STRUCTURAL ANALYSIS – I

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER –IV

Course Code	22CV42	**CIE**	50
Number ofLecture Hours/Week	2+2(4)	**SEE**	50
Total Number ofLecture Hours	42	**Exam Hours**	03

CREDITS – 03

Course objectives:

This course will enable students to

1. Apply knowledge of mathematics and engineering for calculating slope and deflections of structural elements
2. Identify, formulate and solve engineering problems
3. Analyse structural systems and interpret data
4. Engage in lifelong learning with the advances in Structural Engineering.
5. To study the Horizontal and Normal thrust and Evaluate Buckling load for columns with different end conditions

Course Outcomes(COs):

*On completion of this course,*the student will be able to

CO#	Course Outcomes	POs	PSOs
CO1	Evaluate the forces in determinate trusses by method of joints and sections..		
CO2	Evaluate the deflection of cantilever, simply supported and overhanging beams by different methods		
CO3	Understand the energy principles and energy theorems and its applications to determine the deflections of trusses and bent frames		
CO4	Determine the stress resultants in arches and cables.		
CO5	Determine the Horizontal and Normal thrust and Evaluate Buckling load for columns with different end conditions.		

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1		√		√	√	
CO2		√		√	√	
CO3		√		√	√	
CO4		√		√	√	
CO5		√		√	√	

Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	3	2	1					1			1	3		
CO2	3	3	3	1	1				1			1	3		

	CO3	3	3	3	2	1				1			1	3		
	CO4	3	2	3	2					1			1	3		
	CO5	3	2	3	1					1			2	3		
	Note: 1-Low, 2-Medium, 3-High															

Modules	**Teaching Hours**	**RBT Level**
Module -1		
Module -1 **Introduction and Analysis of Plane Trusses:** Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and non linear analysis, Static and kinematic indeterminacies of structural systems, Types of trusses, Assumptions in analysis, Analysis of determinate trusses by method of joints and method of sections.	**8 Hours**	**L2,L4,L5**
Module -2		
Deflection of Beams: Definition of slope, Deflection and curvature, Sign conventions, Derivation of moment-curvature equation. Macaulay's method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, &UDL. Moment area method: Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate prismatic beams, Beams of varying section, Use of moment diagram by parts. .	**8 Hours**	**L2,L4,L5**
Module -3		
Energy Principles and Energy Theorems: Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion, Deflection of determinate beams and trusses using total strain energy, Deflection at the point of application of single load, Castigliano's theorems and its application to estimate the deflections of trusses, bent frames.	**8 Hours**	**L2,L4,L5**
Module -4		
Arches and Cable Structures: Two hinged parabolic arches ,Three hinged parabolic 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.	**10 Hours**	**L2,L4,L5**
Module -5		
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..	**8 Hours**	**L2,L4,L5**

Question paper pattern:

1. The question paper will have ten questions.
2. Each full question consists of 10 marks.
3. There will be 2 full questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under a module.

- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

. Reddy C S, Basic Structural Analysis, Tata McGraw Hill, New Delhi.
2. Muthu K U. etal, Basic Structural Analysis, 2nd edition, IK International Pvt.Ltd., New Delhi,2015.
3. Bhavikatti, Structual Analysis, Vikas Publishing House Pvt. Ltd, New Delhi, 2002.
4. Dr. D S Rajendra Prasad, Sapna Book house,2015.

Reference Books:

1. Hibbeler R C, Structural Analysis, Prentice Hall, 9th edition, 2014
2. Devadoss Menon, Structural Analysis, Narosa Publishing House, New Delhi,2008.
1. 3. Prakash Rao D S, Structural Analysis, University Press Pvt. Ltd, 2007.

Hydraulics and Hydraulic machines
B.E., IV Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Subject Code	22CV43	**CIE**	50
Number of Lecture Hours & Tutorial	04	**SEE**	50
Total Number of Lecture Hours	42	**Exam Hours**	03

CREDITS – 03

Course Objectives: The objective of this course will enable the students to learn:

1. Apply the dimensional analysis to design hydraulic models and Design of various models.
2. Design the open channels of various cross sections including design of economical sections.
3. Learn the fundamentals of Uniform and Non-Uniform flow in open channels.
4. Energy concepts of fluid in open channel, Energy dissipation, Water surface profiles at different conditions.
5. Know the working principles of the hydraulic machines for the given data and analyzing the performance of Turbines for various design data.

Course Outcomes (COs):

After a successful completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply dimensional analysis to develop mathematical modeling and compute the parametric values in prototype by analyzing the corresponding model parameters.		
CO2	Design the open channels of various cross sections including economical channel sections.		
CO3	Apply Energy concepts to flow in open channel sections, Calculate Energy dissipation.		
CO4	Calculate the force exerted by jet of water on vanes and the student is expected to have thorough knowledge on the selection of turbines and pumps for practical purposes.		
CO5	Design centrifugal pumps for the given data, and to know their operation characteristics under different operating conditions.		

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	√	√	√	√		
CO2		√	√	√		√
CO3		√	√	√		
CO4	√	√	√	√		
CO5	√	√	√	√		√

Course Articulation Matrix / Course mapping:

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	3	2	2					1			2	3		
CO2	3	3	2	2					1			2	3		
CO3	3	3	2	2					1			2	3		
CO4	3	3	2	2					1			2	3		
CO5	3	2	2	1					1			2	3		
Note: 1-Low, 2-Medium, 3-High															

Modules	**RBTLEVEL/HRS**
Module -1 **Dimensional analysis and similitude**: Dimensional homogeneity, Rayleigh method and Buckingham pie theorem of dimensional analysis, Similitude,similarity laws, Geometric, Kinematic and Dynamic similarities. **Model analysis:** Model analysis, model classification, Reynolds model, Froude's model, Euler's Model, Webber's Numbers, Mach model, Model laws, scale effects, Distorted models. Numerical problems on Reynold's, and Froude's Model**.**	**L1, L2, L3, L4** **9 Hours**
Module -2 **Open Channel Flow-Uniform Flow:** Uniform Flow Introduction, Classification of flows, Chezy's and Manning's equation for flow through open channel, most economical channel sections-Rectangular, Trapezoidal and Circular channels, Uniform flow through Open channels, Numerical Problems.	**L2, L3, L4** **9 Hours**
Module -3 **Open Channel Flow -Non-Uniform Flow:** Specific Energy and Specific energy curve, Critical flow and corresponding critical parameters, Numerical Problems, Hydraulic Jump, Applications of hydraulic jump Expressions for conjugate depths and Energy loss, Numerical Problems, gradually varied flow, Equation for Back water curve and afflux, Numerical problems.	**L2, L3, L4** **8 Hours**
Module -4 **Impact of jets on Vanes :** Introduction, Impulse-Momentum equation. Direct impact of a jet on a stationary and moving Plate when vertical, inclined, curved plate, impact of jet on a series of curved vanes, velocity triangles - Numerical Problems. **Hydraulic machines: Turbines – Impulse Turbines:** Introduction to turbines, General layout of a hydroelectric power plant, Heads and Efficiencies, classification of turbines. Pelton wheel components, working principle.	**L1, L2, L3,L4** **8 Hours**
Module -5 **Reaction Turbines and Pumps:** Radial flow reaction turbines: (i) Francis Turbine-Descriptions, working principles. (ii) Kaplan turbine- Descriptions, working principles. Draft tube theory and unit quantities. (No problems). **Centrifugal pumps**: Components and Working of centrifugal pumps, Types of centrifugal pumps, Work done by the impeller, Heads and Efficiencies, Minimum starting speed of centrifugal pump, Numerical Problems.	**L1,L2,L3,L4** **8 Hours**

Question paper pattern:

1. The question paper will have tenquestions.
2. Each full question consists of 10marks.
3. There will be 2 full questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under amodule.

The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechan ics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi.
2. R.K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi
3. S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines",Tata McGraw Hill,New Delhi.

Reference Books:

1. K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co. Ltd.
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press.
3. C.S.P. Ojha, R. Berndtsson, and P.N. Chandramouli, *"Fluid Mechanics and Machinery"*, Oxford University Publication – 2010.
4. J.B. Evett, and C. Liu, "Fluid Mechanics and Hydraulic*s"*, McGraw-Hill Book.

Web References:

www.nptel.iitm.ac.in

www.springerlink.com for e-journals.

TITLE OF THE COURSE: BASIC GEOTECHNICAL ENGINEERING
B.E., IV Semester, Civil Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	22CV44	**CIE**	50
Number of Lecture Hours/Week	03	**SEE**	50
Total Number of Lecture Hours	42	**Exam Hours**	03

CREDITS – 03

Course Objectives:

This course will enable students to

1. To appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering. Also, to become familiar broadly with index properties of soil. Geotechnical engineering problems such as, foundation engineering, flow of water through soil medium and terminologies associated with geotechnical engineering.
2. To comprehend the classification of soil and fundamental constituents minerals of soil.
3. To become familiar with engineering problems such as flow of water through soil medium and assess the improvement in mechanical behavior by densification of soil deposits using compaction.
4. To know the basic engineering properties and the mechanical behavior of different types of soil. This includes strength-deformation characteristics under shearing stresses. Also consolidation properties of clayey soils.

Course Outcomes(COs):

After a successful completion of the course, the student will acquire :

CO#	Course Outcomes	POs	PSOs
CO1	An understanding of different types of soils, index properties and their importance in geotechnical engineering.		
CO2	The knowledge of classifying the soil based on its index properties and acquire the knowledge of fundamental constituent minerals of fine-grained soil.		
CO3	To determine permeability property of soils, compaction characteristics of soil and apply that knowledge to assess field compaction procedures		
CO4	Estimate shear strength parameters of different types of soils using the data of different shear tests and comprehend Mohr-Coulomb failure theory.		
CO5	Ability to solve practical problems related to estimation of consolidation settlement of soil deposits also time required for the same.		

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√			

CO3	√	√	√	√		
CO4		√	√			
CO5	√	√	√			

Course Articulation Matrix / Course mapping:

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	2	1									1	1		
CO2	3	2	2	2	1					1		1	1		
CO3	3	2	2	2	1					1		1	1		
CO4	3	2	2	2	1					1		1	1		
CO5	3	2	2	2	1					1		1	1		
Note: 1-Low, 2-Medium, 3-High															

Modules	**Teaching Hours**	**RBT Level**
Module -1		
INTRODUCTION: History of soil mechanics, origin and formation of soil. Phase Diagram, definitions related to soil and their interrelationships. **INDEX PROPERTIESOF SOIL:** Laboratory methods to determine index properties of soil such as Consistency limits and indices, Water content (Oven Drying method & Rapid Moisture method), Specific gravity of soil solids (Pycnometer and density bottle method), in-situ density (core cutter and sand replacement method). Problems on above.	**08** HRS	L1,L2
Module -2		
SOIL CLASSIFICATION: BIS soil classification, plasticity chart, Particle size distribution (Sieve analysis and Hydrometer analysis only), gradation curve, Relative Density, Activity of Clay. Problems on above. **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.	**08** HRS	L2,L3
Module -3		
FLOW OF WATER THROUGH SOILS: Darcy's law- assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation, quick sand phenomena, Capillary Phenomena**.** **COMPACTION OF SOILS:** Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil	**08** HRS	L1,L2, L3,L4

properties, Field compaction control - compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability. Problems on above		
Module -4		
SHEAR STRENGTH OF SOIL: Concept Of Shear Strength, Mohr Coulomb Theory, Conventional And Modified Failure Envelops, Effective Stress Concept- Total Stress, Effective Stress And Neutral Stress, Concept Of Pore Pressure, Total And Effective Shear Strength Parameters, Factors Affecting Shear Strength Of Soils, Sensitivity And Thixotropy of Clay. Measurement Of Shear strength Parameters - Direct Shear Test, Unconfined Compression Test, Triaxial Compression Test and Field Vane Shear Test, Test Under Different Drainage Conditions. Total And Effective Stress Paths. Problems on above	**08** HRS	L2, L3
Module -5		
CONSOLIDATION OF SOIL: Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory - assumption and limitations. Derivation of Governing differential Equation Preconsolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils. Consolidation characteristics of soil (Cc, av, mv and Cv. Laboratory one dimensional consolidation test, characteristics of e-log(σ) curve, Determination of consolidation characteristics of soils compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation. Problems on above	**10** HRS	L1,L2, L3,

Question Paper Pattern:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question carries 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

CIE + Assignments: 15+35=50 Marks

There will be a 3 CIE's, the average of best of 2 CIE's will be considered and there will be 35 marks for Assignments.

Text Books:

1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics- (2000), New Age International (P) Ltd., New Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering- (2012), Laxmi Pulications.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering- (1996), 4th Edition, UBS Publishers and Distributors, New Delhi.
4. Braja, M. Das, Geotechnical Engineering; (2002), Fifth Edition, Thomson 25 Business Information India (P) Ltd., India

Reference Books:

1. T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley & Sons, 1969.
2. Donold P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi
3. Shashi K. Gulathi& Manoj Datta, Geotechnical Engineering-. (2009), "Tata Mc Graw Hill.
4. Narasimha Rao A. V. &Venkatrahmaiah C, Numerical Problems, Examples and objective questions in Geotechnical Engineering-. (2000), Universities Press., Hyderabad.
5. Muni Budhu ,Soil Mechanics and Foundation Engg.- (2010), 3rd Edition, John Wiely& Sons

CONCRETE TECHNOLOGY
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Subject Code	22CV45	**CIE**	50
Number ofLecture Hours/Week	04	**SEE**	50
Total Number ofLecture Hours	42	**Exam Hours**	03
CREDITS – 03			

Course objectives: This course will enable studentsto

1. To recognize material characterization of ingredients of concrete and its influence on properties of concrete.
2. Ascertain and measure engineering properties of concrete in fresh concrete.
3. Ascertain and measure engineering properties of concrete in hardened concrete.
4. To carry out mix design concrete using IS 10262:2019.
5. To understand different types of modern concretes.

Course Outcomes(COs):

*On completion of this course,*the student will be able to

CO#	Course Outcomes	POs	PSOs
CO1	Relate material characteristics and understand their influence on microstructure of concrete.		
CO2	Distinguish concrete behavior with respect to its fresh and hardened properties.		
CO3	Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.		
CO4	Adopt suitable concrete making methods and placing methods based on requirement.		
CO5	Select a suitable type of concrete based on specific application.		

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	√	√				
CO2	√	√	√			
CO3	√	√	√			
CO4		√	√		√	√
CO5	√	√	√			

Course Articulation Matrix / Course mapping:

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	3	3	1		2	1				1	1	1		1
CO2	2	1	1	1	2	2	1				1	1	2		1
CO3	2	1	2	1	2	2	2				1	1	2		
CO4	3	1	2	1	2	2	2				1	1	2		2
CO5	3	1	1	1	2	2	2				1	1	2		1

Module	Teaching Hours	RBT Level
Module -1		
Concrete Ingredients Cement – Cement manufacturing process,chemical Composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Aggregate grading and blending of aggregates. Testing on aggregate, requirement. Recycled aggregates. Chemical admixtures plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica fumes and rice husk ash.	10Hours	L1,L2,L3
Module -2		
Fresh Concrete Workability-factors affecting workability. Measurement of workability– slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete-Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing.	8 Hours	L1,L2,L3
Module -3		
Hardened Concrete Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, testing of hardened concrete, Creep –factors affecting creep. Shrinkage of concrete – plastic shrinkage and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Durability requirements as per IS 456. Internal and external factors influencing durability, Mechanisms-Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion.	8 Hours	L1,L2,L3
Module -4		
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. Principles of ACI and DOE method of mix design.	8 Hours	L1,L2,L3,L4, L5

Module -5		
In situ testing of concrete, rebound hammer test, ultrasonic pulse velocity– Principal, applications and limitations. **Special Concretes** RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages.Fiber reinforced concrete - Fibers types, properties, application of FRC. Materials, requirements, properties of Geo polymer Concrete, High Strength Concrete and High-Performance Concrete	8 Hours	L1,L2,L3

Question paper pattern:

- The question paper will have tenquestions.
- Each full question consists of 10marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under amodule.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. M. L. Gambir, "Concrete Manual", Danpat Rai and sons, New Delhi
2. M.S Shetty, "Concrete Technology", S. Chand &Co. Ltd, New Delhi.

Reference Books:

1. Mehta P.K, "Properties of Concrete", Tata McGraw Hill Publications, New Delhi.
2. Neville AM, "Properties of Concrete", ELBS Publications, London.
3. Relevant BIS codes.

BUILDING INFORMATION MODELLING LAB

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Subject Code	22CVL46	**CIE**	50
Number of Lecture Hours/Week	02	**SEE**	50
Total Number of Lecture Hours	28	**Exam Hours**	03

CREDITS -01

Course objectives: The objective of this course is to make students to learn design principles of structure, design different types of structures and detailing of the structures. To evaluate performance of thestructures.

Course Outcomes(COs):

On completion of this course, the student will be able to

CO#	Course Outcomes	POs	PSOs
CO1	Revit for architectural BIM Services is improved design and visualization.		
CO2	It helps architects identify design flaws and adjust before the construction phase begins.		
CO3	It also offers design analysis and simulation capabilities allowing architects to evaluate the building's performance.		
CO4	It allows architects to create detailed building designs, visualize the project in 3D,		
CO5	It allows to produce detailed documentation and construction drawings		

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√			
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			

Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		1				1			1			
CO2	3	2	2		1				1			1			

CO3	3	2	2		1				1			1			
CO4	3	2	2		1				1			1			
CO5	3	2	2		1				1			1			

Modules	**Teaching Hours**	**RBT Level**
Module -1		
Introduction to BIM: Definition and core concepts of Building Information Modelling (BIM) Evolution of BIM from traditional CAD methods, Benefits and advantages of BIM for civil engineering projects, Applications of BIM throughout the project lifecycle (design, construction, operation & maintenance)	**4 Hours**	**L_1,L_2,L_3**
Module -2		
Introduction to Autodesk Revit: Overview of Revit as a BIM authoring tool from Autodesk. Brief history and evolution of Revit software. Key features and functionalities of Revit. User interface basics: Workspace, menus, and tools. **Setting standards for model:** Levels and grids	**4 Hours**	**L_1,L_2,L_3**
Module -3		
Modelling : Walls, Wall Types and Modification **Building components**: Doors, Windows & Components - Adding, Editing. Roofs, Ceilings, and Floors - Creation, Modification	**4 Hours**	**L_1,L_2,L_3**
Module -4		
Stairs, Railings, Ramps – Design and Modification **Annotations**: Linear, Aligned, Angular, Diameter etc. **Graphic Output:** Placing camera, Interior Rendering and Exterior Rendering	**4Hours**	**L_1,L_2,L_3**
Module -5		
Sheet Composition: Setting-up Sheets, Placing views on sheet. **Printing:** Page setup and Plotting	**4 Hours**	**L_1, L_2, L4**

Course outcomes:

On completion of this course, students can:

1. The students will create a modelling environment where architects, engineers, and contractors can work on the same building model.
2. As a result, it helps eliminate the risk of miscommunication and reduces the time required to complete the project
3. BIM also offers real-time communication and feedback capabilities.
4. Upon completion of the course, the student will: Become familiar with the rivet user interface. Understand the fundamental concepts and features of BIM.
5. Use the precision drafting tools in BIM to develop accurate technical drawings.

Question paper pattern:

1. Plan.
2. Components.
3. Elevation.
4. Walkthrough.
5. Estimation.

REFERENCE BOOKS:

1. 1. Autodesk Revit for Architecture Certified User Exam Preparation (Revit 2024 Edition)Available January 23, 2024By Daniel John Stine AIA, IES, CSI, CDT, Well AP
2. 2.Autodesk Revit 2024 Architecture Certified Professional Exam Study GuidePublished October 11, 2023By Elise Moss
3. 3. Interior Design Using Autodesk Revit 2024Published July 27, 2023By Daniel John Stine AIA, IES, CSI, CDT, Well AP
4. 4. Commercial Design Using Autodesk Revit 2024Published July 10, 2023By Daniel John Stine AIA, IES, CSI, CDT, Well AP.

TITLE OF THE COURSE: Surveying Practice –II Lab
B.E., IV Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code: 22CVL47	**CIE Marks: 50**
Number of Lecture Hours/Week :02	**SEE Marks :50**
Total Number of Hours:20	**Exam Hours :03**
Credits – 01	

Course Objectives: The objectives of this course is to make students to:

1. Apply the basic principles of engineering surveying and measurements
2. Follow effectively field procedures required for a professional surveyor.
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

CO#	Course Outcomes	POs	PSOs
CO1	Apply the basic principles of engineering surveying for linear and angular measurements.		
CO2	Comprehend effectively field procedures required for a professional surveyor.		
CO3	Use techniques, skills and conventional surveying instruments necessary for engineering practice.		
CO4	Use of Total station helps to fast working , Data collection , Software mapping ,Documentation		
CO5	The data collected from the field in the software and producing terrain map of different configuration and views and calculating the quantity of earthwork .		

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√	√		
CO2		√	√	√		
CO3		√	√			
CO4	√	√		√	√	
CO5	√	√		√		

Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	2	2	2	2					1			1			

CO2	3	2	2	2					1			1			
CO3	3	2							1			1			
CO4	2	2	2	2					1			1			
CO5	2	2	2	2					1			1			

Experiments:

SL.NO	NAME OF EXPERIMENT	RBT LEVEL
1.	To set-out simple curve by long chord method	L1,L2,L3, L4
2.	To set-out simple curve by Rankine's method	
3.	Setting up , Levelling up , Centering and creation of file in Total station	
4.	Taking out basic measurements RDM ,REM & SHV using Total station	
5.	Determination of Area measurement using Total station	
6.	Establishment of new station using free stationing technique	
7.	Traversing using total station to prepare topographic map of Area	
8.	Contour surveying using Total station	
9.	Plotting of topographic details within contours	
10.	Downloading total station data and map complication	
11.	Strake out using Total station	

Question paper pattern:

1. All are individual experiments.
2. Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
3. All exercises are to be included for practical examination.

Reference Books:

1. B.C. Punmia, **"Surveying Vol.II"**, Laxmi Publications Pvt. Ltd., New Delhi 2009.
2. Kanetkar T P and S V Kulkarni , **Surveying and Levelling Part I**, Pune VidyarthiGrihaPrakashan, 1988
3. S.K. Duggal, **"Surveying Vol.1"**, Tata McGraw Hill Publishing Co. Ltd. New Delhi.-2009.
4. K.R. Arora, **"Surveying Vol. 1"** Standard Book House, New Delhi. – 2010 & Distributors.

Fluid Mechanics and Hydraulic Machines Lab

[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – IV

Subject Code	**22CVL48**	**CIE**	50
Number of Lecture Hours/Week	02	**SEE**	50
Total Number of Lecture Hours	28	**Exam Hours**	03
CREDITS -01			

Course objectives: The objective of this course is to make students to learn calibration of different flow measuring devices and to understand the working and efficiencies of hydraulic machines.

Course Outcomes (COs):

On completion of this course, the student will be able to

CO#	Course Outcomes	POs	PSOs
CO1	Calibration of collecting tank and flow measuring devices.		
CO2	Measure discharge and head losses in pipes.		
CO3	Understand the fluid flow pattern.		
CO4	Determine the force exerted by jet of water on vanes.		
CO5	To understand the working of turbines and pumps.		

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	√	√	√		√	
CO2	√	√	√		√	
CO3	√	√	√	√		
CO4	√	√	√		√	
CO5	√	√	√		√	

Course Articulation Matrix / Course mapping :

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

SL.NO	NAME OF EXPERIMENT	RBT LEVEL
1	Calibration of collecting tank.	L1, L2, L3
2	Calibration of Rectangular, Triangular and Trapezoidal Notch.	L1, L2, L3
3	Calibration of Ogee and Broad crested weir.	L1, L2, L3
4	Determination of Cd for Venturi flume.	L1, L2, L3
5	Determination of Cd for Venturi meter and Orifice meter.	L1, L2, L3
6	Determination of hydraulic coefficients of small vertical orifice.	L1, L2, L3
7	Determination of Major and Minor Losses in Pipes.	L1,L2. L3
8	Experimental determination of force exerted by a jet on flat, inclined and curved plates.	L1,L2, L3, L5
9	Calibration of hydraulic Jump.	L1,L2, L3
10	Demonstration Experiments: Reynold's experiment to understand laminar and turbulent flow.	L1,L2, L3
11	Determination of efficiency of centrifugal pump.	L1,L2, L3, L5
12	Determination of efficiency of Francis turbine.	L1,L2, L3, L5
13	Determination of efficiency of Kaplan turbine.	L1,L2, L3, L5
14	Experimental determination of operating characteristics of Pelton turbine.	L1,L2, L3, L5

Question paper pattern:

1. All experiments are to be included in the examination except demonstration exercises.
2. Candidate to perform experiment assigned to him.
3. Marks are to be allotted as per the split up of marks shown on the cover page of answer script.

REFERENCE BOOKS:

1. Sarbjit Singh , *Experiments in Fluid Mechanics* - PHI Pvt. Ltd.- New Delhi
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press
3. Hydraulics and Fluid Mechanics' – Dr. P.N. Modi & D r S.M. Seth, Standard Book House- New Delhi. 2009 Edition.

PROJECT-IV

[As per Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

Subject Code	22PRJ49	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Lecture Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: Students will be taught to:

1. Get exposure about the civil engineering coursework to solve real-world problems.
2. Design the working model of the open ended problem.
3. Understand concepts of safety durability and environmental impacts.
4. Understand the latest technology and software tools.
5. Prepare technical documentation of the project.

STUDENTS WILL BE GIVEN A OPEN ENDED PROBLEM OF THE SOCIETY AND ASKED TO SOLVE BY DESIGNING AND IMPLEMENTING THE SYSTEM IN TEAM.

Course outcomes: After studying this course, students will be able to:

CO1. Apply the knowledge of civil engineering and to solve the real time problems of the society.

CO2. Analyze the various existing solutions available to solve the real time problem and propose the best solution.

CO3. Design and implement the system to solve the real time problem of the society.

CO4. Conduct investigations on the output and prepare the technical documentation of the designed system in a team.

CO5. Use the modern tool available like advanced software tools.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

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

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2
CO1	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**
CO2	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**
CO3	**-**	**-**	**3**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**
CO4	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

UNIVERSAL HUMAN VALUES

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

Subject Code	22UHV410	CIE Marks	50
Number Lecture Hour/Week	2L+1T	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: Students will be taught to:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.
4. This course is intended to provide a much needed orientaional input in value education to the young enquiring minds.

Module -1	**Teaching Hours**
Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) , Understanding Value Education, Sharing about Oneself , Self-exploration as the Process for Value Education , Continuous Happiness and Prosperity – the Basic Human Aspirations,Exploring Human Consciousness , Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations, Exploring Natural Acceptance	**08 Hours**
Module -2	
Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, Exploring the difference of Needs of Self and Body The Body as an Instrument of the Self, Understanding Harmony in the Self , Exploring Sources of Imagination in the **Self ,** Harmony of the Self with the Body,Programme to ensure self-regulation and Health**,**Exploring Harmony of Self with the Body	**08 Hours**
Module -3	
Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human Interaction**,** 'Trust' – the Foundational Value in Relationship**,** Exploring the Feeling of Trust**,** 'Respect' – as the Right Evaluation **,**Exploring the Feeling of Respect **,**Other Feelings, Justice in Human-to-Human Relationship **,** Understanding Harmony in the Society**,** Vision for the Universal Human Order	**08 Hours**
Module -4	
Harmony in the Nature/Existence : Understanding Harmony in the	**08 Hours**

Nature , Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Exploring the Four Orders of Nature , Realizing Existence as Co-existence at All Levels ,The Holistic Perception of Harmony in Existence ,Exploring Co-existence in Existence	
Module-5	
Implications of the Holistic Understanding – a Look at Professional Ethics : Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct , Exploring Ethical Human Conduct , A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order , Competence in Professional Ethics , Exploring Humanistic Models in Education ,Holistic Technologies, Production Systems and Management Models-Typical Case Studies , Strategies for Transition towards Value-based Life and Profession, Exploring Steps of Transition towards Universal Human Order	**08 Hours**

Course Outcomes: After studying this course, students will be able to:

CO-1- Understand value education, physical facility and to know how to the basic human aspirations.

CO-2- Right understanding of self and the body.

CO-3-Handle the problems with sustainable solutions by maintaining the harmony within and the society.

CO-4-Understanding the harmony in nature and existence.

CO-5-Make use of their understanding in the course for the happiness, prosperous family and society.

Text Books:

1. The Textbook - A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. The Teacher's Manual- Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53

Reference Books:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English).

TITLE OF THE COURSE: APPLIED ENGINEERING GEOLOGY LAB

B.E., IV Semester, Civil Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	**22ACV411A**	**CIE**	50
Numberof Lecture Hours/Week	03	**SEE**	50
Total Number of Lecture Hours	14	**Exam Hours**	03

CREDITS – 01

Course Objectives: The objectives of this course is to enable students:

1.To identify the minerals and rocks based on their inherent properties and uses in civil engineering.

2.To interpret the geological maps related to civil engineering project.

3.To learn the dip and strike , bore hole problem, thickness of geological formation related to foundation, tunnels, reservoirs and mining.

4.To understand subsurface geological condition through a geophysical technique and watershed management.

To visit civil engineering projects like dams, reservoirs, tunnels and quarry sites.

EXPERIMENTS	**Teaching Hours**	**RBT Level**
EXPERIMENT -1		
1.Physical properties of minerals: Identification of **i. Rock Forming minerals** - Quartz group, Feldspar group, Garnet group, Mica group & Talc, Chlorite, Olivine, Asbestos, Calcite, Gypsum, etc **ii. Ore forming minerals**- Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite, etc	4	L1, L2
EXPERIMENT -2		
Engineering Properties of Rocks: Identification of **i. Igneous rocks-** Types of Granites, Dolerite, Granite Porphyry, Basalt, Pumice etc **ii. Sedimentary rocks-** Sandstone, Lime stone, Shale, Laterite, Breccia etc **iii. Metamorphic rocks**- Gneiss, Slate, Schist, Marble, Quartzite etc	3	L1, L2
EXPERIMENT -3		

Dip and Strike problems. Determine Apparent dip and True dip. (2 methods)	2	L3, L4
EXPERIMENT -4		
Calculation of Vertical, True thickness and width of the outcrops. (3 methods)	2	L3, L4
EXPERIMENT -5		
Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities etc. (6 Maps)	3	L3, L4

Course outcomes: During this course, students will develop expertise in;

1. The students able to identify the minerals, utilize them effectively in civil engineering practices.
2. The students able to identify the Rocks, utilize them effectively in civil engineering practices.
3. The students will interpret subsurface information such as thickness of soil, weathered zone, depth of hard rock and saturated zone by using geophysical methods.
4. The students will be able to identify the different structures in the field.
5. students will get the knowledge of geological maps and its interpretation

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	2	3	1	1								
CO2	3	2	2	1	1				1			1
CO3	3	3	2	2	2				1			1
CO4	3	2	2	1	1				1			1
CO5	3	2	2	1	1				1			1

Question paper pattern:

1. All experiments are individual experiments.
2. Instruction as printed on the cover page of answer script for split up of marks to be strictly fallowed.
3. All exercises are to be included for practical examination.

Reference Books:

1. MP Billings, Structural Geology, CBS Publishers and Distributors, New Delhi.
2. B.S. Satyanarayana Swamy, Engineering Geology Laboratory Manual, Dhanpat Rai Sons, New Delhi.
3. LRA Narayan, remote sensing and its applications, UniversityPress.
4. P.K.MUKERJEE, Textbook of Geology, WorldPress Pvt. Ltd., Kolkatta
5. JohnIPlattand John Challinor, Simple Geological Structures,Thomas Murthy & Co, London.

TITLE OF THE COURSE: MX ROAD LAB

B.E., IV Semester, Civil Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	**22ACV411B**	**CIE**	50
Number of Lecture Hours/Week	01	**SEE**	50
Total Number of Lecture Hours	14	**Exam Hours**	03

CREDITS – 01

Course Objectives: The objectives of this course is to enable students:

5. Design 2D and 3D drainage design
6. Build horizontal and vertical alignments
7. Design storm drainage, water and sewer system
8. Understand Pavement and subgrade design
9. Understand Road and junction design

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	2	3	1	1								
CO2	3	2	2	1	1				1			1
CO3	3	3	2	2	2				1			1
CO4	3	2	2	1	1				1			1
CO5	3	2	2	1	1				1			1

EXPERIMENTS	**Teaching Hours**	**RBT Level**
EXPERIMENT -1		
INTRODUCTION TO MX ROAD : General - Scope of study - MX ROADTemplate and string Modelling - MX ROADoverview	1	L1, L2
EXPERIMENT -2		
Design a Carriage Way using MX ROAD software	2	L1, L2
EXPERIMENT -3		
Design a Vertical Profile Using MX ROAD Software	2	L3, L4
EXPERIMENT -4		
Design a Pavement using MX ROAD software	2	L3, L4

EXPERIMENT -5		
Design a Subgrade Layer using MX ROAD software	2	L3, L4
EXPERIMENT -6		
Design a Horizontal Alignment using MX ROAD software	2	L3, L4
EXPERIMENT -7		
Design a Earthwork Road By MX ROAD	2	L3, L4
EXPERIMENT -8		
How to import Data from the multi sources of elements in MX ROAD	1	L1, L2

Course outcomes: During this course, students will develop expertise in

2. Learn how to design 2D, 3D drainage design.
3. Build horizontal and vertical alignments
4. Understand concepts ofGIS, business tools such as PDFs, i-models,and hyper models.
5. Automate production of contract drawings.
6. Design storm drainage, water/sewer system

Question paper pattern:

4. All experiments are individual experiments.
5. Instruction as printed on the cover page of answer script for split up of marks to be strictly fallowed.
6. All exercises are to be included for practical examination.

Reference Books:

6. Highway Engineering, SK KHANNA NEM CHAND
7. MX Road Manual, Creak. Bentley Bentley Company
5.