Vidya Pratishthan's
Kamalnayan BajajInstitute of Engineering and Technology, Baramati.

Faculty of Science and Technology

Board of Studies

Civil Engineering

Syllabus

S.Y. B. Tech. (SEM.-III)
Civil Engineering

(w.e.f. AY: 2025 - 2026)
[2024 pattern]

Syllabus: Second Year (SY B. Tech.) Civil Engineering [2024 patt.]w.e.f. AY:2025-26

SEMESTER-III

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
		TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
BS24201	Mathematics - III	3	-	-	10	30	60			-	100	3	-		3
CE24201	Surveying	3	2	-	10	30	60		30	-	130	3	1		4
CE24202	Geotechnical Engineering	3	2	-	10	30	60			30	130	3	1		4
CE24203	Mechanics of structure	3	2	-	10	30	60			30	130	3	1		4
CE24052	Multi-disciplinary minor	2	2	-	10		60	30		-	100	2	1		3
CE24204	VSEC _AUTO CAD-2D	-	2	1	10			30	30	-	70		1	1	2
CE24205	Community Engineering. Project/ Field Project	-	4	-	10			30		30	70	-	2	-	2
Total		**14**	**14**	**1**	**70**	**120**	**300**	**90**	**60**	**90**	**730**	**14**	**7**	**1**	**22**

BOS
Civil Engineering

DEAN
Academics

DEAN
Autonomy

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VPKBIET BARAMATI * PUNE (MS.)

Vidya Pratishthan's
Kamalnayan BajajInstitute of Engineering and Technology, Baramati.

Faculty of Science and Technology

Board of Studies

Civil Engineering

Syllabus

S.Y. B. Tech. (SEM.-IV)
Civil Engineering

(w.e.f. AY: 2025 - 2026)
[2024 pattern]

Syllabus: Second Year (SY B. Tech.) Civil Engineering [2024 patt.] w.e.f. AY:2025-26																
SEMESTER-IV																
Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits				
		TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	OR	TUT	Total
CE24211	Concrete technology	3	2	-	10	30	60	-	-	30	130	3	1	-	-	4
CE24212	Fluid Mechanics	3	2	-	10	30	60	-	-	30	130	3	-	1	-	4
CE24213	Structural analysis	3	-	-	10	30	60	-	-	-	100	3	-	-	-	3
CE24052	Multi-disciplinary minor	3	2	-	10	30	60	30	-	-	130	3	1	-	-	4
OE240XX	Open Elective	2	-	-	10	-	60	-	-	-	70	2	-	-	-	2
HS24211	Environment Science (All branches)	2	-	-	10	-	60	-	-	-	70	-	2	-	-	2
XX24213	Ability Enhancing Course (Technical English)	1	2		10			30	-	30	70					2
Total		**17**	**8**	**0**	**70**	**120**	**360**	**60**		**90**	**700**	**05**	**01**	-	-	21

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VPKBIET BARAMATI
Affiliated to
S.P.P.U. Pune
Id No. /PU/PN/
Engg /152/2008
PUNE (MS.)

Course Name With Code : Mathematics - III (BS24201)

		Examination Scheme:
Teaching Scheme:	**Credits**	**In-Semester: 30 Marks**
TH: 3 Hrs./Week	**03**	**End-Semester: 60 Marks**
		Activity: 10 Marks

Prerequisites: Differential & Integral calculus, Taylor series, Differential equations of first order and first degree, Fourier series, Collection, classification & representation of data.

Course Objectives: To familiarize the students with concepts and techniques in Ordinary differential equations, Statistics & Probability, numerical methods, and their applications. The aim is to equip them with the strategies to understand advanced-level mathematics and its applications that would enhance analytical thinking power, useful in their discipline.

Course Outcomes (COs): On completion of the course, the learner will be able to

CO1: Apply various numerical methods such as interpolation, differentiation, and integration.

CO2: Develop the concept of numerical methods for solving systems of linear equations, and ordinary differential equations.

CO3: Solve Higher-order linear differential equations and apply them for modeling and analyzing Civil engineering problems.

CO4: Understand the concept of statistical methods correlation and regression.

CO5: Learn the concept of Probability theory and apply it to Engineering problems.

CO6: Solve Partial differential equations such as wave equations and one and two-dimensional heat flow equations.

Course Contents

Unit I: Numerical Interpolation and Integration (7 Hours)

Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formula, Numerical Differentiation.

Numerical Integration: Trapezoidal and Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.

Unit II: Numerical method for Linear Systems and ODE (7 Hours)

System of linear equations: Cholesky, Jacobi, and Gauss-Seidel methods.

Solutions of ordinary differential equations: Euler's, Modified Euler's,Runge-Kutta 4th order methods.

Unit III: Linear Differential Equations (LDE) and Applications (7 Hours)

LDE of n^{th} order with constant coefficients, Complementary Function, Particular Integral, General method, Method of variation of parameters, Cauchy's and Legendre's DE, Modeling of problems on bending of beams, and whirling of shafts.

Unit IV: Statistics and Regression Analysis (7 Hours)

Measures of Dispersion, Moments, Skewness, and Kurtosis. Correlation and Regression Analysis: Least square method, Curve fitting: fitting of straight lines, and parabola.

Unit V: Probability and Probability Distributions (7 Hours)

Probability, Theorems on probability, Random variables, Probability Mass function, Probability Density function, Mathematical Expectation. Probability distributions: Binomial, Poisson, and Normal, Test of hypothesis: Chi-square test.

Unit VI: Applications of Partial Differential Equations (7 Hours)

Basic concepts, modeling of Vibrating String, Wave equation, One and two-dimensional Heat flow equations, method of Separation of variables, use of Fourier series, Applications of PDE to problems of Civil and allied Engineering

Text Books:

1. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill).
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).

Books and Other Resources

1. Advanced Engineering Mathematics, 10e, by Erwin Kreyszig (Wiley India).
2. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
3. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Cengage Learning).
4. Differential Equations, 3e by S. L. Ross (Wiley India).
5. Introduction to Probability and Statistics for Engineers and Scientists, 5e, by Sheldon M. Ross (Elsevier Academic Press).
6. Partial Differential Equations for Scientists and Engineers by S. J. Farlow (Dover Publications, 1993).

Activity:

1. Assignment on each unit.

Course Name with Code: Surveying (CE24211)

Teaching Scheme:	Credits	Examination Scheme:		
TH: 3 Hrs. / week	4	Activity	:	10 Marks
PR: 2 Hrs. / week		In-semester	:	30 Marks
		End semester	:	60 Marks
		PR	:	30 Marks

Prerequisite:

Basic Introduction to Civil Engineering field, Engineering Mathematics

Course Objectives: student should have the capability to

1. To perform and correct surveying measurements
2. To use and adjust leveling and angular measurement instruments
3. To perform plane table, tacheometric and contour surveying
4. To measure angles, perform theodolite traversing, and compute coordinates
5. To set simple circular curves and understand geodetic surveying.
6. To utilize GPS, EDM, Total Station, remote sensing, and drones

Course Outcomes: students will be able to

CO1: Demonstrate various methods of linear and angular measurements

CO2: Analyse different types of surveying data

CO3: Conduct field work and application of scientific methodology in handling field data CO4: Apply various surveying techniques for civil engineering problems

CO5: Analyse curve setting, geodetic surveying, triangulation, and station selection

CO6: Apply GPS, EDM, Total Station, remote sensing, GIS, and drone technology in Civil Engineering

Course Contents

Unit I: Linear Measurements (07 Hours)

Introduction, Principles of surveying, types of errors, ranging, chaining, offsetting, plotting chain survey data, errors in chain and tapes, corrections- length, slope, temperature, pull, sag. Instruments for measuring right angles- open cross staff, optical square, use of prismatic compass, bearing of lines, types of bearings such as Whole Circle Bearing, Quadrantal Bearing, meridian and their types, local attraction, dip, magnetic declination etc. and calculation of true bearings, including numerical of all types.

Unit II: Levelling and Angular Measurements (06 Hours)

(a) Principle Axes of Dumpy Level: study of dumpy level, auto level & digital level, testing and adjustment of axis of bubble tube and line of collimation, rise and fall method, reciprocal levelling, curvature and refraction corrections, distance to the visible horizon.

(b) Theodolite: introduction to 20" Vernier Theodolite, Study of Vernier and Micro Optic Theodolite, Principle Axes of Theodolite: Testing and Permanent adjustments of Transit Theodolite.

Unit III: Plane Table Survey and Tacheometry (07 Hours)

(a) Methods of Plane Table Survey- radiation, intersection, traversing and resection; Two point and Three-point problems and their solutions by different methods, Strength of fix, Lehman's Rules.
(b) Principle of stadia, fixed hair method with vertical staff to determine horizontal distances and elevations of the points. Use of Tacheometry in Surveying, Tacheometric Contour Survey, use of contour maps, direct and indirect methods of contouring. Profile Levelling, Longitudinal Section and Cross-sections, Toposheets.

Unit IV: Theodolite Traversing (06 Hours)

(a) Uses of Theodolite: measurement of horizontal angles, horizontal angles by repetition and by reiteration (errors eliminated), vertical angles, magnetic bearings, prolonging a line, lining in, setting out angles.
(b) Theodolite Traversing: computation of consecutive and independent coordinates, adjustment of closed traverse by Transit rule and Bowditch's rule, Gales traverse table, omitted measurements, area calculation by independent coordinates. Open Traverse- it's uses, measurement of deflection angles using transit theodolite, open traverse survey, checks in open traverse.

Unit V: Curves and Geodetic Surveying (07 Hours)

(a) Curves: Introduction to horizontal and vertical curves, relation between radius and degree of curve, types of curves, notations used and properties of simple circular curves, horizontal curve setting by offsets from a long chord and Rankine's method.
(b) Geodetic Surveying: Objects, Methods in Geodetic surveying, Trilateration, Classification of triangulation systems, Triangulation figures, Strength of figure & derivation for well-conditioned triangle, Selection of stations, intervisibility & height of stations.

Unit VI: Advance Surveying Techniques (06 Hours)

Global Positioning System (GPS): Applications to Civil Engineering, concept of Global Positioning Systems [GPS] and differential GPS, Electromagnetic Distance Meters (E.D.M.) measurement, principle of EDM instruments, Total Station and its uses, fundamental parameters of Total Station, etc. Introduction to remote Sensing and GIS, Introduction to drone.

Text Books:

1. Basak N. N. "Surveying and Levelling", Tata McGraw-Hill Publishing Company Limited.
2. Kanetkar T.P. and Kulkarni S.V. "Surveying and Levelling – Part1", Pune Vidyarthi Griha Prakashan, Pune.
3. Kanetkar T.P. and Kulkarni S.V. "Surveying and Levelling – Part2", Pune Vidyarthi Griha Prakashan, Pune.

Reference Books:

1. Duggal S. K. “Surveying Volume I”, Tata McGraw-Hill Publishing Company Limited.
2. Duggal S. K. “Surveying Volume II”, Tata McGraw-Hill Publishing Company Limited.
3. Bannister A, Raymond S & Baker R. “Surveying”, Pearson Education Ltd.
4. Subramanium R., “Surveying & Levelling”, Oxford University Press.
5. Clark David, “Plane and Geodetic Surveying for Engineers Volume–I”, CBS, 6/E.
6. Clark David, “Plane and Geodetic Surveying for Engineers Volume –II”, CBS, 6/E.
7. Punmia B. C. “Surveying-I”, Laxmi Publications (P) Ltd. New Delhi.
8. Punmia B. C., Jain A, Jain A., “Surveying-II”, Laxmi Publications (P) Ltd. New Delhi.
9. Jensen, John R. “Remote sensing of the environment: An earth resource perspective” 2/e. Pearson Education India, 2009.
10. Reddy, M. Anji. “Geoinformatics for environmental management.” BS publications, 2004.

Surveying Lab

Suggested List of Practical Exercises & Field Projects

Laboratory Outcomes: At the end of the course, the students are able to
CO1: Perform linear, angular and height measurements
CO2: Analyse surveying data
CO3: Select different surveying techniques

Term work

It shall consist of list of practical exercises and projects for surveying as detailed below

a) Perform any 10 Exercises out of 1 to 15 and Any 02 projects:

1. Chain and compass traverse survey
2. Study and use of digital level & auto level to determine elevation of various points
3. Measurement of horizontal and vertical angles by 20’’ transit theodolite
4. Measurement of horizontal angles by repetition method
5. Computation of horizontal distances and elevations by tacheometry
6. Radiation & intersection methods in plane table survey
7. Setting out a given building from a given foundation plan
8. Study and use of one second theodolite and measurement of horizontal angle
9. Setting out a given horizontal angles and measurement of vertical angles using 1’’ or 20’’ second theodolite
10. Setting out a circular curve by Rankine’s method of deflection angles
11. Finding out elevation of high object by trigonometrical levelling using 1’’ or 20’’ second theodolite
12. Study and use of total station
13. Study and use of drone
14. Determination of air base distance using mirror stereoscope
15. Study and use of nautical sextant and measurement of horizontal angles

b) Projects: (Minimum Two)

1. Road project using auto level/ digital level for a minimum length of 200 m including fixing of alignment, profile levelling, cross-sectioning, plotting of L-section and Cross Section. (One full imperial sheet including plan, L-section and any three typical Cross-section.
2. Tachometric contouring project on hilly area with at least two instrument stations about 60 m to 100 m apart and generating contours using both methods, manual as well as using any suitable software such as Autodesk land desktop, Auto-civil, Foresight etc. (minimum contour interval 1 meter).
3. Total Station Traversing.

Practical examination and oral will be based on above term work.

Activity: Perform any 3 activities from 1 to 8 in a group of four students

1. Prismatic Compass and Bearing Measurements: Using a prismatic compass, measure bearings and calculate true bearings, considering local attraction, dip, and magnetic declination.
2. Reciprocal Levelling: Perform reciprocal levelling to determine the difference in elevation between two points across an obstacle and applying corrections for accurate measurements.
3. Theodolite Traversing and Coordinate Computation: Perform theodolite traversing, compute coordinates, and adjustment of a closed traverse using the Transit and Bowditch's rules.
4. Horizontal Curve Setting by Offsets from a Long Chord Method: Setting out a horizontal curve using the offsets from a long chord method.
5. Differential GPS (DGPS) Survey for Accurate Positioning: Perform differential GPS (DGPS) for precise positioning and surveying, including data collection, processing, and analysis.
6. Total Station Survey for Topographic Mapping: Total Station for topographic mapping, including setup, data collection, processing, and analysis.
7. Contouring using Manual and Digital Methods: Create contour maps through manual and digital contouring methods, understanding the principles and applications of contouring in surveying.
8. Creating Thematic Map using QGIS Software: Create a thematic map using QGIS software, including data import, map design, and thematic visualization.

Activity:

Assignment's based on each unit.

Course Name with Code: Geotechnical Engineering (CE24202)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH: 3 Hrs./week	**04**	**Activity: 10 Marks**
PR: 2 Hrs/Week		**In Semester: 30 Marks**
		End Semester: 60 Marks
		OR: 30 Marks

Prerequisite:

1. Fundamentals of Physics,
2. Mathematics,
3. Engineering Mechanics

Course Objectives:

1. To describe soil properties, classification and its behavior under stress.
2. To learn methods for measurements and determination of index & engineering properties of soil.
3. To study the interaction between water and soil and the effects of static vs flowing water on soil strength.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Identify and classify the soil based on the index properties and its formation process.
CO2: Explain permeability and seepage analysis of soil by construction of flow net.
CO3: Illustrate the effect of compaction on soil and identify suitable compaction methods.
CO4: Express shear strength of soil and its measurement under various drainage conditions.
CO5: Evaluate stresses within the soil mass and obtain bearing capacity of foundation.
CO6: Evaluate the earth pressure and analysis of stability of slopes for different types of soils.

Course Contents

Unit I: Introduction and Index Properties (7 Hours)

a) Introduction to Geotechnical Engineering, major soil deposits of India, Soil structure: single grained and honey combed, flocculated and dispersed.

b) Three phase soil system, weight volume relationships, index properties of soil - methods of determination and its significance, I.S. classification of soil.

Unit II: Permeability and Seepage (6 Hours)

Darcy's law, Factors affecting permeability, Determination of permeability by constant head and falling head method as per IS - 2720, field test as per IS – 5529 (part I) - pumping in test and pumping out test. Permeability of layered soils, Seepage forces, General flow equation. Flow net and its application.

Unit III: Compaction (7 Hours)

Introduction, Comparison between compaction and consolidation, Factors affecting compaction, Zero air voids line, Effect of compaction on soil structure. Standard Proctor test and Modified Proctor test as per IS – 2720. Field compaction equipment and methods for cohesive and non-cohesive soils.

Unit IV: Shear Strength of Soil (6 Hours)

Mohr's circle, Mohr-coulomb failure criteria, Effective stress concept. Peak and residual shear strength. Factors affecting shear strength. Laboratory measurement of shear strength by direct, unconfined and triaxial tests under different drainage conditions. Vane shear test.

Unit IV: Stress Distribution and Bearing Capacity (7 Hours)

a) Stress Distribution in Soils: Boussinesq theory- point load and Circular Load, Pressure Distribution diagram on a horizontal and vertical plane, pressure bulb, Westergaard's theory, equivalent point load method, and approximate stress distribution method.

b) Bearing Capacity of Foundation: Types of foundations, Terzaghi's and Meyerhoff bearing capacity analysis, effect of various BC factor on bearing capacity, Shear failure and Settlement criteria, Pile foundation. Use of field test (SPT and Plate Load) data for bearing capacity determination.

Unit IV: Earth Pressure (6 Hours)

a) Lateral Earth Pressure: Earth pressure on vertical wall, effect of wall movement on earth pressure, earth pressure at rest, Rankine's theory, lateral earth pressure due to submerged backfill, backfill with uniform surcharge, backfill with sloping surface, Coulomb's theory.

b) Stability of Slopes: Slope classification, slope failure, modes of failure. Infinite slope in cohesive and cohesion less soil, slope stability analysis using Swedish Slip Circle Method.

Books & Other Resources:

Text books:

1. Gopal Ranjan and A S Rao, "Basic and Applied Soil Mechanics", G. K. Publications pvt. Ltd
2. V. N. S. Murthy, "Soil Mechanics and Foundation Engineering", B.S.Publications (3rd Edition)
3. B. C. Punmia, "Soil Mechanics and Foundation Engineering", Laxmi Publishing Co., New Delhi.
4. Dr. B. J. Kasmalkar ,"Geotechnical Engineering", Pune Vidyarthi Griha Prakashan, 1986

Reference books:

1. Joseph E Bowles, "Engineering Properties of Soils And Their Measurements", McGraw Hill Publications (2001)
2. Lambe and Whitman ,"Soil Mechanics", S. Chand publications (SI Version),(1969).
3. Donald P Coduto, Man-chu Ronald Yeung and William A. Kitch "Geotechnical Engineering Principle and practice", McMillan Press (PHI) (2010)\

4. P Purushothma Raj ,"Geotechnical Engineering", McGraw Hill Publication 4th Edition (2008)
5. Compendium of Indian standards on soil engineering part 1 (1980).

Laboratory Experiments/Assignments

The term work shall consist of a journal giving details of at least 08 out of 13 of the following experiments. Oral Examination would be based on the term work

1. Water content determination by any one method a) Oven drying method, b) Infrared moisture method.
2. Specific gravity determination by Pycnometer /density bottle.
3. Sieve analysis, particle size determination and IS classification as per I.S. Codes.
4. Determination of Consistency limits and their use in soil classification as per I.S. Codes.
5. Field density test by a) Core cutter b) Sand Replacement.
6. Determination of coefficient of permeability by a) Constant head and b) Variable head method.
7. Determination of shear strength parameters of φ soil using direct shear test.
8. Determination of shear strength parameters of C-soil using unconfined Compression Test.
9. Determination of shear strength using lab. vane Shear Test.
10. Determination of shear strength parameters of C- φ soil using triaxial Test.
11. Determination of compaction properties using standard Proctor test / modified Proctor test.
12. Determination of free swell index using differential free swell test.
13. Determination of swell pressure of soil using swelling pressure index test.
14. Exercise on the following topics
    a) Rebhann's and Cullman's graphical method for determination of earth pressure.
    b) Solution of problems on shear strength parameters using graph.

Activity

1.Assignements on each unit.

Course Name with Code: Mechanics of Structure (CE24203)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH: 3 Hrs./week	**04**	**Activity: 10 Marks**
PR: 2 Hrs / week		**In Semester: 30 Marks**
		End Semester: 60 Marks
		OR: 30 Marks

Prerequisite:

1. Centroid and center of Gravity, Trigonometry and Geometry Basics, Beam Reactions

Course Objectives:

1. To study various types of stresses and strains for determinate structural members.
2. To learn the concept of shear force and bending moment diagrams for determinate beams.
3. To learn the concept of shear stress and bending stress for determinate beams.
4. To learn the concept of torsional and principle stresses and strain in structural members.
5. To learn the concept of solving axially and eccentrically loaded Columns.
6. To study the concepts to estimate the slope and deflection of determinate beams.

Course Outcomes:

1. Understand the concept of stress-strain and determine different types of stress, strain in determinate, indeterminate homogeneous and composite structures.
2. Calculate shear force and bending moment in determinate beams for different loading conditions and illustrate the shear force and bending moment diagram.
3. Explain the concept of shear and bending stresses in beams and demonstrate shear and bending
   stress distribution diagram.
4. Use the theory of torsion to determine the stresses in the circular shaft and understand the concept of Principal stresses and strains.
5. Solve axially and eccentrically loaded Columns.
6. Determine the slopes and deflection of determinate beams.

Course Contents

Unit I: Simple Stresses and Strains (7 Hours)

a) Materials used in construction and their nature, Hook's Law, Stress-Strain Diagram for elastic, plastic materials, and brittle material, Idealized stress-strain diagram, Concept of axial stresses, strains, and Elastic constants, Concept of stresses and strains due to temperature change.

b) Stresses, strains, and deformations in determinate and indeterminate structures for homogeneous and concept of composite structures under concentrated loads and temperature changes.

Unit II: Shear Force and Bending Moment Diagram (6 Hours)

Concept of shear force and bending moment, Shear force and bending moment diagrams for determinate beams due to concentrated, uniformly distributed, and couples. Bending moment and loading diagram from given shear force diagram.

Unit III: Shear and Bending Stresses (7 Hours)

a. Shear stresses in beams: Concept of shear, shear stress formula, shear stress distribution for various cross sections, maximum and average shear stress for circular and rectangular sections.

b. Bending stresses in beams: Theory of simple or pure bending, assumptions, flexure formula, bending stress distribution diagrams.

Unit IV: Torsion of Circular Shafts and Principal Stresses and Strains (6 Hours)

a. Torsion of circular shafts: Theory of torsion, assumptions, torsion formula. Stresses, strains, and deformations in determinate and indeterminate shafts of hollow, solid, homogeneous cross-sections subjected to twisting moments. Power transmitted by shafts.

b. Principal stresses and strains: Concept of principal planes and principal stresses, normal and shear stresses on an oblique plane, magnitude, and orientation of principal stresses, and maximum shear stress.

Unit V: Axially and Eccentrically Loaded Columns (7 Hours)

a. Axially loaded columns: Concept of critical load and buckling, Euler's formula for buckling
load with hinged ends, concept of equivalent length for various end conditions, and limitations of Euler's formula.

b. Direct and bending stresses: Direct and bending stresses for eccentrically loaded short columns. Resultant stress diagrams due to axial loads, uni-axial, and bi-axial bending. Concept of the core of section for solid and hollow rectangular and circular sections.

Unit IV: Slope and Deflection of Beams and Trusses (6 Hours)

Slope and deflection of determinate beams by Macaulay's method, Castigliano's first theorem. Joint displacement of determinate trusses by Unit load method.

Books & Other Resources:

Text books:

1. Mechanics of Structures Vol. I &II by S. B. Junnarkar and Dr. H. J. Shah, Twenty second edition, Charotar Publishing House Pvt Ltd.
2. Strength of Materials by R. Subramanian, Oxford University Press.
3. Strength of Materials by S. S. Ratan, Tata McGraw Hill.

Reference books:

1. Elements of Strength of Materials by Timoshenko and Young, East-West Press Ltd.
2. Strength of Materials by F.L. Singer and Andrew Pytel, Harper and Row Publication.
3. Mechanics of Materials by Beer and Johnston, McGraw Hill Publication.
4. Introduction to Mechanics of Solids by E.P. Popov, Prantice Hall Publication.
5. Mechanics of Materials by Gere & Timoshenko, CBC publisher.
6. Elementary Structural Analysis by Norris, Wilbur and Utku, Tata McGraw Hill Publisher.
7. Intermediate Structural Analysis by R. C. Hibbler, Pearson Education Publishers.

Laboratory Experiments:

Oral is based on the term work given below:

1. Tension test on mild and TMT steel.
2. Shear (Single & Double) test on mild steel.

3. Impact (Izod & Charpy) test on mild steel and brass.
4. Compression test on timber (Parallel & Perpendicular).
5. Bending test on timber and plywood.
6. Field tests on bricks.
7. Water absorption test on bricks.
8. Efflorescence test on bricks.
9. Compressive strength test on bricks.

Activity:

1. Assignments on each unit.

Course Name With Code: Concrete Technology (CE24201)

Teaching Scheme:	Credits	Examination Scheme:
TH: 3 Hrs/week	04	Activity: 10 Marks
PR: 2 Hrs/Week		In Semester: 30 Marks
		End Semester: 60 Marks
		OR: 30 Marks

Prerequisite:

Knowledge of Building construction materials

Course Objectives:

1. To know properties of various ingredients of concrete and concept of mix design.
2. To learn the behavior and properties of concrete in fresh and hardened state.
3. To understand special concrete and their applications.
4. To understand the durability aspects and preventive measures to enhance the life of concrete.

Course Outcomes: At the end of the course, the students are able to,

1. Determine properties of various ingredients of concrete.
2. Evaluate various factors affecting quality of fresh concrete.
3. Evaluate various factors affecting quality of hardened concrete.
4. Design concrete mix as per the field requirement using various codes.
5. Get acquainted to concreting equipment's, techniques and different types of special concrete.
6. Predict deteriorations in concrete and get acquainted to various repairing methods and techniques.

Course Contents

Unit I: Ingredients of Concrete (7 Hours)

Cement: Manufacture of Portland cement, chemical composition, hydration of cement, classification and types of cement, tests on cement. Aggregate: Classification of aggregate, physical and mechanical properties of aggregate, deleterious materials in aggregate, alkali- aggregate reaction, Fineness and gradation of aggregates using sieve analysis, tests on aggregates. Water and admixture: Quality of water for use in concrete, role of admixture, classification and types of admixtures like accelerators, retarders, plasticizers, super plasticizers, mineral admixtures-fly ash, silica fume, ground granulated blast furnace slag.

Unit II: Fresh Concrete (7 Hours)

Workability: Factors affecting workability, measurement of workability, segregation andbleeding of concrete. Process of manufacturing fresh concrete: batching, mixing, transportation, compaction, curing of concrete, curing methods, influence of temperature, maturity rule. Tests on fresh concrete: Workability by slump cone, compaction factor,Vee-Bee consist meter and flow table apparatus, Effect of admixture on workability of concrete and optimum dosage of admixture by Marsh cone test.

Unit III: Hardened Concrete (7 Hours)

Strength of concrete, factors affecting strength, stress-strain relationship, relation between tensile

and compression strength, impact strength, abrasion resistance, creep and shrinkage. Destructive tests: compression strength, flexural strength, indirect tensile strength, core test. Nondestructive tests: rebound hammer, ultrasonic pulse velocity and pullout test.

Unit IV: Concrete Mix Design (6 Hours)

Concept and objectives of concrete mix design, factors affecting the mix design, quality control, acceptance criteria, Grade designation and IS requirements as per IS 456 (Exposure conditions, minimum & maximum cement content and maximum W/C ratio. IS code method and DOE method (with and without mineral admixture), Use of spreadsheet/programming/ software for concrete mix design.

Unit V: Concreting Equipment's, Techniques and Special concretes (6 Hours)

Concreting Equipment's and Techniques: Batching plants, concrete mixers, hauling pumps, concrete vibrators and compaction equipment. Special concreting techniques: ready mix concrete, under water concreting, roller compacted concrete, cold and hot weather concreting. Special concretes: Light weight concrete, foam concrete, self-compacting concrete, fiber reinforced concrete, geopolymer concrete and Ferro cement technique.

Unit VI: Deterioration and Repairs in Concrete (6 Hours)

Deterioration: Durability, factors affecting the durability of concrete, Permeability, sulphate attack, acid attack, chloride attack, corrosion of reinforcement, carbonation of concrete.Repairs: Symptoms and diagnosis of distress, evaluation of cracks, selection of repair procedure, repair of defects using various types and techniques: shotcrete and grouting. Introduction to retrofitting of concrete structures by fiber reinforced polymer (FRP), polymer impregnated concrete. Corrosion monitoring and preventive measures.

Books & Other Resources:

Text books:

1. Concrete Technology by M. S. Shetty, S Chand,New Delhi-110055.
2. Concrete Technology by M. L. Gambhir, Tata McGraw-Hill.
3. Concrete technology by A. M. Neville, J.J. Brooks, Pearson.

Reference books:

1. Concrete Technology by A. R. Shantakumar, Oxford University Press, 2018.
2. Properties of Concrete by A. M. Neville, Longman Publishers.
3. Concrete Technology by R.S. Varshney, Oxford and IBH.
4. Microstructure and Properties of Concrete by P. Kumar Mehta, Prentice Hall.
5. Concrete Mix Design by A. P. Remideos, Himalaya Publishing House.
6. Concrete Structures, Repair, Rehabilitation and Retrofitting by J. Bhattacharjee, CBS Publishers & Distributors Pvt. Ltd.
7. Durability Design of Concrete Structures, by A. Sarja and E. Vesiari, E & FN Spon Publication, 1996.

IS Codes: Latest revised editions of IS codes: IS 456, IS 269, IS 1489, IS 4031, IS 383, IS 2386, IS 9103, IS 516, IS 1199, IS 10262, SP 23.IS 13311.

Concrete Technology Lab

Laboratory Experiments/Assignments

Oral is based on the term work. It consists of a journal giving details of all the following experiments.

1. Fineness test on cement.
2. Standard consistency, Initial and final setting time and Soundness test on cement.
3. Compressive strength of cement.
4. Fineness modulus, silt content and specific gravity and bulk density test on fine aggregate.
5. Fineness modulus, water absorption and specific gravity and bulk density test on coarse aggregate.
6. Concrete mix design by IS code method using spread sheet.
7. Workability of concrete with and without admixture by slump cone, compaction factor method.
8. Compressive strength test of concrete on cubes by destructive and non-destructive method (Rebound Hammer and Quality of concrete by ultra-sonic pulse velocity).
9. Compressive strength test of concrete on cylinder.
10. Split tensile strength and flexural strength of hardened concrete.
11. Site visit to RMC plant.

Activity:

1. Assignment on each unit.

Course Name With Code: Fluid Mechanics (CE24214)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH: 3 Hrs./week	**4**	**Activity: 10 Marks**
PR: 2 Hrs./week		**In semester: 30 Marks**
		End Semester: 60 Marks
		OR: 30 Marks

Prerequisite:

1. Engineering Physics, Engineering Mathematics and Engineering Mechanics

Course Objectives:

1. To understand conceptually the properties of fluid, fluid statics, fluid kinematics and fluid dynamics, dimensional analysis, boundary layer theory, open channel flow and fluid flow around submerged objects.
2. Apply principles of continuity, mass, momentum and energy as applied to fluid at rest as well as for fluid flow in open channel.
3. To apply fundamental principles of fluid mechanics for the solution of practical Civil Engineering problems.

Course Outcomes: After Completion of course students will be able to

CO1: Solve the problems related to fluid statics.

CO2: Solve the problems related to fluid kinematics and dynamics.

CO3: Apply the concept of dimensional analysis and boundary layer theory for solving practical Problems with fluid flow.

CO4: Solve the problems on fluid flow through pipes.

CO5: Design the most economical open channel.

CO6: Estimate the GVF profile and calculate drag force and lift force of the fluid flow around Objects.

Course Contents

Unit I: (7 Hours)

Introduction: Fluid & Fluid Mechanics, Applications in Civil Engineering, Physical properties of fluids-mass density, unit weight, specific gravity, compressibility, bulk modulus, surface tension, viscosity, Newton's law of viscosity, Dynamic and kinematic viscosity, classification of fluids.

b. Fluid Statics: Measurement of pressure by manometers and gauges, Hydrostatic law, pressure at a point, Pascal's law, Pressure head, Atmospheric pressure, Absolute and gauge pressure, Total pressure and center of pressure, Pressure diagram, Determination of Total pressure on plane and curves surfaces (water tanks, earthen and gravity dams, spillways, spillway gates, sluice gates, sluice valves). Buoyancy and Floatation: Introduction, Buoyant force and center of buoyancy,

Archimedes Principle, Principle of floatation, Metacenter and metacentric height, Equilibrium of floating bodies.

Unit II: (6 Hours)

a. Fluid kinematics: Types of flow-steady & unsteady, uniform & non-uniform, laminar & turbulent, one, two & three dimensional, rotational & irrotational, compressible and incompressible, Streamline, Streak line, Path line, Stream tube, Stream function, Velocity potential, Flow net- uses, limitations & methods of drawing, Discharge, Continuity equation of fluid flow.

b. Fluid Dynamics: Euler's equation of motion, Bernoulli's equation, assumption and limitations, different forms of energy heads, loss of head, Modified form of Bernoulli's theorem, Energy gradient line and Hydraulic gradient line, Impulse momentum equation, applications of Bernoulli's equation.

Unit III: (7 Hours)

a. Dimensional Analysis and Model Studies:

Dimensional homogeneity, dimensional analysis using Buckingham's π theorem method, geometric, kinematic and dynamic similarity, important dimensionless Numbers (Reynolds No., Froude No., Euler No., Mach no. and Weber No) and their significance, Model Laws (Reynold's law and Froude's Law).

b. Boundary layer Theory: Concept, development of boundary layer on flat plate and factors affecting growth, Boundary layer thickness, displacement thickness, momentum and energy thickness, Laminar sub layer, Local and mean drag coefficients, Hydrodynamically smooth and rough boundary, boundary layer separation and methods to control separation.

Unit IV: (6 Hours)

a. Laminar & Turbulent Flow through Pipe: Characteristics of laminar flow, laminar flow through a circular pipe: Hagen Poiseuille equation, Characteristics of turbulent flow, instantaneous velocity, temporal mean velocity, scale of turbulence and intensity of turbulence, Prandtl's mixing length theory, velocity distribution equation, variation of friction factor for laminar flow and for turbulent flow, resistance to flow in smooth and rough pipes, friction factor for commercial pipes, Moody's diagram.

b. Flow through pipes: Major losses and minor losses, Darcy Weisbach equation, Factor affecting friction factor, Coefficient of friction for commercial pipes, Moody's diagram, Flow through simple pipes, Flow through pipes in series, Flow through pipes in parallel, siphons pipes, Equivalent pipes, Water hammer in pipes-causes, effects & remedial measures

Unit V: **(7 Hours)**

a. Introduction to Open channel flow: Classification of channels, channel flows and geometric elements of channel, Basic governing equations of Channel flow, Velocity distribution in open channel flow.

b. Uniform flow in open channels: Uniform flow formulae: Chezy's and Manning's formulae; Factors affecting Manning's roughness coefficient; Important terms pertaining to uniform flow, Uniform flow computations. Most efficient channel sections: rectangular, triangular, and trapezoidal. Depth-Energy Relationships in Open Channel Flow, Critical depth, Conditions for occurrence of critical flow; Froude's number, flow classification based on it, Important terms pertaining to critical flow

Unit VI: **(6 Hours)**

a. Gradually Varied Flow (GVF) in Open Channel Flow: Theory and Computation Basic Assumptions of GVF; Dynamic equation of GVF - Alternative forms; Classification of channel bed slopes, Various GVF profiles, Methods of GVF computations: Direct Step method. (Mention of other method).

b. Flow around immersed objects: Concept of boundary layer theory, Practical problems involving flow around immersed objects, Drag and lift-definition & expression, Types of drag, Pressure drag on flat plate, Streamline & bluff bodies.

Books & Other Resources:

Textbooks:

1. Hydraulics & Fluid Mechanics, Modi and S.M. Seth, 14th edition, Standard Book House, New Delhi,2009.

2. Fluid Mechanics, Hydraulics and Hydraulic Machines, Dr. A.K. Arora, 9th edition Standard Publishers Distributors, New Delhi,2009.

Reference books:

1. 1000 Solved Problems in Fluid Mechanics, K. Subramanya, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008.

2. Fluid Mechanics through Problems, R.J. Gadre, New Age International Publishers, New Delhi, 2011.

3. Fluid Mechanics & its Applications, Vijay Gupta & Santosh K. Gupta, 2nd edition, New Age International Publishers, New Delhi, 2011.

4. Fluid Mechanics & Machinery, Agrawal S.K., Tata McGraw Hill Publishing Co. Ltd, 1997. Course.

Suggested List of Laboratory Experiments (Perform any 8)

1. Measurement of viscosity of fluid by Redwood viscometer.
2. Experimental verification of Bernoulli's theorem with reference to loss of energy.
3. Calibration of Venturi meter / Orifice meter.
4. Determination of Darcy-Weisbach friction factor (f) for a given pipe and study of variation of (f) with Reynolds Number (Re).
5. Study of Uniform Flow Formulae for Open channel.
6. Flow around a Circular Cylinder/Aero foil.
7. Determination of Minor Losses in pipes.
8. Calibration of Rectangular and Triangular Notch.
9. Determination of Stability of Floating Bodies using Ship Model.
10. Drawing Flow net by Electrical Analogy for flow below Weir (with & without sheet pile).
11. Study of Measurement of Pressure using different Pressure Measuring Devices (including Transducers /state of arts Digital Instruments also).

B) Exercises: The first exercise is compulsory.

1. Analysis of pipe network using Hardy Cross Method (Minimum two loops) – both by hand calculations and using computer any language/software solution.
2. Developing a Demo Model related to any fluid flow phenomenon (physical model/soft model).
3. Demonstration of any Software related to Fluid Mechanics/Hydraulics.
4. GVF computation using any computer Language/Software

C) Site visit: Report on Site visit to any fluid structure or research institute.

Oral is based on the above laboratory work.

Activity:

Assignment on each unit.

Course Name with Code: Structural Analysis (CE23214)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH: 3 Hrs./week	**3**	**Activity : 10 Marks**
		In-semester : 30 Marks
		End semester : 60 Marks

Prerequisite:

Fundamentals of Physics, Mathematics, Engineering Mechanics and Mechanics of Structures.

Course Objectives: student should have the capability to

To create a foundation for analyzing real life structures by imparting knowledge about various methods involved in the analysis of determinate and indeterminate structures.

Course Outcomes: students will be able to

CO1: Understand the basic concept of static and kinematic indeterminacy and analysed two hinged arches.

CO2: Able to draw influence line diagrams.

CO3: Implement application of the slope deflection method to beams and portal frames.

CO4: Analyses beams and portal frames using moment distribution method.

CO5: Analyses beams and portal frames using matrix method.

CO6: Apply the concepts of plastic theory in the analysis of steel structures and perform approximate analysis multi-storey multi-bay portal frames.

Course Contents

Unit I: Fundamentals of structure and analysis of two hinged arches (7 Hours)

Types and classification of structures based on structural forms, concept of indeterminacy, static and kinematics degree of indeterminacy.

Analysis of Two-Hinged arches, calculation of S.F., B.M and normal thrust.

Unit II: Influence line diagram (6 Hours)

Influence line for rolling loads on beams with concentrated and uniformly distributed loads, for reactions, maximum B.M. and S.F.D.,Influence lines for forces in members of simple trusses

Unit III: Slope-Deflection Method (7 Hours)

Slope-deflection equations, equilibrium equation of Slope-deflection method, application of Slope deflection method to beams with and without joint translation and rotation, yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram.

Sway analysis of rigid joint rectangular single bay single storey portal frames using Slope deflection method. (Involving not more than three unknowns)

Unit IV: Moment Distribution Method (6 Hours)

Stiffness factor, carry over factor, distribution factor, application of Moment distribution method of analysis to beams with and without joint translation and yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram.

Sway analysis of rigid jointed rectangular single bay single storey portal frames using Moment distribution method.

Unit V: Matrix Method **(7 Hours)**

Fundamental concepts of flexibility and stiffness, relation between them. Stiffness method of Analysis-Structure approach only. Application to beams (Involving not more than three unknowns).

Application of Stiffness structure approach to rigid jointed rectangular portal frames (Involving not more than three unknowns).

Unit VI: Plastic Theory and Analysis of multi-storied multi-bay 2-D rigid jointed frames **(6 Hours)**

Introduction to plastic hinge, load factor, shape factor, type of mechanisms and failures calculation of plastic moment capacity (Mp).

Analysis of multi-storied multi-bay 2-D rigid jointed frames by Portal method.

Text Books:

1. Theory of Structures by S. Ramamrutham and R. Narayan, Dhanpat Rai Publishing Company (P) Ltd.
2. Structural Analysis-I & II by S. S. Bhavikatti, Vikas Publishing House Pvt. Ltd.
3. Structural Analysis: A Matrix Approach by G.S.Pandit and S. P. Gupta, Tata McGraw Hill Education Pvt. Limited.

Reference Books:

1. Timoshenko S. P. & Young D.H. "Theory of Structures; International edition", McGraw Hill, 1965.
2. C.S.Reddy "Basics Structural Analysis" McGraw Hill 3rd edition 2010.
3. Jain, O.P. & Arya, A.S. "Theory and Analysis of Structures; Vol. I & II", Nemchand Brothers; Roorkee.
4. Meghre, A.S.; &Deshmukh, S.K. "Matrix Methods of Structural Analysis (1st Edition)", Anand; Charotar Publs, 2003.

Activity:

1.Assignments on each unit.