Second Year (Lateral Entry) Curriculum

Admission Year 2026-27

Bachelor of Technology (Lateral Entry)
Civil Engineering

Faculty of Engineering & Technology

Parul University

Vadodara, Gujarat, India

Semester – 3

a. Course Name: Concrete Technology

b. Course Code: 03010403PC05

c. Prerequisite: Basic Civil engineering knowledge

d. Rationale: Communication confidence laced with knowledge of English grammar is essential for all engineers.

e. Course Learning Objective:

CLOBJ 1	Develop students' ability to actively listen and comprehend spoken content.
CLOBJ 2	Enable students to identify and correct errors in language usage, specifically focusing on tenses, voices, and reported speech.
CLOBJ 3	Equip students with the knowledge and skills to structure various types of speeches, including welcome/introductory, vote of thanks, and farewell speeches.
CLOBJ 4	Instill confidence in students to overcome stage fright, prepare compelling

f. Course Learning Outcomes:

CLO 1	Demonstrate a comprehensive understanding of engineering materials
CLO 2	Apply knowledge of concrete technology
CLO 3	Execute mechanical testing and analysis
CLO 4	Utilize non-destructive testing techniques
CLO 5	Conduct material-specific testing
CLO 6	Evaluate and recommend testing methodologies

g. Teaching & Examination Scheme:

Teaching Scheme				Examination Scheme					
				Internal Evaluation			ESE		
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	**Total**
3	**0**	**0**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics	W	T
1	**Concrete** Concrete as a structural Material, Types of Concrete, Statistics of the recent cement industry, Major companies involved in GDP, Units of measurement. Failure of concrete under low stress, Microstructure of the aggregate phase.	**15**	**4**
2	**Cement Ingredients**	**20**	**6**
	Argillaceous and Calcareous materials, Chemical Composition, Manufacturing Process-Dry Process, Wet Process and Semi-dry Process, Properties of cement, Hydration of cement, Tests on cement, Interfacial Transition zone of concrete, Aggregates –Characteristics and their Significance, Admixtures-Nomenclature, Specifications and Classifications, Water – General requirements & limiting values of impurities.		

3	**Concrete Mix Design** Design of concrete mixes by IS code method - ACI method. Design of high-strength concrete mixes, design of light weight aggregate concrete mixes, design of fly-ash cement concrete mixes, design of high-density concrete mixes. ACI and PCI Codes for Mix Design of SCC, HPC.	**25**	**8**
4	**Concrete at Early Stage & Hardened Concrete** Batching of ingredients; mixing, transport, and placement. Consolidation, finishing, and curing of concrete; initial and final set - significance and measurement. Workability of concrete and its measurement. Strengths of hardened concrete (Tensile & Compressive strength, Flexural & Bond strength), standard test methods as per IS and ASTM Creep and relaxation- parameters affecting; Shrinkage of concrete - types and significance. Parameters affecting shrinkage; measurement of creep and shrinkage.	**25**	**8**
5	**Recent Advances and Concrete in the Future** Properties and applications of: High-strength, high-performance concrete, reactive powder concrete. Lightweight, heavyweight, and mass concrete; Fibre reinforced concrete; Self-compacting concrete, Shrinkage-Compensating Concrete Shot-crete, Mass concrete, Heavyweight Concrete for Radiation Shielding.	**15**	**4**

i. Reference Book:

1 National Building Code of India' Government of India
2 Concrete microstructure, Properties and materials By P Kumar Mehta and Paulo J.M.Monterio
3 Building construction Handbook By Roy Chudley and Roger Greeno
4 Concrete Technology (TextBook) By M.L.Gambhir | Tata McGraw Hill Ltd.
5 Concrete Technology (TextBook) By M.S. Shetty
6 Building Services Handbook' (TextBook) By Roger Greeno and Fred Hall | Routledge

a. **Course Name:** Concrete Technology Lab
b. **Course Code:** 03010403PC06
c. **Prerequisite:** Basic Civil engineering knowledge
d. Rationale: This subject deals with judicious selection of materials, mixed proportioning & proper workmanship so as to result in durable concrete.
e. **Course Learning Objective:**

CLOBJ 1	Develop a comprehensive understanding of the significance of tests such as fineness, consistency, and soundness in assessing the quality of cement, crucial for ensuring the durability and strength of concrete structures.
CLOBJ 2	Gain hands-on experience in conducting various tests, including compressive strength, sieve analysis, and workability measurements, fostering practical skills in laboratory procedures and equipment handling.
CLOBJ 3	Learn to analyze and interpret test results accurately, connecting laboratory findings to the performance characteristics of cement and concrete, and making informed decisions based on these assessments.
CLOBJ 4	Acquire knowledge and skills related to quality assurance and control practices in the construction industry, with a focus on using test results to ensure that construction materials meet industry standards and specifications.
CLOBJ 5	Explore the application of test results in real-world scenarios, including the selection of appropriate cement types for specific construction projects, troubleshooting issues related to concrete quality, and making recommendations for improvements based on test outcomes.

f. **Course Learning Outcomes:**

CLO 1	Identify different materials used in civil engineering applications
CLO 2	Understand the behaviour of concrete and its properties
CLO 3	Asses the laboratory equipment including the electronic instrumentation, the test apparatus, and the data collection system
CLO 4	Observe various modes of failure in compression, tension, and shear
CLO 5	Aware of quality assurance and control in their real life as a professional

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	**0**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Topics
1.	Determination of the Fineness of cement
2.	Determination of Standard Consistency of Cement Paste
3.	Determination of Initial and Final Setting Time of Ordinary Portland Cement
4.	Determination of Soundness of Cement with the Le-Chatelier Apparatus
5.	Determination of Compressive Strength of Cement
6.	Sieve Analysis of Course and Fine Aggregates
7.	Aggregate Crushing Value
8.	Flakiness Index and Elongation Index of Course Aggregate
9.	To Measure the Workability of the Concrete by Slump Method
10.	To Measure the Workability of the Mix by Using Compaction Factor Apparatus

a. Course Name: Building Planning and Design
b. Course Code: 03010403PC07
c. Prerequisite: Knowledge of Basic Civil Engineering
d. Rationale: Basic Civil Engineering knowledge is essential for all engineers

e. Course Learning Objective:

CLOBJ 1	Gain a solid understanding of the fundamental principles of construction practices, including safety, quality, and efficiency.
CLOBJ 2	Gain a comprehensive understanding of different types of foundations, with a specific focus on deep and heavy foundations.
CLOBJ 3	Understand the classification of construction materials based on their properties, composition, and application.
CLOBJ 4	Understand the basic principles underlying groundwater movement, including concepts such as permeability, porosity, and hydraulic conductivity.
CLOBJ 5	Develop a comprehensive understanding of various structural elements in construction, including walls, slabs, beams, columns, and arches.
CLOBJ 6	Familiarize participants with a broad range of construction equipment commonly used in the industry.

f. Course Learning Outcomes:

CLO 1	Importance of Good Construction Practices
CLO 2	Identify, analyse and implement deep and heavy foundations
CLO 3	Analyse the properties and characteristics of different materials used in construction
CLO 4	Describe the principles of groundwater movement and behaviour.
CLO 5	Apply principles of formwork design for different structural elements like walls, slabs, beams, columns, and arches.
CLO 6	To gain knowledge about various construction equipment used for construction work.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**0**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr.	**Topics**	**W**	**T**
1	**Introduction to Planning:** Basic areas in residential buildings, Process of planning, Family requirements and analysis, Conceptual plan outlines, Principles and techniques of functional planning, Planning for building services, Stakeholders' role in changing surrounding area.	**15**	**6**
2	**Principles of Building Planning** Introduction to principles of Building planning, Importance of Vastu Shastra in building planning, Orientation for sunlight and ventilation, Aspect for room placement and daylight, Economy for cost-effective planning, Building Bye-laws for safe and regulated construction, Statutory guidelines for passing building drawings.	**20**	**8**

3	**Residential and Public Buildings Planning** **Residential buildings:** Minimum standards for various parts of buildings -requirements of different rooms and their grouping- characteristics of various types of residential buildings, Draw the Plan, Elevation and sections of a Residential & Public buildings from the given line diagram, Key Plan, Site Plan**.** **Public buildings:** Planning of educational institutions, hospitals, dispensaries, office buildings, banks, industrial buildings, hotels & motels, buildings for recreation	**20**	**9**
4	**Planning of Building Services:** Types of Building Service, Layout of Water Distribution system, Sanitary system, Electrical Layout, HVAC Layout, Working and Approval Drawings.	**20**	**9**
5	**Town Planning:** Ancient Town planning, Necessity of Civic surveys for Planning purpose, types, data and its presentation and analysis, Fundamental principles of Town Planning, Land use Planning, Components of town such as Zones, Road Network, CBD, neighbourhood planning, remedial measures for avoiding slum foundation, Development plans, Master Plan, Modern concepts in town planning-Smart city, Sustainable urban development.	**15**	**8**
6	**FORM WORK** Form works for R.C.C. Wall, slab, beam and column, centering for arches of large spans and dams, design features for temporary works, slip formwork, False work for Bridges	**10**	**5**
7	**Perspective Drawing:** Principles of Perspective drawings, Types of perspective views, Software application in building planning and drawing, Building Information Modelling (BIM)	**15**	**6**

i. Text Book and Reference Book:

1. **Construction Technology**
   By Chudley and Greeno
2. **Advanced Construction Technology**
   By Roger Greeno, R. Chudley, Mike Hurst, Simon Topliss
3. **Construction Planning, Equipments and Methods**
   By R.L. Peurifoy and W.B. Ledbetter | McGraw-Hill Publishers
4. **Fluid mechanics & hydraulic Machines**
   By R.K.Bansal | Lakhsmi publication
5. **Introduction to Fluid Mechanics**
   By Fox, Pritchard and McDonald | John Wiley & Sons
6. **Engineering Fluid Mechanics**
   By D. S. Kumar | S K KATARIA & SONS-NEW DELHI
7. **Hydraulics and fluid mechanics including Hydraulic machines**
   By Modi P.N. and Seth S.M.
8. **Fluid mechanics & hydraulic machines**
   By S.C. Gupta | PERSON Education
9. **Fluid Mechanics and Hydraulic Machines**
   By Dr. R K. Bansal | Laxmi Publications
10. **Building Construction**
    By S.P.Arora, S.P Bindra | Dhanpat Rai Publications
11. **Building Construction**
    By B.C. Punmia
12. **Building Construction**
    By S. C. Rangwala
13. **Building construction and Technology**
    By W. B. Mckay | Longmans, Green and Co | Vol. I to IV

a. Course Name: Building Planning and Design

b. Course Code: 03010403PC07

c. Prerequisite: Knowledge of Basic Civil Engineering

d. Rationale: Basic Civil Engineering knowledge is essential for all engineers

e. Course Learning Objective:

CLOBJ 1	Gain a solid understanding of the fundamental principles of construction practices, including safety, quality, and efficiency.
CLOBJ 2	Gain a comprehensive understanding of different types of foundations, with a specific focus on deep and heavy foundations.
CLOBJ 3	Understand the classification of construction materials based on their properties, composition, and application.
CLOBJ 4	Understand the basic principles underlying groundwater movement, including concepts such as permeability, porosity, and hydraulic conductivity.
CLOBJ 5	Develop a comprehensive understanding of various structural elements in construction, including walls, slabs, beams, columns, and arches.
CLOBJ 6	Familiarize participants with a broad range of construction equipment commonly used in the industry.

f. Course Learning Outcomes:

CLO 1	Importance of Good Construction Practices
CLO 2	Identify, analyse and implement deep and heavy foundations
CLO 3	Analyse the properties and characteristics of different materials used in construction
CLO 4	Describe the principles of groundwater movement and behaviour.
CLO 5	Apply principles of formwork design for different structural elements like walls, slabs, beams, columns, and arches.
CLO 6	To gain knowledge about various construction equipment used for construction work.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	**0**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

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i. Course Content:

Sr. No.	Topics
1.	Practical 1: Introduction to CAD for civil engineering.
2.	Practical 2: Prepare line diagram for residential and public buildings.
3.	Practical 3: Prepare plan for residential building using principles of planning using CAD.
4.	Practical 4: Prepare plan for public building using principles of planning using CAD.
5.	Practical 5: Prepare line plan for industrial building.
6.	Practical 6: Preparation of drawings for foundation.
7.	Practical 7: Preparation of drawings for any building services (Electrical and plumbing).
8.	Practical 8: Preparation of perspective drawing.

a. Course Name: Structural Mechanics

b. Course Code: 03010403PC01

c. Prerequisite: Knowledge of the Mechanics of Solids

d. Rationale: This subject deals with conceptual applications of principles of mechanics of rigid and deformable bodies.

e. Course Learning Objective:

CLOBJ 1	Describe the mechanical behaviour of engineering materials subjected to various types of stresses and compute the resulting strain and strain energy.
CLOBJ 2	Analyse the bending of various types of beams under static loading conditions and compute the shear stress distribution for different cross sections of beams.
CLOBJ 3	Understand that how knowledge of principal planes, stresses and strains and analyse the elastic deformation of members and apply different theories of elastic failures.
CLOBJ 4	Compute the torsion for the circular shaft and analyse the crippling load and equivalent length for various types of columns of different end conditions.
CLOBJ 5	Demonstrate and Compute the deflection of beams and shafts under static loading and stresses in thin walled cylindrical and spherical vessels.

f. Course Learning Outcomes:

CLO 1	Understanding of application and use of Civil Engineering in practical life.
CLO 2	Exposure to concepts of surveying and mapping
CLO 3	Design small buildings and drawing plans and elevations..
CLO 4	Discuss three phase balanced circuits.
CLO 5	Understand Global positioning system, remote sensing & GIS.
CLO 6	Understand construction materials
CLO 7	Understand building materials

g. Teaching & Examination Scheme

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	**Total**
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**-Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr.	**Topics**	**W**	**T**
	Principal Stress and Strain Principal planes: Principal stresses and principal strains, Analytical and graphical method (Mohr's circle) for finding normal and shear stress on an oblique section of a body subjected to direct and shear stresses, Determination of principal stresses and location of principal planes, maximum shear stress and location of plane of maximum shear. **Shear Stresses in beam:** Introduction and derivations of shear stress, shearing stress at any layer in a loaded beam, shear stress distribution of a rectangular section, circular section, I-section, T-section and triangular section.	**5**	**2**

2	**Bending Stresses in Beam Introduction**, Assumptions and derivations of theory of simple bending, position of neutral axis, moment of resistance, distribution of bending moment across the section modulus of section, bending stress in symmetric sections, unsymmetrical sections **Direct and bending stress**: Introduction, eccentric loading, column with eccentric loading, symmetrical column with eccentric loading about one axis and two axes, limit of eccentricity, kernel of a section, structures subjected to lateral pressure.	**5**	**2**
3	**Truss** Classification of truss, Perfect and Imperfect truss, analysis of pin- jointed perfect truss using method of joints and method of sections.	**10**	**4**
4	**Deformation of Beams** Introduction to type of structures: static and kinematic indeterminacy, Elastic curve, relationship of slope deflection with radius of curvature, bending moment, shear force and load intensity, methods of finding slope and deflection at any section of beam by Macaulay's method, Moment area method, Conjugate beam method	**12**	**5**
5	**Fundamentals of Statically Determinate Structures** Types of statically determinate & indeterminate structures, static and kinematic indeterminacy, stability of structures, principle of superposition, Maxwell's reciprocal theorems. Computation of internal forces in statically determinate structures such as plane truss, plane frame, grids.	**12**	**6**
6	**Columns and Struts** Buckling of columns, different end conditions, effective length, least radius of gyration, Euler's and Rankine's formulae, columns with initial curvature, eccentrically loaded columns, columns with lateral loading.	**6**	**2**
7	**Strain Energy** Resilience, strain energy due to axial loads & flexure, proof resilience, modulus of resilience, impact loads, and sudden loads	**5**	**2**

i. Text Book and Reference Book:

1. Structural Analysis
   By Hibbler R C | Pearson Education
2. Intermediate Structural Analysis By
   Wang C. K.
3. Engineering Mechanics of Solids By
   Popov E.P
4. 'Strength of Materials' By R.S
   Khurmi | S. Chand
5. Strength of Materials By
   Ryder G.H
6. Mechanics of Structures Vol-I By
   Junarkar S.B. and Shah H.J.

a. **Course Name:** Structural Mechanics Laboratory
b. **Course Code:** 03010403PC02
c. **Prerequisite:** Knowledge of the Mechanics of Solids.
d. **Rationale**: This subject deals with conceptual applications of principles of mechanics of rigid and deformable bodies.
e. **Course Learning Objective:**

CLOBJ 1	Develop a strong foundation in the principles and methods used to determine displacements in statically determinate structures, enabling students to analyze and predict how structures deform under different loading conditions.
CLOBJ 2	Acquire the skills to calculate and interpret stresses in structural elements subjected to axial and eccentric loading, understanding the impact of loading eccentricity on the behavior of materials and structures.
CLOBJ 3	Understand the concept of buckling and its significance in the stability of columns and struts with various end conditions, enabling students to calculate critical buckling loads and make informed decisions about structural design.
CLOBJ 4	Develop the ability to determine principal stresses and strains in materials under different loading conditions, and learn how to locate principal planes, providing insights into the material's behavior and aiding in the design process.
CLOBJ 5	Gain proficiency in calculating and analyzing bending stresses on extreme fibers of beams, considering different loading configurations and support conditions, and understanding the factors that influence the structural integrity of beams.

f. **Course Learning Outcomes:**

CLO 1	Memorize and recall essential concepts and formulas related to structural analysis, including methods for determining displacements and stresses in statically determinate structures.
CLO 2	Explain the underlying theories and principles behind structural analysis, comprehending the significance of axial loading, eccentric loading, buckling phenomena, and principal stresses and strains in various structural components.
CLO 3	Solve engineering problems by applying learned concepts, demonstrating the ability to calculate and analyze displacements, stresses, buckling loads, and bending stresses in diverse structural scenarios.
CLO 4	Evaluate and interpret the results of structural analyses, identifying critical points of failure and making informed decisions about design modifications or reinforcements, showcasing advanced analytical skills

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**T**	**P**	
0	**0**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

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h. Course Content:

Sr. No.	Topics
1.	Numerical problems on axially loaded short columns.
2.	Numerical problems on eccentrically loaded short columns.
3.	Analysis of a pin-jointed perfect truss using the method of joints.
4.	Analysis of a pin-jointed perfect truss using the method of sections.
5.	Numerical problems on three-hinged arches.
6.	Numerical problems on two-hinged arches.
7.	Analysis of Indeterminate Structures using Force (Flexibility) Methods.
8.	Analysis of Indeterminate Structures using Energy Methods.
9.	Analysis of Indeterminate Structures using Slope-Deflection Method.
10.	Analysis of Indeterminate Structures using the Moment-Distribution Method.

a. **Course Name:** Probability and Statistics

b. **Course Code:** 03019103BS02

c. **Prerequisite:** Knowledge of Mathematics up to 12th science level

d. **Rationale**: The Mathematics I syllabus integrates fundamental calculus concepts, advanced mathematical techniques, and vector calculus, preparing students for engineering challenges with optimized problem-solving skills.

e. **Course Learning Objective:**

CLOBJ 1	Develop a solid understanding of mathematical foundations, including probability spaces, random variables, and key probability distributions such as Binomial, Poisson, and Normal distributions.
CLOBJ 2	Master the solution techniques for first-order partial differential equations using Charpit's method. Skillfully solve second and higher-order linear and non-linear PDEs, including applications to real-world problems.
CLOBJ 3	Analyze correlation and regression to model relationships between variables. Apply the method of least squares for effective curve fitting of linear, quadratic, and more general curves.
CLOBJ 4	Implement numerical methods such as Gauss-Jacobi and Gauss Seidel for solving systems of linear equations. Solve algebraic and transcendental equations using Bisection, Newton-Raphson, and Regula-Falsi methods. Explore finite differences, interpolation, and numerical integration techniques.
CLOBJ 5	Apply numerical methods, including Taylor's series, Euler's method, Modified Euler's method, and the Runge-Kutta method, for solving ordinary differential equations. Develop proficiency in modeling and solving dynamic systems.
CLOBJ 6	Formulate and model practical problems using mathematical techniques, emphasizing the application of PDEs to describe physical phenomena. Demonstrate the ability to translate real-world problems into mathematical equations and solve them effectively.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate the ability to translate physical or engineering problems into mathematical equations and solve them.
CLO 2	Develop analytical and critical thinking skills through the process of solving complex mathematical problems.
CLO 3	Understand and interpret mathematical solutions in the context of the given problems.
CLO 4	Communicate mathematical concepts and solutions clearly and effectively, both in written and verbal forms.
CLO 5	Present mathematical arguments and solutions in a logical and organized manner.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**T**	**P**	
3	3	0	0	20	20	0	60	0	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Content

Sr. No.	Topic	W	T
1	**Probability and Probability Distributions:** Probability Spaces, Conditional Probability, Bayes' Rule, Discrete and Continuous Random Variables, Independent Random Variables, Expectation and Variance of Discrete and Continuous Random Variables, Distribution and Their Properties: Binomial Distribution, Poisson Distribution, Normal Distribution	23%	13
2	**Partial Differential Equations:** First order partial differential equations, solutions of first order linear and nonlinear PDEs, Charpit's Method Solution to homogeneous and nonhomogeneous linear partial differential equations second and higher order by complementary function and particular integral method. Separation of variables method to simple problems in Cartesian coordinates, second-order linear equations and their classification, Initial and boundary conditions, Modeling and solution of the Heat, Wave and Laplace equations.	29%	17
3	**Correlation, Regression and Curve Fitting:** Correlation and Regression – Rank correlation Curve Fitting by The Method of Least Squares- Fitting of Straight Lines, Second Degree Parabolas and More General Curves	15%	9
4	**Solution of a System of Linear Equations, Roots of Algebraic and Transcendental Equations:** Gauss-Jacobi and Gauss Seidel Methods, Solution of Polynomial and Transcendental Equations – Bisection Method, Newton-Raphson Method and Regula-Falsi Method	11%	7
5	**Finite Differences and Interpolation:** Finite Differences, Relation between Operators, Interpolation using Newton's Forward and Backward Difference Formulae. Newton's Divided and Lagrange's Formulae for Unequal Intervals.	11%	7
6	**Numerical Integration:** Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ Rules **Numerical solution of Ordinary Differential Equations:** Taylor's Series, Euler and Modified Euler's Methods. Runge-Kutta Method of Fourth Order for Solving First Order Equations.	11%	7

Text books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Willey India Edition.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2010.
3. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003 (Reprint).

Reference Books:

1. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
2. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.

a. **Course Name:** Highway Engineering
b. **Course Code:** 03010403PC03
c. **Prerequisite:** Knowledge of Basic of Civil Engineering
d. **Rationale:** The rationale for studying transportation engineering lies in its pivotal role in fostering economic development, ensuring safety, and promoting efficient, sustainable movement of people and goods within a society.
e. **Course Learning Objective:**

CLOBJ 1	Understand the principles and components of transportation systems, including modes of transportation, traffic flow theory, and infrastructure design.
CLOBJ 2	Analyze traffic characteristics, including volume, speed, density, and their impact on transportation systems, applying traffic management strategies and control measures.
CLOBJ 3	Gain proficiency in designing and planning highway systems, considering geometric design elements, pavement design, safety measures, and environmental considerations.
CLOBJ 4	Explore the principles and challenges of public transportation systems, including transit planning, multimodal transportation, and sustainable urban mobility solutions.
CLOBJ 5	Understand the policies governing transportation infrastructure development and their environmental implications, including sustainability, emissions, and land use planning.

f. **Course Learning Outcomes:**

CLO 1	Recall and articulate fundamental principles, terminology, and concepts in transportation engineering.
CLO 2	Demonstrate a deep understanding of theories and principles underlying transportation engineering.
CLO 3	Apply transportation engineering knowledge to solve real-world problems related to highway design, construction, and maintenance.
CLO 4	Analyze the impact of design and construction decisions on the performance, safety, and sustainability of road infrastructure.
CLO 5	Evaluate the effectiveness of transportation projects, considering factors like cost-effectiveness, environmental impact, and societal benefits.

g. **Teaching & Examination Scheme:**

Teaching Scheme	**Evaluation Scheme**

L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	20	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr.	Topics	W	T
1	**Road Development and Planning** Brief history of road development, Necessity of highway planning, Jayakar committee, CRF, IRC, CRRI, HRB, NTPC, classification of roads, road patterns, planning surveys, saturation system/maximum utility system, highway planning in India, Nagpur, Bombay, Lucknow road development plans.	**4**	**10**
2	**Highway Location and Alignment** Basic requirements of an ideal alignment and controlling factors, engineering survey for highway location, drawing and reports, highway projects.	**4**	**10**
3	**Highway Geometric Design** Cross-sectional elements; design speed, sight distances; PIEV theory, requirements and design principles of horizontal alignment including radius of curvature, super elevation, extra-widening, design of transition curves, curve resistance, Set-back distance, grade compensation and vertical alignment, summit curve and valley curve.	12	20
4	**Highway Construction Materials** Types, properties and tests of Aggregates, Bituminous materials, and cement.	9	20
5	**Pavement Design** Introduction, pavement design variables, Methods of flexible pavement design: GI, IRC, IRC guidelines, Stresses in the rigid pavement, design of slab thickness, dowel bar and tie bar, joints in cement concrete pavements	12	33
6	**Construction of Roads** Construction of water-bound macadam roads, WMM, bituminous pavements, Rigid Pavement, drainage of roads: surface and subsurface drainage	4	10
7	**Highway Marking, Lighting and Road Side Arboriculture**	1	2
8	**Highway Maintenance** Pavement distress, repair and maintenance of flexible and rigid pavement	2	5

i. Text Book and Reference Book:

1. Highway Engineering S. K. Khanna, C.E.G. Justo
2. Traffic Engineering and Transport Planning Dr. L.R. Kadiyali; Khanna Publishers, New Delhi.
3. Highway Engineering Dr. L.R. Kadiyali; Khanna Publishers, New Delhi
4. Principles, Practice and Design of Highway Engineering Dr. S.K. Sharma; S. Chand & Co., New Delhi

a. **Course Name:** Highway Engineering Laboratory
b. **Course Code:** 03010403PC04
c. **Prerequisite:** Basic of Civil Engineering
d. **Rationale:** Road transportation plays an important role for the development of any country. The study of this subject imparts the knowledge to the students of properties and tests of road construction materials and design process of flexible and rigid pavements.
e. **Course Learning Objective:**

CLOBJ 1	Understand the principles and components of transportation systems, including modes of transportation, traffic flow theory, and infrastructure design.
CLOBJ 2	Analyze traffic characteristics, including volume, speed, density, and their impact on transportation systems, applying traffic management strategies and control measures.
CLOBJ 3	Gain proficiency in designing and planning highway systems, considering geometric design elements, pavement design, safety measures, and environmental considerations.
CLOBJ 4	Explore the principles and challenges of public transportation systems, including transit planning, multimodal transportation, and sustainable urban mobility solutions.
CLOBJ 5	Understand the policies governing transportation infrastructure development and their environmental implications, including sustainability, emissions, and land use planning.

f. **Course Learning Outcomes:**

CLO 1	Carryout laboratory tests on aggregates and bituminous materials.
CLO 2	Carryout preliminary design of flexible and rigid pavements
CLO 3	Traffic volume count methods.
CLO 4	Calculate design speed, maximum speed & minimum speed limits of a location through spot speed

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**0**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

i. **Course Content:**

Sr. No.	**Topics**
1.	To determine the impact value of aggregates
2.	To determine the crushing value of aggregates
3.	To determine the flakiness and elongation index of aggregates
4.	To determine Los- Angeles test on aggregates
5.	To determine the specific gravity and water absorption of aggregates
6.	To determine bulk density and % voids
7.	To determine penetration value of the bitumen
8.	To determine the softening point of bitumen
9.	To determine the ductility value of bitumen
10.	To determine the viscosity of bitumen
11.	Classified traffic volume count
12.	Examples based on geometric design of Highway
13.	Examples based on flexible and rigid pavement design

a. **Course Name:** Cognitive Reasoning
b. **Course Code:** 03010003HM01
c. **Prerequisite:** Knowledge of English language in practical life.
d. **Rationale**: Knowledge and application of English, Aptitude and Management Skills are crucial for better employability as well as professionalism.
e. **Course Learning Objective:**

CLOBJ 1	Demonstrate the ability to communicate clearly and persuasively in oral presentations.
CLOBJ 2	Practice active listening techniques to enhance understanding in professional interactions.
CLOBJ 3	Write professional emails, memos, and reports with clarity and conciseness.
CLOBJ 4	Understand and practice professional etiquette in various business settings.
CLOBJ 5	Demonstrate skills in resolving conflicts and negotiating effectively.
CLOBJ 6	Use digital communication tools and platforms effectively.

f. **Course Learning Outcomes:**

CLO 1	To develop advanced communication skills
CLO 2	To become more proficient in formal writing
CLO 3	To apply interpersonal communication skills to be more productive at the workplace
CLO 4	To identity set and achieve the goals with the help of time management
CLO 5	To use with range of vocabulary to communicate effectively

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**T**	**P**	
0	**2**	**0**	**2**						**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content**

Sr.	**Topic**	**W**	**T**
1	**Technical Writing: Email etiquette & Email writing Letter Writing (Types of Letters & Layout)**: • Trains students on detailed email and letter writing etiquette. • Students will be able to write formal letters following certain stipulated formats. • They will learn different types of letters for different official purposes.	10	4
2	**Interpersonal Communication at Workplace: Dynamics of communication**: • To develop the confidence to handle a wide range of demanding situation more effectively at the workplace • To enable the students to analyse their own interpersonal communication style.	10	2
3	**Debate: The three minute debate planner**: • To enable the students to generate effective critical thinking into primary issues in the given topic. • Students will be able to resolve controversies and recognize strengths and weaknesses of arguments.	10	4
	Goal setting & Tracking:		

4	• To enable the students to define strategies or implementation steps to attain the identified goals and make progress every day.	10	2
5	**Time Management & Task Planning (Case –study)**: • To enable the students to identify their own time wasters and adopt strategies to reduce them. • To enable students to clarify and priorities their objective and goals by creating more planning time	5	2
6	**Reading Comprehension: Intermediate level**: • To enable the students develop the knowledge, skills, and strategies they must possess to become proficient and independent readers	5	2
7	**Information design and writing for print and online media: Blog Writing**: • To enable students to design information that is targeted to specific audiences in specific situation to meet defined objectives. • To create blogs and share their own knowledge and experience to the world.	5	2
8	**Advanced vocabulary Building:**: • The students will expand their vocabulary so as to enhance their proficiency in reading and listening to academic texts, writing, and speaking. • The students will attain vocabulary to comprehend academic and social reading and listening texts. • The students will develop adequate speaking skills to communicate effectively.	10	2
9	**Picture Perception**: • To prepare the students for a test for basic intelligence and IQ, generally done on the first day of SSB (Sashastra Seema Bal is one of India's Central Armed Police Forces)	5	1
10	**Appreciation, Apology and Acknowledgement letters**: • To enable the students to maintain productive business relationship through different types of letters. • To enable the students to express their feelings without speaking out loud.	10	2
11	**The Art of Negotiation**: • To enable the students to reach an agreement for mutual benefits through negotiation. • To enable the students to learn a process by which compromise or agreement is reached while avoiding argument and dispute.	5	2
12	**Activity Session (Game of Truth)**: • To make the students think of significance of certain things in their life. • To make them share their thoughts and perception of matters in life, with others.	0	1

i. Text Book and Reference Book:"

1. Business Correspondence and Report Writing SHARMA, R. AND MOHAN, K.
2. Communication Skills Kumar S And Lata P; New Delhi Oxford University Press
3. Practical English Usage MICHAEL SWAN
4. A Remedial English Grammar for Foreign Student F.T. WOOD
5. On Writing Well William Zinsser; Harper Paperbacks,2006; 30th anniversary edition
6. Oxford Practice Grammar, John Eastwood; Oxford University Press
7. Quantitative Aptitude for Competitive Examinations Dr. R.S. Aggarwal

a. **Course Name:** Workshop

b. **Course Code:** 03010902ES01

c. **Prerequisite:** Zeal to learn the subject

d. **Rationale:** The workshop practice is the backbone of the real industrial trades which helps to develop and enhance relevant technical hands-on experience of using various tools and instruments related to various trades. The use of workshop practices in day to day industrial as well domestic life helps to solve the problems. Further, it also deals with basic introduction of system components of electrical and electronic systems, and provides hands on practice in assembling, interconnecting, testing, and repairing such system by making use of various tools used in electrical and electronic workshop. Electronic systems are built on printed circuit board (PCB) and breadboard. One need to use source instruments (power sources and signal sources), and appropriate measuring instruments to study behaviour of a system.

e. **Course Learning Objective:**

CLOBJ 1	Provide an overview of the principles, scope, and importance of mechanical engineering, including its various sub-disciplines and applications.
CLOBJ 2	Emphasize and enforce safety protocols, practices, and procedures to ensure a safe working environment within a mechanical workshop.
CLOBJ 3	Measurement Techniques and Instruments: Familiarize students with various measurement techniques and instruments used in mechanical engineering, emphasizing precision and accuracy in measurements.
CLOBJ 4	Introduce students to basic manufacturing processes such as machining, casting, forming, and welding, providing insights into how different materials are shaped and manipulated.
CLOBJ 5	Hands-on Experience with Tools and Equipment: Familiarize students with basic tools, machines, and equipment commonly used in mechanical engineering through hands-on activities and demonstrations in a workshop setting.

f. **Course Learning Outcomes:**

CLO 1	Comprehend the safety measures required to be taken while working in workshop.
CLO 2	Select the appropriate tools required for specific operation.
CLO 3	Understand the different manufacturing technique for production out of the given raw material.
CLO 4	Understand applications of machine tools, hand tools and power tools.
CLO 5	Understand the importance of the safety measures to be taken while working in the laboratory and safety standards
CLO 6	Understand working principle of various electrical & electronics measurement equipment. Also, the safety measures to be taken while working in the laboratory and safety standards.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**-**	**4**	**2**	**-**	**-**	**40**	**-**	**60**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Electronic Principles by Albert Paul Malvino | TMH
2. Electronic Devices by Thomas L. Floyd | Pearson, Prentice Hall "Linear Systems and Signals" by B.P. Lathi.
3. Electronic Devices and Circuits by David A. Bell | Oxford Publication
4. Electronic Devices and Circuits by Jacob Millman and Halkias | Tata McGraw Hill Publication New Delhi.
5. Shop Theory by Anderson James & Earl E. Tatro | Macmillan/McGraw-Hill School.
6. Workshop Technology by Bava H. S. | Tata McGraw Hill Publishing Co. Ltd.
7. Elements of Workshop Technology Vol. I By Hajra Chaudhary S.K. | Asia Publishing House.
8. Workshop Technology by Chapman, W.A.J. ELBS Low Price Text | Edward Donald Pub. Ltd.
9. Basic Machine Shop Practice Vol. I & II By Tejwani, V.K. | Tata McGraw Hill Pub. Co.
10. Workshop Technology Vol. I & II By Arora, B.D. | Satya Prakashan, New Delhi" Signals and Systems" by Simon Haykin and Barry Van Veen.

SEMESTER – 4

a. **Course Name:** Hydraulic Engineering
b. **Course Code:** 03010404PC01
c. **Prerequisite:** Knowledge of Physics and Mathematics up to 12th science level
d. **Rationale:** Basic Civil Engineering knowledge is essential for all engineers.
e. **Course Learning Objective:**

CLOBJ 1	Understanding the fundamental principles and equations governing open channel flow
CLOBJ 2	Understanding the concepts of water flow, forces leading to water flux and jumps and solving related problems rate, velocity and depth of open flow channels.
CLOBJ 3	Applying various methods and techniques to calculate the hydraulic parameters of open channel flow, such as Manning's equation and the Chezy equation and dimensional analysis.
CLOBJ 4	Evaluating the effects of different factors, such as channel slope, roughness, and cross-sectional shape, on the behavior of turbulent flow.
CLOBJ 5	Understanding the importance of environmental considerations and sustainability in managing open channel flow systems.

f. **Course Learning Outcomes:**

CLO 1	Understanding of application and use of Civil Engineering in practical issues related to water resources.
CLO 2	Exposure to concepts open channel flow.
CLO 3	Solving numerical problems of fluid characteristics.
CLO 4	Understanding the application of dimension analysis.
CLO 5	Understand and analyse the fundamentals of turbulent flow.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	0	0	3	20	20	20	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr.	Topics	W	T
1	**Flow in Open Channel** Open channel and pipe flows; Chezy's formula for uniform flow; Velocity of flow in open channel; Most economical sections of channel, Open channel section for the constant velocity at all depths of flow, Specific energy and specific energy curve; Subcritical flow, critical flow, and supercritical flow	15	6
2	**Non-uniform Flow through Open Channel** Gradually varied flow: Equation of gradually varied flow, Back water curve and afflux, Rapidly Varied Flow: Hydraulic jump, Height of hydraulic jump, Length of hydraulic jump;	20	9

	Loss of energy due to hydraulic jump		
3	**Boundary Layer Theory** Boundary layer characteristics: Boundary layer thickness, displacement thickness, Momentum thickness, Energy thickness; Momentum equation for boundary layer; Concept of Laminar and turbulent boundary layer, Boundary layer separation and its control.	15	6
4	**Ideal Fluid Flow** Source & Sink, Force exerted by a flowing fluid on a body; Expressions for drag and lift; applications of Stoke's law; Drag on a cylinder; Circulation and lift on a circular cylinder: Concept of Flow patterns, development of lift, Position of stagnation points. Pressure at any point on the cylindrical surface, Expression for a lift on the cylinder; Expression for lift coefficient for rotating cylinder; Magnus effect; Lift on an aerofoil	15	6
5	**Dimensional and Model Analysis** Dimensions; Dimensional homogeneity; Methods of dimensional analysis: Rayleigh's method, Buckingham's method, Limitations of dimensional analysis Model analysis; Similitude; Forces influencing hydraulic phenomena; Dimensional numbers and their significance: Reynolds number, Froude number, Euler number, Weber number, Mach number; Model (similarity) laws: Reynolds law, Froude law, Euler law, Weber law, Mach law; Types of models: Undistorted model, Distorted model, Composite model, Sectional model; Scale effects in models; Limitations of hydraulic similitude	20	9
6	**Turbulent Flows** Darcy Weisbach equation: Shear stresses in turbulent flow: Boussinesq's theory, Reynolds theory, Prandtl's mixing length theory; Universal velocity distribution equation Hydrodynamically smooth and rough boundaries: Velocity distribution for turbulent flow in smooth pipes, Velocity distribution for turbulent flow in rough pipes; Velocity distribution for	15	6
	both smooth and rough pipes; Resistance to fluid flow in smooth and rough pipes		

i. Text Book and Reference Book:

1. Fluid Mechanics & Hydraulics Machines By R. K. Bansal | Laxmi Publications.
2. Fluid Mechanics By Fox, McDonald, Pritchard | Wiley.
3. Engineering Fluid Mechanics By D. S. Kumar | S K KATARIA & SONS-NEW DELHI.
4. Engineering Fluid Mechanics By K. L. Kumar | S. Chand Limited.
5. Introduction to Fluid Mechanics and Fluid Machines By S. K. Som and G. Biswas | Tata McGraw Hill.

a. **Course Name:** Hydraulic Engineering Laboratory
b. **Course Code:** 03010404PC02
c. **Prerequisite:** Knowledge of Physics and Mathematics up to 12th science level
d. **Rationale:** Basic Civil Engineering knowledge is essential for all Engineers.
e. **Course Learning Objective:**

CLOBJ 1	Understanding the fundamental principles and equations governing open channel flow
CLOBJ 2	Understanding the concepts of water flow, forces leading to water flux and jumps and solving related problems rate, velocity and depth of open flow channels.
CLOBJ 3	Applying various methods and techniques to calculate the hydraulic parameters of open channel flow, such as Manning's equation and the Chezy equation and dimensional analysis.
CLOBJ 4	Evaluating the effects of different factors, such as channel slope, roughness, and cross-sectional shape, on the behavior of turbulent flow.
CLOBJ 5	Understanding the importance of environmental considerations and sustainability in managing open channel flow systems.

f. **Course Learning Outcomes:**

CLO 1	Understand different types of flow for open channels.
CLO 2	Design efficient channel sections.
CLO 3	Get knowledge about hydraulic jumps and the requirement of energy dissipation devices in hydraulic structures.
CLO 4	Get the basic ideas regarding the model and prototype of the hydraulic structure.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**0**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **Text Book and Reference Book:**

1. Fluid Mechanics & Hydraulics Machines By R. K. Bansal | Laxmi Publications.
2. Fluid Mechanics By Fox, McDonald, Pritchard | Wiley.
3. Engineering Fluid Mechanics By D. S. Kumar | S K KATARIA & SONS-NEW DELHI.
4. Engineering Fluid Mechanics By K. L. Kumar | S. Chand Limited.
5. Introduction to Fluid Mechanics and Fluid Machines By S. K. Som and G. Biswas | Tata McGraw Hill.

a. **Course Name:** Structural Analysis
b. **Course Code:** 03010404PE07
c. **Prerequisite:** Mechanics of Solids, Introduction to Solid Mechanics
d. **Rationale:** This subject deals with conceptual applications of principles of mechanics of rigid and deformable bodies in Engineering. Analysis of Determinate and Indeterminate Structures.
e. **Course Learning Objective:**

CLOBJ 1	Develop a comprehensive understanding of the fundamental principles and theories related to the analysis of fixed and continuous beams, employing both analytical and computational methods.
CLOBJ 2	Acquire proficiency in applying the Consistent Deformation Method, Slope Deflection Method, and Moment Distribution techniques to solve complex structural analysis problems, demonstrating an ability to analyze and assess structural behaviour.
CLOBJ 3	Develop critical thinking skills to evaluate and compare different structural analysis methods, enabling the selection of appropriate techniques based on the characteristics of the given structure and loading conditions.
CLOBJ 4	Apply energy principles to analyze and predict the behaviour of structural elements under various loading conditions, demonstrating an understanding of the relationship between internal forces and deformations.
CLOBJ 5	Gain proficiency in constructing and interpreting Influence Line Diagrams for determinate and indeterminate structures, and demonstrate the ability to use these diagrams for assessing critical loading scenarios.
CLOBJ 6	Develop effective communication skills for presenting structural analysis results through written reports, diagrams, and verbal explanations, facilitating clear and concise dissemination of engineering concepts.

f. **Course Learning Outcomes:**

CLO 1	Recall principles of structural analysis methods and their applications.
CLO 2	Interpret the significance of internal forces and deformations in structures.
CLO 3	Apply deformation methods and energy principles to solve structural problems.
CLO 4	Evaluate and select appropriate analysis methods for different structures.
CLO 5	Critically assess the accuracy and limitations of analysis results.
CLO 6	Communicate analysis outcomes effectively and synthesize knowledge for complex problem-solving.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
3	**0**	**0**	**3**	**20**	**20**	**20**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr.	Topics	W	T
1	**Fixed and Continuous Beams** Computation of fixed-end actions for various types of loads and secondary effects, beams of varying moment of inertia, analysis of propped cantilever beams. Theorem of Three-Moments.	15	7
2	**Consistent Deformation Method** Analysis of propped cantilever beams, rigid & elastic support, beams of varying moment of inertia. Flexibility Method Introduction.	15	7
3	**Energy Principles** Castigliano's theorems, computation of displacements of statically determinate beams, trusses and frames by unit load method, analysis of indeterminate structures – beams, trusses, frames & two hinge arches.	15	7
4	**Slope Deflection Method** Analysis of continuous beams for various loading including Settlement/rotation of support, analysis of simple portal frame with sway.	20	10
5	**Moment Distribution** Analysis of continuous beams & frames including sway, use of symmetry of structure up to two storied/two bay frames.	20	10
6	**Influence Line Diagrams** ILD for statically determinate beams- I.L.D of support reaction, shear force and moment bending moment for beams subjected to u.d.l and several point loads, criteria for maximum effects, ILD for statically determinate trusses, forces in members for u.d.l and point loads.	15	6

i. Text Book and Reference Book:

1. Structural Analysis By Hibbler R C | Pearson Education
2. Intermediate Structural Analysis By Wang C. K.
3. Engineering Mechanics of Solids By Popov E.P
4. Strength of Materials By R.S Khurmi | S. Chand
5. Strength of Materials By Ryder G.H.
6. Matrix Analysis of Framed Structures By Weaver and Gere
7. Strength of Material & Mechanics of Structures By Dr. B C Punamia
8. Mechanics of Structures Vol I & II By S B Junarkar and H J Shah.

a. **Course Name:** Structural Analysis Laboratory
b. **Course Code:** 03010404PE08
c. **Prerequisite:** Mechanics of Solids, Introduction to Solid Mechanics
d. **Rationale:** This subject deals with conceptual applications of principles of mechanics of rigid and deformable bodies in Engineering, Analysis of Determinate and Indeterminate Structures.
e. **Course Learning Objective:**

CLOBJ 1	Develop a comprehensive understanding of the fundamental principles and theories related to the analysis of fixed and continuous beams, employing both analytical and computational methods.
CLOBJ 2	Acquire proficiency in applying the Consistent Deformation Method, Slope Deflection Method, and Moment Distribution techniques to solve complex structural analysis problems, demonstrating an ability to analyze and assess structural behaviour.
CLOBJ 3	Develop critical thinking skills to evaluate and compare different structural analysis methods, enabling the selection of appropriate techniques based on the characteristics of the given structure and loading conditions.
CLOBJ 4	Apply energy principles to analyze and predict the behaviour of structural elements under various loading conditions, demonstrating an understanding of the relationship between internal forces and deformations.
CLOBJ 5	Gain proficiency in constructing and interpreting Influence Line Diagrams for determinate and indeterminate structures, and demonstrate the ability to use these diagrams for assessing critical loading scenarios.
CLOBJ 6	Develop effective communication skills for presenting structural analysis results through written reports, diagrams, and verbal explanations, facilitating clear and concise dissemination of engineering concepts.

f. **Course Learning Outcomes:**

CLO 1	Recall principles of structural analysis methods and their applications.
CLO 2	Interpret the significance of internal forces and deformations in structures.
CLO 3	Apply deformation methods and energy principles to solve structural problems.
CLO 4	Evaluate and select appropriate analysis methods for different structures.
CLO 5	Critically assess the accuracy and limitations of analysis results.
CLO 6	Communicate analysis outcomes effectively and synthesize knowledge for complex problem-solving.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**0**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **List of Topics**

i. Text Book and Reference Book:

1. Structural Analysis By Hibbler R C | Pearson Education
2. Intermediate Structural Analysis By Wang C. K.
3. Engineering Mechanics of Solids By Popov E.P
4. Strength of Materials By R.S Khurmi | S. Chand
5. Strength of Materials By Ryder G.H.
6. Matrix Analysis of Framed Structures By Weaver and Gere
7. Strength of Material & Mechanics of Structures By Dr. B C Punamia
8. Mechanics of Structures Vol I & II By S B Junarkar and H J Shah.

a. **Course Name:** Environmental Engineering
b. **Course Code:** 03010404PC03
c. **Prerequisite:** Knowledge of Physics, Chemistry and Mathematics up to 12th science level and of Biology up to 10th science level. Environmental Studies
d. **Rationale:** Basic knowledge of environmental engineering is essential for all engineers to ensure a sustainable supply of basic civilian needs i.e. pure air, water and food.
e. **Course Learning Objective:**

CLOBJ 1	Interpret the impact of water and wastewater characteristics on human health and the environment, demonstrating a comprehensive understanding of how water quality parameters influence public well-being and ecological sustainability.
CLOBJ 2	Determine the quantity and quality of water needed for public water supply systems, employing comprehensive assessments and analytical techniques. They will develop the skills to evaluate the demands of a community, assess water sources, and implement quality control measures, ensuring the sustainable and efficient provision of safe drinking water to the public
CLOBJ 3	Develop proficiency in designing processes such as coagulation, sedimentation, filtration, and disinfection for water treatment, as well as biological treatment, sludge management, and odor control for sewage treatment.
CLOBJ 4	Develop the skills to analyze and interpret the components of a solid waste management system, gaining a comprehensive understanding of the various strategies and methods employed in the effective handling and disposal of solid waste.
CLOBJ 5	Analyzing the multifaceted impacts of air and noise pollution on both human health and the environment. They will gain a comprehensive understanding of the intricate interplay between pollutants and their adverse effects on respiratory and cardiovascular systems, as well as the broader ecological consequences.

f. **Course Learning Outcomes:**

CLO 1	Interpret the effect of water & wastewater characteristics on human health and environment
CLO 2	Determine the quantity and quality of water required for public water supply
CLO 3	Design different units of water and sewage treatment plant
CLO 4	Classify solid waste and interpret the components of solid waste management system
CLO 5	Analyze the effects of air and noise pollution on human and environment and develop its remedial measures.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
3	**0**	**0**	**3**	**20**	**20**	**20**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr.	**Topics**	**W**	**T**
1	**CHARATERISTICS OF WATER AND WASTEWATER** Physical, chemical and biological characteristics of domestic wastewater.	15	7
2	**WATER** Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems,		

	need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design. Water Treatment: aeration, sedimentation, coagulation-flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes.	25	11
3	**SEWAGE** Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans, growth systems, recycling of sewage – quality requirements for various purposes. Layout plan and section of municipal wastewater treatment plant, Pre-and Primary Treatment: screens, grit chamber and Primary Settling tank Secondary Treatment: Biological unit processes- Aerobic attached growth and aerobic suspended growth treatment processes, Sludge Handling and Disposal.	25	11
4	**AIR POLLUTION** Sources, classification, characteristics, effects on humans, vegetation & properties, plume behaviour, Maximum Mixing Depth, Stack height, standards for air pollution. Air pollution control: Classification of pollutant, Particulate emission control- Gravitational settling chamber, bag house filter, Cyclone separator, Fabric filter, Electrostatic precipitator, Wet scrubbers.	20	10
5	**SOLID WASTE MANAGEMENT** Introduction: Sources, classification, composition and characteristics of solid wastes. Elements of solid waste management as collection, transportation, processing for recovery and final disposal. E-waste management and recycle. Basics of SWM: Typical generation rate for solid wastes, factors affecting the generation rate. Estimation of quantity of solid waste, Onsite handling, storage and processing, collection services, types of collection systems, Dewatering of solid waste Advanced SWM: Determination of vehicle and labor requirements, collection routes, and transfer stations, location of transfer stations, transfer means and methods, solid waste processing techniques, Mechanical volume reduction, Mechanical size reduction, Thermal volume reduction, manual component separation. Ultimate disposal, land filling with solid waste, Sanitary land filling and composting, reduction at source, recovery and recycle, Visit of Landfill site.	20	9

i. Text Book and Reference Book:

1. Environmental Engineering By Howard S. Peavy, Donald R. Rowe, George Tchobanoglous; McGraw-Hill
2. Solid Waste Treatment and Disposal By G. Tchabanoglous; McGraw Hill Pub.
3. Water Supply and Sanitary Engineering By G.S. Birdie and J.S. Birdie; Dhanpat Rai,Publishing Co
4. Environmental Engineering, Vols. I and II By Garg S.K.; Khanna Publishers
5. Manual on water supply and Treatment By CPHEEO; Government of India.
6. Water Supply Engineering By B. C. Punamia, Ashok Jain, Arun Jain
7. Elements of Water Supply and Waste water Disposal By Davis and Cornwell; John Wiley & Sons, New York., 1998
8. Theory and Practice of Water and Wastewater Treatment By Ronald L. Droste; John Wiley & Sons, New York, 1997.
9. Solid Waste Treatment and Disposal by G. Tchabanoglous; McGraw Hill Pub.

a. **Course Name:** Environmental Engineering Laboratory
b. **Course Code:** 03010404PC04
c. **Prerequisite:** Knowledge of Physics, Chemistry and Mathematics up to the 12th science level and of Biology up to the 10th science level. Environmental Studies
d. **Rationale:** Basic knowledge of environmental engineering is essential for all engineers to ensure a sustainable supply of basic civilian needs i.e. pure air, water and food.
e. **Course Learning Objective:**

CLOBJ 1	Interpret the impact of water and wastewater characteristics on human health and the environment, demonstrating a comprehensive understanding of how water quality parameters influence public well-being and ecological sustainability.
CLOBJ 2	Determine the quantity and quality of water needed for public water supply systems, employing comprehensive assessments and analytical techniques. They will develop the skills to evaluate the demands of a community, assess water sources, and implement quality control measures, ensuring the sustainable and efficient provision of safe drinking water to the public
CLOBJ 3	Develop proficiency in designing processes such as coagulation, sedimentation, filtration, and disinfection for water treatment, as well as biological treatment, sludge management, and odor control for sewage treatment.
CLOBJ 4	Develop the skills to analyze and interpret the components of a solid waste management system, gaining a comprehensive understanding of the various strategies and methods employed in the effective handling and disposal of solid waste.
CLOBJ 5	Analyzing the multifaceted impacts of air and noise pollution on both human health and the environment. They will gain a comprehensive understanding of the intricate interplay between pollutants and their adverse effects on respiratory and cardiovascular systems, as well as the broader ecological consequences.

f. **Course Learning Outcomes:**

CLO 1	Understand and carry out sampling for water, wastewater and air.
CLO 2	Determinable the basic characteristics for water sample.
CLO 3	Find out basic characteristics for wastewater sample.
CLO 4	Conduct noise level monitoring.
CLO 5	Monitor particulate matter in ambient air.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**0**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**-Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Environmental Engineering By Howard S. Peavy, Donald R. Rowe, George Tchobanoglous; McGraw-Hill
2. Solid Waste Treatment and Disposal By G. Tchabanoglous; McGraw Hill Pub.
3. Water Supply and Sanitary Engineering By G.S. Birdie and J.S. Birdie; Dhanpat Rai, Publishing Co..
4. Environmental Engineering, Vols. I and II By Garg S.K.; Khanna Publishers
5. Manual on water supply and Treatment By CPHEEO; Government of India.
6. Water Supply Engineering By B. C. Punamia, Ashok Jain, Arun Jain
7. Elements of Water Supply and Wastewater Disposal By Davis and Cornwell; John Wiley & Sons, New York., 1998
8. Theory and Practice of Water and Wastewater Treatment By Ronald L. Droste; John Wiley & Sons, New York, 1997.
9. Solid Waste Treatment and Disposal by G. Tchabanoglous; McGraw Hill Pub.

a. **Course Name:** Engineering Geology
b. **Course Code:** 03010404PE02
c. **Prerequisite:** Geotechnical Engineering fundamentals and practical knowledge
d. **Rationale:** Basic Civil Engineering knowledge is essential for all Engineers.
e. **Course Learning Objective:**

CLOBJ 1	Gain familiarity with types of rock identification, foundation soil types, various difficulties in geotechnical engineering terms and problems etc.
CLOBJ 2	Solve problems related to Atterberg limit, particle size analysis, soil formation, various soil and rock types, index properties and engineering properties of soil etc.
CLOBJ 3	Acquire knowledge of the soil testing instruments relationship of soil structure interaction.
CLOBJ 4	Understand different soil and rock types and properties, can be able to check soil on field as per basic index and engineering properties of soil.
CLOBJ 5	Demonstrate a clear understanding of the basic concepts, working principles and applications of sieve shaker, direct box shear, triaxial, permeability test, compaction and consolidation test, swelling property of soil.
CLOBJ 6	Study the use of standard proctor test, consolidometer, direct box shear test for identified soil engineering characteristics.

f. **Course Learning Outcomes:**

CLO 1	Understand the application and use of Engineering Geology in Civil Engineering as well as in practical life.
CLO 2	Know soil formation, types of soils, and types of soils found in various parts of India.
CLO 3	Determine the index properties and interrelationships between various soil parameters.
CLO 4	Understand the different types of soil classification systems. Classify field soils as per particle size and Atterberg's indices.
CLO 5	Know types of soil water found in nature, it's permeability characteristics and seepage determination.
CLO 6	Differentiate between compaction and consolidation, their importance and application on field problem

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**0**	**0**	**3**	**20**	**20**	**20**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr.	Topics	W	T
1	**INTRODUCTION** Definition of soil and soil mechanics, Formation of soil, types of soil, three phase system of soil and their relationships, Definition of index properties of soil, their determination and relationship among them.	10	5
2	**CLASSIFICATION OF SOIL** Classification of soil, Grain size analysis, Stoke's law and hydrometer analysis, Consistency of soils, Atterberg's limits and their determination - consistency index, shrinkage ratio, flow index and toughness index, Classification of coarse-grained and fine-grained soil as per IS, Textural Classification.	20	8
3	**SOIL STRUCTURE AND SOILWATER** The shape of particles, Texture and structure of the soil, Types of the structure, properties, conditions for the formation of different structures, types of soil water, Vertical stress distribution, Total vertical stress, pore water pressure, Effective stress.	20	8
4	**PERMEABILITY AND SEEPAGE** Definition of Permeability and seepage, Assumption - one-dimensional flow through soil, Darcy's law, Discharge velocity and seepage velocity, factors affecting the permeability, permeability determination, lab methods, permeability in stratified soil deposits, Introduction of flow net and its properties - application of flow net.	15	6
5	**COMPACTION AND CONSOLIDATION** Compaction, field and lab methods, Proctor's test – factors affecting the compaction, Field density - sand replacement and core cutter method. Effect of compaction on soil properties, ConsolidationTerzaghi's theory of one-dimensional consolidation, partial differential equation (no analytical solution), Lab method, coefficient of consolidation and its Determination - Nt and log t method.	15	6
6	**PHYSICAL GEOLOGY** Branches and scope of Geology; Surface processes and landforms: Weathering and Erosion; Introduction to geological agents (river, wind,	10	5
	oceans, glaciers, groundwater) and their actions (erosion, transport and deposition). Interior of the Earth: internal structure of earth, study of core, mental and crust of the Earth		
7	**GEOLOGICAL TIME-SCALE AND LAWS OF STRATIGRAPHY** Introduction to geological time scale and stratigraphy, laws of stratigraphy, Structural geology: Introduction to primary and secondary geological structures. Study of geological faults, folds, joints and active faulting. Their origin, types and engineering consideration.	10	5

i. Text Book and Reference Book:

1. Mechanics of Soils By Raju. K.V.B .and Ravichandran .P.T; Ayyappaa Publications
2. Basic and applied soil mechanics By Gopal Ranjan, Rao A.S.R.; New age int. (p) ltd.
3. Soil Mechanics and Foundation Engineering By Arora. K.R; Standard Publication Distributors
4. Soil Mechanics in Engineering Practice By Terzaghi. K and Peck .R.B; John Wiley
5. Soil Mechanics By Lambe. T.W, Whitman; John Wiley Ltd.
6. A text book of Soil Mechanics and Foundation Engineering By Murthy, V.N.S

a. **Course Name:** Engineering Geology Laboratory
b. **Course Code:** 03010404PE02
c. **Prerequisite:** Practical knowledge of Geotechnical Engineering
d. **Rationale:** Geotechnical Engineering is required to equip the students to understand the properties and behaviour of soil and Laboratory practicals.
e. **Course Learning Objective:**

CLOBJ 1	Gain familiarity with types of rock identification, foundation soil types, various difficulties in geotechnical engineering terms and problems etc.
CLOBJ 2	Solve problems related to Atterberg limit, particle size analysis, soil formation, various soil and rock types, index properties and engineering properties of soil etc.
CLOBJ 3	Acquire knowledge of the soil testing instruments relationship of soil structure interaction.
CLOBJ 4	Understand different soil and rock types and properties, can be able to check soil on field as per basic index and engineering properties of soil.
CLOBJ 5	Demonstrate a clear understanding of the basic concepts, working principles and applications of sieve shaker, direct box shear, triaxial, permeability test, compaction and consolidation test, swelling property of soil.

f. **Course Learning Outcomes:**

CLO 1	Learn procedures, recording and presentation of field and laboratory data.
CLO 2	Prepare geotechnical investigation reports.
CLO 3	Decide whether geotechnical investigation results, test data, analysis and design based on the test data satisfy specification requirements.
CLO 4	Identify various agencies involved in a project such as geotechnical investigation firm, geotechnical consultant, etc.
CLO 5	Assess whether geotechnical investigation results, test data, analysis and design based on the test data satisfy specification requirements.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**0**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **Text Book and Reference Book:**

1. Mechanics of Soils By Raju .K.V.B .and Ravichandran .P.T; Ayyappaa Publications
2. Basic and applied soil mechanics By Gopal Ranjan, Rao A.S.R.; New age int. (p) ltd..
3. Soil Mechanics and Foundation Engineering By Arora .K.R; Standard Publication Distributors
4. Soil Mechanics in Engineering Practice By Terzaghi .K and Peck .R.B; John Wiley
5. Soil Mechanics By Lambe .T.W, Whitman; John Wiley Ltd.
6. A text book of Soil Mechanics and Foundation Engineering By Murthy, V.N.S; UBS Publishers & Distributors Pvt.

a. **Course Name:** Railway, Bridge and Tunnel Engineering
b. **Course Code:** 03010404PE03
c. **Prerequisite:** Knowledge of Basic of Civil Engineering
d. **Rationale:** The rationale for studying transportation engineering lies in its pivotal role in fostering economic development, ensuring safety, and promoting efficient, sustainable movement of people and goods within a society.
e. **Course Learning Objective:**

CLOBJ 1	Understand the principles and components of transportation systems, including modes of transportation, traffic flow theory, and infrastructure design.
CLOBJ 2	Analyze traffic characteristics, including volume, speed, density, and their impact on transportation systems, applying traffic management strategies and control measures.
CLOBJ 3	Gain proficiency in designing and planning highway systems, considering geometric design elements, pavement design, safety measures, and environmental considerations.
CLOBJ 4	Explore the principles and challenges of public transportation systems, including transit planning, multimodal transportation, and sustainable urban mobility solutions.
CLOBJ 5	Understand the policies governing transportation infrastructure development and their environmental implications, including sustainability, emissions, and land use planning.

f. **Course Learning Outcomes:**

CLO 1	Recall and articulate fundamental principles, terminology, and concepts in transportation engineering.
CLO 2	Demonstrate a deep understanding of theories and principles underlying transportation engineering.
CLO 3	Apply transportation engineering knowledge to solve real-world problems related to highway design, construction, and maintenance.
CLO 4	Analyze the impact of design and construction decisions on the performance, safety, and sustainability of road infrastructure.
CLO 5	Evaluate the effectiveness of transportation projects, considering factors like cost-effectiveness, environmental impact, and societal benefits.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
3	**0**	**0**	**3**	**20**	**20**	**20**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr.	Topics	W	T
1	**Road Development and Planning** Brief history of road development, Necessity of highway planning, Jayakar committee, CRF, IRC, CRRI, HRB, NTPC, classification of roads, road patterns, planning surveys, saturation system/maximum utility system, highway planning in India, Nagpur, Bombay, Lucknow road development plans.	**4**	**10**
2	**Highway Location and Alignment** Basic requirements of an ideal alignment and controlling factors, engineering survey for highway location, drawing and reports, highway projects.	**4**	**10**
3	**Highway Geometric Design** Cross-sectional elements; design speed, sight distances; PIEV theory, requirements and design principles of horizontal alignment including radius of curvature, super elevation, extra-widening, design of transition curves, curve resistance, Set-back distance, grade compensation and vertical alignment, summit curve and valley curve.	12	20
4	**Highway Construction Materials** Types, properties and tests of Aggregates, Bituminous materials, and cement.	9	20
5	**Pavement Design** Introduction, pavement design variables, Methods of flexible pavement design: GI, IRC, IRC guidelines, Stresses in the rigid pavement, design of slab thickness, dowel bar and tie bar, joints in cement concrete pavements	12	33
6	**Construction of Roads**	4	10
	Construction of water-bound macadam roads, WMM, bituminous pavements, Rigid Pavement, drainage of roads: surface and subsurface drainage		
7	**Highway Marking, Lighting and Road Side Arboriculture**	1	2
8	**Highway Maintenance** Pavement distress, repair and maintenance of flexible and rigid pavement	2	5

i. Text Book and Reference Book:

1. Highway Engineering S. K. Khanna, C.E.G. Justo
2. Traffic Engineering and Transport Planning Dr. L.R. Kadiyali; Khanna Publishers, New Delhi.
3. Highway Engineering Dr. L.R. Kadiyali; Khanna Publishers, New Delhi
4. Principles, Practice and Design of Highway Engineering Dr. S.K. Sharma; S. Chand & Co., New Delhi

a. **Course Name:** Railway, Bridge and Tunnel Engineering Laboratory
b. **Course Code:** 03010404PE04
c. **Prerequisite:** Basic of Civil Engineering
d. **Rationale:** Road transportation plays an important role for the development of any country. The study of this subject imparts the knowledge to the students of properties and tests of road construction materials and design process of flexible and rigid pavements.
e. **Course Learning Objective:**

CLOBJ 1	Understand the principles and components of transportation systems, including modes of transportation, traffic flow theory, and infrastructure design.
CLOBJ 2	Analyze traffic characteristics, including volume, speed, density, and their impact on transportation systems, applying traffic management strategies and control measures.
CLOBJ 3	Gain proficiency in designing and planning highway systems, considering geometric design elements, pavement design, safety measures, and environmental considerations.
CLOBJ 4	Explore the principles and challenges of public transportation systems, including transit planning, multimodal transportation, and sustainable urban mobility solutions.
CLOBJ 5	Understand the policies governing transportation infrastructure development and their environmental implications, including sustainability, emissions, and land use planning.

f. **Course Learning Outcomes:**

CLO 1	Carryout laboratory tests on aggregates and bituminous materials.
CLO 2	Carryout preliminary design of flexible and rigid pavements
CLO 3	Traffic volume count methods.
CLO 4	Calculate design speed, maximum speed & minimum speed limits of a location through spot speed

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**0**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **Text Book and Reference Book:**

1. Highway Engineering S. K. Khanna, C.E.G. Justo
2. Traffic Engineering and Transport Planning Dr. L.R. Kadiyali; Khanna Publishers, New Delhi.
3. Highway Engineering Dr. L.R. Kadiyali; Khanna Publishers, New Delhi
4. Principles, Practice and Design of Highway Engineering Dr. S.K. Sharma; S. Chand & Co., New Delhi.

a. **Course Name:** Engineering Ethics & Organizational Behavior
b. **Course Code:** 03010004HM01
c. **Prerequisite:** Knowledge of English language in practical life
d. **Rationale:** Knowledge and application of English, Aptitude and Management Skills are crucial for better employability as well as professionalism.
e. **Course Learning Objective:**

CLOBJ 1	Gain familiarity with electrical current, potential difference, power and energy, sources of electrical energy and elements of electrical circuit.
CLOBJ 2	Solve problems related to Alternating current, alternating voltage, etc, Demonstrate a clear understanding of Pure R, L C circuit and combination of RLC, Series and Parallel combination of R, L and C, etc
CLOBJ 3	Acquire knowledge of the resistor, capacitor, and inductor and their performance characteristics for series and parallel connections.
CLOBJ 4	Understand different single phase and three phase circuits.
CLOBJ 5	Demonstrate a clear understanding of the basic concepts, working principles and applications of transformer, DC machines and AC machines.
CLOBJ 6	Study the use of LT SwitchGear, Fuse, MCB, ELCB etc

f. **Course Learning Outcomes:**

CLO 1	Identity and develop soft skills required for personal and professional growth.
CLO 2	Develop professional etiquette & desired behaviour at the workplace
CLO 3	Speak and participate effectively in oral organizational communication
CLO 4	Improve comprehensive skills for reading.
CLO 5	Know how to be assertive in professional environment

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**1**	**0**	**1**						**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr.	**Topics**	**W**	**T**
1	**Self-Development and Assessment**: Various self-assessments for personal and professional development skills that are relevant to career development: Change, Grow, Persist, Prioritize, Read, Learn, Listen, Record, Remember, Guess, Think, Communicate, Relate, and Dream	**25**	**5**
2	**Corporate Etiquette**: Tips and guide to develop personality and gain various etiquettes manners, case studies and activities. • Telephone etiquette • Etiquette for foreign business trips • Etiquette for small talks • Respecting privacy	**25**	**5**

	Learning to say'No'		
3	**Public Speaking**: It's process of communicating information to an audience and is helpful in career advancement. Effective Public speaking skills includes: • Choosing appropriate pattern • Selecting appropriate method • Art of persuasion • Making speeches effective Delivering different types of speeches	20	4
4	**Reading Skills Activity & Reading Comprehension**: Aims to improve students' Comprehensive Skills in English Language by getting them involved in reading activity and providing practice for reading comprehension.	15	2
5	**Listening Skills- Inquiry Based Listening Questions**: Aims to improve students' listening skills in English Language providing them practice of various types of inquiry based listening tracks. Students will listen and will be able to find out details from the conversations.	15	2

i. Text Book and Reference Book:

1. Business Correspondence and Report Writing SHARMA, R. AND MOHAN, K.
2. Communication Skills Kumar S and Lata P; New Delhi Oxford University Press
3. Practical English Usage MICHAEL SWAN
4. A Remedial English Grammar for Foreign Student F.T. WOOD
5. On Writing Well William Zinsser; Harper Paperbacks,2006; 30th anniversary edition
6. Oxford Practice Grammar, John Eastwood; Oxford University Press
7. Business Correspondence and Report Writing SHARMA, R. AND MOHAN, K.
8. Communication Skills Kumar S and Lata P; New Delhi Oxford University Press
9. Practical English Usage MICHAEL SWAN
10. A Remedial English Grammar for Foreign Student F.T. WOOD
11. On Writing Well William Zinsser; Harper Paperbacks,2006; 30th anniversary edition
12. Oxford Practice Grammar, John Eastwood; Oxford University Press