

COURSE OBJECTIVES:

The objectives of the course are to impart knowledge on

- ✓ Develop a fundamental understanding of indeterminate structures through equilibrium, compatibility, and indeterminacy concepts.
- ✓ Master classical analysis techniques such as the slope deflection, moment distribution, flexibility matrix, and stiffness matrix methods.
- ✓ Utilize approximate analysis methods for horizontal loads and real-world scenarios to evaluate and optimize structural performance.

UNIT - 1 FUNDAMENTAL CONCEPT TO INDETERMINATE 7
STRUCTURES AND ANALYSIS OF TRUSS

Applications: Designing long-span bridges, roof trusses, and industrial frameworks.

Degree of freedom - Degree of Static and Kinematic indeterminacy of structural systems - Types of frames - Trusses analysis - Method of joints - Method of sections - Method of tension coefficients - Introduction to analysis of space trusses using method of tension coefficients

UNIT - 2 SLOPE DEFLECTION METHOD 7

Applications: Analysis of continuous beams bridges, Floor systems in buildings, Building frames, Industrial structures - Foundation design - Infrastructure maintenance.

Slope deflection equations - Equilibrium conditions - Analysis of continuous beams and rigid frames - Support settlements - Symmetric frames with symmetric loadings.

UNIT - 3 MOMENT DISTRIBUTION METHOD 7

Applications: Design of beams and columns, Designing continuous beam bridges, Analyzing floor systems in buildings, Designing multi-story building frames, Analyzing the effects of uneven foundation settlement, Symmetrical roof structures.

Stiffness - Distribution and carryover factors - Analysis of continuous beams - Plane rigid frames with and without sway - Support settlement - Symmetric frames with symmetric loadings.

UNIT - 4 FLEXIBILITY MATRIX METHOD 8

Applications: Analysis of High-Rise Buildings and Skyscrapers - Design of Long-Span Bridges - Offshore and Marine Structures - Seismic Retrofitting of Heritage Structures.

Primary structures - Compatibility conditions - Formation flexibility matrices - Analysis of indeterminate pin-jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach.

UNIT - 5 STIFFNESS MATRIX METHOD 8

Applications: Analysis of Complex Bridge Structures, Computer-Aided Analysis, Finite Element Analysis (FEA), Bridges, Aerospace structures.

Restrained structure - Formation of stiffness matrices - Equilibrium condition - Analysis of continuous beams, Rigid jointed plane frames and Pin joint frame by direct stiffness method.

UNIT - 6 APPROXIMATE ANALYSIS AND INTRODUCTION TO FEM 8

Applications: Seismic design of building frames, where engineers use portal and cantilever methods to quickly estimate lateral loads and corresponding force diagrams for safe structural performance.

Approximate analysis for horizontal loads - Portal method and cantilever method - Axial force, shear force and bending moment diagrams – Introduction to FEM - Discretisation of a structure - Displacement functions - Truss element - Beam element.

TOTAL: 45 PERIODS

OUTCOMES:

After completion of the course, the students will be able to

1. Understand the concept of Indeterminate structure and to calculate the forces using different methods.
2. Analyze continuous beams and rigid frames using slope deflection equations.
3. Analyze continuous beams and plane rigid frames using the moment distribution method.
4. Analyze indeterminate continuous beams, rigid plane frames and pin joint frames using the direct flexibility approach.
5. Analyze indeterminate continuous beams, rigid plane frames and pin joint frames using the direct stiffness method.
6. Analyze horizontal load effects using portal and cantilever methods and understand the concept of introduction to FEM.

TEXT BOOKS:

1. Bhavikatti, S.S, Structural Analysis, Vol.1, & 2, Vikas Publishing House Pvt. Ltd. New Delhi, 2014.
2. Punmia.B.C, Ashok Kumar Jain & Arun Kumar Jain, “Theory of structures”, Laxmi Publications, New Delhi, 2004.
3. Vazrani.V.Nand Ratwani,M.M,—“AnalysisofStructures”,Vol.II,KhannaPublishers,2015

REFERENCES:

1. William Weaver, Jrand James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, Second Edition, Delhi, 2004.
2. Reddy.C.S, “Basic Structural Analysis”, Tata McGraw Hill Publishing Company, 2005.
3. Negi L.S. and Jangid R.S., “Structural Analysis”, Tata McGraw Hill Publishing. Co. Ltd. 2004.
4. Bhavikatti, S.S, Matrix Method of Structural Analysis, I. K. International Publishing House Pvt. Ltd., New Delhi-4, 2014.

CO, PO & PSO MAPPING

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	2	1	-	-	-	-	-	-	-	2	2	2
2	3	3	2	1	-	-	-	-	-	-	-	2	2	2
3	3	3	2	1	-	-	-	-	-	-	-	2	2	2
4	3	3	2	1	-	-	-	-	-	-	-	2	2	2
5	3	3	2	1	-	-	-	-	-	-	-	2	2	2
6	3	3	2	1	-	-	-	-	-	-	-	2	2	2
Avg	3	3	2	1	-	-	-	-	-	-	-	2	2	2
LOW (1) ; MEDIUM (2) ; HIGH (3)														

XXXXX

HIGHWAY AND RAILWAY ENGINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES:

The main objectives of the course are to:

- ✓ Impart knowledge of highway and railway planning, design, construction, and maintenance.
- ✓ Equip students with the ability to understand and implement engineering practices in highway and railway projects.
- ✓ Highlight the role of technology in improving transportation infrastructure for better performance, safety, and sustainability.
- ✓ Develop skills in evaluating materials, methods, and procedures used in the construction and maintenance of highways and railways.

UNIT - 1 HIGHWAY ENGINEERING 8

Applications: *Highways function optimally for both urban and rural needs, reducing congestion, improving connectivity, and fostering economic growth.*

Classification of highways - Institutions for highway planning, Design and construction at different levels - Factors influencing highway alignment - Typical cross sections of urban and Rural roads - Engineering surveys for alignment - Conventional and modern method.

UNIT - 2 DESIGN OF HIGHWAY ELEMENTS 7

Applications: *Engineers must carefully balance safety, traffic requirements, environmental concerns, and budget constraints.*

Cross sectional elements - Horizontal curves, Super elevation, Transition curves, Widening of curves - Sight distances - Vertical curves, gradients - Pavement components and their role - Design practice for flexible and rigid pavements (IRC methods only).

UNIT - 3 HIGHWAY CONSTRUCTION AND MAINTENANCE 7

Applications: *The continuous development of innovative materials and techniques helps improve the performance of highway infrastructure across the globe.*

Highway construction materials, Properties, Testing methods - Construction practice of flexible and rigid pavement - Highway drainage - Evaluation and Maintenance of pavements.

UNIT - 4 RAILWAY PLANNING AND CONSTRUCTION 8

Applications: *Through modern materials, advanced engineering techniques, and innovative technologies, railway systems can be optimized for efficiency, safety, and longevity.*

Elements of permanent way - Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges - Track Stress, coning of wheels, creep in rails, defects in rails - Route alignment surveys, conventional and modern methods - Geometric design of railway, gradient, super elevation, widening of gauge on curves (Problems) - Railway drainage- Level Crossings - Signalling.

UNIT - 5 RAILWAY TRACK CONSTRUCTION MAINTENANCE AND OPERATION 8

Applications: *These concepts in railway engineering are vast and integral to the efficiency, safety, and sustainability of modern rail systems.*

Points and crossings - Design of turnouts, Working principle -Track circuiting - Construction & Maintenance - Conventional, Modern methods and materials, Layouts of railway stations and

yards, Rolling stock, Tractive power, Track resistance - Role of Indian Railways in National Development – Railways for urban transportation – LRT & MRTS Feasibility study, Planning and construction.

**UNIT - 6 BUSINESS STRATEGY AND RECENT TRENDS IN
HIGHWAY AND RAILWAY ENGINEERING**

6

Strategic planning and investment in infrastructure development are essential to meet the growing demand for efficient transportation - Smart highways, metro rail, monorail, automated trains, sustainability practices in construction, and the adoption of green technologies for energy - Efficient transport – Public - Private Partnerships (PPP) - Smart and autonomous transportation (both on highways and railways)

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the student is expected to

1. Plan a highway according to the principles and standards adopted in various institutions in India.
2. Design the geometric features of road network and components of pavement.
3. Test the highway materials and construction practice methods and know its properties and able to perform pavement evaluation and management.
4. Understand the methods of route alignment and design elements in railway planning and constructions.
5. Understand the construction techniques and maintenance of track laying and railway stations.
6. Understand business strategies and recent trends in highway and railway engineering, emphasizing smart transportation, green technologies, PPP models, and autonomous system integration.

TEXT BOOKS:

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nemchand Publishers, 2014.
2. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai,2010.
3. Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications, 6th edition Delhi, 2015.
4. C. Venkatramaiah., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels. Universities Press (India) Private Limited, Hyderabad, 2015.

REFERENCES:

1. Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements, (Third Revision), IRC:37-2012
2. Indian Road Congress (IRC), Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, (Third Revision), IRC: 58-2012.
3. Yang H. Huang, "Pavement Analysis and Design", Pearson Education Inc, Ninth

Impression, South Asia, 2012.

4. Ian D. Walsh, "ICE manual of highway design and management", ICE Publishers, 1st Edition, USA, 2011.

CO, PO & PSO MAPPING

CO	PO											POS		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	-	-	-	-	-	-	-	-	-	2	2	2
2	3	2	1	-	-	-	-	-	-	-	-	2	2	2
3	3	2	-	-	-	-	-	-	-	-	-	2	2	2
4	3	2	-	-	-	-	-	-	-	-	-	2	2	2
5	3	2	1	-	-	-	-	-	-	-	-	2	2	2
6	3	2	-	-	-	-	-	-	-	-	-	2	2	2
Avg	3	2	2	-	-	-	-	-	-	-	-	2	2	2
LOW (1) ; MEDIUM (2) ; HIGH (3)														

COURSE OBJECTIVES:

- ✓ To develop proficiency in public speaking, including its history, significance, and benefits.
- ✓ To explore the **history and evolution of public speaking**.
- ✓ To engage with the audience, especially in high-pressure situations like press meets.
- ✓ To apply structured debate formats to evaluate arguments critically and develop reasoning skills.
- ✓ To synthesize and articulate ideas effectively by engaging in complex and abstract discussions
- ✓ To demonstrate public speaking skills in real-world contexts by presenting on topics related to education, history, entertainment, and current affairs.

UNIT - 1	BASICS OF PUBLIC SPEAKING	2
-----------------	----------------------------------	----------

History of public speaking – benefits

Practice :Effective practices for public speaking- Public speaking topics

UNIT – 2 LISTENING TO FAMOUS SPEECHES 2

TED talks – presentations, Josh talks

Practice: Key elements of TED talk presentations - prioritize **simplicity in visuals and strong stage presence**

UNIT - 3 RESPONDING AND TACKLING THE QUESTIONS 2

Facing the audience (Press meet)

Practices: Engaging with the audience in a press meet – Handling Challenging questions

UNIT - 4	GROUP DEBATE	2
-----------------	---------------------	----------

Dos and Don'ts of group debate – Practising various types of debate format

Practice : Structuring a debate session - Focusing on **moral reasoning**

UNIT - 5 **GROUP DISCUSSION LEVEL 2** **2**

Engaging in discussions on complex and contemporary topics

Practice: Argument structure & logical flow

UNIT - 6 PUBLIC SPEAKING PRACTICES 2

Topics in Education, History, Entertainment, Current affairs

Practice: Content, delivery, engagement, and overall effectiveness

TOTAL: 12 PERIODS

OUTCOMES:

At the end of the course the students would be able to

1. Initiate and manage professional conversations with correct greetings and courtesies.
2. Demonstrate proficiency in asking clear and appropriate questions in professional and technical conversations.
3. Adjust their tone and intonation based on the context of the conversation.
4. Demonstrate confidence in handling one-on-one interviews and personal conversations through effective communication strategies.
5. Students will be able to formulate and ask open-ended brainstorming questions.
6. Understand the importance and purpose of group discussions in professional and academic settings.

REFERENCES:

1. "Advanced Communication Skills" by Mathew Richardson, Charlie Creative Lab, 2020.
2. "English for Academic Purposes: A Handbook for Students" by A. S. K. K. S. Pandit.
3. Andy Gillett, Using English for Academic purposes for students in higher Education.
<https://www.uefap.org/reading>.
4. "Effective Communication Skills" by M. K. Dhawan.

CO – PO MAPPING

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	-	-	-	-	-	-	-	-	3	3	3	-	-	-
2	-	-	-	-	-	-	-	-	3	3	3	-	-	-
3	-	-	-	-	-	-	-	-	3	3	3	-	-	-
4	-	-	-	-	-	-	-	-	3	3	3	-	-	-
5	-	-	-	-	-	-	-	-	3	3	3	-	-	-
LOW (1) ; MEDIUM (2) ; HIGH (3)														

HOLISTIC PERSONALITY DEVELOPMENT AND BEHAVIORAL SKILLS

SELF AWARENESS

Understanding Self (Self-Identity, Self-Concept, Self-Confidence, Self-Image)
Techniques of Self Awareness (Johari Window, Self-Characteristics, Stages of Self Awareness)

FEAR MANAGEMENT

Understanding Fear (e.g., fear of failure, public speaking, exams, job interviews) - The science behind fear (Fight or Flight response) - Changing negative thoughts into positive ones - Facing fears step by step.

SELF ESTEEM

Self Esteem & Effectiveness (Importance, High & Low Self-Esteem, Measurement, Steps to Improve) Adopting a growth mindset for continuous improvement. Building Positive Attitude (Types & Importance of Attitude)

EMOTIONAL INTELLIGENCE

Emotional Intelligence (Difference Between IQ, EQ, and SQ) Managing Emotions & Building Emotional Competence - Power of Now.

RELATIONSHIP MANAGEMENT

Understanding Relationships (Roles, Healthy Relationships) - Bridging Individual Differences (TA & Communication Styles) - Impression Management

INTERPERSONAL RELATIONSHIP

Interpersonal Relationship Development (Skills & Types) - Theories of Interpersonal Relationships (Social Exchange, Uncertainty Reduction) - Building Interpersonal Competence.

GROUP DYNAMICS AND TEAM BUILDING

Group Formation (Types, Benefits, Stages) - Group Functions (Internal & External Conditions, Cohesiveness, Conflict) - Teams (Building Effective Teams, Collaboration)

COURSE OBJECTIVES:

- ✓ To gain a comprehensive understanding of the properties, composition, and behavior of concrete and its constituents.
- ✓ To develop proficiency in concrete mix design using various standard methods and quality control techniques.
- ✓ To explore recent advancements in concrete technology, including AI applications and sustainable practices in the cement and aggregate industry.

UNIT - 1**CONCRETE CONSTITUENTS**

8

Applications: Cement constituents provide strength and durability in buildings, bridges, and dams, while admixtures improve workability, setting time, and sustainability in concrete construction.

Cement - Different types of cement - Chemical composition and properties - Manufacturing of cement - Hydration of cement - Tests on cement - IS specifications - Admixtures - Types of admixtures - Mineral and chemical admixtures - Aggregates - Classification - Chemical and mineralogical composition- Physical and Mechanical properties and Tests as per BIS Grading requirements.

UNIT - 2**CONCRETE MIX DESIGN**

7

Applications: mix proportioning ensures optimal concrete strength, durability, and cost-effectiveness for concrete construction projects.

Principles of mix proportioning - Methods of concrete mix design, IS method, ACI method - Statistical quality control - Mix design examples.

UNIT – 3**PROPERTIES OF FRESH CONCRETE**

8

Applications: Essential for ensuring proper placement and compaction of concrete in high-rise buildings, Quick on-site check of concrete consistency before pouring foundations, Ensures adequate compaction in mass concreting projects like dams.

Workability - Factors affecting workability and their control -Tests for workability of concrete- Slump Test , Compacting factor Test, Flow Test, Vee-Bee Consistometer Test and Kelly Ball Test - Segregation and Bleeding - self-compacting concrete – Test on SSC - slump-flow test, L-box test, V- funnel test, and J- ring test.

UNIT – 4**PROPERTIES OF HARDENED CONCRETE**

7

Applications: Used in construction quality control to ensure structural integrity of buildings and bridges.

Hardened concrete properties - Destructive testing - Compressive Strength Test, Split Tensile Test and Flexural Strength Test - Nondestructive tests on concrete - Ultrasonic Pulse Velocity (UPV) Testing, Rebound Hammer Test, Cover Meter Testing, Half-Cell Potential Test, Penetration Resistance Test and Impact Echo Testing - Durability of Concrete.

UNIT – 5

CONCRETING PRACTICES

7

Application: *Concreting practices include mixing, placing, compaction, and curing to ensure strength and durability. They are used in buildings, roads, and bridges for better workability and longevity.*

Process of manufacturing of concrete - Batching - Mixing - Transportation - Placing - Compaction and Curing of Concrete - Special concreting methods - Vacuum dewatering - Underwater Concrete.

UNIT – 6

BUSINESS STRATEGY AND RECENT TRENDS IN CONCRETE TECHNOLOGY

8

Introduction to artificial intelligence in concrete construction - Applications and benefits – AI Driven innovations in concrete manufacturing - Impact of AI on concrete production cost and sustainability - Marketing strategies for construction materials - Aggregate and cement Industry in India - Market demand and growth.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

1. Describe different types of cement, their composition, properties, and IS specifications.
2. Identify the suitability of different types of aggregates and admixtures for enhancing the properties of concrete.
3. Design concrete mixes using IS and ACI methods with quality control techniques.
4. Test fresh and hardened concrete using standard and non-destructive methods.
5. Apply best concreting practices, including batching, mixing, placing, and curing.
6. Use AI applications in concrete technology and their impact on sustainability and cost.

TEXT BOOKS:

1. Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2. Shetty, M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003.
3. Joseph T. Bockrath, "Contracts and the Legal Environment for Engineers and Architects", McGraw Hill, 2000.
4. Concrete: Micro structure, Properties and Materials – P. K. Mehta and J. M. Monteiro, McGraw Hill Publishers.

REFERENCES:

1. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London, 1995.
2. Gambhir. M.L. Concrete Technology, Fifth Edition, McGraw Hill Education, 2017.
3. Job Thomas., Concrete Technology, Cengage learning India Private Ltd, New Delhi, 2015.
4. IS10262-2019 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.

CO – PO MAPPING

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	-	-	-	-	-	-	-	-	-	-	3	2	1
2	3	-	-	-	-	-	-	-	-	-	-	3	2	1
3	3	2	-	-	-	-	-	-	-	-	-	3	3	1
4	3	-	-	-	-	-	-	-	-	-	-	3	3	1
5	3	-	-	-	-	-	-	-	-	-	-	3	3	1
6	3	-	-	-	-	-	-	-	-	-	-	2	-	-
LOW (1) ; MEDIUM (2) ; HIGH (3)														

LABORATORY

LIST OF EXPERIMENTS:

1. Determination of the Setting Time of Cement.
2. Determination of the Grading of Fine and Coarse Aggregates.
3. Determination of the Compacted and Loose Bulk Density of Coarse Aggregate.
4. Determination of the Slump Cone Test.
5. Determination of the Compaction Factor Test.
6. Determination of the Flow Table Test.
7. Determination of the Vee-Bee Consistometer Test.
8. Determination of the Compressive Strength of Concrete.
9. Determination of the Flexural Strength of Concrete.
10. Determination of the Split Tensile Strength of Concrete.
11. Determination of the Rebound Hammer Test.
12. Determination of the Ultrasonic Pulse Velocity Test.

TOTAL: 30 PERIODS

TOTAL: 75 PERIODS

XXXXX

HYDRAULIC ENGINEERING

L T P C
3 0 2 4

COURSE OBJECTIVES:

- ✓ To understand hydraulic flow principles and their applications.
- ✓ To study hydraulic machines and structures for efficient design and operation.
- ✓ To explore industry trends and sustainability in hydraulic engineering.

UNIT - 1 OPEN CHANNEL FLOW 7

Applications: Rivers, canals, and drainage systems support efficient water management, while Chezy and Manning equations help design hydraulic structures for optimal flow.

Definition and differences between pipe flow and open channel flow - Types of flow - Properties of open channel - Fundamental equations - Subcritical, Super-critical and Critical flow - Velocity distribution in open channel - Velocity distribution in open channel - Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow - Specific energy and specific force.

UNIT - 2 GRADUALLY VARIED FLOW 8

Applications: Flood forecasting, river flow modeling, water surface profiles in engineering projects.

Dynamic equations of gradually varied flows - Water surface flow profile classifications: Hydraulic slope, Hydraulic curve - Classifications: Computation by direct step method and Standard step method - Change in grades.

UNIT - 3 RAPIDLY VARIED FLOW 8

Applications: Energy dissipation, flood control, and water flow management in rivers, dams, drainage systems, hydropower, navigation, and coastal protection.

Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation - Celerity – Positive surges and Negative surges.

UNIT - 4 TURBINES 7

Applications: Hydropower plants, irrigation systems, and industries for energy conversion.

Turbines - Classification of turbines - Pelton wheel - Francis turbine - Kaplan turbine - Specific speed - Characteristic curves of turbines - Draft tube and cavitation.

UNIT - 5 PUMPS 8

Applications: Water supply, irrigation, and industries depend on pumps for fluid transport, with NPSH, cavitation, and pump types affecting performance.

Centrifugal pumps - NPSH - Cavitation in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Indicator diagrams and its variations.

UNIT - 6 BUSINESS STRATEGY AND CURRENT TRENDS IN HYDRAULIC ENGINEERING 7

Strategic importance of hydraulic engineering: Cost-effective design and maintenance strategies - Emerging technologies: AI, smart turbines, pumps, and energy - efficient systems - Sustainability & compliance: green designs, energy savings, and regulatory standards - Investment & economy: public - private partnerships, cost-effective solutions, and innovations -

Future trends: renewable energy advancements.

THEORY TOTAL: 45 PERIODS

PRACTICAL

LIST OF EXPERIMENTS

1. Determination of discharge of Rotameter.
2. Verification of conservation of energy principle for given flow system using Bernoulli's theorem.
3. Determination of minor losses for a given pipe.
4. Assessments of discharge of a given pipe flow using Venturi Meter.
5. Determination of discharge in an open channel using notches
6. Determination of metacentric height of floating bodies.
7. Characteristics of Centrifugal Pump.
8. Characteristics of Reciprocating pumps.
9. Evaluation of discharge of a given pipe flows using Orifice Meter.
10. Performance test on Gear Pump.

PRACTICAL TOTAL: 30 PERIODS

TOTAL: 75 PERIODS

OUTCOMES:

At the end of the course, the students will be able to

1. Explain the fundamentals of open channel flow, its classification, and the computation of uniform flow under steady-state conditions using the specific energy concept and its practical applications.
2. Illustrate water surface profiles, and calculate flow length using direct and standard step methods while measuring the impact of grade variations.
3. Use the derivation of the relationship between sequent depths in rapidly varied flow and estimate energy loss in a hydraulic jump, including the effects of positive and negative surges.
4. Apply the working principles, classifications, and performance characteristics of turbines, including Pelton, Francis, and Kaplan turbines.
5. Compute the performance of centrifugal and reciprocating pumps, considering cavitation effects, multistage configurations, and efficiency factors.
6. Explain business strategies, sustainability trends, and innovations in hydraulic engineering to understand their impact on industry growth and environmental efficiency.

TEXT BOOKS:

1. Subramanya.K, "Flow in open channels", Tata McGraw Hill, New Delhi, 2013.
2. Modi P.N and Seth.S.M "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2017.
3. Chandramouli P.N., "Applied Hydraulic Engineering", Yes Dee Publishing Pvt. Ltd., 2017.

REFERENCES:

1. Bansal R.K., "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi, 2017.
2. Subramanya K, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co. Ltd, 2010
3. Rajput R.K., Fluid Mechanics and Hydraulic Machines, S. Chand, 2014.

CO – PO MAPPING

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	2	1	-	-	-	-	-	-	-	3	2	2
2	3	3	2	1	-	-	-	-	-	-	-	3	2	2
3	3	3	2	1	-	-	-	-	-	-	-	3	2	2
4	3	3	2	1	-	-	-	-	-	-	-	2	2	2
5	3	3	2	1	-	-	-	-	-	-	-	2	2	2
6	3	2	1	-	-	-	-	-	-	-	-	3	2	2
LOW (1) ; MEDIUM (2) ; HIGH (3)														

XXXX
(Lab Code)

**COMPUTER AIDED BUILDING MODELLING
LABORATORY**

L T P C
0 0 2 1

COURSE OBJECTIVES:

- ✓ Students will learn to create and modify walls, doors, windows, floors, ceilings, roofs, stairs, and ramps.
- ✓ Students will apply text, dimensions, annotations, rendering, camera views, and walkthroughs for better presentation.
- ✓ Students will work with top surfaces, sub-regions, building pads, site components, and mass creation using sweeps and extrusions.

LIST OF EXERCISES:

30

Introduction to Revit Interface & Basic Commands

1.
 - Understanding Revit's workspace, toolbars, and navigation tools.
 - Basic modeling concepts and project setup.

Creation of Grid, Levels & Setting Up the Project

2.
 - Defining grids and levels for structural and architectural components.
 - Setting up units, templates, and project standards.

Creating Building Elements (Beam and Columns)

3.
 - Beams and Columns Type
 - Level and Offset
 - Modelling of Beams
 - Modelling of Columns

Modeling Ceiling & Roofs

4.
 - Model the different types of ceiling and roofs

Modeling Staircases and Ramps

5.
 - Creating different types of stairs (straight, spiral)

Annotation & Visualization Tools

6.
 - Paint, Colour Scheme, Creating new Materials, Sweep, Extrude Modeling, Executing Sweep and Extrusion.
 - Camera view, Hide elements, Render view, Walkthrough.
 - Massing and Site, top-surface, sub region, building pad, site component, parking site.

TOTAL: 30 PERIODS

OUTCOMES:

At the end of the course the students will be able to

1. Model and Edit Building Components such as walls, doors, windows, floors, ceilings, roofs, stairs, and ramps.
2. Apply Annotation and Visualization Tools including text, dimensions, render views, camera views, and walkthroughs for detailed presentations.
3. Design Site Features and Materials by creating top surfaces, sub-regions, building pads, site components, and custom materials using sweeps and extrusions.

CO – PO MAPPING

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	-	-	-	2	-	-	-	-	-	-	2	1	1
2	2	-	-	-	2	-	-	-	-	-	-	2	1	1
3	2	-	-	-	2	-	-	-	-	-	-	2	1	1
LOW (1) ; MEDIUM (2) ; HIGH (3)														

XXXXX
(Lab Code)

HIGHWAY ENGINEERING LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES:

- ✓ To learn the principles and procedures of testing of materials used in the construction of highways.

LIST OF EXPERIMENTS:

30

1. Determination of abrasion value of the coarse aggregate sample.
2. Determination of water absorption capacity of the coarse aggregate sample.
3. Determine the Penetration test of bitumen.
4. Specific gravity determination of the bitumen/asphalt sample.
5. Determination of consistency of the bituminous material.
6. Viscosity determination of bituminous binder.
7. Determination of softening point of the asphalt/bitumen sample.
8. Determination of ductility value of the bitumen sample.
9. Estimation of loss of bitumen on heating.
10. Determination of optimum binder content by Marshall method.

TOTAL: 30 PERIODS

OUTCOMES:

At the end of the course the students will be able to

1. Characterize Pavement Aggregate through relevant test.
2. Ascertain the Quality of Bitumen.
3. Evaluate the Consistency and Properties of Bitumen.

CO – PO MAPPING

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	1	-	-	-	-	-	-	-	-	-	2	2	1
2	3	1	-	-	-	-	-	-	-	-	-	2	2	1
3	3	1	-	-	-	-	-	-	-	-	-	2	2	1
LOW (1) ; MEDIUM (2) ; HIGH (3)														