals (SDGs), United Nations Global Compact, Significance and Challenges of Sustainable Development , Sustainability as a key driver of Innovation , Introduction to National and Global Reporting Standards	**10 hours** **L1, L2**
Module 2 Aspects of Sustainability Development: Introduction to Sustainability Development, Economic Aspects- Meaning, Ways of Achieving Economic Sustainability, Socio Political Aspects – Meaning, Ways of Achieving Socio Political Sustainability, Ecological (Environmental) Aspects – Meaning, Ways of Achieving Ecological Sustainability	**10 hours** **L1, L2**
Module 3 Natural Resources and Sustainable Development: Meaning of Natural Resources, Importance of Natural Resources, Classification of Natural Resources, Natural Resources Utilization and Sustainable Development, Salient features of Environment Protection Act 1986, Water Act 1974, Air Act 1981, Salient features of Kyoto Protocol from Indian perspective	**10 hours** **L1, L2**

Module 4 Sustainability and Roles, Strategies of Business: Need to adopt sustainable strategy, Triple-bottom line Approach – People, Planet & Profit (3 BL Approach), Various Strategies for Sustainable Development:-Community Knowledge, Harness Technology, Innovative Practices, Co-Operation and Partnership, Green Organizations, Corporate Social Responsibility and Corporate Governance	**10 hours** **L1, L2**
Module 5 Sustainable Development Policies and Programs: The proposal for SDGs at Rio+20; Illustrative SDGs; Goal-Based Development; Financing for Sustainable Development; Principles of Good Governance; National Environmental Policy, CDM, Need for Public Awareness about Environment.	**10 hours** **L1, L2**

COURSE OUTCOMES:

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

CIV23405E.1	Understand the concept of Sustainable Development
CIV23405E.2	Acquire knowledge about various Economic, Socio-Political and Ecological aspects of Sustainable Development.
CIV23405E.3	Acquire knowledge about natural resources and their importance with respect to sustainable development
CIV23405E.4	Understand the strategies, Polices and Programs adopted by various firms for Sustainable Development.

Textbooks:

1. Harharalyer G, "Green Building Fundamentals", 18 edition, Notion Press, 2022.
2. Di. 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 Publication - ECBC Code 2007.

Web Reference:

Module 1: https://onlinecourses.nptel.ac.in/noc21_mg94/preview
Course Name – Business and Sustainable Development (Swayam, IIT Bombay)
https://onlinecourses.swayam2.ac.in/cec22_hs37/preview
Course Name – NGOs and Sustainable Development – SWAYAM

Module 2: www.iimb.ac.in/18th-podcast-series-sustainabilitybusiness
Podcast series name - Role of India's Future Business Leaders in Sustainability (IIM Bangalore)

Module 3: https://smartnet.niua.org/content/655d620c-84a7-4ac0- bd95-01fae6e3a944
Video name - Environment Natural Resources and Sustainable Development – SmartNet (Ministry of Housing and Urban Affairs, Govt. of India)

Module 4 and 5:
https://onlinecourses.nptel.ac.in/noc21_mg94/preview
Course Name – Business and Sustainable Development
(Swayam)
https://onlinecourses.swayam2.ac.in/imb21_mg13/preview
Course Name - Strategy and Sustainable Enterprise –
(Swayam)
https://onlinecourses.swayam2.ac.in/cec22_hs37/preview
Course Name – Business and Sustainable Development (IIT Bombay)

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. Average of three test marks will be added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and two tests. 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
CIV23405E.1	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23405E.2	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23405E.3	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23405E.4	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
Average	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**1**	**1**	**1**	**-**	**2**	**-**	**-**	**2**

SEMESTER – IV

Course: Finance for Professionals

Course Code	**CIV23406A**	**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 give learners an overview of finance and develop their finance sense

Content	**No. of Hours/ RBT levels**
Module-1 Economics: Introduction to economics, Economic policies, Role of monetary policy in managing the economy	**10 hours** **L2**
Module-2 Finance Vocabulary and Financial Statements: Unique role of finance, Unique role of finance example, Accounting, finance & auditing, Capital vs. revenue, Capital vs. revenue example, Sources & uses of funds, Sources & uses of funds example, Revenue recognition principles, Double entry bookkeeping, Illustration of double entry book keeping, Understanding profit & loss, Understanding profit & loss example, Profit and profitability, Profit and profitability example 1, Profit and profitability example 2	**10 hours** **L2**
Module - 3 Financial Statement and Risk Analysis: Finance metrics & financial statement analysis, Finance metrics & financial statement analysis example, understanding liquidity, understanding liquidity example, Funds flow analysis, Example of funds flow analysis, Cash flow analysis, Example of cash flow analysis, Introduction to risk management, understanding risk management example, Management of risk, understanding risk management measurement example, Understanding risk management products example, Holistic look at risk management.	**10 hours** **L2**
Module – 4 Time Value of Money: Time value of money, understanding time value of money, understanding financial functions, Applications of time value of money, Capital structure, Capital structure example, Cost of capital, Cost of capital example, Capital budgeting, Understanding capital budgeting - example	**10 hours** **L2**
Module – 5 Personal Finance: Financial Instrument, Approaches to investing, Ratios for investment, Portfolio management principles, Example of portfolio, forming a portfolio, Forming a portfolio example	**10 hours** **L2**

COURSE OUTCOMES:

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

CIV23406A.1	Understand how their work and effort contribute to organizational financial performance
CIV23406A.2	Comprehend financial acumen and tools to optimize outcomes

Textbooks:

1. Financial Management: Theory & Practice | 11th Edition by Prasanna Chandra
2. International Financial Reporting Standards (Bangalore Univ)

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. Average of three test marks will be added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and two tests. 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
CIV23406A.1	3	3	1					2				3			
CIV23406A.2	3	3	1		3			2				3		2	
Average	3	2.5	1		3			2				3		2	

SEMESTER – IV

Course: Construction Equipment, Plants and Machinery

Pre-requisite: NA

Course Code	**CIV23406B**	**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 provide insight on the different functions and operations of different equipment and techniques during construction
CLO2	To impart knowledge on the various maintenance and safety to be considered during construction
CLO3	To acquire knowledge on the life cycle of a construction equipment
CLO4	To adopt mechanization in the Construction industry

Content	**No. of Hours/ RBT levels**
Module-1 Basics and Hydraulics of Construction Equipment: Introduction to Construction EquipmentFunctions, Operations of Construction EquipmentIntroduction to Four & Two Stroke Engine and their components- Introduction and Components to Automobiles. Introduction to Principles of Hydraulic- Calculation of Pressure, Force & Flow- Components of a Hydraulic System- Basic layout of Hydraulic SystemApplications of Hydraulics- Strand Jack Operation	**10 hours** **L1, L2**
Module 2 Concreting, Earth Moving, Road Making and Quarry/Mining Equipment: Operations of a Batching Plant - Introduction and Components of Concrete Pump & Placer- Concrete PipelineLaying and Cleaning- Bulldozer- Classification and Components- Classification, Components and Attachments of Excavator- Backhoe Loader- Classification & components- Introduction and classification to Hot mix Plant Process of Asphalt Paver-PQC Paver-Classification & Components- Motor Grader Classification & Components- Horizontal Movement VehiclesQuarry/Mining	**10 hours** **L1, L2**
Module 3 Equipment Life Cycle Management: Life Cycle of an Equipment- Equipment Performance Parameters - Introduction to Maintenance- Types of Maintenance- Maintenance Practices	**10 hours**

	L1, L2
Module 4 Tunnelling Equipment / Piling Equipment: Introduction to Tunnel Boring Machines- Details and Operation of a Hard-Rock TBM Details of Earth Pressure Balance (EPB) TBM- Details and operation of Slurry TBM & Components- Hydraulic Grabs- Piling Rig	**10 hours** **L1, L2**
Module 5 Tunnelling Equipment / Piling Equipment: Introduction to Tunnel Boring Machines- Details and Operation of a Hard-Rock TBM Details of Earth Pressure Balance (EPB) TBM- Details and operation of Slurry TBM & Components- Hydraulic Grabs- Piling Rig Mechanized Equipment- Introduction to 3D Concrete Printer- Importance of Safety- Various PPE & Purpose- Safety of Men & Machines at Work- Safety During Construction Activities Safety with Tools & Tackles	**10 hours** **L1, L2**

COURSE OUTCOMES:

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

CIV23406B.1	Evaluate equipment and techniques required during construction
CIV23406B.2	Understand the operation of a batching plant
CIV23406B.3	Analyse the equipment life cycle management.
CIV23406B.4	Comprehend mechanization and digitalisation in construction

Textbooks:

1. Velumani. P, "Construction Techniques and Practices", SIA Publishers & Distributers Pvt Ltd, 2020.
2. Dr. Manoranjan Samal, "Advanced Construction Techniques and Equipment" S.K. Kataria & Sons
3. S.C.Sharma, "Construction Equipment and management" E-Book .2019

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. Average of three test marks will be added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and two tests. 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
CIV23406B.1	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23406B.2	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23406B.3	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23406B.4	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
Average	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**1**	**1**	**1**	**-**	**2**	**-**	**-**	**2**

SEMESTER – IV

Course: Concreting Techniques and Practices

Pre-requisite: NA

Course Code	**CIV23406C**	**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 present the basics of concrete and different materials used in it.
CLO2	To impart knowledge on materials used in concrete, relevant Indian standard codes, and practical aspects on concreting activities at projects.
CLO3	To explain the importance of making good quality concrete to build durable structures.
CLO4	To introduce the Design of concrete mixes from the Industrial experiences at Sites and optimization of higher grades of Concrete.
CLO5	To learn the best practices in concrete construction from industry's decades of experiences, thumb rules, mitigation of concreting issues at Sites

Content	**No. of Hours/ RBT levels**
Module-1 Introduction to concrete, overview of materials- cement, low carbon cement, coarse aggregate and fine aggregate, and mineral admixture:- fly ash, GGBS, micro silica / silica fume, metakaolin / rice husk ash, composite cement and ultrafine materials, lab test - fineness of fly ash, recycled aggregate	**10 hours** **L1, L2**
Module 2 Water and chemical admixture: source, requirements, limits and testing Blending of aggregate -: Blending of fine and coarse aggregate, gradation for optimization and practical aspects.	**10 hours** **L1, L2**
Module 3 Mix design - Volumetric mix design, mix design by absolute volume method, worked out practical examples based on industries experience at project sites over several decades, higher grades of concrete, high performance concrete, test on concrete: workability of concrete, flexural and compressive strength tests.	**10 hours** **L1, L2**
Module 4 Production of concrete-: batching plant, calibration, mixing and transportation of concrete	**10 hours**

handling of concrete at construction, ready-mix concrete, pumping, placing of concrete with boom placers, levelling, vibration and compaction, cold joints, finishing and curing and protection of concrete	**L1, L2**
Module 5 Special types of concrete: self-compacting concrete, mass concrete, dry lean concrete, geopolymer concrete, pavement quality concrete, fiber reinforced concrete, composite concrete, lightweight concrete, ferrocement, shotcreteing, guniting, grouting, challenges faced at sites: plastic shrinkage cracks, plastic settlement, honey comb, bug holes, cover to concrete, do's and don'ts in concrete construction, site shoot, introduction on 3D printing.	**10 hours** **L1, L2**

COURSE OUTCOMES:

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

CIV23406C.1	Evaluate the properties of concrete by conducting test on cement, aggregate and concrete (with & without admixtures) for using the data for Mix design procedures
CIV23406C.2	Understand to Select and proportionate different materials used in a concrete mix including admixtures
CIV23406C.3	Design a concrete mix as per requirement of construction project
CIV23406C.4	Apply the best practices in concrete construction from industry's requirement, thumb rules, mitigation of concreting issues at Sites.

Textbooks:

1. Concrete Technology by M. S. Shetty, S Chand, New Delhi-110055.
2. Concrete Technology by M. L. Gambhir, Tata McGraw-Hill.
3. IS 456, IS 269, IS 516, IS 1786, IS 1893, IS 12269, IS 9103, IS 8112

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. Average of three test marks will be added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and two tests. 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
CIV23406C.1	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23406C.2	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23406C.3	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23406C.4	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
Average	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**1**	**1**	**1**	**-**	**2**	**-**	**-**	**2**

SEMESTER – IV

Course: Watershed Management

Pre-requisite: NA

Course Code	**CIV23406D**	**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 understand Watershed Hydrology
CLO2	To estimate water demand and learn, water conservation methods
CLO3	To understand application of Remote Sensing and GIS in watershed management
CLO4	Sustainable measures for watershed management

Content	**No. of Hours/ RBT levels**
Module-1 Principles of Watershed Management: Basics concepts, hydrology and water availability, surface water, ground water, conjunctive use, human influences in the water resources system.	**10 hours** **L1, L2**
Module 2 Water resources systems: Integrated water resources system, river basins morphometric analysis of watersheds for watershed management, watershed management practices in arid and semi-arid regions, watershed management through wells, management of water supply, short term and long-term strategic planning.	**10 hours** **L1, L2**
Module 3 Conservation of Water: Perspective on recycle and reuse, wastewater reclamation, social aspects of watershed management and community participation, private sector participation, institutional issues, socio-economy, integrated development, water legislation and implementations, case studies. Water Harvesting: Rainwater management, conservation, storage and effective utilization of rainwater, structures for rainwater harvesting, roof catchments system, check dams, aquifer storage	**10 hours** **L1, L2**
Module 4 Sustainable Watershed Approach: Sustainable integrated watershed management, natural resources management, agricultural practices, integrated farming, soil erosion and conservation.	**10 hours** **L1, L2**

Module 5	
Applications of RS and GIS in Watershed management: Role of decision support system in watershed management, watershed characteristics of coastal regions, coastal aquifer tor management, uniqueness of coastal water resources.	**10 hours** **L1, L2**

COURSE OUTCOMES:

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

CIV23406D.1	Discuss surface and ground water resources system and, human influences
CIV23406D.2	Integrate water resources system in arid and semi-arid regions and explain watershed aquifer for management.
CIV23406D.3	Analyse water resources related issues for conservation and synthesize augmentation of water resources
CIV23406D.4	Design integrated watershed management system
CIV23406D.5	Apply modern tools in watershed management

Textbooks:

1. Singh Vir, Raj., "Watershed Planning and Management", Yash Publishing House, Bikaner.3rd Revised Edition, 2016.
2. Murthy, J. V. S., "Watershed Management in India", New Age Publishers, New Delhi. 2nd Edition, 2017.
3. Decision Support System for Integrated Watershed Management", Colorad State University. 2012.

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. Average of three test marks will be added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and two tests. 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
CIV23406D.1	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23406D.2	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23406D.3	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23406D.4	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
CIV23406D.5	2	2	-	-	-	2	2	1	1	1	-	2	-	-	2
Average	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**1**	**1**	**1**	**-**	**2**	**-**	**-**	**2**

SEMESTER – IV

Course: Design Studio

Course Code	**CIV23406E**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:4**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**3**

Prerequisites: Computer Aided Engineering Drawing, Planning, and designing of buildings

Course Objectives: Students will be taught:

CLO1	To understand the Basics of modelling and tools in Autodesk Revit
CLO2	To Model and analyse the elements and structures in Staad Pro
CLO3	To understand the basics of modelling and tools in Autodesk Revit
CLO4	Develop plan and elevation of given residential and commercial building using architectural software's
CLO5	Develop plan and elevation of various types of footings, staircase using architectural software's

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 plans and elevation for the given line diagram of a residential building. **2.** Prepare plans and elevation for the given line diagram of a commercial building. **3.** Drawing of plan, elevation and sectional elevation including electrical, plumbing and sanitary services using software for: a. Single story residential building b. Single story residential building c. Hostel Building d. School Building Different types of staircases – Doglegged, Open well.	**15 hours** **L2, L3**
Module - 3 **Introduction to Autodesk Revit:** Fundamentals of Autodesk Revit, Basics of modelling, use of Autodesk Revit for drawings.3D Modelling of Residential Unit; Modelling of floors and	**15 hours**

walls; Parametric modelling of basic components; Annotation styles and drafting methods.	**L2, L3**

COURSE OUTCOMES:

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

CIV23406E.1	Apply Kani's method to analyze the indeterminate structures
CIV23406E.2	Apply the tools of Staad Pro to analyze structural elements and multi storey structures.
CIV23406E.3	Use Auto desk Revit to plan and model the structures
CIV23406E.4	Apply the tools of Staad Pro to analyze structural elements and multi storey structures.

Textbooks:

1. Malik R S and Mco G S, "Civil Engineering Drawing", Asian Publishers/Computech Publications Pvc Ltd 2020
2. "Mastering Autodesk Revit" Series by James Vandezande, Eddy Krygiel, and Phil Read 1st edition 2012
3. "Introducing Autodesk Revit Architecture" by Patrick Davis, Charlie Busa, and Beau Turer 2010
4. "Structural Analysis"9th edition 2017 by R.C. Hibbeler

Reference books:

1. "Revit Architecture 2023" by Munir M. Hamad **1**
2. Fink A, "Conducting research literature reviews: From the Internet to Paper", SAGE publications, 2013
3. "Autodesk Revit 2023 Architecture: Fundamentals" by Elise Moss
4. "Structural Analysis and Design of Tall Buildings:1st edition 2011, Steel and Composite Construction" by Bungale S. Taranathi
5. "STAAD. Pro V8i for Beginners" by T.S. Sarma,2014
6. Structural Analysis" by Aslam Kassimali 5th edition 2015

Web Reference:

- https://help.autodesk.com/view/rvt/2021/enu/?guid=guid-9e9688a2-0645-4f8e-9d96 11676291a6c6
- https://www.udemy.com/course/staadpro-es/
- https://archive.nptcl.ac.in/courses/121/106/121106007/

Scheme of Examination:

Semester End Examination (SEE):

Maximum of **THREE QUESTIONS** will be set for SEE as per the pattern given below:

Modules	Marks allocated
Module 1: Answer any ONE question out of TWO questions from Kani's method and using STAAD.Pro	40
Module 2: Answer any ONE question out of TWO questions from modelling using Auto CADD Software	30
Module 3: Answer any ONE question out of TWO questions from modelling using REVIT Software	30
Total marks:	100

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.

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
CIV23406E.1	3	3	1					2				3			
CIV23406E.2	3	3	1		3			2				3		2	
CIV23406E.3	3	2	1		3			2				3		2	
CIV23406E.4	3	2	1		3			2				3		2	
Average	3	2.5	1		3			2				3		2	

SEMESTER – IV

Course: Engineering Survey Laboratory

Course Code	**CIVL23408**	**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	Employ conventional surveying for data capturing and processing.
CLO2	Understand procedures carried out by a professional surveyor in field measurement
CLO3	Design proper types of curves for deviating type of alignments.

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 locate the points using Radiation and Intersection method of Plane table surveying.	2 Hours/ L3
7	To solve three-point problem in plane table using Bessel's graphical solution.	2 Hours/ L3
8	Curve Setting: Using chain, tape and accessories.	2 Hours/ L3
9	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.	2 Hours/ L3

	c. Base of the object inaccessible - Single plane and double plane method.	
10	Transfer of points to ground from CSV file using total station.	2 Hours/ L3
11	Demo Class: Chain Survey 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.	2 Hours/ L2

COURSE OUTCOMES:

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

CIVL23408.1	***Comprehend*** effectively field procedures required for a professional surveyor.
CIVL23408.2	***Use techniques***, skills and conventional surveying instruments necessary for engineering practice.
CIVL23408.3	***Execute*** total station survey and generate profile, cross section and contour drawings.

Textbooks:

1. B. C. Punmia, Surveying & levelling Vol. I, Laxmi Publications; seventeenth edition,2016.
2. S. K. Duggal, Surveying Vol.I', McGraw Hill Education; Fourth edition, 2017.

Reference books:

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

Web Reference:

1. https://surveyofindia.gov.in/
2. https://gsi.gov.in/
3. https://usgs.gov/

Scheme of Examination:

Semester End Examination (SEE):

1. Students are expected to choose any two experiments (one simple and one advanced) for write-up and execute the same,
   a. Write- up – 15 marks
   b. Viva-voce – 15 marks

c. Conduction – 70 marks.

Continuous Internal Evaluation (CIE):

1. **Record – 25 Marks**
   a. Write- up – 5 marks
   b. Viva-voce – 5 marks
   c. Conduction – 15 marks.
2. CIE to be conducted for 100 marks and reduced to 25 marks.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CIVL23408.1	3	1	1	-	-	-	-	1	2	1	-	1	-	-	-
CIVL23408.2	2	2	-	-	-	-	-	1	2	1	-	1	-	-	-
CIVL23408.3	3	3	-	-	3	-	-	1	2	-	-	-	-	-	-
Average	**2.67**	**2**	**1**	**-**	**3**	**-**	**-**	**1**	**2**	**1**	**-**	**1**	**-**	**-**	**-**

SEMESTER – IV

Course: Environmental Engineering Laboratory

Course Code	**CIVL23409**	**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	Understand potable water & wastewater quality standards.
CLO2	Determine the physical, chemical, and biological characteristics of water and wastewater through suitable experiments as per stipulated standards.

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:

CIVL23409.1	Estimate the concentration of different parameters as per standards for potable and wastewater.
CIVL23409.2	Interpret the result with standards and discuss based on the purpose of analysis.
CIVL23409.3	Determine type and degree of treatment for potable and wastewater

Textbooks:

1. S. K. Garg, Environmental Engineering Volume-I, Water supply Engineering – M/s Khanna Publishers, New Delhi2010
2. B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi2010.
3. S.K.Garg, "Environmental Engineering vol-II, Water supply Engineering", Khanna Publishers, – New Delhi, 28th edition and 2017

Reference books:

1. Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering" - Tata McGraw Hill, New York, Indian Edition, 2013
2. Karia G.L., and Christian R.A, "Wastewater Treatment Concepts and Design Approach" , Prentice Hall of India Pvt. Ltd., New Delhi. 3rd, Edition, 2017
3. B C Punmia, "Environmental Engineering volume-II", Laxmi Publications 2nd, 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 wee 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
CIVL23409.1	2	2	-	-	2	1	2	1	-	-	-	-	2	2	-
CIVL23409.2	2	2	3	-	-	2	2	-	-	-	-	1	2	2	-
CIVL23409.3	2	2	3	-	-	2	2	-	-	-	-	-	2	2	-
Average	**2**	**2**	**3**	-	**2**	**1.67**	**2**	**1**	-	-	-	**1**	**2**	**2**	-

SCHEME AND SYLLABUS

Department of Civil Engineering

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

V - VI Semester Scheme (2023-24)

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.**

H.M. Rajashekhar Swamy

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

Global Academy of Technology

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B.E. in Civil Engineering Scheme of Teaching and Examinations 2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Effective from 2023-24

V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lectue	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	CIV23501	Construction Management	PSB: Civil TD: Civil	3	0	0		03	50	50	100	3
2	IPCC	CIV23502	Design & Drawing of RCC Elements		2	2	2		03	50	50	100	4
3	PCC	CIV23503	Basic Geotechnical Engineering		3	0	2		03	50	50	100	4
4	PCCL	CIVL23504	Green Audit Laboratory		0	0	2		03	50	50	100	1
5	PEC	CIV23505X	Professional Elective - I		3	0	0		03	50	50	100	3
6	PROJ	CIVP23506	Mini Project / Extensive Survey		0	0	4		03	100		100	2
7	AEC	RMIK23507	Research Methodology and IPR	Any Department	2	2	0		03	50	50	100	3
8	MC	CIVK23508	Environmental Studies	TD: CV/Env/Chem PSB:CV	2	0	0		02	50	50	100	2
9	MC	UHK23509	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	0
		PEK23509	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		YOK23509	Yoga	Yoga Teacher									
									Total	**550**	**350**	**900**	**22**

Professional Elective Course - I			
CIV23505A	Advanced Mechanics of Solids	CIV23505C	Ground Water Hydrology
CIV23505B	Environmental Impact Assessment	CIV23505D	Modern Construction Materials and Technology
CIV23505E	Hydrology and Irrigation Engineering		

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation. **K :** The letter in the course code indicates common to all the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course.

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L: T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. 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 faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the 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.

No SEE component for Mini-Project.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

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B.E. in CIVIL Engineering Scheme of Teaching and Examinations 2023

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2023-24)

VI SEMESTER -Scheme -A

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	CIV23601	Design & Drawing of steel structural elements	TD: PSB:	2	2	2		03	50	50	100	4
2	PCC	CIV23602	Transportation Engineering	TD: PSB:	3	0	2		03	50	50	100	4
3	PEC	CIV23603X	Professional Elective – II	TD: PSB:	3	0	0		03	50	50	100	3
4	OEC	CIV23604X	Open Elective -I	TD: PSB:	3	0	0		03	50	50	100	3
5	PROJ	CIVP23605	Major Project Phase – I	TD: PSB:	0	0	4		03	100	--	100	2
6	PCCL	CIVL23606	Project management software laboratory	TD: PSB:	0	0	2		03	50	50	100	1
7	AEC/ SDC	CIV23607X	Ability Enhancement Course/ SkillDevelopment Course - III	TD & PSB: Concerned Department	If the course is offered as a Theory: 1	0	0		01	50	50	100	1
					If course is offered as a practical: 0	0	2						
8	MC	UHK23608	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		PEK23608	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		YOK23608	Yoga	Yoga Teacher									
9	IKS	CIVK23609	Indian Knowledge System		1	0	0		01	100	0	100	0
									Total	**600**	**300**	**900**	**18**

Professional Elective Course			
CIV23603A	Structural Dynamics & Earthquake Engineering	CIV23603C	Water resources Engineering
CIV23603B	Ground Improvement Techniques	CIV23603D	Geospatial Surveying
CIV23603E	Advanced Geotechnical Engineering		
Open Elective Course			
CIV23604A	Environmental Pollution & Control	CIV23604C	Sustainable Development Goals
CIV23604B	Smart Cities and Digital Infrastructure	CIV23604D	Cyber-Physical Systems for Infrastructure
Ability Enhancement Course / Skill Enhancement Course - III			
CIV23607A	Quality Control and assurance	CIV23607C	Visual Basic Analysis & Microsoft project
CIV23607B	Applications of AI in Civil Engineering	CIV23607D	Forensics and rehabilitation

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to al the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**: Project Phase -I, **OEC**: Open Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulationgoverning the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

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B.E. in Civil Engineering Scheme of Teaching and Examinations 2023

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2023-24)

VI SEMESTER- Scheme -B

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	CIV23601	Design & Drawing of steel structural elements	TD: PSB:	2	2	2		03	50	50	100	4
2	PCC	CIV23602	Transportation Engineering	TD: PSB:	3	0	2		03	50	50	100	4
3	PEC	CIV23603X	Professional Elective – II	TD: PSB:	3	0	0		03	50	50	100	3
4	OEC	CIV23604X	Open Elective -I	TD: PSB:	3	0	0		03	50	50	100	3
5	PCCL	CIVL23606	Project management software laboratory	TD: PSB:	0	0	2		03	50	50	100	1
6	AEC/ SDC	CIV23607X	Ability Enhancement Course/ Skill Development Course - III	TD & PSB: Concerned Department	If the course is offered as a Theory: 1	0	0		01	50	50	100	1
					If course is offered as a practical: 0	0	2						
7	MC	UHK23608	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		PEK23608	Physical Education (PE) (Sports and Athletics)	PED									
		YOK23608	Yoga	Yoga Teacher									
8	IKS	CIVK23609	Indian Knowledge System		1	0	0		01	50	50	100	0
9	MC	CIVL23609	Universal Human Values	Any department	1	0	0		01	50	50	100	0
								Total		**500**	**400**	**900**	**16**

SEMESTER – V

Course: Construction Management

Course Code	**CIV23501**	**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	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 entrepreneurial 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. **Comparison of alternatives:** Present worth, annual equivalent, capitalized and rate	**8 Hours L2, L3**

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:

CIV23501.1	Discuss the importance of management and its approaches.
CIV23501.2	Classify planning and resources required in a construction project.
CIV23501.3	Understand the importance of quality control and safety concept in construction industry.
CIV23501.4	Summarize entrepreneurship types, characteristics, schemes, and policies.
CIV23501.5	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
CIV23501.1						1		1	2	2	3				
CIV23501.2									1	1	1	2			
CIV23501.3											2	1			
CIV23501.4		1				1		1	2	2		2			
CIV23501.5		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	**CIV23502**	**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:

CIV23502.1	Describe the concepts of design philosophies, stress block parameters and limit state criterion
CIV23502.2	Design of RC Beams for Strength, serviceability requirements such as deflection and crack width.
CIV23502.3	Design of RC Slabs for Strength and serviceability requirements under various boundary conditions.
CIV23502.4	Calculate the axial and bending moment to design columns and footings.
CIV23502.5	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/DjT5G6Klf1M 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 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
CIV23502.1	3	3			2									3	
CIV23502.2	3	3			2							1		3	
CIV23502.3	3	3			2							1		3	
CIV23502.4	3	3			2							1		3	
CIV23502.5	3	3			2							1		3	
Average	**3**	**3**			**2**							1		**3**	

SEMESTER – V

Course: Basic Geotechnical Engineering

Course Code	**CIV23503**	**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 i. Sieve analysis	**2 Hours L2, L3**

ii. Hydro meter analysis	
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:

CIV23503.1	Describe the properties, inter relationships of soil and classify based on its index properties
CIV23503.2	Explain the concepts of clay mineralogy and soil structures and their applications
CIV23503.3	Explain the concepts of permeability, seepage flow of soil, effective stress based on assumptions and validity of Darcy's law
CIV23503.4	Determine the characteristics of compaction and consolidation of soil by principle of compressibility.
CIV23503.5	Apply the Mohr-Coulomb failure concepts to determine the shear strength parameters from various laboratory shear tests under different drainage conditions
CIV23503.6	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:

1. https://nptel.ac.in/courses/105101201
2. 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 the 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
CIV23503.1	3	2	2	1										2	
CIV23503.2	3	2	2	1										2	
CIV23503.3	3	2	2	1										2	
CIV23503.4	3	2	2	1										2	
CIV23503.5	3	2	2	1										2	
CIV23503.6	3	2	2	1										2	
Average	3	2	2	1										2	

SEMESTER – V

Course: Green Audit Laboratory

Course Code	**CIVL23504**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**3**

Course Objectives: Students will be taught:

CLO1	Green building and carbon rating concepts
CLO2	calculations of various energy consumption of individual components
CLO3	various Green building Certifications mechanisms
CLO4	Rating of buildings as per various national and international standards

Sl. No.	**Experiments**	**No. of Hours/ RBT levels**
1	Green Building Components & Carbon Rating concept	2 (L2)
2	Various Green building Certifications	2 (L2)
3	Introduction & Components - GRIHA	2 (L2)
4	Calculations - GRIHA	4 (L3)
5	Introduction & Components - LEED	2 (L2)
6	Calculations - LEED	4 (L3)
7	Introduction & Components - IGBC	2 (L2)
8	Calculations - IGBC	4 (L3)
9	Calculations of the Green buildings – Commercial - Case Study 1	4 (L3)
10	Calculations of the Green buildings – Non-commercial - Case Study 2	4 (L3)
11	Computation of carbon foot print using REVIT	4 (L3)
12	Case Study Presentation – 1	3 (L3)
13	Case Study Presentation – 2	3 (L3)

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

CIVL23504.1	Understand green building and carbon rating concepts
CIVL23504.2	Calculate energy of individual components of a building
CIVL23504.3	Analyze various Green building Certifications mechanisms
CIVL23504.4	Rate a green building based on LEED, GRIHA and IGBC Guidelines

References:

1. IGBC Manual
2. LEED Manual
3. GRIHA User Manual

Scheme of Examination:

Semester End Examination (SEE):

Presentation of commercial and non-commercial green building audit

Continuous Internal Evaluation (CIE):

CIE will be conducted for 50 Marks. This will include reports and one practical test.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CIVL23504.1	3	-	1	-	-	2	2	-	-	-	-	-	-	-	3
CIVL23504.2	3	2	1	-	-	2	2	-	-	-	-	-	2	-	3
CIVL23504.3	3	2	1	-	-	2	2	-	2	1	-	-	2	1	3
CIVL23504.4	3	2	1	-	-	2	2	-	2	1	-	2	2	1	3
Average	3	2	-	-	-	2	2	-	2	1	-	2	2	1	3

SEMESTER – V

Course: Advanced Mechanics of solids

Course Code	**CIV23505A**	**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	

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.	**8 Hours L3**
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:

CIV23505A.1	**Construct** differential equations for beams on elastic foundation
CIV23505A.2	**Construct** differential equations for beam-column for different loads with various end conditions
CIV23505A.3	**Calculate** the critical load for prismatic and non-prismatic columns
CIV23505A.4	**Compute** stresses, deflections, and shear center in symmetric and unsymmetrical sections.
CIV23505A.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.J 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
CIV23505A.1	3	2	-	-	-	-	-	-	-	-	-	1	1	-	-
CIV23505A.2	3	3	1	-	-	-	-	-	-	-	-	1	1	-	-
CIV23505A.3	2	3	2	-	-	-	-	-	-	-	-	1	1	-	-
CIV23505A.4	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CIV23505A.5	2	2	1	-	-	-	-	-	-	-	-	1	1	-	-
Average	**2.4**	**2.4**	**1.25**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**

SEMESTER – V

Course: Environmental Impact Assessment

Course Code	**CIV23505B**	**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:

CIV23505B.1	Describe the fundamental concepts of EIA.
CIV23505B.2	Identify various attributes and methods of EIA
CIV23505B.3	Apply prediction and assessment methods to EIA of air, water, land and noise environment.
CIV23505B.4	Understand the Environmental Parameter Activity Relationships in preparing EIA and Settlement.
CIV23505B.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:

1. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv104-Page1.htm
2. nptel.ac.in/courses/105101084/https://ay14-15
3. 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
CIV23505B.1	1	1	2							1		1			
CIV23505B.2	1	1	2							1		1			
CIV23505B.3	1	1	2							1		1			
CIV23505B.4	1	1	2							1		1			
CIV23505B.5	1	1	2							1		1			
Average	1	1	2							1		1			

SEMESTER – V

Course: Groundwater Hydrology

Course Code	**CIV23505C**	**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:

CIV23505C.1	Describe the concepts of the groundwater flow phenomenon.
CIV23505C.2	Understand the different flow conditions and problems associated with groundwater pollution.
CIV23505C.3	Understanding the subsurface using geophysical techniques.
CIV23505C.4	Apply the concepts and techniques necessary to determine aquifer parameters.
CIV23505C.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
CIV23505C.1	2	3				2	2						1		
CIV23505C.2	2	2				1							1		
CIV23505C.3	2					2	2						1		
CIV23505C.4	2					2			2				1		
CIV23505C.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	**CIV23505D**	**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:

CIV23505D.1	Understand fundamentals and Various equipment's used for Earth work operations
CIV23505D.2	Understand Maintenance & repair of formworks
CIV23505D.3	Describe various equipment's used for shoring and soil stabilization
CIV23505D.4	Infer modern Construction techniques in repairing and rehabilitation of structures
CIV23505D.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
CIV23505D.1	3					1		1				2			
CIV23505D.2	3					1		1				2			
CIV23505D.3	3					1		1				2			
CIV23505D.4	3					1		1				2			
CIV23505D.5	3					1		1				2			
Average	3					1		1				2			

SEMESTER – V

Course: Hydrology and Irrigation Engineering

Course Code	**CIV23505E**	**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 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:

CIV23505E.1	Understand the importance of hydrology and its components.
CIV23505E.2	Measure precipitation and analyze the data and losses in precipitation
CIV23505E.3	Estimate runoff and develop unit hydrographs.
CIV23505E.4	Estimate the benefits and ill-effects of irrigation and the water requirement of crops.
CIV23505E.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 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 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
CIV23505E.1	3	2	1												
CIV23505E.2	3	2	1	1									2		
CIV23505E.3	3	2											1		
CIV23505E.4	3	2		1			1						1		
CIV23505E.5	3	2		1			1						1		
Average	3	2	1	1			1						1.25		

SEMESTER – V

Course: Mini Project/ Extensive Survey

Course Code	**CIVP23506**	**CIE Marks**	**100**
Hours/Week (L: T: P)	**0:0:4**	**SEE Marks**	**-**
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:

CIVP23506.1	Understand the type of survey to be carried out for various civil works.
CIVP23506.2	Use appropriate surveying equipment to carry out required survey work.
CIVP23506.3	Analyze the field data and prepare required drawings.
CIVP23506.4	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:

Continuous Internal Evaluation (CIE):

- Presentation on all the projects.

Component		Marks	Total Marks
CIE	Presentation	**100**	**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
CIVP23506.1	3	3	3	2	3	2	2	1	2	1	1	1	1	1	1
CIVP23506.2	3	3	3	2	3	2	2	1	2	1	1	1	1	1	1
CIVP23506.3	3	3	3	2	3	2	2	1	2	1	1	1	1	1	1
CIVP23506.4	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: Research Methodology and IPR

Course Code	**RMIK23507**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**03**

Course Objectives:

CLO1	To make the student understand the foundations of Research and problem solution
CLO2	Knowledge in Research design, Qualitative and Quantitative Research
CLO3	Knowledge to formulate and derive static and dynamic aero elastic equations of motion.
CLO4	To understand the different types of IPR

Content
Module 1 (08 hours)
RESEARCH METHODOLOGY: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. **DEFINING THE RESEARCH PROBLEM:** Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration
Module 2 (08 hours)
REVIEWING THE LITERATURE: Place of the literature review in research, bringing clarity and focus to research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed. **RESEARCH DESIGN**: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs
Module 3 (08 hours)
DESIGN OF SAMPLE SURVEYS: Design of Sampling: Introduction, Sample Design, Sampling and Non-Sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. **MEASUREMENT AND SCALING:** Qualitative and Quantitative Data, **DATA COLLECTION:** Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.
Module 4 (08 hours)
TESTING OF HYPOTHESES: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.

INTERPRETATION AND REPORT WRITING: Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.
Module 5 (08 hours)
INTELLECTUAL PROPERTY: Principles of IPR, Kinds of IPR, Patent- Concepts, Novelty, Utility Inventiveness/Non-obviousness, Procedure for granting and obtaining patents; Copyright- conditions for grant of copyright, Copyright in Literary, Dramatic and Musical ,Works, Sound Recording, Cinematograph Films, Copyright in Computer Programme, Author Special Rights, Right of Broadcasting and performers, Trademark Law and Practices - Procedure of registration of trademark; Emerging Issues and Challenges; Few Future Aspects of Intellectual Property Rights;

Textbook:

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
4. Lionel Bently., Brad Sherman-Intellectual Property Law, 3rd Edition

Reference Books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.

COURSE OUTCOMES:

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

RMIK23507.1	Understand the research problem by literature review to solve problems
RMIK23507.2	Develop skills in qualitative and quantitative data analysis and presentation.
RMIK23507.3	Develop advanced critical thinking skills.
RMIK23507.4	Understand to write the report writing and awareness about IPR

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 Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

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

CO/PO	PO6	PO8	PO12
RMIK23507.1	3	3	3
RMIK23507.2	3	3	3
RMIK23507.3	3	3	3
RMIK23507.4	3	3	3
Average	3	3	3

Low-1: Medium-2: High-3

SEMESTER – V

Course: Environmental Studies

Course Code	**CIVK23508**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:0**	**SEE Marks**	**50**
No. of Credits	**2**	**Examination Hours**	**3**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	To understand ecosystem functions and 17 SDG's for sustainable development
CLO2	To understand advanced energy systems and natural resource management.
CLO3	To understand global environmental issues, related policies and solutions.
CLO4	To understand key environmental legislation related to water, air, waste and environmental protection.
CLO5	To understand e-waste management.

Content	**No. of Hours/ RBT levels**
Module 1 – Ecosystem and Sustainability Ecosystem: Structure of Ecosystem, Types: Forest, Desert, Wetlands, Riverine, Oceanic ecosystems. Sustainability: 17SDG targets and possible actions. Self-Study **Component (SSC): Components of the environment.**	**6 Hours L2**
Module 2 - Natural Resource Management Natural Resources: Water resources – Availability & Quality aspects, Energy: Different types of energy, Conventional sources & non-conventional sources of Energy, Solar energy, OTEC Wind Energy, Hydrogen as an alternative energy Self-Study Component (SSC): Alternative Energy sources Disaster Management, Sustainable Mining - case studies and Carbon Trading **Self-Study Component (SSC): Alternative Energy sources.**	**6 Hours L2**
Module 3 – Environmental Pollution & Waste Management Environmental Pollution: Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Water Pollution, Waterborne diseases & water induced diseases, Noise pollution, Soil Pollution, Air pollution (Sources, Impacts, Preventive measures and Public Health Aspects. Waste Management: Bio-medical Wastes; Solid waste; Hazardous wastes;	**6 Hours L2**

Industrial and Municipal Sludge Solid Waste Management , types and sources, functional elements of SWM, Biomedical Waste Management - Sources, Characteristics **Self-Study Component (SSC): Case studies of air pollution episodes.**	
Module 4 - Global Environmental Issues and Environmental Legislation 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 **Environmental Legislation** Environmental Legislation: Water Act 1974, Air Act 1981, Environmental Protection Act 1984, Solid Waste Management Rules-2016, E- Waste management Rule - 2022, Biomedical Waste management- 2016 **Self-Study Component (SSC): Case studies on waste management options**	**6 Hours L2**
Module 5 - E - Waste Management E - Waste Management Introduction of E- waste; composition and generation. Global context in e- waste; E-waste pollutants, E waste hazardous properties, Effects of pollutant (E- waste) on human health and surrounding environment, domestic e-waste disposal, Basic principles of E waste management, Component of E waste management. E-waste (Management and Handling) Rules, 2011; and E-Waste (Management) Rules, 2022 - Salient Features and its implications. **Self-Study Component (SSC): E-Waste (Management) Amendment Rules, 2023, 2024**	**6 Hours L2**

COURSE OUTCOMES:

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

CIVK23508.1	**Analyze** ecosystem dynamics to formulate strategies for addressing sustainability challenges and implementing the SDGs.
CIVK23508.2	**Evaluate** energy technologies to design effective resource management strategies.
CIVK23508.3	**Evaluate** the impacts of pollution to develop effective waste management strategies.
CIVK23508.4	**Evaluate** global environmental issues to design solutions for sustainable management.
CIVK23508.5	**Interpret** environmental laws and regulations for sustainable management practices.

CIVK23508.6	**Understand** e-waste management in a global scenario.

Suggested Learning Resources:

Textbooks:

1. S M Prakash , "Environmental Studies" 3rd Edition, Elite Publishing House, Mangalore, 2018.
2. Hester R.E., and Harrison R.M, Electronic Waste Management. Science, 2009.

Reference Books:

1. EarchBarucha, "Environmental Studies for UG students", 2004.
2. Benny Joseph (2005), "Environmental Studies" , Tata McGraw – Hill Publishing Company Limited.
3. R. Rajagopalan, "Environmental Studies- From Crisis to Cure" , 2nd Edition, Oxford university press, New Delhi, 2013.
4. Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi.
5. Raman Sivakumar, "Principles of Environmental Science and Engineering", 2nd edition, Cengage learning Singapur, 2005.
6. G. Tyler Miller Jr., "Environmental Science – working with the Earth", Eleventh Edition, Thomson Brooks /Cole, 2006
7. Dr. Pratiba Singh, Dr.Anoop Singh and Dr. PiyushMalaviya, "Text Book of Environmental and Ecology", Acme Learning Pvt. Ltd. New Delhi.

Web Reference:

1. https://www.hzu.edu.in/bed/E%20V%20S.pdf
2. https://onlinecourses.nptel.ac.in/noc23_hs155/preview
3. https://onlinecourses.swayam2.ac.in/cec19_bt03/preview
4. https://sdgs.un.org/goals
5. https://kspcb.karnataka.gov.in/waste-management/biomedical-waste E Waste (Management) Rules, 2022:
6. https://kspcb.karnataka.gov.in/sites/default/files/inlinefiles/E%20Waste%20%28Management%29%20Rules%2C%202022.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 40 marks each. Average of three test marks will be added to test component. 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**

Understand e-waste management in a global scenario.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CIVK23508.1	2					1	1	1				2			3
CIVK23508.2	2	2	2			1	3	1				1			3
CIVK23508.3		2	2	2		1	3	1							2
CIVK23508.4		2	2	2		1	3	1				1			2
CIVK23508.5	1	2	2	2		1	2	1						1	2
CIVK23508.6	2	2	1			2	2	1				1			2
Average	1.75	2	1.8	2		1.16	2.3	1				1.25		1	2.33

SEMESTER – VI

Course: Design and Drawing of Steel Structural Elements

Course Code	**CIV23601**	**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:

CIV23601.1	Evaluate the collapse load, plastic moment for continuous beams and portal frames subjected to various types of loads.
CIV23601.2	Estimate number of bolts, welded strength properties for bolted and welded connections in steel structures.
CIV23601.3	Design of Compression members, built-up columns, laced and battened systems as per IS:800 codal provisions.
CIV23601.4	Design of tension members, lug angles, splices and gusseted base as per IS:800 codal provisions.
CIV23601.5	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:

1. https://archive.nptel.ac.in/courses/105/106/105106216/
2. 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
CIV23601.1	2	3	2		2							1		3	
CIV23601.2	2	3	3		2							1		3	
CIV23601.3	2	3	3		2							1		3	
CIV23601.4	1	2	2		2							1		3	
CIV23601.5	3	2	2		3							1		3	
Average	**2**	**2.6**	**2.4**		**2.2**							**1**		**3**	

SEMESTER – VI

Course: Transportation Engineering

Course Code	**CIV23602**	**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:

CIV23602.1	Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data..
CIV23602.2	Design road geometrics, structural components of pavement and drainage
CIV23602.3	Acquires capability of geometric design aspects of railway system
CIV23602.4	Acquire the capability of airport runway orientation with design aspects and to identify required type of visual and/or navigational aids for the same.
CIV23602.5	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	**4 Hours L2**

2. Viscosity test 3. Specific gravity test 4. Flash and fire point test 5. Ductility test 6. Softening point test	
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
CIV23602.1	2	2												2	
CIV23602.2	2	2	2											2	
CIV23602.3	2	2	2											2	
CIV23602.4	2	2												2	
CIV23602.5	2	2												2	
Average	2	2	2											**2**	

SEMESTER – VI

Course: Structural Dynamics and Earthquake Engineering

Course Code	**CIV23603A**	**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:

CIV23603A.1	**Construct** mathematical model for free vibration of SDOF systems under damped and undamped conditions.
CIV23603A.2	**Compute** the response of single degree of freedom systems for various types of excitations.
CIV23603A.3	**Determine** natural frequencies and mode shapes of multi degree of freedom systems under free and forced vibration conditions.
CIV23603A.4	**Understand** the causes of earthquakes, its risk and mitigation methods
CIV23603A.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:

1. https://eerc.iiit.ac.in/
2. https://www.nicee.org/
3. https://isr.gujarat.gov.in/
4. 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
CIV23603A.1	3	2	3												
CIV23603A.2	2	3	1												
CIV23603A.3	2	3	2									1	2		
CIV23603A.4	2	3	2			1						1	2		
CIV23603A.5	1	2	1											1	
Average	**2**	**2.6**	**1.8**			**1**						**1**	**2**	**1**	

SEMESTER – VI

Course: Ground Improvement Techniques

Course Code	**CIV23603B**	**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.	**8 Hours L2**

Chemical Modification-II: Lime stabilization – suitability, process, criteria for 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:

CIV23603B.1	Explain the objectives of ground improvement and various methods, compaction mechanics and methods.
CIV23603B.2	Describe dewatering and methods, pre-compression, vertical drains
CIV23603B.3	Understand methods of chemical stabilization using cement, lime, fly-ash, and other chemicals.
CIV23603B.4	Illuminate vibration and grouting techniques, procedures, and applications.
CIV23603B.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:

1. https://nptel.ac.in/courses/105108075
2. 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
CIV23603B.1	3				1									2	
CIV23603B.2	3	2			1										
CIV23603B.3	3				1										
CIV23603B.4	3	2			1										
CIV23603B.5	3				1								1		
Average	3	2			1								1	2	

SEMESTER – VI

Course: Water Resources Engineering

Course Code	**CIV23603C**	**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 control. Storm water Analysis Calculation of runoff and peak – Design of storm water network systems	**8 Hours 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:

CIV23603C.1	Analyze components of the hydrological cycle and uses of water
CIV23603C.2	Estimate the extent of drought and its management.
CIV23603C.3	Estimate floods and its management
CIV23603C.4	Identify different aspects of urban flood and storm water control.
CIV23603C.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:

1. https://nptel.ac.in/courses/105105110
2. https://nptel.ac.in/courses/105105110
3. 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
CIV23603C.1	3	2				2							1		
CIV23603C.2	3	2	1			2							1		
CIV23603C.3	3	2	1			2							1		
CIV23603C.4	3	2				2							1		
CIV23603C.5	3	2	1			2							1		
Average	3	2	1			2							1		

SEMESTER – VI

Course: Geo Spatial Engineering

Course Code	**CIV23603D**	**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:

CIV23603D.1	Understand the principles and components of remote sensing.
CIV23603D.2	Understand the principles and components of GIS.
CIV23603D.3	Apply principles of image enhancement and digital image processing.
CIV23603D.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:

1. NPTEL Lectures:
2. Modern Surveying Techniques by Prof. Onkar Dikshit, IIT Kanpur
3. 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 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.

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
CIV23603D.1	3				1								1		
CIV23603D.2	3				1								1		
CIV23603D.3	3	2		1	1										
CIV23603D.4	3	1	1	1	2				1				2		
Average	**3**	**1.5**	**1**	1	**1.25**				**1**				1.33		

SEMESTER – VI

Course: Advanced Geotechnical Engineering

Course Code	**CIV23603E**	**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 theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and	**8Hours L2, L3**

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:

CIV23603E.1	Plan and execute geotechnical site investigation program for different civil engineering projects
CIV23603E.2	Understanding stress distribution in soil and estimate the settlement beneath loaded footings on soils.
CIV23603E.3	Analyze the factor of safety against failure of slopes and compute lateral pressure distribution behind earth retaining structures.
CIV23603E.4	Determine bearing capacity of soil and study the effect of ground water table on bearing capacity of soil.
CIV23603E.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:

1. https://nptel.ac.in/courses/105105176
2. https://nptel.ac.in/courses/105101201
3. 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
CIV23603E.1	3	3	1										1		
CIV23603E.2	3	3	1											2	
CIV23603E.3	3	3	1												
CIV23603E.4	3	3	1										1	2	
CIV23603E.5	3	2	1											2	
Average	3	2.75	1										1	**2**	

SEMESTER – VI

Course: Environmental Pollution and Control

Course Code	**CIV23604A**	**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 classification, Hazardous waste management techniques, Treatment and	**8Hours L2**

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:

CIV23604A.1	Identify the air pollutant control devices and have knowledge on the NAAQ standards and Noise pollution standards.
CIV23604A.2	Describe the source of water pollution and differentiate the treatment techniques used for sewage and industrial wastewater treatment
CIV23604A.3	Understand the fundamentals of solid waste management, practices adopting in town or village and its importance in keeping the health of the city
CIV23604A.4	Describe the soil contamination methods and Identify various Remediation Techniques.
CIV23604A.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:

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

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 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
CIV23604A.1	2	2	2							1		1	1		
CIV23604A.2	2	2	2							1		1	1		
CIV23604A.3	2	2	2			1				1		1	1		
CIV23604A.4	2	2	2							1		1	1		
CIV23604A.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	**CIV23604B**	**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:

CIV23604B.1	Adopt different urban infrastructures policies and programmes for development of smart cities.
CIV23604B.2	Acquire knowledge and understanding of the current trends in Urban Planning with introduction of Sustainability and various strategies regarding environmental concerns.
CIV23604B.3	Adopt the fundamentals of IOT in planning of smart cities.
CIV23604B.4	Adopt different utilities of urban mobility and implementation of smart transport in development of smart cities.
CIV23604B.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:

1. https://www.coursera.org/learn/smart-cities
2. 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
CIV23604B.1	2													1	
CIV23604B.2	2	2	1				2							1	
CIV23604B.3	2	2	1	1	2	2			1	2		2			
CIV23604B.4	2	2	1	1			2		1						
CIV23604B.5	2	2		1	1	2									
Average	2	2	1	2		2	2		1	2		2			

SEMESTER – VI

Course: Sustainable Development Goals

Course Code	**CIV23604C**	**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 introduce the fundamentals and components of Sustainable Development
CLO2	To provide details of Sustainable Cities
CLO3	Understand the Sustainable Development Goals.

Content	No. of Hours/ RBT levels
Module-1 Sustainable Development: Introduction to Sustainable Development Economic Growth and Progress, Continuing Poverty, Environmental Threats, Business as Usual Versus Sustainable Development	**8 Hours L2**
Module 2 Sustainable Cities: The Patterns of Urbanization Around the World, development of Sustainable city, Smart Infrastructure, Urban Resilience, Planning for Sustainable Development.	**8 Hours L2**
Module 3 Curbing Climate Change The Basic Science of Climate Change, Consequences, Mitigation, Adaptation, Mitigation Policies:	**8 Hours L2**
Module 4 Saving Biodiversity: Concept of Biodiversity, Biodiversity Under Threat, Oceans and Fisheries, Deforestation International Dynamics.	**8 Hours L2**
Module 5 Sustainable Development Goals Introduction to Sustainable Development Goals, Goal-Based Development, Financing for Sustainable Development, Principles of Good Governance, Feasibility of Sustainable Development.	**8 Hours L2**

COURSE OUTCOMES:

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

CIV23604C.1	Understand basic idea about Sustainable Development.
CIV23604C.2	Get knowledge about Sustainable Cities
CIV23604C.3	Gain knowledge on Saving Biodiversity.
CIV23604C.4	Understand Sustainable Development Goals.

Textbooks:

1. Ram Kumar Mishra, Ch Lakshmi Kumari, Sandeep Chachra, P.S. Janaki Krishna "Smart Cities for Sustainable Development" Springer, 2022 Edition
2. The Sustainable Development Goals Report 2020 Kindle Edition, Department of Economic and Social Affairs

References:

1. 'The Sustainable Development Goals" Hardcover – December 4, 2018 United Nations.

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
CIV23604C.1	2	2				2	1						1		
CIV23604C.2	2	2				2	1						1		
CIV23604C.3	2	2				2	1						1	1	
CIV23604C.4	2	2				2	1			1			1		
CIV23604C.5	2	2				2	1						1		
Average	2	2				2	1			1			1	**1**	

SEMESTER – VI

Course: Cyber-Physical Systems for Infrastructure

Course Code	**CIV23604D**	**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	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:

CIV23604D.1	Realize the need of CPS, sensors, and instrumentation in civil engineering.
CIV23604D.2	Utilize the concepts of wireless communications in major infrastructure planning
CIV23604D.3	Adopt various structural control systems
CIV23604D.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:

1. https://inl.gov/secure-and-resilient-cyber-physical-systems/
2. 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**
CIV23604D.1	3		1		1							1			
CIV23604D.2	3	2	1		1							1			
CIV23604D.3	3	2	1		1	2						1			
CIV23604D.4	3	2	1		1	2						1			
Average	3	2	1		1	2						1			

SEMESTER – VI

Course: Project work Phase 1

Course Code	**CIVP23605**	**CIE Marks**	**100**
Hours/Week (L: T: P)	**0:0:4**	**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 – VI

Course: Project Management Software Laboratory

Course Code	**CIVL23606**	**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:

CIVL23606.1	Describe a project life cycle, and skillfully map each stage in the cycle.
CIVL23606.2	Understand project management terminologies
CIVL23606.3	Identify the resources needed for each stage, stakeholders, tools and supplementary materials.

CIVL23606.4	Provide internal stakeholders with information regarding project costs by considering estimated cost, variances and profits
CIVL23606.5	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
CIVL23606.1	2	1			3				1		3	1	1		1
CIVL23606.2	2											1			
CIVL23606.3		1			3				1		2				1
CIVL23606.4	1				3				1		3			1	
CIVL23606.5	1	1			2				2	2	2				
Average	1.5	1			2.75				1.25	2	2.5	1	1	1	1

SEMESTER – VI

Course: Quality Control and Assurance

Course Code	**CIV23607A**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:0**	**SEE Marks**	**50**
No. of Credits	**01**	**Examination Hours**	**01**

Prerequisites:

Course Objectives:

CLO1	Understand the elements of quality planning and the implication.
CLO2	Become aware of objectives and advantage of quality assurance.
CLO3	Study the relationship between quality and safety management

Content	No. of Hours/ RBT levels
Module-1 Construction Quality, Inspection and Testing, Quality control, Quality Assurance, Quality Certification for companies and laboratories (ISO Certification, NABL certification) Total Quality Management, Critical factors of TQM, TQM in Projects, Benchmarking, concepts of quality policy, standards, and manual.	**8 Hours** **L2**
Module 2 Third Party Certification: Construction Safety-meaning and scope, Safety in construction- Technological aspects, organizational aspects and behavioral aspects, Safety legislation and Standards, Contract conditions on safety in Civil Engineering projects	**8 Hours** **L2**
Module 3 Safety in Construction: Causes, classification, cost and measurement of an accident, safety programme for construction, protective equipment, accident report, safety measure: (a) For storage and handling of building materials. (b) Construction of elements of a building (c) In demolition of buildings Safety lacuna in Indian scenario Types of injuries, Factors affecting safety, Strategic Planning for safety provisions. Personal & Structural safety - Safety consideration during construction, demolition and during use of equipment. Recording injuries and accident indices. Method statement, SOPs, PPE, Inspections, Investigations. Site safety programmes - JSA, JHA, Root cause analysis, meetings, safety	**8 Hours** **L2**

policy, manuals, training & orientation. Safety legislation regard to violation	

COURSE OUTCOMES:

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

CIV23607A.1	Be exposed to means of quality control.
CIV23607A.2	Take safety measures in construction.

Textbooks:

1. N. Logothetis, "Management for Total Quality", Prentice Hall
2. David Gold Smith, "Safety Management in construction and Industry", Mc Graw Hill
3. K N Vaid, "Construction Safety Management", NICMAR, Bombay

Reference books:

1. D S Rajendra Prasad, "Quality Management System in Civil Engineering", Sapna Book House, Bangalore
2. "The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996, Universal Law Publishing Co. Pvt. Ltd.
3. Robert (QMP) " Bench Marking", " The search for industry Best Practices that led to superior performance" American Society of Quality 1995
4. Break Joseph and Susan Joseph " Total Quality Management", Excel Books , New Delhi, 1995.
5. Juran Frank, J.M. and Gryna, F.M. "Quality Planning and Analysis", Tata McGraw Hill 2002.
6. James, J.O Brian, "Construction Inspection Handbook –Quality" 2009

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 50 marks. The pattern of the question paper is MCQ's with 50 questions of 1 mark each. The time allotted for SEE is 1 hour.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average marks scored in all three tests is added

to the test component. The pattern of the question paper is MCQ's questions of 1 mark each. 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**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CIV23607A.1	2							1		1		1			
CIV23607A.2	2							1		1		1			
Average	**2**							**1**		**1**		**1**			

SEMESTER – VI

Course: Applications of AI in Civil Engineering

Course Code	**CIV23607B**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:0**	**SEE Marks**	**50**
No. of Credits	**01**	**Examination Hours**	**01**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	To understand different approaches, techniques and branches of AI
CLO2	To understand different applications of AI

Content	No. of Hours/ RBT levels
Introduction to Artificial Intelligence, topics: Definitions, goals, approaches, techniques, and branches;.	**3 Hours L2**
Intelligent behavior, understanding AI, hard or strong AI, soft or weak AI, cognitive science. General, engineering and science based AI Goals. AI approaches - cognitive science, laws of thought, turing test, and rational agent.	**4 Hours L2**
AI Techniques that make system to behave as intelligent describe and match, goal reduction, constraint satisfaction, tree searching, generate and test, rule based systems. Biology-inspired AI techniques - neural networks, genetic algorithms, reinforcement learning.	**4 Hours L2**
Branches of AI - logical AI, search in AI, pattern recognition, knowledge representation, inferencing, common sense knowledge and reasoning, learning, planning, epistemology, ontology, heuristics, genetic programming.	**3 Hours L2**
Applications of AI - game playing, speech recognition, understanding natural language, computer vision, expert systems	**3 Hours L2**

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

CIV23607B.1	Understand different approaches, techniques and branches of AI understand different approaches, techniques and branches of AI
CIV23607B.2	Understand different applications of AI

Textbooks:

1. Artificial Intelligence A Modern Approach Third Edition, PRENTICE HALL SERIES IN ARTIFICIAL INTELLIGENCE Stuart Russell and Peter Norvig, Editors

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 50 marks. The pattern of the question paper is MCQ's with 50 questions of 1 mark each. The time allotted for SEE is 1 hour.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average marks scored in all three tests is added to the test component. The pattern of the question paper is MCQ's questions of 1 mark each. 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**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CIV23607B.1	3	3	3		2							3	-	2	
CIV23607B.2	3	3	3		2							3	-	2	
Average	**3**	**3**	**3**		**2**							3	-	2	

SEMESTER – VI

Course: Visual Basic Analysis and Microsoft Project

Course Code	**CIV23607C**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:0**	**SEE Marks**	**50**
No. of Credits	**01**	**Examination Hours**	**01**

Prerequisites:

Course Objectives:

CLO1	Understand the VBA Programming
CLO2	Understand planning using MSP

Content	No. of Hours/ RBT levels
Macro recording, VBA procedures, and debugging Introduction to visual basic for applications (VBA) and foundational tools required to create basic procedures in VBA. Different data types and the scope of variables, troubleshooting code, and how to record basic macros using both absolute and relative referencing modes.	**4 Hours L2**
User-Defined VBA Functions Basic VBA expression entry, creating user-defined functions, functions to Add-Ins in Excel, how to borrow Excel's built-in functions, how to troubleshoot VBA functions when not working.	**4 Hours L2**
Exchanging Information Between Excel and VBA Reference and move information to VBA from Excel and vice versa. types of objects, properties, methods, and events in VBA. Dealing with errors that arise in subroutines.	**4 Hours L2**
Programming structures in VBA problem solving using programming in VBA. common programming structures in VBA (sequence, selection, and repetition) .	**4 Hours L2**
Introduction to Project Management and Project Life Cycle Management Integration Management, Schedule Management, Cost Management, Quality Management, Resource Management, Stakeholder Management	**4 Hours L2**

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

CIV23607C.1	Apply VBA programming to solve civil Engineering problems.
CIV23607C.2	Plan effectively construction activities using MSP.

Textbooks:

1. Excel 2016 Power Programming With VBA, Micheal Alexander and Dick Kudeika, Willey Publications.

Reference books:

1. Learning Microsoft Project 2019, Srikanth Shirodkar.

Scheme of Examination:

Continuous Internal Examination (CIE): One CIE will be conducted at the end of the semester for 50 marks and proportionately reduced to 30.

Week wise CIE Evaluation		
Sl.no	**Activity**	**Marks**
1	Conduction	15
2	Viva voce	05
Total		20

Continuous Internal Examination		
Sl.no	**Activity**	**Marks**
1	Write-up	5
2	Conduction	20
3	Viva voce	5
Total		30

Final CIE Evaluation		
Sl.no	**Activity**	**Marks**
1	Week wise CIE Evaluation	20
2	Continuous Internal Examination	30
Total		50

Semester End Examination (SEE):

1. All laboratory experiments are to be included for practical examination.
2. Students can pick one experiment from the questions lot prepared by the examiners.
3. Change of experiment is allowed only once and 20% marks allotted to the conduction part to be made zero.

Semester End Examination Evaluation		
Sl.no	**Activity**	**Marks**
1	Write-up	15
2	Conduction	70
3	Viva voce	15
Total		100

Note: The marks scored will be proportionately reduced to 50.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CIV23607C.1	2	1			2				1		1	1			
CIV23607C.2	2				2				1	1	1	1			
Average	**2**	**1**			**2**				**1**	**1**	**1**	**1**			

SEMESTER – VI

Course: Forensics and Rehabilitation

Course Code	**CIV23607D**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:0**	**SEE Marks**	**50**
No. of Credits	**01**	**Examination Hours**	**01**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	To understand structural failures and causes of distress in structural members
CLO2	To understand different methods of visual and non destructive testing

Content	No. of Hours/ RBT levels
Module-1 **Forensics and Rehabilitation:** Failure of Structures, review of the construction theory, performance problems, responsibility and accountability, case studies, learning from failures, causes of distress in structural members, design and material deficiencies, over loading.	**8 Hours** **L2**
Module 2 **Diagnosis and Assessment of Distress**: Visual inspection, non- destructive tests, ultrasonic pulse velocity method, rebound hammer technique, ASTM classifications, pullout tests, Bremor test, Windsor probe test, crack detection techniques, case studies, single and multistorey buildings, fibreoptic method for prediction of structural weakness	**8 Hours** **L2**

COURSE OUTCOMES:

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

CIV23607D.1	Understand material deficiencies and causes of failures
CIV23607D.2	Understand various non destructive tests to predict structural weakness

Textbooks:

1. Philip W. (1994) Industrial sensors and applications for condition monitoring, MEP
2. Armer G S T (2001) Monitoring and assessment of structures, Spon, London

Reference books:

1. Raikar,R.N., (1994) Learning from failures – Deficiencies in design, construction and service – R&D Centre (SDCPL), Raikar Bhavan

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 50 marks. The pattern of the question paper is MCQ's with 50 questions of 1 mark each. The time allotted for SEE is 1 hour.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average marks scored in all three tests is added to the test component. The pattern of the question paper is MCQ's questions of 1 mark each. 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**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CIV23607D.1	2														
CIV23607D.2	2														
Average	**2**														

SEMESTER – VI

Course: Indian Knowledge System

Course Code	**CIVK23609**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:0**	**SEE Marks**	**50**
No. of Credits	**0**	**Examination Hours**	**1**

Prerequisites: - None

Course Objectives:

CLO1	To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system
CLO2	To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.

Content
Module 1 (05 hours)
Introduction to Indian Knowledge Systems (IKS): Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge.
Module 2 (05 hours)
Traditional Knowledge in Humanities and Sciences: Lingistics, Number and measurements-Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology
Module 3 (05 hours)
Traditional Knowledge in Professional domain: Town planning and architecture Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.

Reference Books:

1. Introduction to Indian Knowledge System- concepts and applications, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93- 91818-21-0
2. Traditional Knowledge System in India, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230,
3. Knowledge Traditions and Practices of India, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334,

COURSE OUTCOMES:

Upon completion of this course, student would:

CIVK23609.1	Provide an overview of the concept of the Indian Knowledge System and its importance.
CIVK23609.2	Appreciate the need for and importance of protecting traditional knowledge.
CIVK23609.3	Recognize the relevance of Traditional knowledge in different domains.
CIVK23609.4	Establish the significance of Indian Knowledge systems in the contemporary world

Scheme of Examination:

Semester End Examination (SEE):
SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour.
Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests.
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	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**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**
CIVK23609.1						3									
CIVK23609.2						3									
CIVK23609.3						3									
CIVK23609.4						3									
Average						3									

SCHEME AND SYLLABUS

VII - VIII Semester Scheme (2023-24)

Civil Engineering

Department of Civil Engineering

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

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.**

H.N. Rajashekar Gowda
Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

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B.E. in CIVIL Engineering Scheme of Teaching and Examinations 2023

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme A- VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lectue	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	CIV23701	Estimation & Contract Management	TD: , PSB:	3	2	0		03	50	50	100	4
2	IPCC	CIV23702	Design & drawing of irrigation and Bridge Structures	TD: , PSB:	3	0	2		03	50	50	100	4
3	PCC	CIV23703	Design & drawing of RCC & Steel structures	TD: , PSB:	2	2	2		03	50	50	100	4
4	PEC	CIV23704x	**Professional Elective-III**	TD: PSB:	3	0	0		03	50	50	100	3
5	OEC	CIV23705x	**Open Elective- II**	TD: PSB:	3	0	0		01	50	50	100	3
6	PROJ	CIVP23706	**Major Project Phase-II**		0	0	12		03	100	100	200	6
									Total	**350**	**350**	**700**	**24**

Professional Elective Course

CIV23704A	Finite Element Method	CIV23704C	Pavement Design & Maintenance
CIV23704B	Design of PSC & RCC Bridge	CIV23704D	Integrated Water Resources Management
CIV23704E	Advanced Foundation Engineering		

Open Elective Course

CIV23705A	AI/ML in infrastructure Engineering	CIV23705C	Engineering Economics
CIV23705B	Disaster Mitigation and management	CIV23705D	Sensor Technologies for Infrastructure

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI

semester.
(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:
Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

PROJECT WORK (21MEP75): The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To install responsibilities to oneself and others.
(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:
(1) 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 project work, shall be based on the evaluation of the project work 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.
(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work 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 procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

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Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme A- VIII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	CIV23801x	**Professional Elective -IV (Online Courses)**	TD: PSB:	3	0	0		03	50	50	100	3
2	OEC	CIV23802x	**Open Elective - III (Online Courses)**	TD: PSB:	3	0	0		03	50	50	100	3
3	INT	CIVI23803	**Internship (Industry/Research) (14 - 20 weeks)**	TD:	0	0	12		03	100	100	200	10
									Total	**200**	**200**	**400**	**16**

Professional Elective Course (Online courses)

CIV23801A	Urban transport & Intelligent Transportation System	CIV23801E	Deep Excavation and Tunnels
CIV23801B	Solid waste management	CIV23801F	Metro and Seaports Engineering
CIV23801C	Economic evaluation & DPR	CIV23801G	Geo environmental Engineering
CIV23801D	Pavement construction, maintenance and management	CIV23801H	Advanced Design of Steel Structures

Open Elective Courses (Online Courses)

CIV23802A	Energy Conservation in Buildings	CIV23802C	Green Buildings
CIV23802B	Occupational Health and Safety	CIV23802D	Integrated Building Services

L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**:
Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work, **INT**: Industry Internship / Research Internship / Rural Internship

Note: VII and VIII semesters of IV years of the programSwapping Facility

- Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate **research internships/ industry internships/Rural Internship** after the VI semester**.**
- Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester **Research Internship /Industrial Internship / Rural Internship**shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, centre of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. **University shall not bear any cost involved in carrying out the internship by students.** However, students can receive any financial assistance extended by the organization.

Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students on the VTU web portal.

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B.E. in CIVIL Engineering Scheme of Teaching and Examinations 2023

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2022-23)

Scheme B- VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lectue	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	CIV23701	Estimation & Contract Management(To be completed in the 6 th semester)	TD: , PSB:	2	2	0		03	50	50	100	3
2	IPCC	CIV23702	Design & drawing of irrigation and Bridge Structures (To be completed in 5th/6th semester)	TD: , PSB:	3	0	2		03	50	50	100	4
3	PCC	CIV23703	Design & drawing of RCC & Steel structures (To be completed in 5th/6th semester)	TD: , PSB:	2	2	2		03	50	50	100	4
4	PEC	CIV23704x	**Professional Elective-III**	TD: PSB:	3	0	0		03	50	50	100	3
5	OEC	CIV23705x	**Open Elective- II**	TD: PSB:	3	0	0		01	50	50	100	3
									Total	**250**	**250**	**500**	**17**

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B.E. in CIVIL Engineering Scheme of Teaching and Examinations 2023

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme B- VIII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lectue	Tutorial	Practical /Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	CIV23801x	**Professional Elective -IV (Online Courses)**	TD: PSB:	3	0	0		03	50	50	100	3
2	OEC	CIV23802x	**Open Elective - III (Online Courses)**	TD: PSB:	3	0	0		03	50	50	100	3
3	PROJ	CIVP23802	**Project - outcome of training**		0	0	12		03	200	200	200	9
4	INT	CIVI23803	**Internship (Industry/Research) (14 - 20 weeks)**	TD:	0	0	12		03	100	100	200	10
									Total	**400**	**400**	**600**	**25**

SEMESTER – VI

Course: Estimation and Contract Management

Course Code	**CIV23701**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:2:0**	**SEE Marks**	**50**
No. of Credits	**4**	**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 - centre line method. Estimate of R.C.C structures including Slab, beam, column, footings.	**8 Hours L3**
Module – 2 Estimate of Steel truss, manhole and septic tanks and slab culvert. Quantity **Estimation for Roads:** Computation of volume of earthwork fully in banking, cutting, partly 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 detail 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	**8 Hours L2**

Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.	
Module – 4 **Contract Management-Tender and its Process:** Invitation to tender, Prequalification, administrative approval & 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: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC). Law of Contract as per Indian Contract act 1872, Types of Contracts, Joint venture. **Contract Forms:** FIDIC contract Forms, CPWD, NHAI, NTPC, NHEPC	**8 Hours L2**
Module 5 **Contract Management-Post award:** Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, Disputes & its resolution mechanism, Contract management and administration. **Valuation:** Definitions of terms used in valuation process, Purpose of valuation, Cost, Estimate, Value and its relationship, Capitalized value. Freehold and lease hold and easement, Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation: Rent fixation, valuation for mortgage, valuation of land.	**8 Hours L2**

COURSE OUTCOMES:

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

CIV23701.1	Compute quantities, cost and prepare abstract for building components
CIV23701.2	Compute quantities, cost and prepare abstract for various structural works: water supply, Sanitary and road works.
CIV23701.3	Prepare specifications and rate of analysis for various items of work.
CIV23701.4	Assess Contract and tender documents for various construction works.
CIV23701.5	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_bGAFPlrfM7qlX47

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
CIV23701.1	3	2	1								1			3	
CIV23701.2	3	2	1			1					1			3	
CIV23701.3	3	2												2	
CIV23701.4	3	2						1			1			1	
CIV23701.5											2	1			
Average	**3**	**2**	**1**			1		1			**1.25**	**1**		**2.25**	

SEMESTER – VII

Course: Design & Drawing of Irrigation and Bridge Structures

Course Code	**CIV23702**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**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	Analyse 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:

CIV23702.1	**Design** of Tank sluice, Canal drop, Canal regulator and Direct sluice for Strength and serviceability requirements.
CIV23702.2	**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=7HXF3oGWRlA&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
CIV23702.1	3	2			2			1				2		3	
CIV23702.2	3	2			2			1				2		3	
Average	**3**	**2**			**2**			1				**2**		**3**	

SEMESTER – VIII

Course: Design and Drawing of RCC and Steel Structures

Course Code	**CIV23703**	**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:

CIV23703.1	Design of combined footing, retaining wall, Portal frame and water tank for Strength and serviceability requirements.

CIV23703.2	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
CIV23703.1	3	3	2		2									3	
CIV23703.2	3	3	2		2									3	
Average	**3**	**3**	**2**		**2**									**3**	

SEMESTER – VII

Course: Finite Element Method

Course Code	**CIV23704A**	**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 Elements, Numerical integration by Gaussian quadrature rule for one, two- and three-	**8 Hours L3**

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:

CIV23704A.1	**Understand** the basic concepts of finite element analysis
CIV23704A.2	**Construct** mesh and shape functions for beam and truss problems
CIV23704A.3	**Compute** element stiffness matrix for various types of finite elements
CIV23704A.4	**Apply** Gaussian quadrature rule for one, two and three dimensional problems.
CIV23704A.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
CIV23704A.1	3	1											1		
CIV23704A.2	3	2			2							1	1		1
CIV23704A.3	2	3	3		1							1	1		1
CIV23704A.4	2	2											1		
CIV23704A.5	3	3	3		2							1	1		1
Average	**2.6**	**2.2**	**3**		**1.67**							**1**	**1**		**1**

SEMESTER – VIII

Course: Design of PSC and RCC Bridges

Course Code	**CIV23704B**	**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	**08 Hours**

PSC Bridge: Introduction to Pre-& Post Tensioning, Proportioning of 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.	**L3**
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:

CIV23704B.1	Understand the concepts of bridges, IRC loadings and distribution theory as per IRC standards.
CIV23704B.2	Design slab culvert and box culvert subjected to various loading combinations and IRC standards.
CIV23704B.3	Analyse the maximum bending moment and shear force for T Beam bridge and PSC bridge as per COURBON'S method.
CIV23704B.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
CIV23704B.1	3	3			2									3	
CIV23704B.2	3	3			2							1		3	
CIV23704B.3	3	3			2							1		3	
CIV23704B.4	3	3			2							1		3	
Average	**3**	**3**			**2**							**1**		**3**	

SEMESTER – VII

Course: Pavement Design and Maintenance

Course Code	**CIV23704C**	**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:

CIV23704C.1	Analyze the components and factors considered in fundamental design of pavements.
CIV23704C.2	Design the thickness of flexible pavements by different methods and compute the stresses and deflection under the action of wheel load.
CIV23704C.3	Design the thickness of concrete pavements and joints associated with CC pavements in addition to the computation of stresses in CC pavements.
CIV23704C.4	Analyze the types of flexible pavement failures and propose suitable remedies.
CIV23704C.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
CIV23704C.1	2	2													
CIV23704C.2	2	2						2					2		
CIV23704C.3	2	2	1					2					2		
CIV23704C.4	2	2	1												
CIV23704C.5	2	2	1												
Average	2	2	1					2					2		

SEMESTER – VII

Course: Integrated Water Resources Management

Course Code	**CIV23704D**	**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:

CIV23704D.1	Understand water management system components, their characteristics and functioning of such systems
CIV23704D.2	Analyse integrated water management scenarios and implementation
CIV23704D.3	Utilize the Geographic Information System (GIS) in water resources management
CIV23704D.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
CIV23704D.1	2	2				1	1					1	1		
CIV23704D.2	2	2				1	1					1	1		
CIV23704D.3	2	2				1	1					1	1		
CIV23704D.4	2	2				1	1					1	1		
Average	2	2				1	1					1	1		

SEMESTER – VII

Course: Advanced Foundation Engineering

Course Code	**CIV23704E**	**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 settlements of raft foundation, Rigid methods, Flexible methods, coefficient of sub	**8 Hours L2, L3**

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:

CIV23704E.1	Understand the principles of subsoil exploration and concepts of Settlement analysis
CIV23704E.2	Classify the different types of foundation and their suitability for particular site and structures.
CIV23704E.3	Evaluate the soil shear strength parameters and bearing capacity for various sub-soil profile
CIV23704E.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:

1. https://nptel.ac.in/courses/105105207
2. 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
CIV23704E.1	2	3	2		2							1		3	
CIV23704E.2	2	3	3		2							1		3	
CIV23704E.3	2	3	3		2							1		3	
CIV23704E.4	1	2	2		2							1		3	
Average	**1.75**	**2.75**	**2.5**		**2**							**1**		**3**	

SEMESTER – VII

Course: AI&ML in Infrastructure Engineering

Course Code	**CIV23705A**	**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:

CIV23705A.1	Understand the concepts of deep networks and data collection
CIV23705A.2	Understand machine learning algorithms in civil & infrastructure engineering
CIV23705A.3	Analyze problems in deterministic and random environments
CIV23705A.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:

1. https://www.viktor.ai/blog/40/artificial-intelligence-machine-learning-engineering-construction
2. 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**
CIV23705A.1	3	2	2		3							3	1		
CIV23705A.2	3	2	3	2	3							3	1		
CIV23705A.3	3	2	3	2	3							3	1		
CIV23705A.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	**CIV23705B**	**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:

CIV23705B.1	Explain the application of Disaster Concepts to Management
CIV23705B.2	Identify extent and damaging capacity of a disaster
CIV23705B.3	Understand the means of losses and methods to overcome /minimize it.
CIV23705B.4	Describe role of individual and various organization during and after disaster
CIV23705B.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
CIV23705B.1	2	1	1		3	3	2			2			1		
CIV23705B.2	2	1	1		3	3	2			2			1		
CIV23705B.3	2	1	1		3	3	2						1		
CIV23705B.4	2	1	1	1	3	3	2						1		
CIV23705B.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	**CIV23705C**	**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:

CIV23705C.1	Describe the principles of economics that govern the operation of any organization under diverse market conditions.
CIV23705C.2	Comprehend macroeconomic principles and decision making in diverse business set up
CIV23705C.3	Explain the inflation and price change as well as present worth analysis.
CIV23705C.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:

1. www.finmin.nic.in ,
2. www.rbi.org.in ,
3. 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 / 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
CIV23705C.1	2										1		1		
CIV23705C.2	2	1													
CIV23705C.3	2														
CIV23705C.4	2							1			1				
Average	2							1			1		1		

SEMESTER – VII

Course: Sensor Technologies for Infrastructure

Course Code	**CIV23705D**	**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:

CIV23705D.1	**Understand** the basic concepts of sensor data acquisition systems
CIV23705D.2	**Apply** instruments and sensors for structural health monitoring
CIV23705D.3	**Explain** various methods of structural health monitoring
CIV23705D.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
CIV23705D.1	3	1			1								1		
CIV23705D.2	3	2			1								1		1
CIV23705D.3	2	3			1								1		1
CIV23705D.4	2	2			1								1		1
Average	**2.5**	**2.0**			**1**								**1**		**1**

SEMESTER – VII

Course: Major Project Phase 1I

Course Code	**CIVP23706**	**CIE Marks**	**100**
Hours/Week (L: T: P)	**0:0:12**	**SEE Marks**	**100**
No. of Credits	**6**	**Examination Hours**	**3**

Major Project Guidelines:

- Continuous monitoring of project work will be carried out and cumulative evaluation will be done.
- The students are required to meet their internal guides once in a week to report their progress in project work.
- **Weekly Activity Report** (WAR) has to be maintained in the form of a diary by the project batch and the same has to be discussed with the Internal Guide regularly.
- In case of ***Industry project,*** during the course of project work, the internal guides will have continuous interaction with external guides and will visit the industry at least twice during the project period.
- For CIE assessment the project groups must give a final seminar with the draft copy of the project report.
- The presentation by each group will be for 20-30 minutes and every member of the team needs to justify the contributions to the project.
- The project team is required to submit Hard copies of the detailed Project Report in the prescribed format to the department.
- For CIE 40% weightage should be given to the project guide, 40% weightage to the project evaluation committee and 20% weightage to HoD.
- Before the final evaluations the project group is required to produce a No dues certificate from Industry, Central Library and Department.

COURSE OUTCOMES:

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

CIV23706.1	Apply knowledge of mathematics, science and engineering to solve respective engineering domain problems.
CIV23706.2	Design, develop, present and document innovative/multidisciplinary modules for a complete engineering system.
CIV23706.3	Use modern engineering tools, software and equipment to solve problem and engage in life-long learning to follow technological developments.
CIV23706.4	Function effectively as an individual, or leader in diverse teams, with the understanding of professional ethics and responsibilities

Scheme of Evaluation:

Continuous Internal Evaluation (CIE):

The following are the weightings given for the various stages of the project

Sl No.	Activity	Weightage
1	Execution of Project	30%
2	Presentation, Demonstration and Results Discussion	40%
3	Report Writing & Publication	30%

Semester End Evaluation (SEE):

The following are the weightings given during Viva Examination

Sl No.	Activity	Weightage
1	Presentation/Demonstration of the project	30%
2	Methodology and Experimental Results & Discussion	30%
3	Report	20%
4	Viva Voce	20%

SEMESTER – VIII

Course: Urban Transport and Intelligent Transportation Systems

Course Code	**CIV23801A**	**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	**8Hours** L2,L3

Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, 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 Systems Vehicles 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:

CIV23801A.1	Design, conduct and administer surveys to provide the data required for transportation planning.
CIV23801A.2	Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
CIV23801A.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.

CIV23801A.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.
CIV23801A.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
CIV23801A.1	2	2	2										2		
CIV23801A.2	2	2	2										2		
CIV23801A.3	2	2	2										2		
CIV23801A.4	2	2	2										2		
CIV23801A.5	2	2	2										2		

Average	2	2	2										2		

SEMESTER – VIII

Course: Solid Waste Management

Course Code	**CIV23801B**	**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 numerical, 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	**8 Hours L2**

processes. Vermicomposting	
Module 4 **Sanitary Land Filling:** Different types, trench area, Ramp and pit method, site selection, basic steps involved, cell design, prevention of site pollution, leachate & gas collection and control methods, geosynthetics fabrics in sanitary landfills. **Incineration:** Process – 3 T's, factors affecting incineration process, incinerators – types, prevention of air pollution, pyrolysis, 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, reuse in other industries, plastic waste, environmental significance and reuse.	**8 Hours L2**

COURSE OUTCOMES:

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

CIV23801B.1	Identify improper practices of solid waste disposal and their environmental implications. Know the basic engineering principles of solid waste management
CIV23801B.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
CIV23801B.3	Understand the management concepts, define 4 R approach, apply PPP model and community involvement for effective management of solid waste
CIV23801B.4	Develop a concise idea on various conventional and advanced treatment options for solid waste
CIV23801B.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
CIV23801B.1	3	2				1									
CIV23801B.2	3	2				1	2								
CIV23801B.3	3	2			1	2	1					1			
CIV23801B.4	3	2			1	2						1	1		
CIV23801B.5	3	2			1	1	2					1			
Average	**3**	**2**			1	1.4	1.7					1	1		

SEMESTER – VIII

Course: Economic Evaluation and DPR

Course Code	**CIV23801C**	**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 economic development and employment generation, input industries, clients,	**8 Hours L2**

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 and loss account, balance sheet, income statement, cash flow and fund flow statements.	**8 Hours L2**

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:

CIV23801C.1	Discuss the basics of Micro and macroeconomics in the economic development of a country
CIV23801C.2	Understand types of funds associated with finance management.
CIV23801C.3	Compare the various alternatives and selection criteria.
CIV23801C.4	Understand different accounting in finance management
CIV23801C.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:

1. https://especia.co.in/post/what-is-dpr/
2. 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.

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
CIV23801C.1	1														
CIV23801C.2	1														
CIV23801C.3	1														
CIV23801C.4	1													1	
CIV23801C.5	1													1	
Average	**1**													**1**	

SEMESTER – VIII

Course: Pavement Construction, Maintenance & Management

Course Code	**CIV23801D**	**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,	**8 Hours L2**

quality control during construction. Construction of special Cement concrete 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:

CIV23801D.1	Design the drainage requirements for different components of the road structure and maintenance with suitable remedies.
CIV23801D.2	Design bituminous surfacing and other layers along with safety aspects needed during construction.
CIV23801D.3	Design CC pavements with appropriate base course thickness and along with safety aspects needed during construction.
CIV23801D.4	Select suitable equipment for preparation of subgrade in cutting or filling and also the preparation steps for base and subbase layers.
CIV23801D.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
CIV23801D.1	3	2												2	
CIV23801D.2	3	2												2	
CIV23801D.3	3	2												2	
CIV23801D.4	3	2												2	
CIV23801D.1	3	-												2	
Average	3	2												**2**	

SEMESTER – VIII

Course: Deep Excavation and Tunnels

Course Code	**CIV23801E**	**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	Introduce various underground structures such as tunnels, caverns, shafts, and stations
CLO2	Explain the construction methodology, support systems and challenges in the construction of Tunnels, caverns, shafts, and stations.
CLO3	Explain design aspects in the field on geotechnical/rock engineering and tunnelling, Instrumentation, and monitoring of tunnels
CLO4	Impart knowledge on the field challenges to the students through introduction of problem statements in each module and to assess the comprehension of course through case studies as project work

Content	**No. of Hours/ RBT levels**
Module-1 **Introduction to underground constructions and tunnelling:** General Description of Various Tunnels and other underground structures, Components of a tunnel, Stress around an underground opening, Methods of excavations, Subsurface investigation Surface investigation, Sampling Techniques, Laboratory and in-situ testing of soil and rock, Indian standard codes.	**10 Hours L3**
Module 2 **Construction, challenges and solutions for Caverns, shaft and underground stations:** Factors affecting the choice of method of tunnel construction, Cut and cover method, Bored method, Drill and blast method, Sequential excavation method and shaft method, Norwegian tunnel boring method (NTM), New Austrian tunnel boring method (NATM), Methods of construction of caverns and shafts and underground stations, Challenges and solutions for execution of these methods, Different types of Tunnel boring machines.	**10 Hours L3**

Module 3 Design methodology, Instrumentation and monitoring for tunnels: Rock mass classification, Geotechnical and geological inputs for design, Empirical, semi empirical and joint set analysis, Numerical 2D modelling and final support recommendations, Need for Instrumentation and monitoring in tunnels, Types of Instruments - Planning and execution	**10 Hours L3**
Module 4 **Support systems and design software for tunnels:** Need for pre-excavation support system, Fore piling, Bolts and Anchors, Shotcrete, wire meshes, lattice girders and integrated support systems, Different types of retaining structures and their applicability. Secant piles, Sheet piles, contiguous piles and soldier piles and D wall. Requirement of investigation to be carried out for underground structure, Preparation geotechnical interpretation report for design of retaining structure, Numerical analysis to be performed for temporary / permanent retaining system, Introduction to software to be used in embedded retaining system, Case studies.	**10 Hours L3**
Module 5 **Indian and International Code provisions:** Introduction to interpretation using Rock data, Introduction to Wallap, Introduction to Plaxis Introduction to RS-2, Introduction to CIRIA 143, Wallap and their application Practical application & case studies	**10 Hours L3**

COURSE OUTCOMES:

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

CIV23801E.1	Analyze unrestrained beams and beam column behavior in frames as per IS:800 codal provisions
CIV23801E.2	Design steel beams with web openings and Vierendeel girders.
CIV23801E.3	Evaluate the behavior of Light gauge steel members.
CIV23801E.4	Design steel structures subjected to fire resistance.

Textbooks:

1. CIRIA -C760 “Guidance on Embedded retaining wall design”
2. David Chapman, Nicole Metje, Alfred Stark ” Introduction to Tunnel Construction “2017 , CRC Press

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
CIV23801E.1	2	2	2		2									3	
CIV23801E.2	2	2	2		2									3	
CIV23801E.3	2	2	2		2									3	
CIV23801E.4	2	2	2		2									3	
Average	**2**	**2**	**2**		**2**									**3**	

SEMESTER – VIII

Course: Metros and Seaports Engineering

Course Code	**CIV23801F**	**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	Elaborate on the salient features and types of Transit oriented development and its significance
CLO2	Explain the planning, Analysis, design and execution of elevated and underground Metro viaducts, tunnels including monitoring systems and stations
CLO3	Explain the design and Analysis of Earth retaining structures used in Metro systems
CLO4	Introduce the future trends and technologies in Transportation systems.
CLO5	Introduce the salient features of seaports
CLO6	Explain the different permanent and enabling structures in seaports

Content	No. of Hours/ RBT levels
Module 1 **Introduction to Mass Rapid Transit System (MRTS) and Planning of Metros:** Overview of Metro, Transit Oriented Development, Feasibility Study for MRTS Project, Sustainable and Smart Technologies, Recent Advancements & Future Technologies (High Speed Rail Technology, 'Maglev & Ground Effect Trains etc.). Basic Interfacing Principles – Alignment, Urban level planning, constraints and restrictions, Building Information Modelling in Metros, HVAC Systems, Tunnel Ventilation System, Public Health Engineering, Fire Alarm System etc.	**8Hours L2**
Module 2 **Design, Construction and Quality Control:** Introduction to Contracts, Overview of FIDIC standards, Introduction to Quality Systems, Precasting Yard Development, Types of Precast Super Structure, Precast Mould development, Formwork System Overview, introduction to Precast Erection, Superstructure launching Methods, Obligatory Spans, substructure and foundation Construction Methodology, Challenges in Foundation Construction Alignment / Span configuration of elevated structures, Soil condition and type of foundations, Substructure system, Choosing type of Pier based on alignment profile, Rail / Over	**8Hours L2**

Head Equipment mast, Station overall layout, Pier arm - spine wing / cantilever and Platform- precast/cast-in-situ system. Erection methods and case studies Overview of Elevated station, Analysis and Design, Spine beam method, Design of station components, Loads and introduction to IRC/IRS Codes, 'Analysis and Design of superstructure, Substructure and foundation, 'Introduction to Modelling Software - STAAD Pro .	
Module 3 **Earth Retaining systems, Underground Metro Stations, Tunnels and monitoring systems:** Underground Stations and its configurations, Shoring Systems, supporting systems, Construction Methodology (Bottom Up method/ Top Down method), Tunnelling methods and monitoring systems, Earth retaining structures, Secant pile wall design, Guide walls, Introduction to Loads, Load combinations, Fire resistant criteria and Floatation check, 2D & 3D model generation, SOD restrictions & Element sizing for UG Stations, Design of all the components of UG station	**8Hours L2**
Module 4 **Introduction to Seaports:** Introduction and evolution of Ports and Harbors, Terminologies, Overview of Marine Structures, Operation and components of Ports, Site investigation and survey, Approach facilities and navigational aids. Design considerations and functional requirements of typical port structures, Breakwater Structures, Berthing structures, Piers, Wharfs, Jetties, Quays, Dolphins, Fenders, Dredging facilities, Shipyard structures (dry dock and floating dock), Shore protection and Reclamation	**8Hours L2**
Module 5 **Enabling structures:** Cofferdams and Dewatering – Case study, Load Out Jetty (LOJ) – Design of retaining structure, Elevated platform and Hydraulic ramp. Casting Yard Planning and Mould Optimization. Piling Gantry – Layout, Loading. Rock Works – Breakwater construction, Revetment. Floating Stability/Caisson launching – Casting bed, Ballasting. Modular Construction – Modularization, Erection.	**8Hours L2**

COURSE OUTCOMES:

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

CIV23801F.1	Create the basic layout of elevated and underground metro stations as per laid down codes and regulations.
CIV23801F.2	Interpret design recommendations and Codes of Practice for Elevated and Underground Metros and select suitable construction practices
CIV23801F.3	Design the earth retaining systems for the excavations of underground stations

CIV23801F.4	Comprehend the different permanent and enabling structures of seaports and harbors
CIV23801F.5	Design Enabling structures of Ports and Harbors.

Textbooks:

1. Indian Standard code - IS 456, Guidance on embedded retaining wall design CIRIAC760
2. David Chapman, Nicole Metje, Alfred Stark " Introduction to Tunnel Construction "2017 , CRC Press
3. M. Ramachandran ,"Metro Rail Projects in India- A Study in Project Planning "2011, Oxford University Press

References:

1. Srinivasan, R., Harbour, Dock & Tunnel Engineering, Charotar Publishing House
2. Bindra, S.P., A course in Docks and Harbour Engineering, Dhanpat Rai & Sons
3. Port Design - Guidelines and recommendations by C. A. Thoresen, Tapir Publications

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.
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
CIV23801F.1	2	1	2							1					
CIV23801F.2	2	1	2				1			1					
CIV23801F.3	2	1	2							1					
CIV23801F.4	2	1	2	1						1					
CIV23801F.5	2	1	2							1					
Average	2	1	2	1			1			1					

SEMESTER – VIII

Course: Geo-Environmental Engineering

Course Code	**CIV23801G**	**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:

CIV23801G.1	Identify various Sources of Contaminations.
CIV23801G.2	Describe the Characterization solid wastes with respect to waste management strategies.
CIV23801G.3	Understand the contaminant transport process like Bioremediation, Phytoremediation.
CIV23801G.4	Identify various active and passive methods of Remediation Techniques.
CIV23801G.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.

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
CIV23801G.1	2	1	2							1					
CIV23801G.2	2	1	2				1			1					
CIV23801G.3	2	1	2							1					
CIV23801G.4	2	1	2	1						1					
CIV23801G.5	2	1	2							1					
Average	2	1	2	1			1			1					

SEMESTER – VIII

Course: Energy Conservation in Buildings

Course Code	**CIV23802A**	**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 facilitate learners to understand climatology, heat ingress in building and energy efficiency.
CLO2	To expose the learners to comfort in buildings.
CLO3	To impart fundamental knowledge on Life cycle assessment and Energy conservation.

Content	No. of Hours/ RBT levels
Module-1 Introduction to Climatology and heat ingress in building: Basics of climatology, Earth – Sun relationship, Solar angles and sun path diagram, Design of shading systems. Basics of Thermodynamics, Convection/radiation heat transfer, Heat gain through various elements of a building, Thermal comfort models and case studies.	**8 Hours L2**
Module 2 Building acoustics, Indoor air quality and Lighting in buildings: Basics of sound and Building acoustics – Acoustic defects, prevention of sound transmission and acoustic measure for office building. Indoor Air Quality – Effects, control of contaminants and moisture in indoor environment, Integrated approach for IAQ management. Fundamentals of lighting- Daylighting and its metrics – Strategies for daylighting and its control. Artificial lighting – Design and control strategies – Visual comfort enhancement.	**8 Hours L2**
Module 3 Energy efficient buildings, Water and Waste management in buildings: Energy efficiency – Energy efficiency in building envelope and energy efficient HVAC and Lighting as per Energy conservation building code (ECBC) 2017, Energy simulation, Energy management system – Renewable energy and Energy Audit. (demand control ventilation) Water Efficiency – Planning and design of water management system, Rain water harvesting, Water efficient design and fixtures,	**8 Hours L2**

Treatment and reuse and Water efficient landscape system. Waste management – Types of waste and its treatment methods, Construction and demolition waste management, Waste management in residential, commercial buildings, healthcare facilities.	
Module 4 Life Cycle Assessment of Buildings and Green project management: Materials – Green product certifications, features of sustainable building materials and sustainable alternatives for structural, envelope and finishing materials. Low carbon cement, Zero emission bricks and lean construction practices. Life cycle assessment and its types – Modelling and Analysis, Greenhouse gas emission. Different phases of Green building project management.	**8 Hours L2**
Module 5 Energy conservation: Energy efficiency rating for distribution transformers, diesel generator set, motors, pumps, electrical appliances, lighting fixtures and lifts as per Bureau of Energy Efficiency (BEE). Energy efficiency in HVAC system – Variable Frequency Drive (VFD), Air volume drive. Roof top solar installations and solar water heaters, Heat recovery system in buildings, Building Management System (BMS) – Occupancy sensors and energy efficient lighting controls, Smart Buildings	**8 Hours L2**

COURSE OUTCOMES:

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

CIV23802A.1	Comprehend climatology, shading system and analyze heat transfer mechanism in buildings.
CIV23802A.2	Assess the design considerations and parameters for lighting, acoustics and indoor air quality.
CIV23802A.3	Develop solutions for energy efficiency, water efficiency and waste management in buildings.
CIV23802A.4	Calculate energy savings and CO2 mitigation using web tools such as ECONIWAS and Solar rooftop calculator
CIV23802A.5	Adopt green project management methodology and evaluate building life cycle assessment.
CIV23802A.6	Implement energy conservation measures in buildings.

Textbooks:

1. HarharaIyer G, Green Building Fundamentals, Notion Press
2. Dr. Adv. HarshulSavla, Green Building: Principles & Practices

3. The Sustainable Habitat Handbook (6 Volume Set), GRIHA Version 2019

References:

1. National Building Code – 2016, Volume 1&2, Bureau of Indian Standards
2. Energy Conservation Building Code – 2017 (with amendments up to 2020), Bureau of Energy Efficiency

Web Reference:

1. https://nptel.ac.in/courses/114106017
2. https://www.youtube.com/watch?v=8nbOI-0U9Co
3. https://www.youtube.com/watch?v=Be9inw8xlw8
4. https://www.youtube.com/watch?v=n7oUOUCIblg
5. https://www.youtube.com/watch?v=gzgNLvHTrfY
6. 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
CIV23802A.1	2	2				2	1						1		
CIV23802A.2	2	2				2	1						1		
CIV23802A.3	2	2				2	1						1	1	
CIV23802A.4	2	2				2	1			1			1		
CIV23802A.5	2	2				2	1						1		
CIV23802A.6	2	2				2	1						1		
Average	2	2				2	1			1			1	**1**	

SEMESTER – VIII

Course: Occupational Health and Safety

Course Code	**CIV23802B**	**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:

CIV23802B.1	Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
CIV23802B.2	Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
CIV23802B.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
CIV23802B.4	Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors
CIV23802B.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:

1. https://nptel.ac.in/courses/114106017
2. https://www.youtube.com/watch?v=8nbOI-0U9Co
3. https://www.youtube.com/watch?v=Be9inw8xlw8
4. https://www.youtube.com/watch?v=n7oUOUCIblg
5. https://www.youtube.com/watch?v=gzgNLvHTrfY
6. 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
CIV23802B.1	2	2				2	1						1		
CIV23802B.2	2	2				2	1						1		
CIV23802B.3	2	2				2	1						1	1	
CIV23802B.4	2	2				2	1			1			1		
CIV23802B.5	2	2				2	1						1		
Average	2	2				2	1			1			1	**1**	

SEMESTER – VIII

Course: Green Buildings

Course Code	**CIV23802C**	**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	Understand the Definition, Concept & Objectives of the terms cost effective construction and green building
CLO2	Apply cost effective techniques in construction
CLO3	Apply cost effective Technologies and Methods in Construction
CLO4	Understand the Problems due to Global Warming
CLO5	State the Concept of Green Building 6. 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 Poszolana Cement- Gypsum Board- Light Weight Beams- Fiber Reinforced Cement Components Fiber Reinforced Polymer Composite- Bamboo- Availability of different materialsRecycling 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 - Costford - 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 L2**
Module 5 Utility of Solar Energy in Buildings Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. Green Composites for Buildings Concepts of Green Composites. Water Utilisation in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.	**8 Hours L2**

COURSE OUTCOMES:

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

CIV23802C.1	Understand cost effective building materials
CIV23802C.2	Choose environment friendly construction procedure
CIV23802C.3	Design eco-friendly buildings to reduce global warming
CIV23802C.4	Understand the different green rating of buildings
CIV23802C.5	Estimate energy saving in construction

Textbooks:

1. Harhara Iyer G, Green Building Fundamentals, Notion Press 2. Dr. Adv. Harshul Savla, Green Building: Principles & Practices

Web Reference:

1. https://www.youtube.com/watch?v=THgQF8zHBW8
2. 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 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
CIV23802C.1	2	2				2	1						1		
CIV23802C.2	2	2				2	1						1		
CIV23802C.3	2	2				2	1						1	1	
CIV23802C.4	2	2				2	1			1			1		
CIV23802C.5	2	2				2	1						1		
Average	2	2				2	1			1			1	**1**	

SEMESTER – VIII

Course: Integrated Building Services

Course Code	**CIV23802D**	**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	Understand Electrical System along with substation for a building infrastructure
CLO2	Learn ELV System and its interface with other allied services
CLO3	Design and implement HVAC System
CLO4	Learn and implement Fire Alarm System (PAS)
CLO5	Understand and implement importance of Public Health Services

Content	**No. of Hours/ RBT levels**
Module-1 Advanced Electrical System Design for Buildings: Basics of Electrical System, Electrical terminologies, Major Electrical equipment, Building power distribution and its schemes, Fundamentals of Power& distribution transformers, HT, LT, DG Sets, Cables & Wires, UPS and its importance, Introduction of HT, LT switchgears systems, Importance of Lighting design & different Light fixtures used in buildings – Interior, external, street & offices, RMU, HT consumer, Substation Building in Master plan - Space planning for RMU,HT, DG set, HSD yard, Space provision for Electrical Equipment including Substation, Various equipment clearance requirements, HVAC, PHE, FPS service-electrical load input for designing electrical power distribution, Pedestals & ceiling support requirement for all Electrical equipment.	**8 Hours L2**
Module 2 Extra Low Voltage System for Infrastructure: Introduction & Brief of ELV Systems, Concept of Building Management System (BMS) & Fire Alarm System, Interface with Architecture/ Structure, Access control, CCTV & Public address system - Brief and purpose, BMS - Brief and purpose, BMS interfaces with Electrical, HVAC, Fire & Life Safety and PHE, BMS interfaces with airport systems.	**8 Hours L2**

Module 3 Heating, Ventilation & Air conditioning systems: Basics of HVAC - Psychrometry and its importance - Major Components of Air conditioning System - Fundamental concepts of Heat transfer, Air-conditioning system, Ventilation system, Pressurization Systems and their importance to Life safety, Chilled water system, Cooling towers and major HVAC equipment, Pumping system in HVAC, Importance of Thermal and Acoustic Insulation, Introduction and basics of Variable Refrigerant Flow (VRF) systems, Radiant cooling, Underfloor distribution, Chilled beams – Space planning - Importance of Static weight / Operating weights of mechanical equipment - Importance of Floor slab and Terrace roof slab openings / cut-outs	**8 Hours** **L2**
Module 4 Fire Protection and Life Safety System: Basics of Fire Protection System - Active Fire protection system - Passive Fire protection system - Basics of Smoke Control and Fire Stop Systems - Codes & Standards and Statutory Compliance - Fire and its Classes - Hazard Classification based on building occupancy - Means of Egress and its components - Importance of Life Safety - Refuge Area, Fire Tower and Fire Lift - Occupant Load and Capacity factors - Fire Stopping Materials - Compartmentation in a building - Smoke control & management in Fire Zoning - Components of Fire Compartments.	**8 Hours** **L2**
Module 5 Public Health Engineering: Scope of works in Public Health Engineering - Sanitary fixtures and types - Water supply and treatment - Rain water drainage system - Landscape irrigation features – Water demand calculation based on building occupancy – Piping for different plumbing systems in buildings – Pump selection – Plant room sizing - Sewage treatment process - External water supply, storm drainage & sewerage system - Solid waste management - Interfacing PHE system with Architect and Structural engineers.	**8 Hours** **L2**

COURSE OUTCOMES:

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

CIV23802D.1	Understand Electrical System along with substation for a building infrastructure
CIV23802D.2	Learn ELV System and its interface with other allied services.
CIV23802D.3	Design and implement HVAC Systems
CIV23802D.4	Learn and implement Fire Alarm System (PAS)
CIV23802D.5	Understand and implement importance of Public Health Services

Textbooks:

1. Building Services Integration, P K Barton, Barry G Fryer, David Highfield, ISBN-13 978-0419120308, SPON Press, 1983

Web Reference:

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

Scheme of Examination:

Semester End Examination (SEE):
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	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.

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CIV23802D.2	2	2				2	1						1		
CIV23802D.3	2	2				2	1						1	1	
CIV23802D.4	2	2				2	1			1			1		
CIV23802D.5	2	2				2	1						1		
Average	2	2				2	1			1			1	**1**	

SEMESTER – VIII

Course: Internship

Course Code	**CIV23803**	**CIE Marks**	**100**
Hours/Week (L: T: P)	**0:0:12**	**SEE Marks**	**100**
No. of Credits	**10**	**Examination Hours**	**3**

Guidelines for Internship

1. The duration of the internship shall be for a period of 14-20 weeks on full time basis after VII semester final exams.
2. The student must submit letters from the industry clearly specifying his / her name and the duration of the internship on the company letter head with authorized signature.
3. Internship must be related to the field of specialization of the respective UG programme in which the student has enrolled.
4. Students undergoing internship training are advised to report their progress and submit periodic progress reports to their respective guides.
5. Students have to present the internship activities carried out to the departmental committee and only upon approval by the committee, the student can proceed to prepare and submit the hard copy of the final internship report. However, interim or periodic reports as required by the industry / organization can be submitted as per the format acceptable to the respective industry /organizations.
6. The reports shall be printed on A4 size with 1.5 spacing and Times New Roman with font size 12, outer cover of the report (wrapper) has to be Ivory color for UG circuit Programs and Light Blue for Non-Circuit Programs.
7. The broad format of the internship final report shall be as follows
   - Cover Page
   - Certificate from College
   - Certificate from Industry / Organization
   - Acknowledgement
   - Synopsis

- Table of Contents
- ✓ Chapter 1 - Profile of the Organization: Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices,
- ✓ Chapter 2 - Activities of the Department
- ✓ Chapter 3 - Tasks Performed: summaries the tasks performed during 8-week period
- ✓ Chapter 4 – Reflections: Highlight specific technical and soft skills that you acquired during internship
- ✓ References & Annexure

Scheme of Evaluation

The evaluation committee shall consist of Guide, Professor/Associate Professor and Assistant Professor. The committee shall assess the presentation and the progress reports in two reviews.

The evaluation criteria shall be as per the rubrics given below:

Continuous Internal Evaluation (CIE):

Reviews	**Activity**	**Weightage**
Review-I	Explanation of the application of engineering knowledge in industries, ability to comprehend the functioning of the organization/ departments	45%
Review- II	Importance of resource management, environment and sustainability presentation skills and report writing	55%

Semester End Evaluation (SEE):

The SEE examination shall be conducted by an external examiner (domain expert) and an internal examiner. Evaluation shall be done in batches.