GLOBAL INSTITUTE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS)
COURSE CATALOGUE
REGULATIONS B.TECH – GR - 24
CIVIL ENGINEERING
III YEAR I SEMESTER

Course Code	Course Name	Subject Area	Category	Periods Per Week			Credits	Scheme of Examination Max Marks		
				L	T	P		CIA	SEE	Total
THEORY										
CE501PC	Structural Analysis – II	PCC	Core	3	0	0	3	40	60	100
CE502PC	Geotechnical Engineering	PCC	Core	3	0	0	3	40	60	100
CE503PC	Structural Engineering -I (RCC)	PCC	Core	3	0	0	3	40	60	100
SM504MS	Business Economics & Financial Analysis	HSMC	Foundation	3	0	0	3	40	60	100
CE505PC	Transportation Engineering	PCC	Core	3	0	0	3	40	60	100
CE506PC	Hydrology and Water Resources Engineering	PCC	Core	3	0	0	3	40	60	100
PRACTICAL										
CE507PC	Transportation Engineering Laboratory	PCC	Core	0	0	2	1	40	60	100
CE508PC	Geotechnical Engineering Laboratory	PCC	Core	0	0	2	1	40	60	100
			Total Credits	**18**	**0**	**4**	**20**			

COURSE CONTENT

STRUCTURAL ANALYSIS – II								
III Year - I Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
CE501PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite:								

1. COURSE OVERVIEW

The course builds upon basic mechanics to analyze advanced stress-strain relationships in structural members. It covers topics such as torsion of circular shafts, columns and struts, and theories of failure. Students study bending and shear stresses in curved beams and unsymmetrical bending. The course also includes energy methods like strain energy and Castigliano's theorems. It enhances students' ability to evaluate structural safety and performance under complex loading conditions.

2. COURSE OBJECTIVE

The objectives of the course is to:

1) Identify the various actions in arches.
2) Understand classical methods of analysis for statically indeterminate structures.
3) Differentiate the approximate and numerical methods of analysis for indeterminate structures.
4) Find the degree of static and kinematic indeterminacies of the structures.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	**Analyze** the two hinged arches.	Analyze
CO 2	**Solve** statically indeterminate beams and portal frames using classical methods.	Apply
CO 3	**Sketch** the shear force and bending moment diagrams for indeterminate structures.	Apply
CO 4	**Formulate** the stiffness matrix and analyze the beams by matrix methods.	Analyze
CO 5	**Plot** the variation of S.F and B.M when a moving load passes on indeterminate structures	Apply

4. COURSE CONTENT

UNIT - I:

Two Hinged Arches: Introduction – Classification of Two hinged Arches – Analysis of two hinged parabolic arches – Secondary stresses in two hinged arches due to temperature and elastic shortening of rib.

Moment Distribution Method - Analysis of continuous beams with and without settlement of supports using - Analysis of Single Bay Single Storey Portal Frames including side Sway - Analysis of inclined frames -Shear force and Bending moment diagrams, Elastic curve.

UNIT - II:

Kani's Method: Analysis of continuous beams including settlement of supports - Analysis of single bay single storey and single bay two Storey Frames including Side Sway using Kani's Method - Shear force and bending moment diagrams - Elastic curve.

Cables and suspension bridges:
Equilibrium of a Suspension Cable subjected to concentrated loads and uniformly distributed loads - Length of a cable - Cable with different support levels - Suspension cable supports - Suspension Bridges - Analysis of Three Hinged Stiffening Girder Suspension Bridges.

UNIT - III:
Matrix Methods -Flexibility Matrix Method: Introduction to Flexibility matrix methods of analysis; Analysis of continuous beams including settlement of supports; Analysis of pin-jointed determinate plane frames.

UNIT - IV:
Matrix Methods - Stiffness Matrix Method: Introduction to Stiffness matrix methods of analyses using 'system approach' up-to three degree of indeterminacy– Analysis of continuous beams including settlement of supports- Analysis of pin-jointed determinate plane frames; Analysis of single bay single storey portal frames using stiffness method - Shear force and bending moment diagrams - Elastic curve.

UNIT-V:
Influence Lines for Indeterminate Beams: Introduction – Influence line diagram for shear force and bending moment for two span continuous beam with constant and different moments of inertia - influence line diagram for shear force and bending moment for propped cantilever beams.

5. TEXT BOOKS

1) Structural Analysis Vol –I &II by Vazarani and Ratwani, Khanna Publishers.
2) Structural Analysis Vol I & II by G.S. Pandit S.P. Gupta Tata McGraw Hill Education Pvt. Ltd.
3) Indeterminate Structural Analysis by K.U. Muthu et al., I.K. International Publishing House Pvt. Ltd.

6. REFERENCE BOOKS

1) Structural analysis T. S Thandavamoorthy, Oxford university Press
2) Mechanics of Structures Vol –II by H.J. Shah and S.B. Junnarkar, Charotar Publishing House Pvt. Ltd.
3) Basic Structural Analysis by C.S. Reddy., Tata McGraw Hill Publishers.
4) Examples in Structural Analysis by William M.C. McKenzie, Taylor & Francis.
5) Structural Analysis by R. C. Hibbeler, Pearson Education
6) Structural Analysis by Devdas Menon, Narosa Publishing House.
7) Advanced Structural Analysis by A.K. Jain, Nem Chand & Bros.

CO-PO-PSO Mapping

	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
CO 1	**3**	**3**	**2**	**3**								**3**	**2**	**2**
CO 2	**3**	**3**	**2**	**3**								**3**	**2**	**2**
CO 3	**3**	**3**	**2**	**3**								**3**	**2**	**2**
CO 4	**3**	**3**	**2**	**3**								**3**	**2**	**2**
CO 5	**3**	**3**	**2**	**3**								**3**	**2**	**2**

COURSE CONTENT

GEOTECHNICAL ENGINEERING								
III Year - I Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
CE502PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite:								

1. COURSE OVERVIEW

This course provides an introduction to the principles of geotechnical engineering, focusing on the mechanical behavior of soil and rock and their application in civil engineering design. It covers soil classification, permeability, compaction, consolidation, and shear strength, along with the analysis and design of foundations, retaining structures, and slopes. The course emphasizes practical problem-solving, site investigation, and safe, economical design of earth-supported structures.

2. COURSE OBJECTIVE

The objectives of the course is to:

1) Understand the formation of soil and classification of the soils.
2) Characterize the Index & Engineering Properties of Soils.
3) Determine the flow characteristics & stresses due to externally applied loads.
4) Estimate the consolidation properties of soils.
5) Determine the shear strength parameters.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	**Characterize** and classify the soils.	Apply
CO 2	**Estimate** seepage, stresses under various loading conditions.	Apply
CO 3	**Understand** laboratory and field compaction characteristics of soil.	Apply
CO 4	**Analyze** the compressibility of the soils.	Analyze
CO 5	**Understand** the strength of soils under various drainage conditions.	Understand

4. COURSE CONTENT

UNIT - I:

Introduction: Soil formation and structure – moisture content – Mass, volume relationships – Specific Gravity- Field density by core cutter and sand replacement methods-Relative density.
Index Properties of Soils: Grain size analysis – consistency limits and indices – I.S. Classification of soils.

UNIT - II:

Permeability: Soil water – capillary rise – flow of water through soils – Darcy's law- permeability – Factors affecting permeability – laboratory determination of coefficient of permeability –Permeability of layered soils.

Effective Stress & Seepage through Soils: Total, neutral and effective stress – principle of effective stress - quick sand condition – Seepage through soils – Flownets: Characteristics and Uses.

UNIT - III:

Stress Distribution in Soils: Boussinesq's and Westergaard's theories for point load, uniformly loaded circular and rectangular areas, pressure bulb, variation of vertical stress under point load along the vertical and horizontal plane, and Newmark's influence chart for irregular areas.

Compaction: Mechanism of compaction – factors affecting compaction – effects of compaction on soil properties – Field compaction Equipment – compaction quality control.

UNIT - IV:

Consolidation: Types of compressibility – Immediate Settlement, primary consolidation and secondary consolidation **-** stress history of clay; e-p and e-log(p) curves – normally consolidated soil, over consolidated soil and under consolidated soil – pre-consolidation pressure and its determination - Terzaghi's 1-D consolidation theory – coefficient of consolidation: square root time and logarithm of time fitting methods - computation of total settlement and time rate of settlement.

UNIT-V:

Shear Strength of Soils: Importance of shear strength **–** Mohr-Coulomb Failure theories – Types of laboratory tests for strength parameters – strength tests based on drainage conditions – strength envelops – Shear strength of sands - dilatancy – critical void ratio, Introduction to stress path method.

5. TEXT BOOKS

1) Basic and Applied Soil Mechanics by Gopal Ranjan & A. S. R. Rao, 2nd Edition, New age International Publishers, 2006
2) Soil Mechanics and Foundation Engineeringby V. N. S. Murthy, CBS Publishers & Distributors / Alkem Company (S), 2011
3) Principals of Geotechnical Engineering by Braja, M. Das, Cengage Learning Publishers, 10th Edition, 2020

6. REFERENCE BOOKS

1) An Introduction to Geotechnical Engineering by R. D. Holtz, W. D. Kovacs, and Thomas Sheahan, Pearson, 2nd edition (2011).
2) Geotechnical Engineering by C. Venkataramiah, New age International Pvt. Ltd, (2002).
3) Geotechnical Engineering Principles and Practices by Coduto and M. Y. Ronald, Pearson 2nd edition (2010).
4) Geotechnical Engineering by Manoj Dutta & Gulati S.K – Tata McGraw-Hill Publishers New Delhi (2017).
5) Foundation Engineering by P.C. Varghese, PHI (2005).

CO-PO-PSO Mapping

	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
CO 1	**3**	**2**	**1**	**1**								**2**	**2**	**2**
CO 2	**3**	**2**	**1**	**1**								**2**	**2**	**2**
CO 3	**3**	**2**	**1**	**1**								**2**	**2**	**2**
CO 4	**3**	**2**	**1**	**1**								**2**	**2**	**2**
CO 5	**3**	**2**	**1**	**1**								**2**	**2**	**2**

COURSE CONTENT

STRUCTURAL ENGINEERING – I (RCC)								
III Year - I Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
CE503PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Strength of Materials I & II, Structural Analysis								

1. COURSE OVERVIEW

This course introduces the fundamental principles of reinforced cement concrete (RCC) design used in building and infrastructure projects. It covers the properties of concrete and steel, limit state design concepts, and the analysis and design of basic RCC elements such as beams, slabs, columns, and footings. Emphasis is placed on understanding structural behavior, codal provisions, and safe, economical design practices through practical examples and design problems.

2. COURSE OBJECTIVE

The objectives of the course is to:

1) Identify the basic components of any structural system and the standard loading for the RC structure.
2) Identify the codal provisions given in IS.456.
3) Describe the salient feature of limitstate method, compare with other methods and the concepts of limitstate of collapse and limitstate of serviceability.
4) Evaluate the behaviour of RC member under flexure, shear and compression, torsion and bond.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	**Design** the singly reinforced, doubly reinforced and flanged sections under flexure.	**Analyze**
CO 2	**Design** the axially loaded, uniaxial and biaxial bending columns	**Analyze**
CO 3	**Design** One, Two-way, continuous slabs with different end conditions using Limit state design for serviceability.	**Analyze**
CO 4	**Design** compression members using design charts and IS Codal provisions	**Analyze**
CO 5	**Design** the isolated square, rectangular and circular and combined footings	**Analyze**

4. COURSE CONTENT

UNIT – I:

Introduction- Structure - Components of structure - Different types of structures - Equilibrium and compatibility– Safety and Stability - Loads – Different types of Loads – Dead Load, Live Load, Earthquake Load and Wind Load– Forces – What is meant by Design? – Different types of materials – RCC, PSC and Steel – Planning of structural elements- Concepts of RCC Design – Different methods of Design- Working Stress Method and Limit State Method – Load combinations as per Limit state method - Materials - Characteristic Values – Partial safety factors – Behaviour and Properties of Concrete and Steel- Stress Block Parameters as per IS 456 -2000.

Limit state Analysis and design of sections in Flexure – Behaviour of RC section under flexure - Rectangular, T and L-sections, singly reinforced and doubly reinforced Beams – Detailing of reinforcement

UNIT – II:

Design for Shear, Bond and Torsion - Mechanism of shear and bond failure - Design of shear using limit state concept – Design for Bond –Anchorage and Development length of bars - Design of sections for torsion - Detailing of reinforcement

UNIT - III:

Design of Two-way slabs with different end conditions, one-way slab, and continuous slab Using I S Coefficients -Limit state design for serviceability for deflection, cracking and codal provisions.

UNIT - IV:

Design of compression members - Short Column - Columns with axial loads, uni-axial and bi-axial bending – Use of design charts- Long column – Design of long columns - I S Code provisions.

UNIT - V:

Design of foundation - Different types of footings – Design of flat isolated square, rectangular, combined footings for two columns.

5. TEXT BOOKS

1) Limit state designed of reinforced concrete – P.C. Varghese, PHI Learning Pvt. Ltd.
2) Reinforced concrete design by S. Unnikrishna Pillai & Devdas Menon, Tata McGraw Hill.
3) Reinforced concrete design by N. Krishna Raju and R.N. Pranesh, New age International Publishers.

6. REFERENCE BOOKS

1) Reinforced concrete structures, Vol. 1, by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd.
2) Fundamentals of Reinforced concrete design by M. L. Gambhir, Prentice Hall of India Pvt.Ltd.,
3) Design of Reinforced Concrete Structures by N.Subramanian, Oxford University Press
4) Design of concrete structures by J.N. Bandhyopadhyay PHI Learning Private Limited.
5) Design of Reinforced Concrete Structures by I. C. Syal and A. K. Goel, S. Chand & company.
6) Design of Reinforced Concrete Foundations – P.C. Varghese Prentice Hall of India.

CO-PO-PSO Mapping

	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
CO 1	**3**	**3**	**1**	**2**								**2**	**2**	**2**
CO 2	**3**	**3**	**1**	**2**								**2**	**2**	**2**
CO 3	**3**	**3**	**1**	**2**								**2**	**2**	**2**
CO 4	**3**	**3**	**1**	**2**								**2**	**2**	**2**
CO 5	**3**	**3**	**1**	**2**								**2**	**2**	**2**

COURSE CONTENT

BUSINESS ECONOMICS & FINANCIAL ANALYSIS								
III Year - I Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
SM504MS	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Nil								

1. COURSE OVERVIEW

This course introduces the fundamentals of **business, economics, and financial accounting**, focusing on business structures, demand and supply analysis, production and cost functions, market structures, and pricing strategies. It also covers accounting principles, preparation of financial statements, and ratio analysis, enabling students to apply economic and accounting tools for effective business decision-making.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To learn the basic business types, impact of the economy on Business and Firms specifically.
2) To analyze the Business from the Financial Perspective.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Understand the structure of business firms and apply economic concepts such as national income, inflation, and business cycles in analyzing business decisions.
CO 2	Apply the concepts of demand, elasticity, and supply in business decision making and forecasting.
CO 3	Analyze production and cost functions, and evaluate pricing strategies under different market structures.
CO 4	Prepare and interpret basic financial statements using accounting principles, conventions, and the double-entry system.
CO 5	Evaluate financial performance of a business through ratio analysis and interpretation.

4. COURSE CONTENT

UNIT – I (10L)

Introduction to Business and Economics Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance. Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply and Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT – II (10L)

Demand and Supply Analysis Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting. Supply Analysis: Determinants of Supply, Supply Function and Law of Supply.

UNIT – III (10L)

Production, Cost, Market Structures & Pricing Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions. Cost analysis: Types of Costs, Short run and Long run Cost Functions. Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition. Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

UNIT – IV (9L)

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts (Simple Problems).

UNIT – V (9L)

Financial Ratios Analysis: Concept of Ratio Analysis, Importance and Types of Ratios, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios – Analysis and Interpretation (simple problems).

5. TEXT BOOKS

1) D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2) Dhanesh K Khatri, Financial Accounting, Tata Mc –Graw Hill, 2011.
3) Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata Mc Graw Hill Education Pvt. Ltd. 2012

6. REFERENCE BOOKS

1) Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2) S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

CO-PO-PSO Mapping

	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
CO 1	**3**	**2**	**2**	**1**	**1**	**2**	**1**	**1**						
CO 2	**3**	**3**	**3**	**1**	**1**	**1**	**2**	**1**						
CO 3	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**1**						
CO 4	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**2**						
CO 5	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**2**						

COURSE CONTENT

TRANSPORTATION ENGINEERING								
III Year - I Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
CE505PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite:								

1. COURSE OVERVIEW

This course introduces the principles of planning, design, construction, and maintenance of transportation systems. It covers the engineering aspects of highways with emphasis on geometric design, traffic engineering, pavement materials, and pavement design. The course also addresses traffic flow characteristics, safety, and sustainable transportation practices, preparing students to analyze and solve real-world transportation engineering problems.

2. COURSE OBJECTIVE

The objectives of the course is to:

1) To understand the fundamental principles of transportation systems and their role in economic and social development.
2) To study the planning and geometric design of highways, railways, airports, and other transportation facilities.
3) To analyze traffic characteristics, traffic flow, and apply traffic engineering techniques for safe and efficient movement.
4) To gain knowledge of pavement materials, construction methods, and pavement design for sustainable transportation infrastructure.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	**Understand** the history of highway development, road plans and government schemes implemented in highway development and maintenance.	Understand
CO 2	**Design** Geometric elements of highways using IRC Codal Provisions	Apply
CO 3	**Evaluate** the issues related to road traffic and provide engineering solutions supported with an understanding of road user psychological and behavioural patterns	Analyze
CO 4	**Understand** the Experimental procedures to assess the suitability of the highway materials likesoil, bitumen, aggregates and a variety of bituminous mixtures.	Understand
CO 5	**Design** flexible rigid highway pavements and overlays for varying traffic compositions as well as soil subgrade and environmental conditions using the standards stipulated by Indian RoadsCongress.	Analyze

4. COURSE CONTENT

UNIT – I:

Introduction: History and Importance of Highways, Characteristics of road transport, Current road development plans in India, Highway development in India, Highway planning, Highway alignment, Engineering surveys for Highway alignment, Highway projects, Highway drawings and reports, Detailed

Project Report preparation, PPP schemes of Highway Development in India, Government of India initiatives in developing the highways and expressways in improving the mobility and village road development in improving the accessibility.

UNIT – II:

Introduction to Highway Geometric Design: Width of Pavement, Formation and Land, Cross Slopes etc; Concept of Friction: Skid and Slip; Elements of geometric design of highways; Sight Distances: Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance; Horizontal alignment: Design of horizontal curves, super elevation, extra widening of pavement at curves; Vertical Alignment: Gradients, Compensation in Gradient, Design of summit curves and valley curves using different criteria; Integration of Horizontal and Vertical Curves.

UNIT - III:

Basic Traffic Characteristics: Speed, volume and concentration, relationship between flow, speed and concentration; Highway capacity and Level of service (LOS) concepts: Factors affecting capacity and LOS, relationship between V/C ratio and LOS; Traffic volume and spot speed studies: Methods; Road Safety; Traffic Signals: Types, warrants for signalization, design of isolated traffic signal by IRC method; Parking and road accidents: Types of parking facilities – on-street and off street, introduction to parking studies; Accident studies, road safety auditing; Introduction to street lighting; Road Intersections: Design considerations of at-grade intersections, introduction to interchanges.

UNIT - IV:

Tests on Soils: CBR, Field CBR, modulus of sub-grade reaction, Tests on Aggregates: specific gravity, shape (flakiness and elongation indices), angularity number, water absorption, impact, abrasion, attrition, crushing resistance, durability (weathering resistance), stone polishing value of aggregates; Tests on bitumen: spot, penetration, softening point, viscosity, ductility, elastic recovery, flash and fire points, Introduction to modified bituminous binders like crumb rubber modified, natural rubber modified and polymer modified bitumen binders; Bituminous Concrete: Critical parameters controlling bituminous concrete mixture design, aggregate blending concepts viz. Rothfuch's method, trial and error procedure. Introduction to advanced concretes for road applications.

UNIT - V:

Introduction to Pavement Design: Types of pavements and their typical cross sections: flexible, rigid and composite; Flexible Pavement analysis and design: Introduction to multi layered analysis, IRC 37- 2012 method of flexible pavement design; Rigid pavement analysis and design: Factors controlling rigid pavement design, types of stresses in rigid pavements, critical load positions, load stresses and temperature stresses in interior, corner and edge locations of jointed plain cement concrete pavement slabs, IRC 58-2015 method of rigid pavement design; Overlay Designs: Types of overlays on flexible and rigid pavements.

5. TEXT BOOKS

1) Khanna, S.K, Justo, A and Veeraragavan, A, 'Highway Engineering', Nem Chand & Bros. Revised Tenth Edition, 2014.
2) KadiyaliL.R. and Lal N B, Principles and Practices of Highway Engineering; Seventh Edition, First Reprint; Khanna Publishers, New Delhi, 2018.

Code of Provisions:

Design Codes: IRC 37-2012, IRC 58-2015, IRC 81-1997

6. REFERENCE BOOKS

1) Papacoastas, C. S. and Prevedouros, Transportation Engineering and Planning, Third Edition, Third Impression; Pearson Education, 2018.
2) Khisty C J and Lall B Kent; Transportation Engineering: An Introduction, Third Edition, 1st Indian Adaptation; Pearson India Education Service Pvt. Ltd, New Delhi 2017.
3) Subhash C Saxena, Text Book of Highway and Traffic Engineering; First Edition; CBS

Publishers and Distributors. New Delhi, 2014
4) C Venkatramaih, Transportation Engineering Volume 1 – Highway Engineering, 1st Edition, Universities Press, 2016
5) Garber, N.J. and Hoel, L.A. Traffic and Highway Engineering, Fourth Edition; Cengage Learning, Stamford, CT, USA, 2010
6) Parthachakroborty and Animesh Das, Principles of Transportation Engineering, PHI, 2013
7) Nicholas J Garber and Lester AHoel, Traffic and Highway Engineering, 5th Edition, Cengage Learning India Private Limited, New Delhi, 5th Indian Reprint, 2011.

CO-PO-PSO Mapping

	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
CO 1	**3**	**2**	**1**			**1**	**1**					**2**	**2**	**2**
CO 2	**3**	**2**	**2**	**2**		**1**						**2**	**2**	**2**
CO 3	**3**	**2**	**2**	**1**		**1**						**2**	**2**	**2**
CO 4	**3**	**2**	**2**	**2**		**1**	**1**					**2**	**2**	**2**
CO 5	**3**	**2**	**2**	**2**		**1**						**2**	**2**	**2**

COURSE CONTENT

HYDROLOGY AND WATER RESOURCES ENGINEERING								
III Year - I Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
CE506PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite:								

1. COURSE OVERVIEW

This course provides a comprehensive understanding of hydrologic processes and water resources engineering principles essential for planning, design, and management of water systems. It covers the hydrologic cycle, precipitation measurement and analysis, abstractions such as evaporation, evapotranspiration, infiltration, and runoff estimation. The course also includes hydrograph analysis, groundwater hydrology, well hydraulics, crop water requirements, and irrigation practices. In addition, it addresses canal systems, channel design, waterlogging, drainage, and sustainable management of surface and groundwater resources for agricultural and engineering applications.

2. COURSE OBJECTIVE

The objectives of the course is to:

This course provides the description of hydrological cycle and derives various formulas used in estimation of different basic components of surface and Ground water cycle. and its components. Further it will explain the water requirement for irrigation and connectivity of hydrology to the field requirement.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	**Understand** the concepts and terms used in engineering hydrology.	Understand
CO 2	**Evaluate** abstractions from precipitation such as evaporation, evapotranspiration, infiltration, and runoff, and apply standard methods for runoff estimation and watershed analysis**.**	Apply
CO 3	**Analyze** rainfall–runoff relationships using hydrographs, unit hydrograph theory, and synthetic hydrographs for flood estimation and water resources planning.	Analyze
CO 4	**Explain** groundwater occurrence and movement, apply well hydraulics principles, and assess crop water requirements, irrigation practices, and soil–water relationships.	Apply
CO 5	**Design** canal systems, outlets, and drainage measures, and assess issues related to waterlogging, canal lining, and efficient irrigation management	Apply

4. COURSE CONTENT

UNIT – I:

Introduction: Concepts of Hydrologic cycle, **Precipitation:** Forms of precipitation, characteristics of precipitation in India, measurement of precipitation: Recording and non-recording types, rain gauge network: mean precipitation over an area: Missing Rainfall Data – Estimation, Consistency of Rainfall

records, depth area- duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India.

UNIT – II:

Abstractions from precipitation:

Evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, evapotranspiration equations: Penman and Blaney & Criddle Methods, potential evapotranspiration over India, actual evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.

Run off: Components of Runoff, Factors affecting runoff, Basin yield, SCS-CN method of estimating runoff, Flow duration curves, Mass curve of runoff – Analysis, concepts of watershed management.

UNIT - III:

Hydrographs: Hydrograph –Distribution of Runoff – Hydrograph Analysis Flood Hydrograph – Effective Rainfall – Base Flow- Base Flow Separation - Unit Hydrograph, definition, limitations and applications and Unit hydrograph, S-hydrograph, Synthetic Unit Hydrograph.

UNIT - IV:

Groundwater Hydrology: Occurrence, movement and application of groundwater, aquifers – types, Specific Yield, Permeability, Storage coefficient, Transmissibility, Darcy's Law. **Well Hydraulics -** Steady radial flow into well for confined and unconfined aquifers, Recuperation tests. Well constants. Crop water requirements – Water requirements of crops – crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zones oil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, Micro irrigation.

UNIT - V:

Canal systems: alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels, alluvial channels. canal outlets: non-modular, semi modular and modular outlets. Canal outlets non-modular, semi-modular and modular outlets. Waterlogging: causes, effects and remedial measures. Lining of canals-Types of lining-Advantages and disadvantages. Drainage of irrigated lands-necessity, methods.

5. TEXT BOOKS

1) Hydrology by K. Subramanya (Tata McGraw-Hill).
2) Irrigation Engineering and Hydraulic structures by Santhosh kumar Garg Khanna publishers.
3) G L Asawa, Irrigation Engineering, Wiley Eastern

6. REFERENCE BOOKS

1) Elements of Engineering Hydrology by V.P. Singh (Tata McGraw-Hill).
2) Engineering Hydrology by Jaya Rami Reddy (Laxmi Publications.
3) Ground water Hydrology by David Keith Todd, John Wiley & Son, New York.
4) Elements of Water Resources Engineering by K.N. Duggal and J.P. Soni (New Age International)
5) Manual on Storm Water Drainage System- 2019, CPH EO New Delhi.

CO-PO-PSO Mapping

	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
CO 1	**3**	**2**	**1**			**1**	**1**					**2**	**2**	**2**
CO 2	**3**	**2**	**2**	**2**		**1**	**1**					**2**	**2**	**2**
CO 3	**3**	**2**	**2**	**2**		**1**	**1**					**2**	**2**	**2**
CO 4	**3**	**2**	**2**	**2**		**1**	**1**					**2**	**2**	**2**
CO 5	**3**	**2**	**2**	**2**		**1**	**1**					**2**	**2**	**2**

COURSE CONTENT

TRANSPORTATION ENGINEERING LABORATORY								
III Year - I Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
CE507PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**1**	**40**	**60**	**100**
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32				**Total Classes: 32**		
Prerequisite: Building Materials, Highway Materials								

1. COURSE OVERVIEW

The Transportation Engineering Laboratory course provides practical exposure to testing and evaluating materials and components used in transportation infrastructure. It covers experiments on bituminous materials, aggregates, pavement materials, and soil for road construction, as well as traffic studies and surveys. The course emphasizes hands-on learning, data analysis, and interpretation to understand material behavior, pavement performance, and traffic characteristics, supporting the design, construction, and maintenance of safe and durable transportation systems.

2. COURSE OBJECTIVE

The objectives of the course is to:

1) To learn laboratory tests and their procedures cement, fine aggregate, course aggregates and bitumen.
2) To Evaluate fresh concrete properties.
3) To Understand the test procedures for characterization of Concrete and bituminous mixes.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	**Evaluate** the physical and mechanical properties of aggregates through tests such as impact, crushing, abrasion, and shape to assess their suitability for pavement construction.	Apply
CO 2	**Determine** the key properties of bituminous materials, including penetration, softening point, ductility, elasticity, viscosity, and flash/fire points, for appropriate selection in road construction.	Apply
CO 3	**Prepare** and test bituminous mixes using the Marshall method to assess mix stability, flow, and suitability for pavement design**.**	Apply
CO 4	**Conduct** field-based traffic studies, including volume, speed, and parking surveys, to analyze traffic characteristics and flow patterns for planning and design purposes.	Apply
CO 5	**Understand** the principles of road safety and geometric design through observational studies and audits to enhance transportation safety and infrastructure planning.	Understand

4. COURSE CONTENT

List of Experiments:

Tests on Aggregates

1. Impact test
2. Crushing value test
3. Los Angeles Abrasion test
4. Shape test

Tests on Bitumen

1. Penetration and softening point
2. Ductility and Elastic recovery
3. Viscosity
4. Flash and Fire points (Demo)

Mix preparation (Demo)

1. Marshall's Stability sample preparation
2. Marshall's Stability sample testing

Traffic Lab

1. Volume Studies at Mid blocks
2. Volume Studies at Intersections
3. Speed Studies using Spot speeds
4. Speed Studies using Moving car method
5. Parking Studies
6. Road safety Audit with respect to Geometric design (video demonstration only)

5. REFERENCE BOOKS

TEXT BOOKS:

1. Highway Material Testing manual, Khanna, Justo and Veeraraghavan, Nemchand Brothers

IS CODES:

1. IS 1201 -1220 (1978) "Methods for testing tars and bituminous materials"
2. IRC SP 53 -2010 "Guidelines on use of modified bitumen"
3. MS-2 Manual for Marshalls Mix design 2002

CO-PO-PSO Mapping

	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
CO 1	**2**	**1**	**1**	**2**				**1**	**2**	**1**		**2**	**2**	**2**
CO 2	**2**	**1**	**1**	**2**				**1**	**2**	**1**		**2**	**2**	**2**
CO 3	**2**	**1**	**1**	**2**				**1**	**2**	**1**		**2**	**2**	**2**
CO 4	**2**	**1**	**1**	**2**				**1**	**2**	**1**		**2**	**2**	**2**
CO 5	**2**	**1**	**1**	**2**	**1**			**1**	**2**	**1**		**2**	**2**	**2**

COURSE CONTENT

GEOTECHNICAL ENGINEERING LABORATORY								
III Year - I Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
CE508PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**1**	**40**	**60**	**100**
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32				**Total Classes: 32**		
Prerequisite:								

1. COURSE OVERVIEW

The Geotechnical Engineering Laboratory course provides hands-on experience in determining the engineering properties of soils through standard laboratory tests. The course includes experiments on soil classification, index properties, permeability, compaction, consolidation, and shear strength characteristics. Emphasis is placed on proper testing procedures, interpretation of results, and correlation of laboratory findings with field behavior to support safe and effective geotechnical design.

2. COURSE OBJECTIVE

The objectives of the course is to

To obtain index and engineering properties of locally available soils, and to understand the behavior of these soil under various loads.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	**Determine** the index properties of soils, including Atterberg limits, specific gravity, grain size distribution, and free swell characteristics for soil classification.	Apply
CO 2	**Evaluate** in-situ soil density using core cutter and sand replacement methods and assess field compaction quality.	Apply
CO 3	**determine** soil permeability and compaction characteristics and analyze their significance in engineering applications	Apply
CO 4	**Determine** the consolidation characteristics of soils and evaluate settlement behavior using consolidation test results.	Apply
CO 5	**Determine the** strength characteristics of soils through unconfined compression, direct shear, and vane shear tests for geotechnical design purposes.	Apply

4. COURSE CONTENT

List of Experiments:

1. Atterberg Limits (Liquid Limit, Plastic Limit, and shrinkage limit)
2. Field density by core cutter method and
3. Field density by sand replacement method
4. Determination of Specific gravity of soil Grain size distribution by sieve analysis
5. Permeability of soil by constant and variable head test methods
6. Standard Proctor's Compaction Test
7. Determination of Coefficient of consolidation (square root time fitting method)
8. Unconfined compression test
9. Direct shear test

10. Vane shear test
11. Differential free swell index (DFSI) test

5. REFERENCE BOOKS

1) Measurement of Engineering Properties of Soils by. E. Saibaba Reddy & K. Rama Sastri, New Age International, 2002.
2) Manual of Soil Laboratory Testing, K. H., Head, CRC Press, 2006, 3rd Edition.

CO-PO-PSO Mapping

	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
CO 1	**3**	**2**	**1**	**2**		**1**		**1**	**2**	**1**		**2**	**2**	**2**
CO 2	**3**	**2**	**1**	**2**		**1**		**1**	**2**	**1**		**2**	**2**	**2**
CO 3	**3**	**2**	**1**	**2**		**1**		**1**	**2**	**1**		**2**	**2**	**2**
CO 4	**3**	**2**	**1**	**2**		**1**		**1**	**2**	**1**		**2**	**2**	**2**
CO 5	**3**	**2**	**1**	**2**		**1**		**1**	**2**	**1**		**2**	**2**	**2**