Title of Course:	**:**	**Transportation and Highway Technology (Th + Pr) (2 + 2)**			
Course Code	**:**	CET 206			
Semester	**:**	4th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		50% Sessional Work, ----------, 50% Final Lab. Examination	
Credit Hours/week	**:**	**Th**	2	**Pr**	2
Minimum Contact Hours	**:**	**Th**	32	**Pr**	96
Marks	**:**	**Th**	50	**Pr**	100

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Explain** concepts of transportation systems and its planning.	C2	1
2	Theory	**Use** fundamental concepts of Highway geometry, traffic operations and Highway Design for effective traffic system implementation.	C3	1
3	Practical	**Practice** use of equipment to investigate the properties of aggregate, bitumen, and Hot Mix Asphalt.	P3	4
4	Practical	**Practice** basic tools and commands of traffic operations	P4	5
5	Practical	**Respond** actively during lab work.	A2	9

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Teamwork:	√
4	Investigation:	√	10	Communication:	
5	Modern Tool Usage:	√	11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

1. To develop an understanding of the fundamentals of highway geometry and to apply it in the design of Highways.

2. To produce an ability to use the survey works in the development of layouts of Highways.

COURSE OUTLINE:

Introduction to Transportation Systems and Planning

Modes of transportation, Principles of planning for communication facilities (road network, rail-road network & airport, port, and harbor facilities), Planning process and mode choice decisions, Overview of Mass Transit Systems.

Geometric Features of Highway

Functional classification of roads. Design controls of Vehicle, Speed, Driver, Volume and Sight Distances

Horizontal and Vertical Alignments

Horizontal curves, Vertical Curves, Transition, curves, Grades Super-elevation, Attainment of super elevation.

Pavement Types and Loads

Types of Pavements, Pavement Layers, Wheel loads, Equivalent Single Axle load, Repetition & impact factors, Constructions / Maintenance of pavement, Construction Equipment.

Pavement Construction and Equipment

Construction Techniques, Mixing of Asphalt, Compaction of layers, Construction Equipment used in field.

Traffic Operations

Introduction, Highway safety, Traffic control devices, Traffic sign, Traffic signals, Capacity Analysis, Traffic Management.

PRACTICAL WORK TO BE CARRIED OUT:

1. To determine the Los Angeles abrasion value (% wear) of aggregate sample.
2. To determine the flakiness and elongation index of aggregate.
3. To determine the aggregate impact value of the given aggregate sample.
4. To determine the soundness of the aggregate using different chemicals.
5. To determine specific gravity, flash & fire point, and ductility of bitumen.
6. To determine penetration grade and softening point of bitumen.
7. To determine aggregate gradation used for job mix formula considering different standard specifications.
8. Open-ended Lab: To determine volumetrics of Hot Mix Asphalt
9. Perform traffic survey to analyze the spot speed on selected road using different methods.
10. To carry out intersection traffic count including turning movement on an intersection using manual and camera technique.
11. To calculate Peak hour factor, ADT, AADT of any selected road section.
12. To calculate intersection delay at any selected signalized intersection.
13. To carry out parking study in any parking lot.

RECOMMENDED BOOKS:

1. The Design and a performance of Road Pavement, David Croney, HMSO London, Latest

Edition
2. Highway Engineering, Justo and Khanna, Publication Company, Delhi, Latest Edition
3. Traffic engineering and Design, R. J Salter, McGraw Hill Book Company, Latest Edition
4. ASHTO Standards, Vall& Valli, Latest Edition
5. Traffic & Highway Engineering, Nicholas J Garber lester H. Hoel, Latest Edition
6. Highway Engineering, Paul H. wright / Karen K Dixon, Latest Edition

Approval:	Industrial Advisory Board	Res. No. 4(ii)	Dated:01.11.2023
	Board of Studies	Res. No. 2.1	Dated:07.11.2023
	Board of Faculty	Res. No. 1.3(b)	Dated: 29-11-2023
	Academic Council	Res. No. 106.10(iii)	Dated: 14-12-2023

Title of Subject:	:	**Soil Mechanics (Th + Pr) (01 + 02)**			
Course Code	:	CET 207			
Semester	:	4th			
Discipline	:	Civil Engineering Technology			
Effective	:	22 – Batch and onwards			
Pre-requisite	:	Nil			
Co-requisite	:	Nil			
Assessment	:	Theory		Practical	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		50% Sessional Work, ----------, 50% Final Lab. Examination	
Credit Hours/week	:	Th	1	**Pr**	02
Minimum Contact Hours	:	Th	16	**Pr**	32
Marks	:	Th	50	**Pr**	100

Course Learning Outcomes:

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

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Discuss** fundamentals of soil properties, behavior, and classification systems.	C2	1
2	Theory	**Solve** various problems related to soil permeability, consolidation and shear strength.	C3	2
3	Practical	**Perform** various experiments of soil mechanics related to index properties, permeability and shear strength of soil.	P5	9
4	Practical	**Respond** actively to experimental work.	A2	1

Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Teamwork:	√
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

1. To develop a basic understanding of the composition, classification, structure and properties of soils.
2. To obtain knowledge of application of soil as a construction material
3. To acquire laboratory skills for determination of soil properties.

COURSE CONTENTS:

Introduction: Importance of mechanics of soils in Civil Engineering Technologists.

Index Properties of Soil: Phase diagrams of soil, Phase relations of soil: water content, void ratio, porosity, degree of saturation, air content, percentage air voids, unit weights and specific gravity, Consistency of soils, States of consistency and Atterberg's limits, Determination of Atterberg's limits and consistency indices, Grain Size distribution of soils: particle size distribution curves, sieve analysis, Stoke's law, hydrometer analysis.

Soil Classification: Particle size classification systems, AASHTO classification system, Unified soil classification system, Identification and classification of expansive soils, Collapsible and dispersion soils.

Permeability of Soil: Permeability, Darcy's law, Factors affecting permeability, Permeability of stratified soils, Laboratory and field determination of permeability.

Consolidation: Introduction to Consolidation, Laboratory consolidation tests, Graphical representation of data, Compression index, Coefficient of compressibility, Calculation of voids ratio and coefficient of volume change, Degree of consolidation, Primary and secondary consolidation, Determination of pre-consolidation pressure and over consolidation ratio, Normally and pre-consolidated clays.

Shear Strength: Shear strength parameters of soils, shear strength of cohesive and cohesion less soil, Laboratory measurement of shear strength parameters: shear box test, unconfined compression test, vane shear test and tri-axial shear test.

PRACTICAL WORK TO BE CARRIED OUT:

1. Introduction to the Soil Mechanics Laboratory and HSE (Health, Safety and Environment) measures.
2. Collection of soil samples from field and to prepare the representative soil sample for laboratory testing:

a). Quartering Method b). Riffle Box Method

3. To determine the water content of soil sample by:

a). Oven Drying Method b). Hot Plate Method c). Sand Bath Method
d). Speedy Moisture Tester e). Infrared Moisture Tester

4. To determine the particle size distribution of coarse-grained soil by Sieve Analysis.
5. To determine the particle size distribution of fine-grained soil by Hydrometer Analysis and pipette analysis.
6. To determine the liquid limit of fine-grained soil by Casagrande Apparatus and or Fall Cone (Penetrometer) Method
7. To determine the liquid limit of fine-grained soil by.
8. To determine the shrinkage limit of fine-grained soil.
9. To determine the specific gravity of fine-grained soil by Density Bottle Method.
10. To determine the coefficient of permeability of coarse-grained soil by Constant Head Method.
11. To determine the coefficient of permeability of fine-grained soil by Falling Head Method.
12. To determine consolidation parameters of saturated fine-grained soil by One Dimensional Consolidation Test.
13. To determine free swell of clayey soils.
14. To determine the minimum and maximum dry density of cohesion less soil sample by Vibrating Table.
15. To determine the shear strength parameters of sandy/clayey soil by Direct Shear Box Test.

16. To determine the shear strength of clayey soil by Un-Confined Compression Test and Pocket Penetrometer Test.
17. To determine the shear strength of a clayey soil by Laboratory Vane Shear Test.
18. To determine shear strength of fine grained and coarse-grained soils by CU/CD/UU-Tri-Axial Test.
19. To determine sand equivalent value of sand.
20. To perform the open-ended lab.

RECOMMENDED BOOKS:

1. Principles of Geotechnical Engineering, Das, B.M, Brook/Cole. Latest Edition
2. Introduction to Soil Mechanics Laboratory Testing by Dante Fratta, Jennifer Aguettant and Lynne Roussel-Smith, Latest Edition.
3. Fundamentals of Soil Mechanics, M. Siddique Qureshi and Aziz Akbar, Latest Edition.

Approval:	Industrial Advisory Board	Res. No. 4(ii)	Dated:01.11.2023
	Board of Studies	Res. No. 2.1	Dated:07.11.2023
	Board of Faculty	Res. No. 1.3(b)	Dated: 29-11-2023
	Academic Council	Res. No. 106.10(iii)	Dated: 14-12-2023

Title of Course:	**:**	**Structural Principles (Th + Pr) (2 + 0)**			
Course Code	**:**	CET 208			
Semester	**:**	4th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		N.A	
Credit Hours/week	**:**	**Th**	2	**Pr**	0
Minimum Contact Hours	**:**	**Th**	32	**Pr**	0
Marks	**:**	**Th**	50	**Pr**	0

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Analyze** beams and frames and trusses.	C2	2
2	Theory	**Compute** deflections and slopes in determinate and indeterminate structures.	C3	2

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:		7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Teamwork:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

1. To calculate deflections and slopes in determinate structures.

COURSE OUTLINE:

Introduction to structural analysis:
Definition, types of structures, structural idealization, loads. Free body concept, conditions

of support and attachment to other bodies. Support reactions under different types of loading. Introduction to shear force and bending moment diagrams. Determinacy, indeterminacy, and stability of structures. Analysis of determinate beams, frames, and trusses. Common types of trusses, classification of coplanar trusses. Method of joints, method of sections and graphical method for analysis.

Analysis of Statically Determinate Rigid jointed plane frame:

Determinacy and stability of plane frames. Analysis, (sign convention etc.), Shear & bending moment diagrams of frames.

Deflection in beams and frames

Deflection diagrams and elastic curves, various methods to compute deflections in beams and frames, by -Double integration, Moment area, Conjugate beam Unit load method and theory of Castigijliano.

RECOMMENDED BOOKS:

1. Engineering Mechanics by R.C. Hibbeler (Latest Edition).
2. Engineering Mechanics Statics and Dynamics, J.L. Mariam & L.G. Kraige (Latest Edition).
3. Vector Mechanics for Engineers, Ferdinand P. Beer and E. Russel Johnston Jr, (Latest Edition).

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Title of Course:	**:**	**Computer Aided Drawing and BIM (Th + Pr) (1 + 2)**			
Course Code	**:**	CET 209			
Semester	**:**	4th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		50% Sessional Work, ----------, 50% Final Lab. Examination	
Credit Hours/week	**:**	**Th**	1	**Pr**	02
Minimum Contact Hours	**:**	**Th**	16	**Pr**	96
Marks	**:**	**Th**	50	**Pr**	100

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Understand** development of computer aided Architectural and structural 3D drawings of basic nature including architectural and structural.	C2	5
2	Theory	**Apply** BIM Models up to 5D of basic nature architectural and structural.	C3	5
3	Practical	**Describe** different commands and tools in CAD and BIM	C1	1
4	Practical	**Practice** CAD and BIM software to develop building and structural drawings.	P3	5

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Teamwork:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:	√	11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

1. To enhance the capabilities of student to independently prepare the building drawings and develop an ability to analyses and design structures by commercially used computer packages

COURSE OUTLINE:

Computer Aided Drawing using Revit:

Overview of Revit, Core Concepts, Understanding the Process of Developing 3D Architectural and Structural Models in Revit, Different Perspectives of 3D Models, develop proficiency in Autodesk Revit software, Understanding architectural building models with structural and MEP systems.

BIM:

BIM Fundamentals: BIM Overview; BIM vs. Traditional CAD; Common BIM Terminology; Value of BIM; BIM as a Communication and Collaboration Tool; BIM Benefits; Typical BIM Process; BIM Implementation Needs and Challenges, Understanding the role of BIM in sustainability; Analyzing energy performance; Implementing green design strategies, Discussion on BIM Benefits, Clash detection between models of different disciplines.

BIM Technology: Phased Structure of a BIM project; Common BIM Applications; Develop understanding of how BIM models are integrated with schedules, Developing Templates for Estimating (5D), Walkthroughs/ Flythroughs/ Animation, Presentation Issues/ Rendering.

PRACTICAL WORK TO BE CARRIED OUT:

1. Orientation to Revit Environment (Architectural Perspective), Starting a Project and Modelling Basics
2. Setting Up a Project (Create a Revit project file and template Set up project parameters and units)
3. Setting Up Walls (Exterior and Interior walls), Doors, Windows, Floors, Roofs, and Ceilings.
4. Setting Up Plumbing and Mechanical Systems Including HVAC ducts, vents, and equipment
5. Setting up electrical systems (Electrical wiring, circuits, panels, light fixtures, and switches)
6. Setting the dimensions, detail drawing from views, Camera views and walkthroughs Photorealistic rendering.
7. Creating and editing families in Revit (using Family tool in Revit and Creating and editing layers)
8. Developing 3D Architectural Model of single unit (80-120 Sq-Yd) including plan, section and elevation. The following components of Revit to be covered while developing the 3D Model:
9. Links; Imports and Groups, Sketch Based Modelling Components Stairs and Complex Walls
10. Visibility and Graphics Controls
11. Rooms, Schedules and Tags, Annotation and Details
12. The Basics of Families Sheets, Plotting and Publishing
13. Developing 3D Structural Model of single unit (80-120 Sq-Yd) including foundation layout and details, plinth beam layout and details, framing plan and reinforcement details of slabs and beams
14. Estimating Quantities of 3D Model including Architectural and Structural of single unit (80-120 Sq-Yd)
15. Understanding the basics of Navisworks, the interface of Navisworks and introduction to the BIM clash detection.
16. Development of Schedule and Cost of 80 Sq-Yd House on MS Excel/ MS Project/

Primavera/

17. Integration of Schedule with Architectural Model of 80 Sq-Yd House on Navisworks
18. Developing 5D Model of 80 Sq-Yd House
19. Developing Simulation of 5D BIM Model and Quantization, Pulse Amplitude Modulation, Pulse Position and Pulse width Modulation, Quantization Noise, Signal to Quantization Noise Ratio, Pulse code Modulation, Delta Modulation, Frequency Shift Keying, Phase Shift Keying.
20. Open Ended Problem

RECOMMENDED BOOKS:

Autodesk manual (Latest Edition).

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	Board of Studies	Res. No. 2.1	Dated:07.11.2023
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	Academic Council	Res. No. 106.10(iii)	Dated: 14-12-2023

Title of Course:	**:**	**Fundamentals of Applied Economics (Th + Pr) (2 + 0)**			
Course Code	**:**	NSC 202			
Semester	**:**	4th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		N. A	
Credit Hours/week	**:**	**Th**	2	**Pr**	0
Minimum Contact Hours	**:**	**Th**	32	**Pr**	0
Marks	**:**	**Th**	50	**Pr**	0

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Understand** economics, its key sub-domains, and its relationship with micro and macro indicators	C2	6
2	Theory	**Understand** the relationship of economics with the civil and construction industry	C2	6
3	Theory	**Analyze** cost benefit of technology solutions related to civil engineering and construction industry	C4	6

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:		7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:	√	12	Lifelong Learning:	

OBJECTIVES:

- To familiarize students with the basic Concepts of Economics in engineering.
- To enable the students to make better economic decisions in their course of action.

COURSE CONTENTS

- Basic Concepts and Principles of Economics
- Thinking like an Economist
- Overview of Macro and Micro Economic theories
- Market Forces of Supply and Demand
- Elasticity and its Application
- Government Economic and Interest Policies
- Price-supply-demand-relationship
- Efficiency vs Equality
- Firm Behavior and Organization of Industry
- Introduction to construction industry economics
- Nature of construction firms and construction industry
- Micro economic principles for construction business
- Macro-economic concepts and their relevance to the construction industry
- Time Value of Money Concept
- Role of Technologist in Economics and Decision Making
- Earned Value Analysis
- Economical Appraisal Methods and Applications in civil construction projects
- Cost benefit analysis of technology solutions in civil engineering and construction industry domains
- Construction project supply chains

BOOKS RECOMMENDED:

1. Principles of Economics. N. Gregory Mankiw. Latest Edition. South Western Cenage Learning (Latest Edition).
2. The Economics of the Construction Industry. Gerald Finkel. Routlege(Latest Edition).

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