

# SEMESTER III

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21017: BUILDING PLANNING AND ARCHITECTURE**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

**Pre-requisite:** Engineering Drawing

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

To provide an overview of the building planning and its interior and exterior design aspects by considering the standard regulations and bye-laws. This subject helps the student to build up their knowledge in the field of infrastructure development.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Identify building components and apply regulations in site planning.
2. Utilize environmental design principles in architectural planning.
3. Implement functional planning and integrate basic building services.
4. Describe architectural history and the architect's professional role.
5. Create architectural compositions and produce technical drawings.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	2	-	-	-	-	-	3	-	-	-	3
<b>CO2</b>	2	3	-	2	-	-	-	3	-	-	-	3
<b>CO3</b>	3	2	-	2	-	-	-	3	-	-	-	3
<b>CO4</b>	2	1	-	2	-	-	-	3	-	-	-	3
<b>CO5</b>	2	2	-	3	-	-	-	3	-	-	-	3
<b>Target</b>	2.4	2	-	1.8	-	-	-	3	-	-	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:**

**Theory:**

**Unit - 1**

Introduction to various building component, their definition and function.

Regulation and bye-laws, setbacks and open spaces, ground coverage and F.A.R., Site planning and infrastructure provisions.

**Unit - 2**

Principles of Planning: Orientation, Climate consideration, Design for solar radiation, Ventilation, Lighting, Noise reduction.

Functional planning: Space Standards for various functions and optimization of space.

**Unit - 3**

Introduction to various services like artificial lighting, ventilation and sanitation. Design principles of stair case.

**Unit - 4**

Meaning of Architecture and role of Architect in planning.

Brief Introduction to World Architecture: Roman, Greek, Buddhist, Islamic and Hindu.

**Unit - 5**

Architectural Composition: Elements of composition, Unity, Symmetry and Balance, Proportion and Scale, System characteristics, Texture Pattern and Colour.

Expression working drawings, plans, elevations, sections, site plan and detailing, elements of perspective view, parallel and oblique perspective.

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Theory examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Shah M.H. & Kale, Building Drawing, Tata McGraw Hill, New Delhi.
2. Swami N.K. & Rao A.K., Building Planning and Drawing, Charotar Publishing House Pvt. Ltd., 7th Edition, 2014
3. Publication Town and Country Planning Department Madhya Pradesh
4. Deodhar S.V., Building science & Planning, Khanna publishers, 4th Edition, 2011

**Reference Books**

1. Miles Danby, Grammar of Architectural Design. Oxford University Press.
2. National Building Code (NBC 2016), Bureau of Indian Standards.
3. M.P. BhumiVikas Rules 2012, Madhya Pradesh

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21401: BUILDING PLANNING AND ARCHITECTURE LABORATORY**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
-	2	-	-	1	CW	END SEM	SW	END SEM	50
					-	-	40	60	

**Pre-requisite:** Engineering Drawing

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

To develop students' proficiency in architectural drawing techniques, from basic conventions to complex building designs, while cultivating skills in both manual drafting and AutoCAD software for creating precise and professional architectural representations across various building types.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Interpret and apply architectural drawing conventions, including sign conventions, symbols, and standard representations of building elements.
2. Create accurate architectural drawings for various residential structures, including doors, windows, staircases, and different house types.
3. Utilize AutoCAD software to produce professional-quality plans, elevations, and sections for institutional and commercial buildings, as well as perspective views.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	2	3	-	-	-	-	2	2	-	-	3
<b>CO2</b>	3	3	3	-	-	-	-	2	3	-	-	3
<b>CO3</b>	3	3	3	-	-	-	-	2	3	-	-	3
<b>Target</b>	3	3	3	-	-	-	-	2	2.67	-	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:**

**Practical:**

1. Sheet 1 on sign conventions and symbols.
2. Sheet 2 on plan, elevation and section of doors and windows.
3. Sheet 3 on plan, elevation and section of stair case.
4. Sheet 4 on plan, elevation and section of detached house.
5. Sheet 5 on plan, elevation and section of semi-detached house.
6. Sheet 6 on plan, elevation and section of row house.
7. Sheet 7 on plan, elevation and section of institution building using AutoCAD
8. Sheet 8 on plan, elevation and section of commercial building AutoCAD
9. Sheet 9 on plan, elevation and section of commercial building AutoCAD
10. Sheet 10 on perspective views.

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Practical examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Shah M.H. & Kale, Building Drawing, Tata McGraw Hill, New Delhi.
2. Swami N.K. & Rao A.K., Building Planning and Drawing, Charotar Publishing House Pvt. Ltd., 7th Edition, 2014
3. Publication Town and Country Planning Department Madhya Pradesh
4. Deodhar S.V., Building science & Planning, Khanna publishers, 4th Edition, 2011

**Reference Books**

1. Miles Danby, Grammar of Architectural Design. Oxford University Press.
2. National Building Code (NBC 2016), Bureau of Indian Standards.
3. M.P. BhumiVikas Rules 2012, Madhya Pradesh

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21012 GEODESY**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

**Pre-requisite:** Fundamental of civil engineering and applied mechanics.

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

To develop students' proficiency in advanced surveying techniques, including theodolite operation, tachometry, trigonometric levelling, curve setting, and aerial surveying, enabling them to accurately measure angles, distances, elevations, and analyze topographical features for various civil engineering applications.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Determine the horizontal and vertical angle with theodolite
2. Calculate horizontal distance using different method of tachometry.
3. Apply the concept of trigonometry levelling for the determination of RL of an object when base of object is accessible and inaccessible.
4. Analyze the different elements of curves in setting out the curve.
5. Discuss the fundamental concept of Aerial Surveying.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	2	2	-	-	-	-	-	-	-	3
<b>CO2</b>	3	3	2	3	-	-	-	-	-	-	-	3
<b>CO3</b>	3	3	3	3	-	-	-	-	-	-	-	3
<b>CO4</b>	3	3	3	3	-	-	-	-	-	-	-	3
<b>CO5</b>	3	2	2	2	-	-	-	-	-	-	-	3
<b>Target</b>	3	2.8	2.4	2.6	-	-	-	-	-	-	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:**

**Theory:**

**Unit - 1**

Description of Theodolite, Measurement of angles, Modern theodolite, EDM & Total Station, GPS and its applications in geodesy.

**Unit - 2**

Introduction to Tacheometry, Different system of tacheometric measurement, radial contouring, trigonometric levelling: Determination of height and distance in case where base of object are accessible and inaccessible and inaccessible.

**Unit - 3**

Traversing, adjustments of errors in linear and angular measurements, estimation of latitude and departure, Gale's traverse table, triangulation & trilateration.

**Unit - 4**

CURVES: Simple circular curve its geometry, setting out of curve. Introduction to compound, reverse and transition curve. Introduction to vertical curves. Layout of buildings, bridges, road & railway alignment.

**Unit - 5**

Photogrammetry: Principle, definitions and classification of terrestrial and aerial photogrammetry flight planning for aerial photography, scale and relief displacements of vertical aerial photographs, stereoscopic vision on vertical photographs, computation of position, length and elevations of objects using photographs and photo mosaic. Introduction to field astronomy.

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Theory examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Punamia B.C., "Surveying Vol. I and vol II", 15th Edition, Laxmi publication Limited, 2015.
2. Arora K.R., "Surveying Vol. I and vol II," 14th Edition, Standard Book house Publication, 2016.
3. Duggal S.K. "Surveying Vol. I and vol II," 14th Edition, Tata McGraw- hill Edition, 2013.

**Reference Books**

1. Francis H. Moffit & Bouchard Harry, "Surveying", 10th Edition, New York Intext Educational Publishers
2. Carl F. Meyer, Route Surveying & Design, 4th Edition, International Textbook Co.
3. Olliver and Clendinning, "Principles of Surveying Vol. II", Van Nost. Reinhold, U.S.
4. Chandra A.M., "Plain Surveying, New", Age International, 2015.
5. Chandra A.M., "Higher Surveying", New Age International, 2015.



**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21402 GEODESY LABORATORY**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
-	2	-	-	1	CW	END SEM	SW	END SEM	50
					-	-	40	60	

**Pre-requisite:** Fundamental of civil engineering and applied mechanics.

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

To develop students' proficiency in surveying techniques, enabling them to accurately measure angles using a theodolite, determine relative levels of points, and implement simple circular curves in field applications.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Demonstrate proficiency in using theodolites for accurate angle measurements in surveying.
2. Apply various methods of traverse calculations to determine geographic positions.
3. Perform height measurements of accessible and inaccessible objects using trigonometric leveling techniques.
4. Utilize tacheometric principles for distance and elevation measurements in surveying applications.
5. Develop skills in setting out circular curves for infrastructure projects using surveying instruments.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	2	-	3	-	-	-	2	-	-	3
<b>CO2</b>	3	3	2	2	-	-	-	-	2	-	-	3
<b>CO3</b>	3	3	2	2	2	-	-	-	2	-	-	3
<b>CO4</b>	3	3	2	2	3	-	-	-	2	-	-	3
<b>CO5</b>	3	3	3	2	3	-	-	-	2	-	-	3
<b>Target</b>	3	3	2.2	1.6	2.2	-	-	-	2	-	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:**

**Practical:**

1. To measure the horizontal angle between two station by repetition method using theodolite.
2. To measure the horizontal angle between two station by reiteration method using theodolite.
3. To measure the vertical angle between two station by theodolite.
4. To determine the latitude and departure of a close traverse.
5. To determine the R.L. of the top of the object when base is accessible.
6. To determine the R.L. of the top of the object when base is inaccessible and instrument is in the same vertical plane.
7. To determine the R.L. of the top of the object when base is inaccessible and instrument is not in the same vertical plane.
8. To determination the tacheometric constants using theodolite.
9. To setting out the simple circular curve.
10. To Demonstration of Total station and GPS.

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Practical examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Punamia B.C., "Surveying Vol. I and vol II", 15th Edition, Laxmi publication Limited, 2015.
2. Arora K.R., "Surveying Vol. I and vol II," 14th Edition, Standard Book house Publication, 2016.
3. Duggal S.K. "Surveying Vol. I and vol II," 14th Edition, Tata McGraw- hill Edition, 2013.

**Reference Books**

1. Francis H. Moffit & Bouchard Harry, "Surveying", 10th Edition, New York Intext Educational Publishers
2. Carl F. Meyer, Route Surveying & Design, 4th Edition, International Textbook Co.
3. Olliver and Clendinning, "Principles of Surveying Vol. II", Van Nost.Reinhold,U.S.
4. Chandra A.M., "Plain Surveying,New", Age International, 2015.
5. Chandra A.M., "Higher Surveying", New Age International, 2015.

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21013: STRENGTH OF MATERIALS**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	1	-	4	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

**Pre-requisite:** Fundamental of civil engineering and applied mechanics.

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

To equip students with the knowledge and skills to analyze and design structural elements under various loading conditions, focusing on stress-strain behavior, internal force distribution, bending theory, deflection analysis, and combined loading effects in beams and shafts.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Analyze the elastic behavior of bodies and mechanical properties of materials and analyze the stress-strain characteristics on any plane and also determine principal planes, principal stresses and location of planes carrying maximum shear stresses.
2. Evaluate the distribution of internal forces (shear force, bending moment and axial force at any section) in determinate beam and frames.
3. Analyze and design the beams of various cross-sections including composite sections based on the theory of bending.
4. Calculate deflections and slopes in beams using different methods,
5. Evaluate the effects of shear and torsional stresses on beam and shafts, and analyze their behavior under combined bending and torsion.

## Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	1	-	2	-	-	-	-	-	3
CO2	3	3	-	1	-	-	-	-	-	-	-	3
CO3	3	3	1	1	-	2	-	-	-	-	-	3
CO4	3	3	-	1	-	2	-	-	-	-	-	3
CO5	3	3	2	1	-	2	-	-	-	-	-	3
Target	3	3	0.6	1	-	1.6	-	-	-	-	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:****Theory:****Unit - 1**

Elastic Behaviour of Bodies: Stress and Strain. Normal and Shear Stresses and Strains. Hooke's Law and Poisson's Ratio. Complementary Shear. Relations between the Elastic Constants. Complex stresses. Stresses on Oblique Planes. Principal planes and Principal stress and strains. Mohr's diagrams.

Mechanical Properties of Materials: Strength, Stiffness, Elasticity, Plasticity, Toughness, Hardness, Ductility etc. Ultimate Strength, Working stress and Factor of safety.

**Unit - 2**

Bending Moment and Shear Force: Bending Moment and Shear Forces at a Section of Beam subject to Vertical Loads, Inclined Loads and Couples. Relation between B.M., S.F. and Loads. Graphical Methods for drawing B.M. diagram and S.F. diagram.

**Unit - 3**

Stresses due to Bending: Theory of Bending Stresses. Distribution of Stresses along the Section. Modulus of Section and Modulus of Rupture. Beams of varying Cross Section and Beams of uniform strength. Composite beams.

**Unit - 4**

Deflection of Beams: Uniform Curvature. Relation between the Deflection, Curvature and Bending Moment. Slopes and Deflection of Beams. Double Integration Method, Macaulay's method, Moment area method, Conjugate beam method. Deflection due to Shear.

**Unit - 5**

Stresses due to Torsion and Shear: Theory of Torsion: Twisting of Solid and Hollow Circular Cross Sections. Stresses due to Torsion. Transmission of Power by Circular Shafts. Design of Shafts. Combined Bending and Twisting. Compound shafts.

Derivation of equation for shear stress in beams, Computation of shear stresses in beams of various cross-sections and design of beams based on shear.

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Theory examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Rajput R. K., Strength of Materials, S.Chand Publications New Delhi, 6th Edition 2015
2. Ramamurtham S., Strength of Materials, Dhanpat Rai Publications New Delhi. Edition 2014
3. Punmia B.C., Mechanics of Material, Lakxmi Publication New Delhi. Edition 2017.
4. Singh Sadhu, Strength of Materials, Khanna Publishers New Delhi Edition 2009.

**Reference Books**

1. Timoshenko S., Strength of MaterialsPart-1,CBS Publishers & Distributors Edition 3rd 2004.
2. Surendra Singh, Strength of Materials.,StosiusInc/Advent Books Division Edition 1982
3. Ryder G.H., Strength of Materials, Red Globe Press London, 1969

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE:21403: STRENGTH OF MATERIALS LABORATORY**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
-	2	-	-	1	CW	END SEM	SW	END SEM	50
					-	-	40	60	

**Pre-Requisite:** Fundamentals of civil engineering and applied mechanics.

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

To equip students with the knowledge and skills to perform material testing, analyze mechanical properties, verify fundamental laws of mechanics, and evaluate compound stresses and structural behavior through practical applications and graphical methods.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Apply the knowledge of material testing techniques to evaluate mechanical properties and shall be able to justify the application of material.
2. Demonstrate the ability to analyze and verify fundamental laws of mechanics.
3. Ascertain the compound stresses on any oblique plane and shall be able to draw SFD BMD using graphical approach.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	2	3	3	-	-	-	1	-	-	2
<b>CO2</b>	3	3	2	3	2	-	-	-	1	-	-	2
<b>CO3</b>	3	3	2	3	2	-	-	-	1	-	-	2
<b>Target</b>	3	3	2	3	2.3	-	-	-	1	-	-	2

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:**

**Practical:**

1. To carry out tension test on tor steel and mild steel specification and to draw stress strain diagram.
2. To find the modulus of elasticity of a given bar of steel and timber by deflection method.
3. To find the modulus of rigidity of a given rigid cord.
4. To determine the brinell hardness number for a surface of mild steel, cast iron, brass and aluminium.
5. To carry out charpy and izod impact on mild steel, cast iron and aluminium specimen to determine their impact value.
6. To verify law of polygon using universal force table.
7. To understand the variation of different loading condition on simply supported beam.
8. To determine the support reaction using graphical method for the simply supported beam.
9. To understand the principal stress using mohr's circle.

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Practical examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Rajput R. K., Strength of Materials, S.Chand Publications New Delhi, 6th Edition 2015
2. Ramamurtham S., Strength of Materials, Dhanpat Rai Publications New Delhi. Edition 2014
3. Punmia B.C., Mechanics of Material, Lakxmi Publication New Delhi. Edition 2017.
4. Singh Sadhu, Strength of Materials, Khanna Publishers New Delhi Edition 2009.

**Reference Books**

1. Timoshenko S., Strength of MaterialsPart-1,CBS Publishers & Distributors Edition 3rd 2004.
2. Surendra Singh, Strength of Materials.,StosiusInc/Advent Books Division Edition 1982
3. Ryder G.H., Strength of Materials, Red Globe Press London, 1969

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE:21015: ENGINEERING MATERIAL**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

**Pre-requisite:** XII standard (HSSC)

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

This course covers properties and manufacturing of construction materials including lime, clay products, glass, timber, and plastics. It explores laminates, adhesives, rubber, and waterproofing compounds. Students will analyze concrete ingredients, mix design, and alternative materials. The course also examines material behavior under various loads and heat insulation properties.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Demonstrate the composition, manufacturing and properties of brick, lime and clay products.
2. Describe and explain the type's uses and properties of glasses, timber and plastics in buildings.
3. Discuss and explain the properties of decorative materials such as rubber, organic coating, and laminates water proofing etc.
4. Classify the properties of fresh and hardened concrete. Design and recommend the proportion of concrete mix using the specification of ingredients.
5. Discuss Alternate & Innovative Construction Material for Housing and classify the properties of heat insulating materials and behavior of various materials under compression, tension, bending, fatigue, creep and hardness under different loading.



## Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	2	-	-	-	1	-	3
CO2	3	1	-	-	-	2	-	-	-	1	-	3
CO3	3	1	-	-	-	2	-	-	-	1	-	3
CO4	3	2	2	-	-	2	-	-	-	1	-	3
CO5	3	2	1	-	-	2	-	-	-	2	-	3
Target	3	1.4	0.6	-	-	2	-	-	-	1.2	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:****Theory:****Unit - 1**

**Brick:** Manufacturing, characteristics, Classification and uses, Improved brick from inferior soils, Hand molded brick table, Fly Ash Brick, AAC Block

**Lime:** Classification, properties, slaking test, I.S. specification, Manufacture, uses.

**Clay Products:** Tiles, Different kinds of tiles, manufacture, varieties, glazing, Porcelain, Refractory materials, classification, properties.

**Unit - 2**

**Glass:** Definition, constituents, manufacture, classification commercial forms, uses of different types of Glasses.

**Timber:** Definition, uses of Timber, Physical and Mechanical properties, defects, Seasoning, Preservation, Miscellaneous wood product.

**Plastics:** Classification, Ingredients, General properties, fabrication of plastic products, Ultra Poly Vinyl chloride Pipes, cpvc pipes etc.

**Polycarbonates;** Classification, Behaviours etc.

**Unit - 3**

**Rubber:** Classification, uses, vulcanization, compounding of rubber, reclaimed rubber.

**Organic Coating:** Ingredients, Types, Luminescent Coating, Fire Retarding Coating.

**Laminates and Adhesives:** Definitions, Types, Laminated Wood, Compressed Laminated, Plastic, Adhesive

**Water Proofing Compound.**

**Unit - 4**

**Concrete –Materials:** Cement, Aggregate, Admixtures, types and properties, workability, segregation and Bleeding, Tensile and Compressive Strength, Modulus of Elasticity, Effect of Shrinkage and Creep. Mixing, Transporting, Placing, Compaction, Finishing, Curing, Quality Control.

**Design of Concrete Mixes:** Introduction, Basic Considerations, Factors, IS Methods.

**Unit - 5**

**Heat Insulating and Acoustic Materials:** Classification, Composition, Tests, Sound Absorption, types of Acoustical Materials. Acoustical Treatment, Noise Reduction.

**Material Science:** Inter atomic bonds, bonding force, bond energy, intermolecular bonds, thermal energy, Behavior of materials under compression, tension, bending, fatigue, creep, hardness, behavior of common materials under different loadings

**Precast Sandwich Panel Systems:** Introduction, Behaviour of Sandwich Composite Panels, With Connectors, Insulating Core, Structural Skins, EPS Core Panel System.

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Theory examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Surendra Singh, Engineering Materials, Vikas Publishing House.
2. S C Rangwala, Engineering Materials, Charotar Publications.
3. Shetty M.S., Concrete Technology, Theory and Practical, S. Chand & Co. Ltd., New Delhi.
4. S K Duggal, Building Materials, New Age International.
5. Gurcharan Singh, Building Construction and Materials

**Reference Books**

1. Mills A.P., Hayward H.W., Radar L.F., Materials of Construction, John Wiley & Sons, New York.
2. Nord M., Text Book of Engineering Materials, John Wiley & Sons, New York.
3. C.B.R.I., Building Materials, Roorkee.
4. P C Varghese, Building Materials, PHI Learning.
5. A M Neville, J J Brooks, Concrete Technology, Prentice Hall.
6. SPA Delhi & Building Materials & Technology Promotion Council Ministry of Housing & Urban Affairs Government of India “Alternate & Innovative Construction Systems for Housing”.

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21404: ENGINEERING MATERIAL LABORATORY**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
-	2	-	-	1	CW	END SEM	SW	END SEM	50
					-	-	40	60	

**Pre-requisite:** XII standard (HSSC)

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

To equip students with practical skills in testing, analyzing, and designing construction materials, emphasizing cement, aggregates, and concrete properties.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Analyze cement properties through standardized tests.
2. Evaluate aggregate characteristics and behavior.
3. Assess concrete workability and strength parameters.
4. Examine various construction materials properties.
5. Apply concrete mix design principles and methods.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	-	-	3	-	-	3	3	3	-	3
<b>CO2</b>	3	3	2	-	3	-	-	3	3	3	-	3
<b>CO3</b>	3	3	3	-	3	-	-	3	3	3	-	3
<b>CO4</b>	3	3	0	-	3	-	-	3	3	3	-	3
<b>CO5</b>	3	3	2	-	-	-	-	3	3	3	-	3
<b>Target</b>	3	3	1.4	-	2.4	-	-	3	3	3	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:**

**Practical:**

1. To determine the specific gravity of OPC & PPC cement.
2. To determine the fineness of OPC & PPC cement sample by sieving a 90 micron IS sieve.
3. To determine (a) standard consistency and (b) initial and final setting time given OPC & PPC cement sample by vicat's apparatus.
4. To determine soundness of a given OPC & PPC cement and lime samples by Le-Chatelier Method.
5. To determine fineness modulus and grain size distribution of a given
6. (a) Coarse (b) fine aggregate.
7. To determine necessary adjustment for bulking of fine aggregate by field method and to draw a curve between water content and bulking.
8. To determine consistency of concrete mix of a given preparation by slump test.
9. To determine compressive strength of 1:3 cement-sand mortar cube after 3 days 7 days and 28 days curing.
10. To determine specific gravity and water absorption by coarse aggregate.
11. To determine cube strength of concrete of a given preparations.
12. To determine compressive strength of paving block.
13. Tests on Fly Ash Brick & Tests of AAC (Air Aerated Concrete) Block
14. Testing of Tiles (Wall & Glazed Tiles)
15. Concrete Mix Design as per guidelines of IS/IRC/ACI Method
16. Tests for determination of flexural strength of concrete

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Practical examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Surendra Singh, Engineering Materials, Vikas Publishing House.
2. S C Rangwala, Engineering Materials, Charotar Publications.
3. Shetty M.S., Concrete Technology, Theory and Practical, S. Chand & Co. Ltd., New Delhi.
4. S K Duggal, Building Materials, New Age International.
5. Gurcharan Singh, Building Construction and Materials

**Reference Books**

1. IS 4031: Methods of physical tests for hydraulic cement
  - Part 1: Determination of fineness by dry sieving
  - Part 3: Determination of soundness
  - Part 4: Determination of consistency of standard cement paste

- Part 5: Determination of initial and final setting times
  - Part 6: Determination of compressive strength of hydraulic cement other than masonry cement
  - Part 11: Determination of density
2. IS 2386: Methods of test for aggregates for concrete
    - Part 1: Particle size and shape
    - Part 3: Specific gravity, density, voids, absorption and bulking
  3. IS 1199: Methods of sampling and analysis of concrete
  4. IS 516: Method of tests for strength of concrete
  5. IS 15658: Precast concrete blocks for paving - Specification
  6. IS 12894: Fly Ash Lime Bricks - Specification
  7. IS 2185 (Part 3): Specification for concrete masonry units - Autoclaved cellular concrete blocks
  8. IS 13630: Ceramic tiles - Methods of test, sampling and basis for acceptance
  9. IS 10262: Concrete mix proportioning – Guidelines

# SEMESTER IV

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21512: CONSTRUCTION TECHNOLOGY-I**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

**Pre-requisite:** Material Technology.

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

To equip students with comprehensive knowledge of traditional and contemporary construction materials, their properties and applications, while developing skills in material selection, concrete and steel construction procedures, and design considerations for essential building components such as floors, roofs, and stairs.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Describe the various available conventional and new construction materials and techniques.
2. Explain the suitability of materials required for various structural elements.
3. Describe the suitability different construction techniques.
4. Apply the suitability of locally available material in building constructions.
5. Explain the application of globally available equipment's in construction technology.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	-	-	-	-	-	-	-	-	-	3
<b>CO2</b>	3	3	-	-	-	-	-	-	-	-	-	3
<b>CO3</b>	3	3	-	-	-	-	-	-	-	-	-	3
<b>CO4</b>	3	3	-	-	-	-	-	-	-	-	-	3
<b>CO5</b>	3	3	-	-	-	-	-	-	-	-	-	3
<b>Target</b>	3	3	-	-	-	-	-	-	-	-	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:**

**Theory:**

1. **Stone Masonry:** Terms used and definitions, Type of Stone Masonry, Plant & Equipment Used, Defects in Stones. Stone Masonry Details at Doors Window opening Cornices.
2. **Brick Masonry:** Characteristics and Classification of Bricks Laying and Bonds in Bricks Masonry, Construction details of composite wall, Cavity wall, Hollow Block Construction, reinforced Brick work.
3. Concrete Construction
  - **Cast in Situ RCC Construction:** Cost in Situ RCC Construction, Form Work for Various Structural Components, Mixing and Placing Concrete, Reinforcement and its Placing, Formwork and its design principles.
  - **Precast & Prestressed Construction:** Introduction to precast & prestressed construction, Joints in precast construction.
  - **Steel Construction:** Method of Structural Connections, Bolting, Riveting, Welding, Fabrication, Erection of Various Structural Components including girders and trusses.
4. **Timber Construction:** Method of Structural connections, Fastenings used, Structural Components including Trusses.
5. **Construction of Structure:** Load Bearing, Framed and composite Construction, different types of foundations, Bridging Elements, Arches and Lintels. Various Types of Retaining walls, Prefabricated Construction.
6. **Floors:** Ground, Basement and Storey Floors, Types, Varieties of floor finishers.
7. **Roof:** Types, Layout, Structure of Roof, Types of Coverings, Drainage arrangements, Ceilings.
8. **Stairs:** Types, Layout Design and Construction, Ramps, Ladders, Lifts, Escalators, Doors, Windows, Ventilators – Their Types.
9. **Finishes:** Plastering, Pointing, white washing, Distempering Painting, Sources of dampness and remedial measures. Types, cost of owning and operating, prime cost, depreciation economic life, maintenance, repair, Earth Moving Machines, Concrete Construction Equipment, Aggregate preparation Equipment, Dewatering equipment, The study of these Equipments should include Types, Output Efficiency, Size, Application, Operation.

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Theory examination of 3 Hours duration and Practical Viva Voice Examination by external examiner



**Books & References Recommended:**

1. Building Construction, Sushil Kumar, Standard Publishers Distributors, 8th Edition 2016
2. Building Construction, Rangwala S C., Charotar Publishing House., 1980, 16th Edition 2009
3. Building Construction, McKay W.B., "Vol.1 to 4, Orient Longman Ltd., Hyderabad, Bombay, Madras, Delhi, Vol.1 & 2 -1995, Vol. 3-1996, Vol. 4-1998.

**Reference Books**

1. A Text Book of Building Construction, Punmia, B.C., Laxmi Publications, Delhi, Madras.
2. Engineering Materials, Singh Surendra., Konark Publishers Pvt. Ltd. 1994. Civil Engg. Materials, TTTI Chandigarh, Tata McGraw- New Delhi

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21801: CONSTRUCTION TECHNOLOGY-I LABORATORY**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
-	2	-	-	1	CW	END SEM	SW	END SEM	50
					-	-	40	60	

**Pre-requisite:** Material Technology

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

Develop practical skills in foundation work, masonry techniques, and essential building components through hands-on experiments and technical drawings.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Analyze and apply fundamental concepts in building construction, including foundations, masonry techniques, and structural elements.
2. Evaluate and compare different types of construction materials and methods used in flooring, roofing, and staircase design.
3. Develop practical skills in interpreting and creating technical drawings related to various building components and systems.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	-	-	-	-	-	2	-	-	-	3
<b>CO2</b>	3	3	-	-	-	-	-	-	-	-	-	3
<b>CO3</b>	3	3	-	-	-	-	-	2	-	-	-	3
<b>Target</b>	3	3	-	-	-	-	-	1.3	-	-	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:**

**Theory:**

1. Sheet 1 on foundations.
2. Sheet 2 on stone masonry
3. Sheet 3 on brick masonry
4. Sheet 4 on block masonry
5. Sheet 5 on types of flooring.
6. Sheet 6 on types of roofs.

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Practical examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Building Construction, Sushil Kumar, Standard Publishers Distributors, 8th Edition 2016
2. Building Construction, Rangwala S C., Charotar Publishing House., 1980, 16th Edition 2009
3. Building Construction, McKay W.B., "Vol.1 to 4, Orient Longman Ltd., Hyderabad, Bombay, Madras, Delhi, Vol.1 & 2 -1995, Vol. 3-1996, Vol. 4-1998.

**Reference Books**

1. A Text Book of Building Construction, Punmia, B.C., Laxmi Publications, Delhi, Madras.
2. Engineering Materials, Singh Surendra., Konark Publishers Pvt. Ltd. 1994. Civil Engg. Materials, TTTI Chandigarh, Tata McGraw- New Delhi

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT  
B. E. II Year (4YDC)  
CE21514: TRANSPORTATION ENGINEERING**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

**Pre-requisite:** Basic traffic engineering, surveying, and civil design fundamentals.

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

To develop students' expertise in analyzing, designing, and improving various transportation infrastructure systems, including roads, intersections, highways, railways, and harbors, with emphasis on performance assessment, safety enhancement, geometric design principles, traffic management, and environmental considerations.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Apply the principles of highway classification, historical development, and survey techniques for effective road planning and development.
2. Design the geometric elements of roads, including cross sections, sight distances, and alignments.
3. Analyze traffic studies and design traffic control measures, including signals, markings, and intersection types.
4. Explain the components and design principles of railway systems, including permanent way, points, and crossings.
5. Design and plan dock and harbor facilities, including protective coastal works and port structures.

## Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	2	-	-	-	3	-	-	-	3
CO2	3	3	3	-	1	-	-	3	-	-	-	3
CO3	3	3	3	2	1	-	-	3	-	-	-	3
CO4	3	3	-	3	-	-	-	3	-	-	-	3
CO5	3	3	3	-	-	-	-	3	-	-	-	3
Target	3	3	1.8	1.4	0.4	-	-	3	-	-	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:****Theory:****Unit - 1**

**Highways:** Classification of Roads, Road Patterns, Brief History of Road Development around the World, Road Development Plans of the India, Present Status of Roads in India, Alignment Design, Requirements and Controlling Factors, Use of Aerial Photography and Remote Sensing, Other surveys.

**Unit - 2**

**Geometric Design:** Typical Cross Sections in Urban and Rural roads, Various Cross Sections Elements, Width of Carriage-way, Shoulders, Medians, Width of Roadways, Right of Way, Camber, Design Speed, Sight Distance, Stopping Sight Distance, Passing Sight Distance, Sight Distance at Inter-Section, Passing Zones, Super Elevations, Set Back, Extra Widening on Horizontal Curve, Transition Curve, Design of Horizontal and Vertical Alignment, Combinations of Horizontal and Vertical Alignment.

**Unit - 3**

**Traffic Engineering:** Definition, Road User and Vehicle, Traffic Studies - Speed, Volume, Origin & Destination, Capacity, Parking and Accidents, Traffic Signs, Traffic Markings, Traffic Signals - Types, Signal systems, Warrants and Design, Traffic Management, Intersection Types - At Grade & Grade Separation, Rotary Design, Street Lighting.

**Unit - 4**

**Railway Engineering:** Early development in rail transport, Permanent Way, Gauges, Sleepers, Ballast, Rails, Rail Fastenings, Calculation of Materials for Permanent way, Coning of Wheels, Rail Cross Section, Tilting of Rails, Wear & Creep of Rails, Geometrics, Gradients, Transition Curves, Widening of Gauges on Curves, Cant & Cant Deficiency.

Points & Crossing - Design of Turn outs and description of Track Junctions, Signalling and Interlocking, Classification of Signals and Points, Control of Train, Track Circuits, Station Yards.

**Unit - 5**

**Dock & Harbour Engineering:** Ship Characteristics, Wind Waves, Currents, Tides Harbour - Selection of site, Planning & Design, Classes, Desirable features, Protective Coastal Works, Break Waters, Jetties, Groins, Revetments & Bulk Heads, Vertical Walls.

Process due to break Waters, Concepts and Principles of Design of different Structures, Planning & Design of Port Facilities, General Layout and Design Considerations, Pier and Wharf Structure, Fender Systems, Container, Port, Birth and ship Dimensions.

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Theory examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Khanna S.K. & Justo, C.E.G. "Highways Engineering" 10th edition. Nem Chand and Brothers, 2015.
2. O. Flaherty C.A., "Highway Vol. I & II:", Butterworth Heinemann, 2002.
3. O. Flaherty C.A., "Traffic Engineering and Transport Planning", 2006.
4. Anita K.F., "Railway Track Design, Construction, Maintenance and Renewal of permanent way, Bombay", New Book Company, 1945.
5. Paul H. Wright and Norman J. Ashford, "Transportation Engg. Planning and Design", 4th edition, 1998.
6. L.R.Kadiyali & N.B.Lal, "Principles & Practices of Highway Engg, Khanna Publishers", 2005.

**Reference Books**

1. IRC -.67-2012, "Code of Practice for Road Signs".
2. IRC - 35-1997, "CODE OF PRACTICE FOR ROAD MARKINGS".
3. IRC - 83-1988, "Code of Practice for Road Bridges".
4. IRC - 86-1983, "Geometric design standards for urban roads in plains".
5. IRC – SP No.23, "Vertical Curves for Highways".
6. IRC-106-1990, "Guidelines of Capacity of Urban Roads in Plain Areas".

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21802: TRANSPORTATION ENGINEERING LAB**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
-	2	-	-	1	CW	END SEM	SW	END SEM	50
					-	-	40	60	

**Pre-requisite:** Basic traffic engineering, surveying, and civil design fundamentals.

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

To develop students' expertise in analyzing, designing, and improving various transportation infrastructure systems, including roads, intersections, highways, railways, and harbors, with emphasis on performance assessment, safety enhancement, geometric design principles, traffic management, and environmental considerations.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Assess and analyze the performance and level of service of existing road infrastructure.
2. Design and develop intersection solutions for urban traffic management.
3. Apply geometric design principles to the layout of highways and railways.
4. Conduct traffic volume and capacity studies to improve road safety and efficiency.
5. Design harbor layouts and protective coastal structures considering environmental and operational factors.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	-	2	-	-	-	3	3	-	-	3
<b>CO2</b>	3	3	3	-	-	-	-	3	3	-	-	3
<b>CO3</b>	3	3	3	2	-	-	-	3	3	-	-	3
<b>CO4</b>	3	3	-	3	-	-	-	3	3	-	-	3
<b>CO5</b>	3	3	3	-	-	-	-	3	3	-	-	3
<b>Target</b>	3	3	1.8	1.4	-	-	-	3	3	-	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:**

**Practical:**

1. To determine the level of service of an existing road.
2. To determine the spot speed of the vehicles with the help of enoscope.
3. To design a rotary at any given intersection.
4. To design a signal at any given intersection.
5. To prepare various railway sheets.
6. Design of Horizontal and Vertical Curves for a given Highway Alignment.
7. Analysis and Design of Pavement Cross-Sections for Urban and Rural Roads.
8. Determination of Traffic Volume and Capacity at a given location.
9. To prepare typical cross section for National Highway.
10. To prepare Layout for Harbor with Protective Coastal Works.
11. To prepare the various traffic control devices sheets

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Practical examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Khanna S.K. & Justo, C.E.G. "Highways Engineering" 10th edition. Nem Chand and Brothers, 2015.
2. O. Flaherty C.A., "Highway Vol. I & II", Butterworth Heinemann, 2002.
3. O. Flaherty C.A., "Traffic Engineering and Transport Planning", 2006.
4. Anita K.F., "Railway Track Design, Construction, Maintenance and Renewal of permanent way, Bombay", New Book Company, 1945.
5. Paul H. Wright and Norman J. Ashford, "Transportation Engg. Planning and Design", 4th edition, 1998.
6. L.R.Kadiyali & N.B.Lal, "Principles & Practices of Highway Engg, Khanna Publishers", 2005.

**Reference Books**

1. IRC -.67-2012, "Code of Practice for Road Signs".
2. IRC - 35-1997, "CODE OF PRACTICE FOR ROAD MARKINGS".
3. IRC - 83-1988, "Code of Practice for Road Bridges".
4. IRC - 86-1983, "Geometric design standards for urban roads in plains".



5. IRC – SP No.23, “Vertical Curves for Highways”.
6. IRC-106-1990, “Guidelines of Capacity of Urban Roads in Plain Areas”.

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21518: ENGINEERING GEOLOGY**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

**Pre-requisite:** XII standard (HSSC)

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

To develop students' understanding of geological principles and techniques essential for civil engineering applications, from basic concepts to advanced technologies.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Comprehend fundamental geological concepts and their relevance to civil engineering.
2. Analyze rock properties and structural geology for engineering applications.
3. Evaluate geological hazards, particularly landslides and earthquakes.
4. Apply geological investigation techniques for various civil engineering projects.
5. Utilize remote sensing, GPS, and GIS technologies in civil engineering and resource mapping.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	2	-	-	-	2	-	-	-	3	-	3
<b>CO2</b>	2	3	-	-	-	2	-	-	-	3	-	3
<b>CO3</b>	3	2	-	-	2	2	-	-	-	3	-	3
<b>CO4</b>	2	1	-	-	2	2	-	-	-	3	-	3
<b>CO5</b>	2	2	-	3	2	2	-	-	-	3	-	3
<b>Target</b>	2.4	2	-	0.6	1.2	2	-	-	-	3	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:**

**Theory:**

**Unit - 1**

**General Geology:** Introduction, Disciplines and scope of engineering geology, Importance of geology in Civil Engineering, Earth surface features and internal structure, Geomorphological process and classification, Weathering of rocks, Geological action of running water, wind, and underground water, Mineralogy.

**Unit - 2**

**Petrology and Structural Geology:** Rock cycle, Classification and strength aspects of Igneous, Sedimentary and Metamorphic rocks and their suitability as engineering materials, Relationship between physical and geo-mechanical properties of rock, Rock deformation, dip, strike, outcrops, Classification and field identification of Folds, Joints, Faults, Unconformity and their importance in civil engineering.

**Unit - 3**

**Landslides and Earthquake:** Causes, types and classification of landslides, Preventive measures of landslides, Causes and effects of Earthquakes, Measurement of Earthquakes, Seismic zones of India, Geological consideration for construction of building and other projects in seismic areas.

**Unit - 4**

**Geological Investigation:** Geological investigations for Dams and reservoirs, tunnelling in rocks, bridges, railways and highways, Classification of geophysical methods, Geophysical explorations for surface and subsurface structures, Scope of rock excavation, Geological maps, Study of geological models.

**Unit - 5**

**Remote sensing:** Uses of remote sensing technique. Types, components and elements of remote sensing, EMS and MSS, Visual interpretation technique, application of Global Positioning system (GPS) and Geographic Information System (GIS) in civil engineering and resource mapping (site selection, water resources, rocks and soil).

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Theory examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Engineering Geology for Civil Engineers by P. C. Varghese, PHI Learning Pvt. Ltd., New Delhi, 2019.
2. Geology and Engineering, R.F. Legget, McGraw Hill.
3. Engineering Geology, S.K. Duggal, Tata McGraw Hill Publishing Company Ltd. New Delhi.

**Reference Books**

1. Remote Sensing and image interpretation by Lillesand T.M. and Kiefer R.W.
2. Integrating GIS and the Global Positioning System by Karen Steede-Terry
3. Engineering and General Geology by Prabin Singh Katson Educational Series.
4. Foundations of Engineering Geology, by Tony Waltham, Taylor & Francis.

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21803: ENGINEERING GEOLOGY LABORATORY**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
					CW	END SEM	SW	END SEM	50
-	2	-	-	1	-	-	40	60	

**Pre-requisite:** XII standard (HSSC)

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

To develop students' practical skills in analyzing geological structures, interpreting features, and reading geological maps for civil engineering applications.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Analyze geological structures including folds, faults, and unconformities.
2. Interpret geological features relevant to civil engineering projects.
3. Develop skills in geological map reading and cross-section drawing.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	2	-	-	-	-	2	-	-	-	-	2
<b>CO2</b>	2	3	-	2	-	-	2	-	2	-	-	2
<b>CO3</b>	3	2	-	2	-	-	-	-	2	-	-	2
<b>Target</b>	1.6	1.4	-	0.8	-	-	0.8	-	0.8	-	-	1.2

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:**

**Practical:**

1. Study of folded structures.
2. Study of faulted structures.
3. Study of unconformity and other structures.

4. Study of tunnels, rainfall and volcanoes.
5. Drawing of various cross sections of a geological map.
6. Study of rocks and minerals.

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Practical examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Engineering Geology for Civil Engineers by P. C. Varghese, PHI Learning Pvt. Ltd., New Delhi, 2019.
2. Geology and Engineering, R.F. Legget, McGraw Hill.
3. Engineering Geology, S.K. Duggal, Tata McGraw Hill Publishing Company Ltd. New Delhi.

**Reference Books**

1. Remote Sensing and image interpretation by Lillesand T.M. and Kiefer R.W.
2. Integrating GIS and the Global Positioning System by Karen Steede-Terry
3. Engineering and General Geology by Prabin Singh Katson Educational Series.
4. Foundations of Engineering Geology, by Tony Waltham, Taylor & Francis.

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21524: STRUCTURAL MECHANICS**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

**Pre-requisite:** Applied Mechanics.

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

Course objective is to make aware the students about behaviour of different structural members. In this subject detailed study of analysis of columns, methods of deflections, unsymmetrical bending is given. This subject provides a base for the students in the structural engineering field.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Determine the deflection of determinate structures using energy methods.
2. Analyze axially loaded and eccentric columns and calculate buckling loads.
3. Analyze curved flexural members, springs, shells and pressure vessels.
4. Compute stresses in beams subjected to unsymmetrical bending.
5. Analyze and interpret response of single degree of freedom systems subjected to harmonic loading.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	3	-	-	-	-	-	-	-	-	3
<b>CO2</b>	3	3	3	-	-	-	-	-	-	-	-	3
<b>CO3</b>	3	3	3	-	-	-	-	-	-	-	-	3
<b>CO4</b>	3	3	3	-	-	-	-	-	-	-	-	3
<b>CO5</b>	3	3	3	-	-	-	-	-	-	-	-	3
<b>Target</b>	3	3	3	-	-	-	-	-	-	-	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:**

**Theory:**

**Unit - 1**

**Strain Energy:** Resilience and Proof Resilience, Elastic Strain Energy in Materials subjected to Tension, Compression, Shear, Bending and Torsion. Theories of Elastic Failure. Gradually and suddenly applied Loads. Impact and Falling Loads.

**Deflection of Structures:** Strain Energy Method for Deflection of Beams and Determinate Trusses, Castigliano's First Theorem and its Application to find Deflections

**Unit - 2**

**Columns and Struts:** Long and Short Columns, Axial and Eccentric Loads. Euler's Theory and Rankine's Formula for Axially Loaded Columns. Eccentrically Loaded Columns, ISI-Formula for Columns, Introduction to Beam-Column behaviour and Column with Lateral Loads.

**Unit - 3**

**Unsymmetrical Bending:** Principal Moment of Inertia, Unsymmetrical Bending of Standard Structural Section, Change in Orientation of Neutral axis-plane, Shear Centre.

**Shells and pressure vessels:** thin walled cylindrical and spherical pressure vessels under internal and external radial pressure. Wire wound thin tubes

**Unit - 4**

**Bending of curved bars and rigid frames:** Stresses in Bars of Small Initial Curvature. Stresses in Bars of Large Initial Curvature. Deflection of Curved Bars (Direct Method). Deflection from Strain Energy (Castigliano's Theorem). Portal Frame by Strain

**Springs:** Closed coiled and open coiled helical springs. Stress in the spring materials. stiffness of springs, spring subjected to axial loads and couples. Grouping of springs. Leaf Spring, Semi Elliptic, Quarter Elliptic Spring.

**Unit - 5**

**Basics of Mechanical Vibration:** Single degree of freedom system: Free & Forced vibration, Linear viscous damper, Coulomb Damper, response Harmonic Excitation Rotation Unbalance & support Excitation, Vibration isolation and Transmissibility. Single Degree of freedom system as vibrometer accelerometer.

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner



**Semester-end:**

Theory examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Punmia B.C., Strength of Material and Mechanics of Structure, Vol. II., Standard Publishers Distributors Edition 12th 2004.
2. Ryder G.H., Strength of Material., Palgrave Macmillan; Student international edition 3rd 1969.
3. Timoshenko, Strength of Material. , CBS Publishers & Distributors Edition 3rd 2004.
4. Mario Paz, Structural Dynamics., Springer; 5th Corrected ed. 2004
5. Singh Sadhu, Strength of Material., Khanna Book Publishing New Delhi Edition 2009

**Reference Books**

1. Reddy, C.S, Structural Analysis., McGraw-Hill Education New Delhi Edition 2nd 2007
2. Ramamurtham, Theory of Structure. Dhanpat Rai New Delhi Edition 2015

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21804: STRUCTURAL MECHANICS LABORATORY**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
-	2	-	-	1	CW	END SEM	SW	END SEM	50
					-	-	40	60	

**Pre-requisite:** Applied Mechanics.

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

Course objective is to make aware the students about behaviour of different structural members. In this subject detailed study of analysis of columns, methods of deflections, unsymmetrical bending is given. This subject provides a base for the students in the structural engineering field.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Develop a thorough understanding of the behavior of various structural elements (beams, trusses, and columns) under different loading conditions.
2. Apply theoretical principles such as strain energy methods, Euler's theory, and Castigliano's theorem to analyze and predict structural responses.
3. Enhance analytical and computational skills by verifying experimental results through analytical methods and developing computer programs for structural analysis.
4. Develop proficiency in conducting experiments related to deflection, bending, shear force, and moment of inertia and verify results with theoretical calculations.
5. Gain hands-on experience in using experimental and computational tools to analyze structural elements, enhancing the ability to apply these techniques in real-world engineering problems.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	-	-	3	-	-	3
CO2	3	3	3	-	-	-	-	-	3	-	-	3
CO3	3	3	3	-	-	-	-	-	3	-	-	3
CO4	3	3	3	-	-	-	-	-	3	-	-	3
CO5	3	3	3	-	-	-	-	-	3	-	-	3
Target	3	3	3	-	-	-	-	-	3	-	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:****Practical:**

1. To determine the deflection in overhanging beam experimentally and verification of the same by the strain energy method.
2. To determine deflection in curved bars experimentally and verification of the same by the strain energy method.
3. To determine deflection in truss experimentally and verification of the same by the strain energy method.
4. To study the behaviour of a cantilever beam under unsymmetrical and symmetrical bending.
5. To determine Euler's crippling load experimentally for various end conditions of column and verification of the theoretically.
6. To verify Castigliano's theorem by means of a mild steel bar.
7. To draw the shear force and bending moment diagram for a fixed and continuous beam.
8. To draw the Mohr's circle for the determination of principal moment of inertia and verify it analytically.
9. To develop the computer program for the analysis of beams, trusses and frames.
10. To develop the computer program for the shear force and bending moment diagram in beams and trusses.

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Practical examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Punmia B.C., Strength of Material and Mechanics of Structure, Vol. II., Standard Publishers Distributors Edition 12th 2004.
2. Ryder G.H., Strength of Material., Palgrave Macmillan; Student international edition 3rd 1969.
3. Timoshenko, Strength of Material. ,CBS Publishers & Distributors Edition 3rd 2004.
4. Mario Paz, Structural Dynamics., Springer; 5th Corrected ed. 2004
5. Singh Sadhu, Strength of Material., Khanna Book Publishing New Delhi Edition 2009

**Reference Books**

1. Reddy, C.S, Structural Analysis., McGraw-Hill Education New Delhi Edition 2nd 2007
2. Ramamurtham, Theory of Structure. Dhanpat Rai New Delhi Edition 2015

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21517: FLUID MECHANICS**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

**Pre-requisite:** Concepts of forces & equilibrium, mechanics of solids and basic laws of statics and dynamics.

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

The candidate should be able to understand the behaviour of fluids at rest and in motion with the concepts of fluid statics, kinematics and dynamics. The student should also understand the fluid flow concepts in pipes as well as open channels under various conditions of flows. As basic introduction to model studies the student should gain knowledge of the modelling of various hydraulic structures and systems through the principle of similarity and similitude.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Compute hydrostatic forces acting on submerged surfaces.
2. Apply conservation laws to solve steady state fluid flow problems.
3. Apply the principles of dimensional analysis for design of experiments.
4. Analyze the characteristics of flow through pipes and Design simple pipe systems.
5. Compute flow profiles in channel transitions and due to hydraulic structures.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	-	3	-	-	-	-	-	-	-	3
<b>CO2</b>	3	1	1	-	-	-	-	-	-	-	-	3
<b>CO3</b>	3	1	1	3	-	-	-	-	-	-	-	3
<b>CO4</b>	3	2	3	3	-	-	-	-	-	-	-	3
<b>CO5</b>	3	3	3	3	-	-	-	-	-	-	-	3
<b>Target</b>	3	2	1.6	2.4	-	-	-	-	-	-	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**COURSE CONTENTS:**

**Theory:**

**Unit - 1**

**Introduction:** Scope and Application of Fluid Mechanics: Physical Properties of Fluids: Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity, Dynamic & Kinematic Viscosity, Newton's Law of Viscosity, Classification of Fluids, Compressibility, Cohesion, Adhesion, Surface Tension, Capillarity, Vapour Pressure.

**Equilibrium of Fluids:** Pressure at a Point, Pressure Variation, Barometer, Gauges, Manometers, Hydrostatic Forces, Equilibrium of Fluid in Motion, Floatation - Stability of Floating and Submerged Bodies, Fluid Masses subjected to Rotation, Free and Forced Vortices.

**Unit - 2**

**Kinematics of Fluid Flow:** Velocity field, classification of flows, Stream, Path & Streak Lines, Continuity Equation, Stream Function, Velocity Potential, Flow-nets.

**Dynamics of Fluid Flow:** Euler's Equations of Motion, Bernoulli's equation, Pitot tube, Prandtl Tube, Flow through Openings - Orifices, Mouth pieces etc., Flow through Notches Weirs, Empirical formulae.

**Unit - 3**

**Dimensional Analysis & Model Study:** Units and Dimensions, Dimensional Homogeneity, Buckingham-II-Theorem, Dimensionless Numbers, Principles of Similitude & Applications.

**Unit - 4**

**Flow Through Pipes:** Laminar Flow, Flow between Parallel Plates, Measurement of Viscosity, Reynold's experiment, Turbulent flow in Pipes, Solution of Pipe Flow Problems, Flow in Pipe Network- Hardy Cross Method, Losses in Pipes, Measurement of Pipe Flow - Orifice, Nozzle, Bend Meters, Rotameters. Concept of Water Hammer and Surges.

**Unit - 5**

**Flow Through Open Channels:** Classification, Geometric Elements, Continuity, Energy and Momentum Equations, Pressure, Velocity Distributions, Uniform flow, Concept of Normal Depth, Chezy, Manning and other formulae. Best Hydraulic Sections, Specific Energy, Specific Force, Hydraulic Jump and its characteristics, Gradually Varied Flow, Surface Profiles, Dynamic Equations,

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Theory examination of 3 Hours duration and Practical Viva Voice Examination by

external examiner

**Books & References Recommended:**

1. Nagaratnam S., Fluid Mechanics, Khanna publishers, 5th Edition, 2005
2. Jain A.K., Fluid Mechanics, Khanna publishers, 5th Edition, 2014
3. Subramanyam K., Fluid Mechanics, McGraw Hill Education (India) Private Limited, 9th edition 2001
4. Modi P.N. & S.M. Seth, Hydraulics & Fluid Mechanics, Standard Book House, New Dehli, 20th Edition, 2015

**Reference Books**

1. Chow V.T., Open Channel Hydraulics, The Blackburn Press, 6th Edition
2. Rangaraju K.G., Flow Through Open Channels, Tata McGraw Hill, New Dehli, 2nd Edition, 1993

**CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT**  
**B. E. II Year (4YDC)**  
**CE21805: FLUID MECHANICS LABORATORY**

**CREDITS:**

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
					CW	END SEM	SW	END SEM	
-	2	-	-	1					50
					-	-	40	60	

**Pre-requisite:** Concepts of forces & equilibrium, mechanics of solids and basic laws of statics and dynamics.

**Syllabus with Course Outcomes (COs)**

**COURSE OBJECTIVES:**

This course aims to equip students with practical skills in fluid mechanics through hands-on experiments, enabling them to apply theoretical concepts, use measurement instruments, and analyze fluid flow phenomena in engineering contexts.

**COURSE OUTCOMES (CO):**

Students should be able to:

1. Apply Bernoulli's theorem and analyze fluid flow using venturi meters and orifice meters.
2. Evaluate major and minor losses in piping systems for various materials and configurations.
3. Analyze jet impact forces and determine L/D ratios for orifices and mouthpieces.

**Mapping of CO with PO**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	2	-	-	-	-	-	2	-	-	3
<b>CO2</b>	3	3	2	-	-	-	-	-	2	-	-	3
<b>CO3</b>	3	3	2	-	-	-	-	-	2	-	-	3
<b>Target</b>	3	3	2	-	-	-	-	-	2	-	-	3

**Legends**

0 - No Correlation    1 - Low Correlation    2 - Medium Correlation    3 - High Correlation



**COURSE CONTENTS:**

**Practical:**

1. Verification of Bernoulli's theorem.
2. Calibration of venturi meter and orifice meter.
3. To determine pipe friction losses for different materials.
4. To determine minor losses, sudden contraction, bend, elbow, sudden expansion.
5. To determine impact of jet.
6. To determine LD ratio for orifices and mouthpieces.

**Assessment:**

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

**Semester-end:**

Practical examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

**Books & References Recommended:**

1. Nagaratnam S., Fluid Mechanics, Khanna publishers, 5th Edition, 2005
2. Jain A.K., Fluid Mechanics, Khanna publishers, 5th Edition, 2014
3. Subramanyam K., Fluid Mechanics, McGraw Hill Education (India) Private Limited, 9th edition 2001
4. Modi P.N. & S.M. Seth, Hydraulics & Fluid Mechanics, Standard Book House, New Dehli, 20th Edition, 2015

**Reference Books**

1. Chow V.T., Open Channel Hydraulics, The Blackburn Press, 6th Edition
2. Rangaraju K.G., Flow Through Open Channels, Tata McGraw Hill, New Dehli, 2nd Edition, 1993