Syllabus

For

4-Years B. Tech. in Civil Engineering

3rd to 8th Semester

Effective from 2017-2018 Academic Sessions

Department of Civil Engineering

National Institute of Technology Sikkim

South Sikkim - 737 139

CE13106 MATHEMATICS III

L	T	P	C
3	1	0	4

Prerequisite: MA12101 Mathematics II
Total hours: 40

Module 1 (12 hours)
Complex Analysis
Complex functions, Derivative, Analytic function, Cauchy- Reimann equations, Line integral in the Complex plane, Cauchy's Integral Theorem, Cauchy's Integral formula, Derivatives of analytic functions. Power series, Taylor series and Maclaurin's series, Laurent's series, Singularities and Zeros, Residue integration method.

Module 2 (9 hours)
Matrix Theory
Minimal and characteristic polynomials, Jordon canonical form, Caley-Hamillton theorem and its applications, Complex matrices, Types of matrices, linear transformation, Reduction to diagonal form - Reduction of a quadratic form to canonical form.

Module 3 (9 hours)
Optimization Techniques
Introduction to Linear Programming Model, Graphical method, Simplex Method, Nonlinear Optimization, Lagrange Method, Karush–Kuhn–Tucker conditions.

Module 4 (10 hours)
Statistics
Definitions of random sample, parameter and statistic, sampling distribution of a statistic, sampling distribution of sample mean, standard errors of sample mean, sample variance and sample proportion. Null and alternative hypotheses, level of significance, Type I and Type II errors, their probabilities and critical region. Large sample tests, use of CLT for testing single proportion, difference of two proportions, single mean, difference of two means, standard deviation and difference of standard deviations by classical and p –value approaches.

References:

1. G. B. Thomas Jr. and R. L, Finney, Calculus and Analytic Geometry, 9th edition, Pearson Education, India, 1996.
2. J. W. Brown and R.V. Churchill, Complex Variables and Applications, 7thedn., Mc-Graw Hill, 2004.
3. G. Strang, Linear Algebra and Its Applications, 4thedn. Brooks/Cole India, 2006.
4. H. A. Taha, Operation Research: An Introduction, 9th edition, Dorling Kindersley, Pearson.
5. S.M. Ross, Introduction to Probability and statistics for Engineers, 3rd edition, Academic Press, Delhi, 2005.
6. J.H. Mathews and R.W. Howell, Complex Analysis for mathematics and engineering, 3rdedn.,Narosa, 1998.
7. Dennis G. Zill and Patrick D. Shanahan, A first course in Complex analysis with applications, 2ndedn., Jones and Bartlett, 2010.

CE13101 MECHANICS OF SOLIDS

L	T	P	C
3	1	0	4

Prerequisite: ME12101 Engineering Mechanics
Total hours: 42

Course Objectives:

1. To learn the fundamentals of deformable body mechanics in general and strength of material in particular.
2. To study the internal effects produced and deformations of bodies caused in structural elements by externally applied forces.
3. To gain insight into the strain energy concepts and statically indeterminate problems.
4. To introduce the concepts of elastic stability and buckling of bars
5. To expose the students to the basics of thin and thick cylinders subjected to pressure.
6. Finally, to understand the strength characteristics of different materials and structural members subjected to shear, torsion and bending.

Module 1 (9 hours)

Tension, compression & shear: types of external loads – self weight – internal stresses – normal and shear stresses – strain – Hooke's law – Poisson's ratio – relationship between elastic constants – stress strain diagrams working stress – elongation of bars of constant and varying sections – statically indeterminate problems in tension and compression – assembly and thermal stresses – strain energy in tension, compression and shear.

Module 2 (14 hours)

Analysis of stress and strain: stress on inclined planes for axial and biaxial stress fields - principal stresses - Mohr's circle of stress - principal strains - strain rosette – principal stress/strain problem as an eigenvalue problem.

Bending moment and shear force: different types of beams - shear force and bending moment diagrams for simply supported overhanging and cantilever beams - relationship connecting intensity of loading, shearing force and bending moment - shear force and bending moment diagrams for statically determinate plane frames.

Review of Truss Analysis: method of Joint and Method of Section.

Module 3 (9 hours)

Stresses in laterally loaded symmetrical beams: theory of simple bending - limitations - bending stresses in beams of different cross sections - moment of resistance - beams of uniform strength - beams of two materials - shearing stresses in bending - principal stresses in bending - strain energy due to bending.

Unsymmetrical bending: shear flow - shear centre - determination of shear centre for simple sections.

Module 4 (10 hours)

Theory of columns: axial loading of short strut – long columns – differential equation of the elastic curve – Euler's formula – eccentric loading – direct and bending stresses – buckling load as an eigenvalue problem.

Torsion: torsion of circular solid and hollow shafts – power transmission – strain energy in shear and torsion – close coiled and open coiled helical springs.

Thin and thick cylinders: Lame's equation - stresses in thick cylinders due to internal and external pressures – compound cylinders - shrink fit - wire wound pipes and cylinders.

References:

1. Gere, J.M., Mechanics of Materials, Thomson, Singapore, 2001.
2. Popov, E.P., Mechanics of Materials, Prentice Hall India, New Delhi, 200
3. Timoshenko, S.P., and Young, D.H., Elements of Strength of Materials, East West Press, New Delhi, 2003.
4. Beer, F.P and Johnston, E.R., Mechanics of Materials, Tata Mcgraw hill, New Delhi, 2005
5. Hearn,E.J., Mechanics of Materials Pergamon Press, Oxford 1982.

Course Outcomes (COs):

1. Provide quick solutions to elementary problems of strength of materials.
2. Develop elementary skills of working stress design
3. Acquire all necessary fundamentals needed for pursuing courses on structural analyses and design

CE13102 SURVEYING I

L	T	P	C
3	0	0	3

Prerequisite: Nil
Total hours: 42

Course Objectives: To impart knowledge about the surveying theories and practices like chain surveying, compass surveying, leveling, theodolite survey and tachometric surveying.

Module 1 (10 hours)
Importance of surveying, types of surveying, principle of surveying, provision of control, conventional signs, scales (plain and diagonal), plan and map.
Chain survey, instruments, principles of chain survey, chaining and ranging, survey stations and lines, errors in chaining, chaining on uneven ground, chaining on sloping ground, basic problems in chaining, obstacle in chaining, field book entry, standard conventional symbols for different objects.

Module 2 (8 hours)
Compass survey, prismatic compass and surveyor's compass, whole circle and reduced bearing, true and magnetic bearing, magnetic meridian and magnetic bearing, dip and declination, local attraction.
Traversing, plotting, error of closure graphical and analytical adjustments.
Plane table survey, instruments, methods of plane tabling, orientation, advantages and disadvantages of plane tabling, two point problem and three point problem, errors in plane tabling.

Module 3 (10 hours)
Levelling, objects and use of levelling, equipment, mean sea level, reduced level, bench marks, temporary and permanent adjustments, methods of leveling, level book and computation, missing data, curvature and refraction correction, reciprocal leveling, fly leveling, longitudinal levelling, contour survey, characteristics of contour, uses of contour, methods of contour survey and plotting of contour, areas and volumes, area from latitude and departure, uses of planimeter.

Module 4 (14 hours)
Theodolite surveying, study of theodolite, temporary and permanent adjustments, measurement of horizontal angles, measurement of vertical angles, errors and its elimination, theodolite traversing, calculation of coordinates, balancing of traverse, traverse table.
Tacheometric surveying, instruments used in tacheometry, principles of tacheometry, determination of tachometry constants, methods of tacheometry, stadia system, tangential system, various methods in trigonometric leveling.
Introduction to total station.
Survey adjustments and theory of errors, laws of accidental errors, probability curve, principle of least squares, laws of weights, probable error, normal equation, angle adjustment, station adjustment, figure adjustment, adjustment of triangles, adjustment of a geodetic quadrilateral.

References:

1. Surveying and Levelling by N.N.Basak, TMH Publication
2. Surveying by B.C. Punamia, A.K. Jain and A.K. Jain, Vol. 1, Laxmi Publications (P) Ltd., New Delhi
3. Surveying and levelling by T.P.Kanetkar and S. Kulkarni, Vol-I
4. Surveying by K.R. Arora, Standard Book House, Delhi
5. S.K.Duggal, Surveying, Vol-I, TMH Publications, New Delhi

Course Outcomes (COs): The students would be able to know about

1. chain surveying
2. compass surveying
3. method of traversing to conduct survey
4. different leveling technics
5. plane table survey procedures
6. survey technics using theodolite
7. tachometric surveying

CE13103 CONCRETE TECHNOLOGY

L	T	P	C
2	0	0	2

Prerequisite: NIL
Total hours: 28

Course Objectives:

1. To understand the properties of ingredients of concrete
2. To study the behaviour of concrete at its fresh and hardened state
3. To study about the concrete design mix
4. To know about the procedures in concreting
5. To understand special concrete and their use

Module 1 (7 hours)

Introduction - Concrete materials - Cement: Physical tests on cement - Concrete materials - Tests on aggregates - Quality of Water for mixing and curing - use of sea water for mixing concrete.

Module 2 (6 hours)

Admixtures - accelerating admixtures - Retarding admixtures - water reducing admixtures - Air entraining admixtures - coloring agent - Plasticizers. Batching - Mixing -Transportation - Placing of concrete - curing of Concrete.

Module 3 (8 hours)

Mix Design - factors influencing mix proportion - Mix design by ACI method and I.S. code method - Design of high strength concrete. Strength of Concrete - Shrinkage and temperature effects - creep of concrete - permeability of concrete - durability of concrete - Corrosion - Causes and effects - remedial measures- Thermal properties of concrete - Micro cracking of concrete.

Module 4 (7 hours)

Special Concrete - lightweight concrete - Fibre reinforced concrete - Polymer-polymer modified concrete - Ferrocement - Mass concrete - Ready mix concrete- Self compacting concrete- Quality control - Sampling and testing-Acceptance criteria.

References:

1. Shetty, M.S., Concrete Technology, Theory & Practice, S.Chand and Co, 2004.
2. Gambhir, M.L., Concrete Technology, Tata McGraw Hill, 2004.
3. Nevile, Properties of Concrete, Longman Publishers, 2004.
4. Santakumar A.R., Concrete Technology, Oxford University Press, New Delhi, 2007.

Course Outcomes (COs):

1. Test all the concrete materials as per IS code.
2. Design the concrete mix using ACI and IS code methods.
3. Determine the properties of fresh and hardened of concrete.
4. Design special concretes and their specific applications.
5. Ensure quality control while testing/ sampling and acceptance criteria.

CE13104 CIVIL ENGINEERINGMATERIALS

L	T	P	C
2	0	0	2

Prerequisite: NIL
Total hours: 28

Course Objectives:

1. To identify and characterize building materials
2. To understand the manufacturing process of bricks and cement
3. To identify the methods for preservation of timber and metals
4. To understand the use of non-conventional Civil Engineering materials

Module 1 (7 hours)

Building stones: Classification of stones- Characteristics of good building stones, important types of building atones, their properties and stones and uses.

Brick & other clay products: Composition of brick-earth, manufacturing process of bricks, characteristics of good building bricks, classification and testing of bricks, special types of bricks such as AAC blocks, interlocking bricks, etc., and their uses. Types of tiles and their use in buildings. Terracotta, stoneware.

Module 2 (7 hours)

Lime & cement: IS classification of lime and uses, flow diagram of manufacturing process of cements, chemical composition of cement, IS specifications and tests on Portland cement, different types of cements and their uses. Mortar & concrete: Preparation of cement mortar and concrete, proportion of mortars and concrete for different types of works, properties of concrete in plastic and hardened stages, factors affecting strength of concrete, types of concrete and their specific use. Introduction to Ceramic materials and their use as building materials.

Module 3 (7 hours)

Timber & wood based products: Classification of timber trees, cross section of exogenous tree, hard wood and soft wood, seasoning of timber, important types of timber and their uses, ply wood and its uses.

Module 4 (7 hours)

Steel, Aluminum & Plastics: Types of steel-mild steel, high carbon steel, high strength steel-properties and uses, commercial forms of steel and their uses. Properties and commercial use of Plastics as building material.

References:

1. Rangwala, S. C., Engineering Materials, Charotar Publishing House, 1992.
2. Punmia, B. C., Building Construction, LaxmiPubllications, New Delhi, 1999.
3. Rangwala, S. C., Building Construction, Charotar Publishing House, 1992.
4. Huntington, W. C., Building Construction, John Wiley, New York, 1959.
5. Shetty, M. S., Concrete Technology, S.Chand& Co., New Delhi, 1992,
6. Varghese, P C., Building Materials Prentice Hall of India, 2006

Course Outcomes (COs):

1. Identify and characterize building materials
2. Understand the manufacturing process of bricks and cement
3. Identify the methods for preservation of timber and metals
4. Understand the use of non-conventional Civil Engineering materials

CE13105 FLUID MECHANICS

Prerequisite: NIL
Total Hours: 42

L	T	P	C
3	0	0	3

Course Objectives:
To familiarize the students with fluid properties and their relationships with kinematic and dynamic characteristics of fluids, design pipe system and study of open – channel hydraulics for understanding the flows in river and channels.

Module I (11 hours)

Properties of Fluid: Surface tension, viscosity – Ideal and real fluids, Newtonian and non-Newtonian fluids, Incompressible and compressible fluids.

Fluid pressure and Hydrostatics: Pressure at a point, Pascal's law etc.

Manometer and Mechanical Gauges: Total pressure and centre of pressure on plane and curved submerged bodies.

Buoyancy: Centre of buoyancy, Metacentric height.

Module II (10 hours)

Kinematics of fluid flow: Types of flow, Continuity equation, Velocity potential function and Stream Function.

Dimensional Analysis and Hydraulic Similitude: Dimensional Analysis, Buckingham's theorem, important dimensionless numbers and their significance, Geometric, dynamic and dynamic similarities, Model Analysis.

Module III (10 hours)

Dynamics of fluid flow: Euler's Equation of motion, application of momentum and Bernoulli's equation, Flow through Orifice, Mouth piece, Notches and weirs

Flow through pipes: Laminar and turbulent flow in pipes, concept of losses, flow in sudden expansion and contraction, minor losses in fittings.

Boundary Layer Flow: Boundary layer concept, drag coefficients, separation of boundary layer.

Module IV (11 hours)

Introduction of open channel flow: Critical depth, Concepts of specific energy and specific force, application of specific energy.

Uniform Flow: Chezy's and Manning's equations for uniform flow in open channel, Velocity distribution, most efficient channel section.

Hydraulic Jump, Surges, Water Waves: Classical hydraulic jump, Evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds.

Reference:-

1. Engineering Fluid,Garde, R.J. and Nem Chand & Bros Mechanics A.G. MirajgaokerRoorkee, 1983.
2. Fluid Mechanics,Garde, R.J. Wiley Eastern Limited through Problems New Delhi, 1989.
3. Elementary Mechanics of Fluids, Hunter Rouse. John Wiley & Sons, Inc.,1946
4. Mechanics of Fluids,L.H.Shames. Mc Graw Hill, Int. Student, Education
5. Fluid Mechanics and its Applications, Vijay Gupta and S.K.Gupta Wiley Eastern Ltd
6. Fluid Mechanics, Streeter and Wylie, E.B, V.L Mc Graw Hill, New York, 8th Ed., 1985.
7. Experimental Fluid Mechanics Asawa, G.L Vol 1, Nem Chand and Bros., 1992.
8. Fluid Mechanics and Hydraulic Machines, R.K.Bansal,Laxmi Publication Pvt. Ltd., 2005
9. Open Channel Hydraulics, VenTe Chow, McGraw-Hill, New York, 1959
10. Open Channel Flow, F. M. Henderson, McGraw-Hill, New York, 1966
11. Hydraulics and Fluid Mechanics including Hydraulics Machines, P. N. Modi and S. M. Seth, Standard Book House, 2017
12. Flow in Open Channels, K. Subramanya, McGraw-Hill, 5th Edition, 2019.

Course Outcome:

The students will be able to

1. Estimate hydrostatic forces on structures.
2. Estimate forces due to fluid-structure interaction.
3. Determine discharges in closed conduits and open channels.
4. Design and analyze piping systems and pipe –networks.
5. Plan experimental studies in fluid mechanics using the principles of dimensional analysis and similitude.

CE13201 STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	2	1

Prerequisites:CE13101 Mechanics of Solids or its concurrent registration
Total hours: 28

Course Objectives:

1. To conduct tension test on steel, aluminum, copper and brass
2. To conduct compression tests on spring, wood and concrete
3. To conduct flexural and torsion test to determine elastic constants
4. To determine hardness of metals

List of Experiments

1. To study the stress -strain characteristics of (a) Mild Steel and (b) Tor steel by conducting tension test on U.T.M.
2. To study the stress - strain characteristics of (a) Copper and (b) Aluminum by conducting tension test on Hounsfield Tensometer.
3. To find the Compressive strength of wood and punching shear strength of G.I. sheet by conducting relevant tests on Hounsfield Tensometer.
4. To find the Brinnell's and Vicker's hardness numbers of (a) Steel (b) Brass (c) Aluminum (d) Copper by conducting hardness test.
5. To determine the Modulus of rigidity by conducting Torsion test on (a) Solid shafts (b) Hollow shaft.
6. To find the Modulus of rigidity of the material of a spring by conducting Compression test.
7. Ductility test for steel.
8. Shear test on Mild Steel rods.

References:

1. Timoshenko and Gere, Mechanics of Materials, CBS Publishers, New Delhi, 1996.

Course Outcomes (COs):

1. Conduct tension test on steel, aluminum, copper and brass
2. Conduct compression tests on spring, wood and concrete
3. Conduct flexural and torsion test to determine elastic constants
4. Determine hardness of metals

CE13202 SURVEYING PRACTICE I

L	T	P	C
0	0	3	2

Prerequisite: CE13102 Surveying I or its concurrent registration
Total hours: 42

Course Objectives: To provide skills about the basic technics of surveying by conducting field exercises using surveying equipment.

List of Exercises

1. Chain survey - Traversing and plotting of details
2. Compass survey - Traversing with compass and plotting
3. Plane table survey - Method of radiation and intersection
4. Levelling - Fly leveling - Plane of collimation method
5. Levelling - Fly leveling - Rise and fall method
6. Levelling - Longitudinal and cross sectioning
7. Levelling - Contour surveying
8. Layout of buildings

References:

1. Surveying and Levelling by N.N.Basak, TMH Publication
2. Surveying by B.C. Punamia, A.K. Jain and A.K. Jain, Vol. 1, Laxmi Publications (P) Ltd., New Delhi

Course Outcomes (COs): The students would be able to handle different surveying equipment and obtain an expertise that how conducts the survey work in the field.

CE13203 CONCRETE TECHNOLOGY LABORATORY

L	T	P	C
0	0	3	2

Prerequisites: CE13103 Concrete Technology and CE13104 Civil Engineering Materials
Total hours: 42

Course Objectives:

1. To understand the properties of ingredients of concrete
2. To study the behavior of concrete at its fresh and hardened state
3. To study about the concrete design mix
4. To know about the procedures in concreting

List of Experiments

1. Determination of Fineness and Specific Gravity of cement.
2. Determination of consistency of standard Cement Paste.
3. Determination of initial and Final Setting times of Cement.
4. Determination of Compressive Strength of Cement.
5. Determination of Soundness of Cement by La-Chatalier's Apparatus.
6. Determination of Fineness modulus of Coarse and Fine Aggregates.
7. Determination of percentage of voids, Bulk density, Specific Gravity of course and Fine Aggregates.
8. Workability Tests: Slump Cone Test, Compaction factor test, Vee-Bee consistometer, Flow Test.
9. Preparing and curing concrete specimens for tests & Determination of compressive strength of concrete cubes.
10. Study of stress - strain characteristics of concrete and tests for tensile strength of concrete.
11. Experiments to demonstrate the use of non-destructive test equipment.
12. Mix Design: IS Code method.

References:

1. Properties of Concrete, AM Nevelli – 5th Ed, Prentice Hall Publishers, 2012.
2. Concrete Technology, M. S. Shetty – S Chand Co., Publishers, 2006.
3. Concrete Technology, M. L. Gambhir – Tata Mc Graw Hill Publishers, 2012.
4. IS 10262

Course Outcomes (COs):

1. Test all the concrete materials as per IS code.
2. Determine the properties of fresh and hardened of concrete
3. Design the concrete mix using IS code methods.
4. Ensure quality control while testing/ sampling and acceptance criteria.

CE13204 FLUID MECHANICS LABORATORY

Prerequisite: CE13105 Fluid Mechanics or its concurrent registration
Total Hours: 28

L	T	P	C
0	0	2	1

Course Objectives: This course will provide basic understanding of flow measurements using various types of flow measuring devices, calibration and losses associated with these devices and discharge measurements in open channel.

List of Experiments

1. To verify the Bernoulli's Equation experimentally.
2. To determine the co-efficient of friction in pipe.
3. To verify the momentum equation experimentally.
4. To determine the coefficient of discharge of Venturimeter, Orifice meter and Notches.
5. To determine the Manning's coefficient of roughness 'n' for the bed of a given flume.
6. To study the velocity distribution in an open channel and to determine the energy and momentum correction factors.
7. To study the flow characteristics over a hump placed in an open channel.
8. To study the flow through a horizontal contraction in a rectangular channel.
9. To study the characteristics of free hydraulic jump.
10. To visualize the flow pattern.
11. To determine losses in different pipe fittings.

References:

1. A textbook of Fluid Mechanics by R. K. Bansal, Laxmi publications, 2004
2. Fluid Mechanics with Laboratory Manual by B. Majumdar, Prentice Hall India Pvt. Ltd. 2010.
3. Fluid Mechanics & Hydraulic Machines (A Lab Manual), T.S. Deshmukh, Laxmi Publications, 2001.
4. All relevant BIS codes.

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

1. Measure discharge in pipes
2. Determine the energy loss in conduits
3. Carry out discharge measurements in open channel

CE14101 STRUCTURAL ANALYSIS I

Prerequisite: CE13101 Mechanics of Solids
Total hours: 42

L	T	P	C
3	1	0	4

Course Objective:

1. To provide a comprehensive knowledge on the behaviour of structures in Civil Engineering
2. To provide theoretical background for the calculation of deflection/deformation characteristics of structures using different methods.
3. To study comprehensively, the energy theorems/principles applied to analysis of simple structures.
4. To understand the significance of moving loads and its effects on structures.
5. To develop the influence lines for reactions, shear, bending moment, deflection etc. on simply supported beams and influence lines for reactions and axial force in trusses.

Module 1 (10 hours)

Introduction: structure, loads, response, and method of analysis, classification of structures, stress resultants, degrees of freedom per node, static and kinematic indeterminacy.
Analysis of Plane Truss: classification of pin jointed determinate trusses, analysis of determinate plane trusses by method of joints and sections and method of tension coefficient.

Module 2 (12 hours)

Slope and Deflection of Beams: differential equation of the elastic curve, slope and deflection of beams by method of successive integration, Macaulay's method, moment area method, conjugate beam method, deflection due to shear.

Module 3 (10 hours)

Elastic Theorems and Energy Principles: strain energy and complementary energy, review of strain energy due to axial load, bending, shear and torsion, principle of superposition, principle of virtual work, Castigliano's theorem for deflection, theorem of complementary energy, Betti's theorem, Maxwell's law of reciprocal deflections, principle of least work, application of method of virtual work (unit load method) and strain energy method for determination of deflections of statically determinate beams, pin-joined trusses and rigid frames, temperature effects.

Module 4 (10 hours)

Moving Loads and Influence Lines: introduction to moving loads, concept of influence lines, influence lines for reaction, shear force and bending moment in simply supported beams, influence lines for forces in trusses, analysis for different types of moving loads, single concentrated load, several concentrated loads, uniformly distributed load shorter and longer than the span.

References:

1. Menon, D., Structural Analysis, Narosa publishers, 2008.
2. Wilbur, J. B., Norris, C. H., and Utku, S., Elementary Structural Analysis, McGraw Hill, New York, 2006.
3. Wang, C. K., Intermediate Structural Analysis, McGraw Hill, New York, 1989.
4. Hibbler, R. C., Structural Analysis, Pearson Education, 2006.

5. Timoshenko, S. P., and Young, D. H., Theory of Structures, McGraw Hill, New York, 1988.
6. Reddy, C. S., Basic Structural Analysis, Tata McGraw Hill, New Delhi, 2007.
7. Negi, L. S., and Jangid, R. S, Structural Analysis, Tata McGraw Hill, 2006.

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

1. Check the serviceability conditions of the structure in terms of deflection.
2. Apply the appropriate method for finding the deformation/deflections of the beams under different loading.
3. Use different analytical tools for understanding the behaviour of statically determinate structures.
4. Provide basic energy based analysis techniques for analysis structures.
5. Determine the required design forces in a structure subjected to moving loads like bridges.

CE14102 BUILDING CONSTRUCTION

Prerequisites: CE13104 Civil Engineering Materials
Total hours: 28

L	T	P	C
2	0	0	2

Course Objectives:

1. To identify the factors to be considered in planning and construction of buildings.
2. To understand the construction practices and techniques
3. To plan a building following the bye-laws
4. To understand the techniques of damp proofing and fire resistance

Module 1 (10 hours)

Functional Planning of Buildings: general aspects to consider for planning, bye-laws and regulations, selection of site for building construction, principles of planning, orientation of building and its different elements, components of building.
Masonry: definitions of terms used in masonry, materials used, stone masonry, brick masonry, different bonds used for brick masonry, composite masonry.

Module 2 (6 hours)

Floors and Roofs: components of a floor, materials used for floor construction, different types of flooring, ground floor and upper floors, types of roofs, basic roofing elements and roof coverings.

Module 3 (6 hours)

Doors and Windows: location of roofs and windows, definition of technical terms, size of doors and windows, door frames, types of doors and windows, ventilators, fixtures and fastenings.

Module 4 (6 hours)

Damp proofing, fire protection and thermal insulation: causes and effect of dampness on buildings, materials and methods used for damp proofing, fire hazards, grading of buildings according to fire resistance, fire resisting properties of common building materials, fire resistant construction, general methods of thermal insulation and thermal insulating materials. Introduction to green and sustainable materials.

References:

1. Varghese P. C. Building construction, PHI Learning Pvt. Ltd., 2008.
2. Punmia B. C., Jain A. J. and Jain A. J. Building construction, Laxmi Publications, 2005.
3. Arora S. P., and Bindra S. P. The text book of building construction, Dhanpat Rai Publications, 2010.
4. Design of Steel Structures - Arya &Azmani.
5. National Building code, 2017.

Course Outcomes (COs):

1. Identify the factors to be considered in planning and construction of buildings.
2. Understand the construction practices and techniques
3. Plan a building following the bye-laws
4. Understand the techniques of damp proofing and fire resistance

CE14103 SURVEYING II

L	T	P	C
3	0	0	3

Prerequisite: CE13102 Surveying I
Total hours: 42

Course Objectives: To impart knowledge about different advance surveying technics like triangulation, setting out of curves, hydrographic survey, astronomical survey, photogrammetry etc.

Module 1 (10 hours)
Triangulation, triangulation figures, orders of triangulation, reconnaissance, selection of stations, towers and signals, intervisibility and heights of stations, selection of site for base line, base line measurement, measurement of angles, equipment and corrections, satellite stations.
Curves, types of curves, elements of a curve, simple curves, different methods of setting out, introduction to compound curves, reverse curves, transition curves and vertical curves.

Module 2 (10 hours)
Survey adjustments and theory of errors, laws of accidental errors, probability curve, principle of least squares, laws of weights, probable error, normal equation, angle adjustment, station adjustment, figure adjustment, adjustment of triangles, adjustment of a geodetic quadrilateral.
Astronomical survey terms, spherical triangle, spherical trigonometry, time, sidereal time, apparent time, mean solar time, equation of time, universal time, standard time, conversion of time, determination of time, determination of azimuth, latitude, longitude.

Module 3 (8 hours)
Hydrographic survey, scope, shoreline survey, river survey, soundings, sounding equipment, soundings methods, locating sounding, three point problem.
Photogrammetry, terrestrial and aerial photogrammetry, heights and distances from photographs, flight planning, elements of stereoscopy, photo mosaic, photo interpretation, applications of photogrammetry.

Module 4 (14 hours)
GPS Survey: Global Navigation Satellite System- types, Global Positioning Systems-Components and Principles, Satellite ranging-calculating position, Satellite signal structure, code phase and carrier phase measurements, GPS errors and biases, Application of GPS
Remote Sensing: Definition, Electromagnetic Spectrum, energy interactions with atmosphere and earth surface features, spectral reflectance of vegetation, soil and water,classification of sensors, Active and Passive, Resolution-spatial, spectral radiometric and Temporal resolution, Multi spectralscanning, Along track and across track scanning
Geographical Information System: components of GIS, GIS operations, Map projections-methods, Coordinate systems- Geographic and Projected coordinate systems, Data Types-Spatial and attribute data, Raster and vector data representation, Data Input Methods-Geometric Transformation-RMS error, Vector data Analysis-buffering, overlay.
Remote Sensing applications in natural resource mapping, application of Remote Sensing and GIS with specific reference to Hydrologic modelling and watershed management, impact of mining activities on environment, Urban growth and transportation planning, disaster management.

References:

1. Textbook of Surveying by C. Venkatramaiah, University Press
2. Surveying by B.C. Punamia, A.K. Jain and A.K. Jain, Vol. 2, Laxmi Publications (P) Ltd., New Delhi
3. Surveying and levelling by T.P.Kanetkar and S. Kulkarni, Vol-2
4. Higher Surveying by A. M. Chandra, New age international Publications, Delhi
5. S.K.Duggal, Surveying, Vol-II, TMH Publications, New Delhi
6. Thomas. M. Lillesand, Ralph. W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image Interpretation , John Wiley and Sons, Inc., Fifth Edition, 2007
7. John A. Richards and XiupingJia, Remote Sensing Digital Image Analysis: An Introduction, Springer (Sge), Fourth Edition, 2008
8. Robert A. Schowengerdt, Remote Sensing: Models and Methods for Image Processing, Academic Press, Third Edition, 2009
9. Michael N. Demers, Fundamentals of Geographic Information Systems, Wiley India Pvt. Ltd, Third Edition, 2008
10. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, Second Edition.

Course Outcomes (COs): The students would be able to know about

1. different types of curves and different methods for setting out of simple and transition curves
2. different adjustment methods of survey measurements
3. astronomical survey procedures
4. triangulation system for conducting survey
5. hydrographic survey methods
6. use of terrestrial and aerial photogrammetry to conduct survey
7. remote sensing, GIS and GPS

CE14104 ENVIRONMENTAL ENGINEERING I

Prerequisite: CY11102 Health, Safety and Environment
Total hours: 42

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the study is

1. To discuss the various systems of water supply and factors affecting the water supply.
2. To discuss the water treatment processes of water supply.
3. To introduce the various types and disposal methods of municipal solid waste.

Module 1 (8 hours)

Fundamentals of Environmental Chemistry: Covalent and ionic bonding; Chemical equations, concentration, and activity; Acid-base equilibria; Buffer solution; Carbonate system; Complexation, precipitation, and redox reactions; Inorganic and organic contaminants in water and their speciation; Cation exchange capacity; Base saturation; and Sodium absorption ratio.

Module 2 (14 hours)

Water Demand: Types of demands; Per capita demand; Design period; Forecasting population- different methods and their suitability.
Water Quality and Treatment: Basics of water quality standards – Physical, chemical, and biological parameters; Water quality index; Unit processes and operations - aeration, plain sedimentation, sedimentation with coagulation, filtration, disinfection, and water softening; Miscellaneous and advanced treatment methods- Iron, arsenic, and fluoride removal technologies; Desalination; Membrane filtration.

Module 3 (10 hours)
Water Distribution: Water supply schemes – gravitational, pumping, and combined schemes; Materials of water supply pipes; Distribution systems - different layouts of pipe networks, house connection from mains, valves, meters, and hydrants; Storage and balancing reservoirs; Pressure in the distribution system; Capacity of reservoirs; Type of reservoirs; Detection and prevention of leaks in distribution systems and maintenance.

Module 4 (10 hours)
Introduction to Municipal Solid Waste Management: Sources and characteristics of municipal solid waste; Proximate and ultimate analysis; Collection and conveyance of municipal solid wastes; Various disposal methods of municipal solid wastes; Landfilling; Energy recovery processes; Waste management and handling rules and regulations.

References:

1. Environmental Engineering by Howard S. Peavy, Donald R. Rowe, and George Tchobanoglous. McGraw-Hill Education.
2. Integrated Solid Waste Management by Hilary Theisen, S. A. Vigil, and George Tchobanoglous. McGraw-Hill Education.
3. Water Supply and Sanitary Engineering by G. S. Birdie and J. S. Birdie. Dhanpat Rai Publishing Company.
4. Chemistry for Environmental Engineering and Science by Clair Sawyer, Perry McCarty, and Gene Parkin. McGraw-Hill Education.
5. Engineering Chemistry by Jain and Jain. Dhanpat Rai Publishing Company.

Courses Outcomes (COs): After finishing of this course, the students will able to

1. Students will be able to assess water supply schemes depending on population forecasting demand.
2. Students will be able to understand various unit operations under the water treatment plants.
3. Students will be able to prepare a proper distribution network for water supply to individual households.
4. Students will be able to introduce various disposal methods for sustainable municipal solid waste management.

CE14105 WATER RESOURCES ENGINEERING I

Prerequisite: CE13105Fluid Mechanics
Total hours: 42

L	T	P	C
3	0	0	3

Course Objectives

To build on the students' background in hydrology and understanding of water resources systems.

Module I (10 hours)
Surface Water Hydrology:

Introduction: Catchment and its physical characteristics; Hydrologic cycle.
Precipitation: Types and forms; measurement of point rainfall; rainfall missing data; Rain gauges; average rainfall over an area –different methods; rainfall mass curve, hyetograph, intensity duration curve.
Evaporation: Process; evapotranspiration and infiltration; methods of measurement and estimation.

Module II (10 hours)
Run-off: Run-off components; factors affecting run-off; estimation of run-off.
Stream flow measurement: different direct and indirect methods; stage discharge curve; unsteady flow and backwater effects.
Hydrographs: Unit Hydrographs-assumptions; derivation, application and limitations-curve, Synthetic unit hydrograph, distribution graph, instantaneous unit hydrograph, Green house, Climate forecasting, Climate changes,water conservation and water harvesting technologies.

Module III (12 hours)
Floods: Rational method, empirical formulae, UH method, flood frequency studies, Gumbel's method, Log Pearson Type III distribution, design flood, design storm, risk reliability and safety factor.
Flood Routing: Hydrologic routing, hydraulic routing
Erosion & Reservoir Sedimentation: Types; physical; characteristics; computation of storage volume; reservoir losses, reservoir sedimentation and control.

Module IV (10 hours)
Ground Water Hydrology:

Introduction: Aquifers, types of aquifers
Ground Water movement: Darcy's law, hydraulic conductivity and transmissibility
Well Hydraulics; Well Losses, specific capacity of well and well efficiency, various types of well, pumping test methods, various construction methods, salt water intrusion, artificial recharge of ground water.

References:

1. Irrigation and Water Resources G.L.Asawa New age International Engineering Publishers
2. Engineering Hydrology K Subramanya Tata-McGrawHill
4. Applied Hydrology V.T.Chow Mc Graw Hill
5. Introduction to Hydrology W.Viesman, Kneep,Harper and Row G.L.Lewis,L.W
6. Modi, P. N., Irrigation, Water Resources, and Water Power Engineering, Standard Book House, 2008.
7. Garg, S. K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 2004.

Course outcomes:

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

1. Understand the essential components of the hydrologic cycle, water balance, surface storage, groundwater flow and storage.
2. Perform hydrologic and hydraulic routing for river flood flows using hydrological data.
3. Know measurement techniques for calculating yield from well.
4. Understand different aspects pertaining to reservoir planning and perform calculations for reservoir capacity and estimation of reservoir life.

CE14106 GEOTECHNICAL ENGINEERING I

L	T	P	C
3	0	0	3

Prerequisite: Nil
Total hours: 42

Course Objectives: To impart knowledge about the geology of the earth, geological materials, basic soil properties and classification of soil and basic soil mechanics like effective stress theory and permeability of soil.

Module 1 (12 hours)
Earth System: shape, size, interior of the solid earth.
Geological materials: rocks, soils, minerals, engineering and genetic classification of rocks, rock cycles, rock-water interaction, and geomorphologic features.
Geology of India: introduction, rock types and mineral wealth.
Engineering applications of geologic structures: rock deformation in nature, recognition and classification of folds, faults, joints and unconformities.

Module 2 (8 hours)
Nature of soil: soil formation and soil types, soil structure and their effects on the basic soil properties, clay mineralogy, thixotropy.
Soil phase relationship: phase diagram, definitions and relationships between soil parameters, laboratory determination of soil parameters, specific gravity determination, in-situ unit weight determination by core cutter and sand replacement methods.

Module 3 (8 hours)
Index properties: grain size distribution by sieve analysis and hydrometer analysis, Atterberg limits and indices of consistency, soil aggregate properties, sensitivity, activity.
Classification of soils: necessity and principles of soil classification, AASHTO soil classification, USCS, IS soil classification, plasticity charts, field identification of soils.

Module 4 (14 hours)
Effective stress Theory: principle and physical meaning of effective stress, effective stress in a soil mass under hydrostatic and steady seepage conditions, total and effective stress diagrams, quick sand condition, capillary in soils.
Permeability: Darcy's law, discharge and seepage velocities, laboratory determination of coefficient of permeability of soil, field determination of coefficient of permeability of soil, factors affecting permeability, effect of stratification on permeability.
Seepage: Laplace's equation, flow nets, flow lines, equipotential lines, seepage in anisotropic soil condition, filters.

References:

1. Bangar, K. M., Principles of Engineering Geology, Standard Publishers, New Delhi, 1995.
2. Bell, F. G., Engineering Geology, Elsevier, India, 2007.
3. Kesavulu, P., Engineering Geology, Oxford University Press, 2nd Edition, 1999.
4. Singh, P., Engineering and General Geology, S. K. Kataria and Sons, 2008, India.
5. Terzaghi, K. and Peck, R. B., Soil Mechanics in Engineering Practice, John Wiley Sons, 1967.
6. Gopal Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International, 2005.
7. Arora, K. R., Soil Mechanics and Foundation Engineering, Standard publications, 2009.
8. Punmia, B. C., Soil Mechanics and Foundations, Saurabh publications, 2005.
9. Murthy, V. N. S., Soil Mechanics and Foundation Engineering, Dhanpat Rai publications, 2009.
10. Khan, I. H., Text Book of Geotechnical Engineering, Prentice Hall of India, 1999.

Course Outcomes (COs): The students would be able to know about

1. The geology of the earth as well as different geological materials like soil, rock etc.
2. The basic soil properties like grain size distribution, specific gravity, density etc.
3. Different classification systems of soil.
4. Effective stress imposed due to the overburden of soil considering different types soil condition.
5. Permeability of soil medium and its effect on the soil properties and construction.

CE14201 BUILDING DRAWING

L	T	P	C
0	0	3	2

Prerequisite: ME11202 Engineering Graphics
Total hours: 42

Course Objectives:

1. To understand the principles of planning and bylaws
2. To draw plan, elevation and section of load bearing and framed structures
3. To draw plan, elevation and section of public and industrial structures
4. To prepare detailed working drawing for doors, windows, etc.

Course Contents

Classification of buildings - Principles of planning - Dimensions of buildings - Building bye-laws for floor area ratio, open spaces - Orientation of buildings - Lighting and Ventilation - Planning and preparing sketches and working drawings of Residential buildings (Flat and sloping roof), Schools, Hostels, Hospitals, Single-storey factory buildings with trusses. Detailed working drawings of the component parts - Doors and Windows - Roof Trusses - Staircases-Toilets.

References:

1. Shah M.G. Kale. M. &Patki SY Building Drawing, Tata Mcgraw Hill, New Delhi, 2000

Course Outcomes (COs):

1. Apply the principles of planning and bylaws used for building planning.
2. Draw plan, elevation and section for various structures.

CE14202 SURVEYING PRACTICE II

L	T	P	C
0	0	2	1

Prerequisite: CE14103 Surveying II or its concurrent registration
Total hours: 42

Course Objectives: To provide skills about the advanced technics of surveying by conducting field exercises using surveying equipment.

List of Experiments

1. Theodolite surveying - Measurement of horizontal angle by method of repetition and reiteration
2. Theodolite traversing
3. Determination of tacheometric constants
4. Heights and distances by stadia tacheometry
5. Heights and distances by tangential tacheometry
6. Heights and distances by solution of triangles
7. Setting out of simple curves - linear methods
8. Setting out of simple curves - angular method
9. Setting out of transition curve
10. Description of total station

References:

1. Surveying by B.C. Punamia, A.K. Jain and A.K. Jain, Vol. 2, Laxmi Publications (P) Ltd., New Delhi
2. Surveying and levelling by T.P.Kanetkar and S. Kulkarni, Vol-2

Course Outcomes (COs): The students would be able to handle advanced surveying instruments and obtain an expertise that how conducts the survey work in the field.

CE14203 WATER RESOURCES ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

Prerequisite: CE14105 Water Resources Engineering Ior its concurrent registration
Total hours: 28

List of Experiments

1. Measurement of rate of evaporation.
2. Measurement of rate of infiltration of water in soil.
3. Rainfall Measurement.
4. Measurement of velocity of flow in river or stream.
5. Performance characteristics of pumps and turbines – Pelton turbine, Francis turbine, centrifugal pumps, reciprocating pumps, gear pumps.
6. Delineation of catchment boundary and drainage network to determine the hydrological parameters.
7. Frequency analysis of Hydrologic Data by Gumbel's method.

References:

1. Engineering Hydrology K Subramanya Tata-McGrawHill
2. Applied Hydrology V.T.Chow Mc Graw Hill
3. Introduction to Hydrology W.Viesman, G.L. Lewis,L.WKneep,Harper and Row
4. Hydrology – Principles, Analysis and Design, H.M. Raghunath, Wiley Eastern Ltd., 1986.
5. Irrigation – Theory and Practice, A.M. Michael, Vikas Publishing House, 1987.
6. A textbook of Fluid Mechanics by R. K. Bansal, Laxmi publications, 2004

Course Outcomes (COs): After the completion of the course, the students will be able to

1. Know about the hydrological processes and the calculation of its parameters.
2. Know about rainfall – runoff correlations and its role in flood prediction.
3. Demonstrate the characteristics curves of pumps
4. Demonstrate the characteristics curves of turbines

CE14204 GEOTECHNICAL ENGINEERING LABORATORY I

L	T	P	C
0	0	3	2

Prerequisite: CE14106 Geotechnical Engineering I or its concurrent registration
Total hours: 42

Course Objectives: To impart knowledge about the testing procedures to obtain the basic properties of the soil.

List of Experiments

1. Specific gravity of fine grained soils
2. Grain size analysis: (a) Sieve analysis (b) Hydrometer test
3. Atterberg's limits and indices
4. Determination of field soil density: (a) Sand replacement method (b) Core cutter method
5. Swelling index test
6. Remolded sample preparation
7. Determination of coefficient of permeability of soil: (a) Constant head method (b) Variable head method

References:

1. Terzaghi, K. and Peck, R. B., Soil Mechanics in Engineering Practice, John Wiley Sons, 1967.
2. Gopal Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International, 2005.
3. Arora, K. R., Soil Mechanics and Foundation Engineering, Standard publications, 2009.
4. Punmia, B. C., Soil Mechanics and Foundations, Saurabh publications, 2005.
5. Murthy, V. N. S., Soil Mechanics and Foundation Engineering, Dhanpat Rai publications, 2009.

Course Outcomes (COs): The students would be able to perform different experiments to obtain different basic properties of the soil like specific gravity, grain size distribution, density, permeability etc.

HS 15101- ENGINEERING ECONOMICS

L	T	P	C
2	0	0	2

Module1: (08 hours)
Introduction to basic economics and Engineering economy- How people make decisions, interact and how the economy works, Relationship among Science, Engineering, Technology and Economic Development, CEUtility Analysis, Laws of Demand and Supply, Market Equilibrium; Elasticity of demand its measurements and application.

Module 2: (08 hours)
Engineering Production function- Output Elasticity, Homogeneous production function, technological progress, Production Function in the short and long run, difference between firm and industry, Economies of scale, Concepts of Cost and revenue Analysis, Break-Even analysis.

Module 3: (08 hours)
Meaning of Market, Structure of markets: Pricing and Output Determination in Perfect competition, Monopoly, Monopolistic and Oligopoly; Macroeconomic concepts-National Income, Business Cycles, Inflation, Deflation, Stagflation; Monetary and Fiscal Policy.

Module 4: (07 hours)
Performance of Indian economy since 1951-Primary Secondary and Tertiary sectors; Economic reforms and liberalization-Indian's growth post liberalization, India's five year plans, Niti Aayog; International Trade- Foreign Exchange Rate, Balance of Payment.

Course Objective and Outcomes

- The aim of the course is to provide basic understanding of economics for engineer.
- The course will improve student's abilities on economic activities which happen in the daily life.
- Students can able to develop their own perceptive of economy based on logical reasoning and
- To sensitize the students on issue and problems on Indian economy.

Assessment and Evaluation

It uses a range of formative assessment, such as mid and end term examination (the weightage of those examination will be 80 percent). The remaining 20 percent will be based on case studies, two to three assignments, class interaction (viz. quizzes, group discussion etc.) and class attendance.

Essential Reading:

1. Gregory. N. Mankiw, "Principles of Microeconomics", Cengage Learning, 7th Edition, 2013.
2. Rudiger Dornbusch and Stanley Fischer, "Macroeconomics", McGraw-Hill Europe. 11th Edition, 2011.
3. Gregory. N. Mankiw, "Principles of Macroeconomics", Cengage Learning, 6th Edition, 2012.
4. JagdishHanda, "Monetary Economics", Routledge, 2nd Edition,

http://dl4a.org/uploads/pdf/Monetary%20Economics.pdf.
5. Engineering Production Functions: A Survey; Author(s): Sören Wibe; Source: Economica, New Series, Vol. 51, No. 204 (Nov., 1984), pp. 401-411; Stable URL: https://www.jstor.org/stable/2554225
6. Lipsey and Chrystal, "Economics", Oxford University Press, 13th Edition, 2015.

Supplementary Reading:

1. Hal R. Varian, "Intermediate Microeconomics : A Modern Approach", SPRINGER (INDIA) PVT. LTD. India, 8th Edition, 2010.
2. James M. Henderson and Richard E. Quandt, "Microeconomic Theory: A Mathematical Approach", McGraw-Hill Book Company, 3rd Edition, 1980.

CE15101 STRUCTURAL ANALYSIS II

L	T	P	C
3	1	0	4

Prerequisite: CE14101 Structural Analysis I
Total hours: 42

Course Objectives:

1. To introduce the concepts of static and dynamic indeterminacy.
2. To explain the procedure for analysis of statically indeterminate structures using force methods namely consistent deformation method, conjugate beam method and theorem of three moments.
3. To explain the procedure for analysing statically determinate structures using displacement methods of analysis namely slope deflection method and moment distribution method.
4. To explain the concept of plastic analysis using equilibrium method and mechanism method.

Module 1 and 2 (20 hours)

Statically indeterminate structures: Degree of static and kinematic indeterminacies - brief introduction to force and displacement methods.

Force method of analysis of indeterminate structures

Fixed and continuous beams - analysis by consistent deformation method - application of moment area and conjugate beam methods for fixed beams - theorem of three moments for continuous beams - shear force and bending moment diagrams - deflection and support settlement

Analysis of rigid frames of different geometry by consistent deformation method – settlement effects - analysis of pin-jointed trusses by consistent deformation method - externally and internally redundant trusses - effects of support settlement and pre-strains.

Module 3 (12 hours)

Displacement method of analysis of indeterminate structures

Slope deflection method - analysis of continuous beams - beams with overhang - analysis of rigid frames – frames with sloping legs - gabled frames - frames without sway and with sway -settlement effects - moment distribution method as successive approximation of slope deflection equations - analysis of beams and frames - non-sway and sway analysis. P-delta analysis.

Module 4 (10 hours)

Plastic Analysis

Plastic theory - introduction - plastic hinge concept - plastic modulus - shape factor - redistribution of moments - collapse mechanism - plastic analysis of beams and portal frames by equilibrium and mechanism methods.

References:

1. Menon, D., Structural Analysis, Narosa publishers, 2008.
2. Wilbur, J. B., Norris, C. H., and Utku, S., Elementary Structural Analysis, McGraw Hill, New York, 2006.
3. Wang, C. K., Intermediate Structural Analysis, McGraw Hill, New York, 1989.
4. Hibbler, R. C., Structural Analysis, Pearson Education, 2006.

5. Timoshenko, S. P., and Young, D. H., Theory of Structures, McGraw Hill, New York, 1988.
6. Reddy, C. S., Basic Structural Analysis, Tata McGraw Hill, New Delhi, 2007.
7. Negi, L. S., and Jangid, R. S, Structural Analysis, Tata McGraw Hill, 2006.

Course Outcomes (COs): Students would be able to

1. Identify static and dynamic indeterminacy of structures.
2. Perform the analysis of statically indeterminate structures using force methods namely consistent deformation method, conjugate beam method and theorem of three moments.
3. Perform the analysis of statically determinate structures using displacement methods of analysis namely slope deflection method and moment distribution method.
4. Address the indeterminacies arising from support settlements and analyse frames with the help of non-sway and sway analysis.
5. Perform plastic analysis using equilibrium method and mechanism method.

CE15102 DESIGN OF REINFORCED CONCRETE STRUCTURES

L	T	P	C
3	1	0	4

Prerequisite: CE 14101 Structural Analysis I and CE 13103 Concrete Technology
Total hours: 42

Course Objectives:

1. To provide a comprehensive knowledge on the behaviour of R.C.C structures.
2. To understand the significance of working stress and limit state design methods.
3. To study comprehensively, the design and reinforcement detailing of beams, columns, slabs, staircases, footings.
4. To develop an understanding of the four virtues of earthquake resistant design e.g stiffness, strength, ductility and configuration.
5. To understand the design and reinforcement detailing procedure of a R.C.C building considering wind and seismic forces as per IS codes.

Module 1 (14 hours)
Introduction to Reinforced concrete structures. Properties of concrete. Codes of practices. Methods of Design of Reinforced Concrete Structures: Working stress and limit state design methods. Design of R.C.C. Beams: Singly and doubly reinforced rectangular/flanged sections, design for shear, torsion, bond and anchorage of reinforcement. Design of Continuous beams.

Module 2 (10 hours)
Design of Slabs: One way & two-way slabs. Design of R.C.C. Staircase. Design of R.C.C. Columns: Axially loaded and under combined bending and axial load.

Module 3 (12 hours)
Design of Foundations: Isolated footings, Combined and Strip footing, Raft foundation, Pile foundation. Design of retaining walls, Ground level and overhead water reservoirs.

Module 4 (6 hours)
Concept of Earthquake Resistant Design (ERD) of R.C.C. structures: Design philosophy, four virtues of ERD: Stiffness, Strength, Ductility and Configurations. Design of R.C.C. structures considering Wind and Seismic forces: Estimation of Wind and Seismic forces as per IS 875 & IS1893 respectively, RCC design as per IS1893, Ductile Design and Detailing of RCC Earthquake Resistant Structures as per IS13920 & IS 4326.Introduction to Prestressed Concrete.

References:

1. Pillai, S. U., and Menon, D., Reinforced Concrete Design Tata McGraw Hill.
2. Varghese, P. C., Limit State Design of Reinforced Concrete, Prentice Hall of India.
3. Mallick, S. K., and Gupta, A. K., Reinforced Concrete, Oxford and IBH.
4. Jain, A. K., Reinforced Concrete - Limit State Design, Standard Book House.
5. Punmia, B. C., Reinforced Concrete Structures Vol. I, Standard Book House.
6. Jain and Jaikrishna, Plain and Reinforced Concrete Vol. I, Nemchand.
7. Sinha, S. N., Reinforced Concrete Design, Tata McGraw Hill.
8. BIS Codes (IS 875, IS 456, IS 1893, IS 4326, IS 13920, IS 3370).

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

1. Understand the behaviour of R.C.C structures. Assess and apply the appropriate design methodology and reinforcement detailing of different types of RCC structural elements i.e. Beams, columns, slabs, staircases and foundations.
2. Understand and apply the four virtues of earthquake resistant design e.g. stiffness, strength, ductility and configuration.
3. Understand the design methodology and reinforcement detailing of multistoried R.C.C. buildings considering wind and seismic forces as per IS codes.

CE15103 GEOTECHNICAL ENGINEERING II

L	T	P	C
3	0	0	3

Prerequisite: CE14106 Geotechnical Engineering I
Total hours: 42

Course Objectives: To impart knowledge about the basic soil mechanics like soil compaction, soil consolidation, shear strength of soil, stability of soil slopes, lateral soil pressure and also provide the knowledge about soil exploration procedures.

Module 1 (12 hours)
Compaction: definition and objectives of compaction, proctor test and modified proctor test, factors influencing compaction, effect of compaction on soil properties, field compaction methods and field control.
Consolidation: definition, concepts of coefficient of compressibility, coefficient of volume change and compression index, e-log p curves, Terzaghi's theory of one dimensional consolidation, determination of coefficient of consolidation, pre-consolidation pressure.

Module 2 (12 hours)
Shear Strength: Definition, Mohr's strength and stress circles, origin of planes, Mohr's envelope, Mohr-Coulomb strength theory, Direct shear test, Triaxial test, UC test, drainage conditions, measurement of pore pressure, vane shear tests, total and effective stress, strength parameters, stress path, liquefaction of sand, choice of test conditions for field problems.
Stability of slopes: Types of slope failure, Swedish circle method, $\varphi = 0$ analysis and $c = 0$ analysis, Taylor's stability number and stability charts, sliding block analysis.

Module 3 (10 hours)
Earth pressure: different types of retaining walls, Earth pressure at rest - Active and passive earth pressure for cohesionless and cohesive soils, Coulomb's and Rankine's theories, Point of application of earth pressure for cases of with and without surcharge in cohesionless and cohesive soils, Design considerations of retaining walls.
Open excavation: Open foundation excavations with unsupported slopes, supports for shallow and deep excavations, stress distribution in sheeting and bracing of shallow and deep excavations, stability of bottom of excavations.

Module 4 (8 hours)
Site investigation and soil exploration: objectives, planning, reconnaissance, depth of exploration, methods of subsurface exploration, test pits, auger boring, wash boring, rotary drilling, percussion drilling, core drilling, sampling, types of soil samples, split spoon sampler, thin walled sampler, piston sampler, hand cut samples, location of water table, Standard penetration test, Static cone penetration test, field vane shear test, geophysical methods, boring log, soil profile.

References:

1. Terzaghi, K. and Peck, R. B., Soil Mechanics in Engineering Practice, John Wiley Sons, 1967.

2. Gopal Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International, 2005.
3. Arora, K. R., Soil Mechanics and Foundation Engineering, Standard publications, 2009.
4. Punmia, B. C., Soil Mechanics and Foundations, Saurabh publications, 2005.
5. Murthy, V. N. S., Soil Mechanics and Foundation Engineering, Dhanpat Rai publications, 2009.

Course Outcomes (COs): The students would be able

1. To compaction of soil for ground improvement.
2. To consolidation behavior of soil.
3. To determination of shear strength of soil.
4. To stability design of soil slopes.
5. To soil pressure on retaining walls and design of retaining walls.
6. To different procedures of site investigation.

CE15104 ENVIRONMENTAL ENGINEERING II

Prerequisite: CE14104 Water Supply and Solid Waste Management
Total hours: 42

L	T	P	C
3	0	0	3

Course Objectives:

1. To introduce the wastewater characterization procedures and wastewater treatment methods.
2. To familiarize the different approaches of wastewater disposal and reuse methods.
3. To introduce the various types of sanitary fixtures and sewage collection system.
4. Introduction of various air pollutants and their effects, noise pollution, and environmental laws.

Module 1 (10 hours)

Design of Sewerage and Drainage: Systems of sewerages; Types of sewage; Sources of sanitary sewage; Estimating the quantity of sanitary sewage and storm sewage; Nomograms; Partial flow diagrams; Design of sewers; Sewer appurtenances; Sewage farming; Pumping of sewage; House drainage.

Characteristics of sewage: Physical, chemical, and biological tests on sewage; Materials used for sewerage and drainage pipes; Testing of sewer lines; Maintenance of sewers.

Module 2 (12 hours)

Wastewater Treatment: Wastewater sampling; Characteristics; Different types of oxygen demand; Population equivalent; Relative stability.

Preliminary treatment of wastewater – screens, grit chamber, sedimentation tank; Biological treatment (process details and design considerations) - Activated sludge process, Trickling filter, Oxidation Pond; Anaerobic treatment- Anaerobic digesters; Septic tank, and soak pit.

Wastewater disposal- disposal into stream, disposal by irrigation; Sludge treatment and disposal; Tertiary treatment methods

Module 3 (12 hours)

Air pollution and control: Primary and secondary air pollutants and their health effects; Sources of air pollutants; Air quality standards, Mixing height; Dispersion; Dispersion modelling; Inversion; Lapse rate; Design of stack height; Different types of plumes.

Particulate and gaseous pollutants: Control of particulate air pollutants using gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP). Control of gaseous contaminants: absorption, adsorption, condensation and combustion

Noise pollution: Sources; Health effects; Standards; Measurement and control methods.

Module 4 (8 hours)

Environmental Management Systems; ISO14000 series; Environmental auditing: Environmental

Impact Assessment; Life cycle assessment.

The Water and Air Acts with amendments; The Environment (Protection) Act (EPA) 1986; National Green Tribunal Act, 2010; Motor vehicles act, 1988.

Sustainable Development: Definition and concepts of sustainable development; Sustainable development goals; Hurdles to sustainability; Environment and economics.

References

1. Environmental Engineering by Howard S. Peavy, Donald R. Rowe, and George Tchobanoglous. McGraw-Hill Education.
2. Water Supply and Sanitary Engineering by G. S. Birdie and J. S. Birdie. Dhanpat Rai Publishing Company.
3. Wastewater Engineering by Metcalf and Eddy**,** McGrawhill Education.
4. Environmental pollution control engineering by C S Rao, New Age publisher.

Course outcomes:

1. Students will be able to design different types of sewer lines.
2. Students will be able to understand various wastewater treatment methods.
3. Students will be able to know various air pollutants and their effects, harmful effect of noise pollution and environmental laws.

CE15105 WATER RESOURCES ENGINEERING II

L	T	P	C
3	0	0	3

Prerequisite: CE 14105 Water Resources Engineering I
Total hours: 42

Course Objectives: The objective of the course is to introduce students to the basic concepts irrigation and drainage system design and construction of various hydraulic structures with their planning and management.

Module 1 (10 hours)
Introduction: Definition, functions and advantages of irrigation, Present Status of irrigation in India, Systems of irrigation, Soil moisture and Crop-Water relations, Irrigation- Water quality, Duty and consumptive use of water, frequency of irrigation, irrigation efficiency.
Water logging and drainage: Causes and effects of water logging, Measures for it prevention, Causes of Reclamation of salt effected Lands, Reclamation Procedure, land drainage, design of drainage system, Tile drains.

Module 2 (10 hours)
Canal Irrigation: Types of canals, Parts of canal Irrigation system, Planning and alignments of irrigation canals, Estimation of design discharge of a canal, Design of Channel, Kennedy's silt theory, Lacey's theory, canal lining types of lining, Types of drainage arrangement, Selection of drainage arrangement, Design aspect of lined channel, procedure of design

Module 3 (10 hours)
Design of Stable Channels: Rigid boundary channels carrying Clearwater and sediment laden water, Alluvial Channels carrying Clearwater and sediment laden water, Procedure for design of irrigation channels, Various components of canal structures, Sediment distribution, Silting and berming of channel.
Hydraulics of Alluvial Rivers: Critical tractive force, incipient motion of sediment, Regimens of flow, Resistance of flow in alluvial channels, Transport of sediment.

Module 4 (12 hours)
Surface and Subsurface Flow considerations for design of Canal Structures: Design for surface and subsurface flows, Bligh's, Lane's and Khosla's methods, Design of falls distributory and cross regulators Diversion head works, Canal head regulators, Canal falls, Outlets, Cross drainage works.
Dams: Types of dams, Factors influencing selection of the type of dam and site, investigations. Gravity dams – forces and load combinations for design, modes of failure and stability requirements, elementary and practical profiles, joints, keys, water stops, openings and galleries, temperature control and foundation treatment.

References:

1. Irrigation and Water Resources G.L.Asawa New age International Engineering Publishers
2. Theory and Design of Irrigation Structure R.S. VarshneyNem Chand & Bros. Roorkee
3. Engineering Hydrology K Subramanya Tata-McGrawHill
4. Applied Hydrology V.T.Chow Mc Graw Hill
5. Introduction to Hydrology W.Viesman, Kneep,Harper and Row G.L.Lewis, L.W
6. Modi, P. N., Irrigation, Water Resources, and Water Power Engineering, Standard Book House, 2008.
7. Garg, S. K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 2004.

8. Irrigation and Water Power Engineering, B. C. Punmia, Pande B. B. Lal, A. K. Jain, Laxmi Publications (P) Ltd.

Course Outcomes (COs): At the end of the course, the students will be able

1. Understand the concept of irrigation and estimate the irrigation water requirements.
2. To plan and execute a canal network in the field.
3. To plan and design irrigation projects.
4. Design channels and other irrigation structures required for irrigation, drainage, flood control and other management projects.

CE15201 STRUCTURAL ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

Prerequisites: CE14101 Structural Analysis I
Total hours: 28

Course Objectives:

1. Casting and test of RCC beams and columns for strength and deformation behavior.
2. Fabrication and test of steel beams and columns for strength and deformation behavior.
3. Perform non-destruction testing on concrete.

List of Experiments

1. Fabrication, casting and testing of simply supported reinforced concrete beam for strength and
deflection behavior.
2. Testing of simply supported built up steel beam sections for strength and deflection behavior.
3. Testing of simply supported standard steel beam sections for strength and deflection behavior.
3. Fabrication, casting and testing of reinforced concrete column subjected to concentric and eccentric loading.
4. Testing of standard steel column sections subjected to concentric and eccentric loading.
5. Testing of built up column sections subjected to concentric and eccentric loading.

Reference:

1. Dally J W, and Riley W F, "Experimental Stress Analysis", McGraw-Hill Inc. New York, 1991.

Course Outcomes (COs): Students will be able

1. To cast and test RC beams and columns for strength and deformation behavior.
2. To fabricate and test steel beams and columns for strength and deformation behavior.
3. To do non-destruction testing on concrete.

CE15202 GEOTECHNICAL ENGINEERING LABORATORY II

L	T	P	C
0	0	3	2

Prerequisite: CE15103 Geotechnical Engineering II or its concurrent registration
Total hours: 42

Course Objectives: To impart knowledge about the testing procedures to find out different soil properties and shear strength of soil.

List of Experiments

1. Standard proctor compaction test
2. Consolidation test
3. Direct shear test
4. Triaxial shear test: (a) Unconsolidated undrain (b) Consolidated drained
5. Unconfined compressive strength test
6. Laboratory vane shear test
7. Standard penetration test

References:

1. Terzaghi, K. and Peck, R. B., Soil Mechanics in Engineering Practice, John Wiley Sons, 1967.
2. Gopal Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International, 2005.
3. Arora, K. R., Soil Mechanics and Foundation Engineering, Standard publications, 2009.
4. Punmia, B. C., Soil Mechanics and Foundations, Saurabh publications, 2005.
5. Murthy, V. N. S., Soil Mechanics and Foundation Engineering, Dhanpat Rai publications, 2009.

Course Outcomes (COs): The students would be able to perform different experiments to find out the consolidation, compaction, swelling characteristics of soil and the shear strength of different types of soil under various in-situ conditions.

CE15203 ENVIRONMENTAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	2

Prerequisite: Water Supply and Solid Waste Management (CE14103)
Total hours: 42

Course Objectives:
1. Performing several laboratory experiments and determining of concentration of various metals and pollutants present in water.
2. Analysis of data, interpretation of results, and writing technical reports.

List of Experiments

1. Determination of turbidity of water.
2. Determination of solids (total, dissolved, and suspended) in water.
3. Determination of optimum coagulant dose of water.
4. Determination of hardness and alkalinity of water.
5. Determination of chlorides in the water.
6. Determination of iron in the water.
7. Determination of arsenic in water.
8. Determination of DO and BOD of sample water.
9. Determination of COD of sample water.
10. Determination of available chlorine in bleaching powder and the chlorine dose required to treat the given water sample.
11. Determination of Bacteriological quality of water.
12. Demonstration of instrumental methods of air pollutant analysis.

References:
1. Standard methods for the examination of water and wastewater (latest edition): APHA, AWWA, WPCF Publication.
2. Relevant BIS codes.

Course Outcomes (COs):
1. To perform several laboratory experiments and determination of concentration of various metals and pollutants present in water.
2. To analyze data, interpret results, and write technical reports.

CE15204 QUANTITY SURVEYING LABORATORY I

L	T	P	C
0	0	2	1

Prerequisites: CE13203 Building Drawing, CE14102 Building Construction and CE15102 Design of Reinforced Concrete Structures
Total hours: 28

Course Objectives:

1. To understand the procedure of estimation of quantities of a two storied R.C.C.building.
2. To know the procedure of estimation of quantities of an underground reservoir, septic tank and surface drain.
3. To understand the bar bending schedule and quantify the reinforcement.

List of Experiments

1. Estimation of quantities of a R.C.C. building.
2. Creating and understanding a bar bending schedule.
3. Estimation of quantities of an underground reservoir.
4. Estimation of quantities of a septic tank.
5. Estimation of quantities of a surface drain.

References:

1. Estimating, Costing, Specification and Valuation in Civil Engineering by M.Chakroborty
2. Estimating and Costing in Civil Engineering by B.N.Dutta, USB Publishers &Distributers
3. S. C. Rangwala, Estimating And Costing, Charotar Publishing House, Anand.
4. G. S. Biridi, Textbook of Estimating & Costing, Dhanapat Rai & Sons. Delhi.
5. Delhi Schedule of Rates.
6. CPWD Specifications Volume I and II.

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

1. To perform the procedure of estimation and find out the quantities of a two storied R.C.C. building.
2. To perform the procedure of estimation and find out the quantities of an underground reservoir, septic tank and surface drain.
3. To create and quantify a bar bending schedule.

HS16101 - PRINCIPLES OF MANAGEMENT

L	T	P	C
2	0	0	2

Module1 (06 hours)
Introduction of organisations and management, Concept of Industrial Management, Characteristics of Management, Management as an art – profession, Principles of Management, The evolution of management, Organisational environment, , Decision making- types, conditions and decision making process, Decision Making Aids.

Module 2 (08 hours)
Dimensions of P-O-L-C: Vision & Mission; Strategizing; Goal & Objectives; Organization Design, Culture, Human Resource Management, Understanding Work Teams, Motivation, Leadership and Communication and Interpersonal Skills, foundation of Control.

Module 3 (10 hours)
Introduction to Functional areas of Management: Operations Management, Marketing Management, Financial Management.

Module 4 (06 hours)
Introduction to Entrepreneurship: Starts ups, Prospects & Challenges., Environmental Issues, CSR, Sustainability, The role of statistics for Industrial management: Simple Linear Regression and Correlation- Assumptions and Properties of Least Square Estimator, Its Application by taking industrial data and its interpretations, Statistical Software-E view to be utilized to solve the industrial problems.

Course Objective and Outcomes

- The aims of the course are to understand the basic principles of management and the four major functions of managers - e.g. planning, organizing, leading and controlling - and how managers actually operate.
- Students will be required to think critically and strategically about management theories and issues, which will enable them to develop their decision-making and analytical skills.
- They will be involved in application exercises and case studies which will assist them to develop graduate attributes.

Assessment and Evaluation

It uses a range of formative assessment, such as mid and end term examination (the weightage of those examination will be 80 percent). The remaining 20 percent will be based on case studies, two to three assignments, class interaction (viz. quizzes, group discussion etc.) and class attendance. They will be involved in application exercises and case studies which will assist them to develop graduate attributes.

Essential Reading:

1. Koontz, H., and Weihrich, H., Essentials of Management: An International, Innovation and Leadership Perspective, 10th ed., McGraw Hill, 2015.
2. Robbins, SP, Bergman, R, Stagg, I, and Coulter, M, Management 7, Prentice Hall, 7th edition, 2015.
3. Richard I Levin, David S Rubin, Statistical management, 7th Edition, Prentice Hall India, 2011.

4. Kotler, P., Keller, Kevin Lane Keller et al. Marketing Management, 3rd Edition, 2016.
5. Eugene F. Brigham and Michael C. Ehrhardt, Financial Mangement: Theory and Practice, South-Western College Pub; 15th Edition, 2016.

Supplementary Reading:

1. Mahadevan, B., Operations Management, Theory and Practice, Pearson Education Asia,
2. A. Aswathapa, Organizational Behaviour, 2010
3. Robert R. Reeder, Briety & Betty H. reeder, Industrial Marketing, Prentice Hall of India Pvt. Ltd, New delhi,2008

CE16101 STRUCTURAL ANALYSIS III

L	T	P	C
3	0	0	3

Prerequisite: CE15101 Structural Analysis II
Total hours: 42

Course Objectives:

1. To review knowledge about static and kinematic indeterminacy of structures, with the force and displacement method of analysis of indeterminate structures.
2. To analyze statically determinate and indeterminate structures using matrix flexibility method.
3. To analyze statically determinate and indeterminate structures using matrix stiffness method.
4. To analyze multi-storey frame subjected to lateral and vertical loads using approximate methods like portal method, cantilever method and by using substitute frames.
5. To analyze special structures like cables, suspension bridges and arches.

Module 1 (8 hours)
Approximate methods of analysis of multi-storey frames
Analysis for vertical load - substitute frames - loading condition for maximum positive and negative bending moment in beams and maximum bending moment in columns - analysis for lateral load - portal method – cantilever method.

Module 2 (15 hours)
Matrix analysis of structures
Review of Static and kinematic indeterminacy - force and displacement methods of analysis - definition of flexibility and stiffness influence coefficients - development of flexibility matrices by physical approach
Flexibility method
Flexibility matrices for truss and frame elements - load transformation matrix - development of total flexibility matrix of the structure - analysis of simple structures - plane truss and plane frame - nodal loads and element loads - lack of fit and temperature effects.

Module 3 (11 hours)
Stiffness method
Development of stiffness matrices by physical approach - stiffness matrices for truss and frame elements - displacement transformation matrix - development of total stiffness matrix - analysis of simple structures – plane truss and plane frame - nodal loads and element loads - lack of fit and temperature effects.

Module 4 (8 hours)
Cables, suspension bridges and arches
Analysis of forces in cables - suspension bridges with three-hinged and two-hinged stiffening girders - theory of arches - Eddy's theorem - analysis of three-hinged and two-hinged arches - settlement and temperature effects.

References:

1. Menon, D., Structural Analysis, Narosa publishers, 2008.

2. Wilbur, J. B., Norris, C. H., and Utku, S., Elementary Structural Analysis, McGraw Hill, New York, 2006.
3. Wang, C. K., Intermediate Structural Analysis, McGraw Hill, New York, 1989.
4. Hibbler, R. C., Structural Analysis, Pearson Education, 2006.
5. Timoshenko, S. P., and Young, D. H., Theory of Structures, McGraw Hill, New York, 1988.
6. Reddy, C. S., Basic Structural Analysis, Tata McGraw Hill, New Delhi, 2007.
7. Negi, L. S., and Jangid, R. S, Structural Analysis, Tata McGraw Hill, 2006.

Course Outcomes (COs): Students would be able

1. To analyse the statically determinate and indeterminate trusses, beams and frames using matrix flexibility method.
2. To analyse the statically determinate and indeterminate trusses, beams and frames using matrix stiffness method.
3. To analyse cables, suspension bridges with three hinged and two hinged stiffening girders and statically determinate and indeterminate arches.
4. Determine bending moment, shear forces and axial force in the frames subjected to lateral and vertical loads using approximate method.
5. Thus to equip the students with the comprehensive methods of structural analysis and to attain the ability to pursue higher studies in Civil Engineering.

CE16102 DESIGN OF STEEL STRUCTURES

L	T	P	C
3	1	0	4

Prerequisites: CE14101 Structural Analysis I
Total Hours: 42

Course Objective: To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections. Design of structural systems such as roof trusses, gantry girders as per provisions of current code (IS 800 - 2007) of practice for working stress and Limit state Method.

Module 1 (10 hours)
Introduction
Introduction to Pre-engineering building. Structural steel types – Mechanical Properties of structural steel- Indian structural steel products. Steps involved in the Design Process -Steel Structural systems and their Elements -Type of Loads on Structures and Load combinations- Code of practices, Loading standards and Specifications - Concept of Allowable Stress Method, and Limit State Design Methods for Steel structures-Relative advantages and Limitations-Strengths and Serviceability Limit states. Allowable stresses as per IS 800.\

Module 2 (8 hours)
Connections
Type of Fasteners- Bolts Pins and welds- Types of simple bolted and welded connections Relative advantages and Limitations-Modes of failure-the concept of Shear lag-efficiency of joints- Axially loaded bolted connections for Plates and Angle Members using bearing type bolts –Prying forces and Hanger connection– Design of Slip critical connections with High strength Friction Grip bolts.- Design of joints for combined shear and Tension- Eccentrically Loaded Bolted Bracket Connections- Welds-symbols and specifications- Effective area of welds-Fillet and but Welded connections-Axially Loaded connections for Plate and angle truss members and Eccentrically Loaded bracket connections.

Module 3 (14 hours)
Tension Members
Types of Tension members and sections –Behavior of Tension Members modes of failure-Slenderness ratio- Net area – Net effective sections for Plates ,Angles and Tee in tension – Concepts of Shear Lag- Design of plate and angle tension members-design of built up tension Members-Connections in tension members – Use of lug angles – Design of tension splice.
Compression Members
Types of compression members and sections–Behavior and types of failures-Short and slender columns- Current code provisions for compression members- Effective Length, Slenderness ratio –Column formula and column curves- Design of single section and compound Angles-Axially Loaded solid section Columns subjected to biaxial bending - Design of Built up Laced and Battened type columns – Design of column bases – Plate and Gusseted bases for Axially loaded columns- Splices for columns.

Module 4 (10 hours)
Flexural Members
Types of steel Beam sections- Behavior of Beams in flexure- Codal Provisions – Classification of cross sections- Flexural Strength and Lateral stability of Beams –Shear Strength-Web Buckling, Crippling and defection of Beams- Design of laterally supported Beams- Design of solid rolled section Beams- Design of Plated beams with cover plates - Design Strength of Laterally unsupported Beams – Design of laterally unsupported rolled section Beams- Purlin in Roof Trusses-Design of Channel and I section Purlins.
Concepts of Allowable stress design for bending and Shear –Check for Elastic deflection-Calculation of moment carrying capacity –Design of Laterally supported Solid Hot Rolled

section beams-Allowable stress deign of Angle Tension and Compression Members and estimation of axial load carrying capacity.

References:

1. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.
2. Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt.
Ltd., 2013
3. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company,
2005
4. Narayanan.R.et.al. "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002
5. Sai Ram. K.S. “Design of Steel Structures “Dorling Kindersley (India) Pvt. Ltd., New Delhi,
2nd Edition, 2015, www.pearsoned.co.in/kssairam
6. Shiyekar. M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd Edition, 2013
7. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800– 2007, IK
International Publishing House Pvt. Ltd., 2009
8. Shah.V.L. andVeena Gore, "Limit State Design of Steel Structures", IS 800–2007, Structures
Publications, 2009.
9. IS 800 :2007, General Construction in Steel - Code of Practice, (Third Revision), Bureau of
Indian Standards, New Delhi, 2007. SP 6(1) Hand book on structural Steel Sections

Course Outcomes (COs): Students will be able to

1. Understand the concepts of various design philosophies
2. Design common bolted and welded connections for steel structures
3. Design tension members, understand the effect of shear lag, and understand the design concept of axially loaded columns and column base connections.
4. Understand specific problems related to the design of laterally restrained and unrestrained steel beams.

CE16103 HIGHWAY ENGINEERING

L	T	P	C
3	0	0	3

Prerequisites: CE13102 Surveying I
Total Hours: 42

Course Objectives:

1. To understand the importance of transportation and characteristics of road transport
2. To know about the history of highway development, surveys and classification of roads
3. To study about the geometric design of highways
4. To study about traffic characteristics and design of intersections
5. To know about the pavement materials and design

Module 1 (10 hours)

Highway Network Planning: Different modes of transportation, role of highway transportation, classification, network patterns, planning surveys, preparation of road plans, final report, master plan, evaluation by saturation system, 20 year road development plans, salient features, determination of road lengths, introduction to highway economics.

Highway Alignment and Geometric Design: Principles of highway alignment, requirements, controlling factors, engineering surveys, importance of geometric design, design controls and criteria, cross section elements, pavement surface characteristics, camber, carriageway, kerbs, road margins, formation, right of way, typical cross sections. Sight distance, stopping sight distance, overtaking sight distance, sight distance at intersections. Design of horizontal alignment, super elevation, transition curves. Design of vertical alignment, gradients, vertical curves.

Module 2 (10 hours)

Traffic Engineering Principles: Traffic characteristics; components of traffic stream: flow-speed Density, measurement and analysis, q-k-v relationships, design hourly volume, concept of EPCU, capacity and level of service. Parking studies and accident studies. Design of intersections, at grade intersections, channelized and rotary. Introduction to grade separated intersections, cloverleaf, trumpet, flyovers.

Traffic Management and Control: Traffic regulations, one-way streets, traffic signs, road markings, signals, warrants. Design of isolated fixed time signal, introduction to signal coordination.

Module 3 (12 hours)

Pavement Materials and Mix Design: Subgrade soil properties, CBR test, aggregates, desirable properties, tests, bituminous materials, bitumen and tar, tests. Bituminous mixes, requirements, design, Marshall Method.

Design of Pavements: Types of pavement structures, functions of pavement components, design factors. Design of flexible pavements, methods, GI method, CBR method, IRC method of flexible pavement design, Burmister's method. Design of rigid pavements, design considerations, wheel load stresses, temperature stresses, frictional stresses, design of joints, IRC method of rigid pavement design.

Module 4 (10 hours)

Highway Construction: Types of highway construction, construction of earth roads, gravel roads, WBM roads. Bituminous pavements, types, surface dressing, penetration macadam, built up spray grout, bitumen bound macadam, bituminous carpet, bituminous concrete. Cement concrete pavements.

Highway Maintenance: Pavement failures, causes, failures in flexible pavements and rigid pavements. Maintenance of highways, routine maintenance, periodic maintenance, special repairs. Strengthening of existing pavements, evaluation, overlay design. Highway drainage, surface and sub-surface drainage.

References:

1. Kadiyali L.R. Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, India, 1997.
2. Khanna, S.K. and C.E.G. Justo Highway Engineering, Nem Chand and Bros, Roorkee, India, 2001.
3. Ministry of Road Transport and Highways. Specifications for Road and Bridge Works, Fourth Edition, Indian Roads Congress, New Delhi, India, 2001.
4. IRC Codes of Practices
5. Papacostas C.S. and PD Prevedouros. Transportation Engineering and Planning, Third Edition. Prentice Hall of India Pvt. Ltd, New Delhi, India, 2002.
6. JotinKhisty C. and B. Kent Lall. Transportation Engineering – An Introduction, Third Edition. Prentice Hall of India Pvt. Ltd, New Delhi, India, 2002.
7. Chakroborty, P. and A. Das Principles of Transportation Engineering, Prentice Hall of India Pvt. Ltd, New Delhi, India, 2005.
8. Rao G.V. Principles of Transportation and Highway Engineering, Tata McGraw-Hill Publishing Company Ltd., New Delhi, India, 1996.
9. McShane, W.R. and R.P. Roess Traffic Engineering, Prentice Hall, New Jersey, USA, 1990.
10. Huang, Y.H. Pavement Analysis and Design, Pearson Prentice Hall, New Jersey, USA, 2004.

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

1. Carry out surveys involved in planning and highway alignment.
2. Design cross section elements, sight distance, horizontal and vertical alignment.
3. Implement traffic studies, traffic regulations and control, and intersection design.
4. Determine the characteristics of pavement materials.
5. Design flexible and rigid pavements as per IRC.

CE16104 FOUNDATION ENGINEERING

L	T	P	C
2	0	0	2

Prerequisite: CE15103 Geotechnical Engineering II
Total hours: 28

Course Objectives: To impart knowledge about the analysis and design of different types of foundations.

Module 1 (4 hours)
Stress distribution: Boussinesq's equations for vertical pressure due to point loads, assumptions and limitations, pressure bulb, influence diagram, vertical pressure due to uniformly distributed loads, line loads and strip loads, Newmark charts and their use, Westergaard's solution.

Module 2 (11 hours)
Foundation: general consideration, functions of foundations, requisites of satisfactory foundations, different types of foundations, definition of shallow and deep foundation, selection of type of foundation, advantages and limitations of various types of foundations, design considerations.
Bearing capacity: Ultimate and allowable bearing capacity, Terzaghi's equation for bearing capacity for continuous circular and square footings, types of shear failures, bearing capacity factors and charts, effect of water table on bearing capacity, Meyerhoff's bearing capacity theory, Skempton's formulae, bearing capacity from field tests, bearing capacity from building codes, net bearing pressure, footings subjected to eccentric loading.

Module 3 (5 hours)
Settlement analysis: causes and effects of settlement, permissible, total and differential settlements, distribution of contact pressure, immediate and consolidation settlement, estimation of initial and final settlement under building loads, empirical formulae for bearing capacity calculation from settlement criteria, limitations in settlement computation, different ground improvement technics for reducing foundation settlement.

Module 4 (8 hours)
Pile foundations: uses of piles, classification of piles, determination of type and length of piles, determination of bearing capacity of axially loaded vertical piles by both static and dynamic formulae, determination of bearing capacity by penetration tests and pile load tests (IS methods), negative skin friction, group action and pile spacing, bearing capacity of pile groups, load distribution by Culmann's method, settlement calculation of piles, introduction to pile construction methods.

References:

1. Joseph, E., and Bowles, Foundation Analysis and Design, McGraw-Hill, 1996
2. Gopal Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International, 2005.
3. Leonards, G. A., Foundation Engineering, McGraw Hill, 1962.
4. Teng, W. C., Foundation Design, PHI, 1984
5. Tomlinson, M. J., Foundation Design and Construction, Pitman, 2001.
6. Terzaghi and Peck, Soil Mechanics in Engineering Practice, Asia Publishing, 1996

7. Arora, K. R., Soil Mechanics and Foundation Engineering, Standard Publications, 2009.
8. Murthy, V. N. S., Soil Mechanics and Foundations, 2009.
9. Iqubal, H. Khan, Geo-technical Engineering, 1999
10. Punmia, B. C., Soil Mechanics and Foundations, Laxmi, 2005.

Course Outcomes (COs): The students would be able

1. To know about the stress distribution on soil due to foundation loading.
2. To know about the design criteria of different types of foundations.
3. To analyze and design different types of shallow foundations like isolated and raft footing.
4. To analyze and design pile foundations.
5. To calculate the settlement of soil due to foundation loading.

CE16201 HIGHWAY ENGINEERING LABORATORY

L	T	P	C
0	0	3	2

Prerequisite: CE 16103 Highway Engineering or its concurrent registration
Total hours: 42

Course Objectives:

1. To learn the characteristics, properties and testing procedures of aggregate
2. To learn the characteristics, properties and testing procedures of bitumen

List of Experiments

1. Determination of Water absorption of road aggregates
2. Determination of Specific gravity of aggregates
3. Determination of Impact Test of aggregates
4. Los Angel's abrasion test
5. Deval abrasion test
6. Test for Crushing Strength of Aggregates
7. Determination of Flakiness and Elongation Indices of aggregates, Angularity number
8. Determination of Penetration of bitumen
9. Determination of Viscosity of bitumen
10. Determination of Specific Gravity of bitumen
11. Determination of Ductility of bitumen
12. Determination of Softening point of bitumen
13. Determination of Water content of bitumen
14. Determination of Loss on Heating of bitumen
15. Marshal Test
16. Determination of CBR value
17. Roughness Measurement by Merlin
18. Roughness Measurement by Bump Integrator.

References:

1. Concrete Technology M.S. Shetty S. Chand & Comp. Ltd.
2. Method of Test for aggregate IS: 2386, (Part I, II, III, and IV) 1963. Bureau of Indian Standards for concrete
3. Determination of softening point of bitumen. IS: 1205-1978 Bureau of Indian Standards
4. Determination of Penetration of bitumen. IS: 1203-1978 Bureau of Indian Standards
5. Determination of Viscosity of bitumen. IS: 1206-1978(I) Bureau of Indian Standards
6. Determination of Flash Point of bitumen. IS: 1209-1978 Bureau of Indian Standards.
7. Determination of Specific Gravity of bitumen. IS: 1202-1978(I) Bureau of Indian Standards
8. Determination of Viscosity of bitumen. IS: 1206-1978(I) Bureau of Indian Standards Determination of Flash Point of bitumen. IS: 1209-1978 Bureau of Indian Standards

Course Outcomes (COs): Upon completing of this course, the students should be able to:

1. Characterize the aggregate used for road construction
2. Characterize the bitumen used for road construction

CE16202 STRUCTURAL DESIGN LABORATORY I

L	T	P	C
0	0	2	1

Prerequisites: CE15102 Design of Reinforced Concrete Structures and CE16102 Design of Steel Structures
Total hours: 28

List of Experiments

1. Introduction to Design software's Graphical User Interface.
2. Creating nodes and members, model generation of simple structural components.
3. Usage of model editing tools to modify a single member and multiple members.
4. Creating models, assigning support, member and material specification.
5. Creating models with load on members.
6. Creating models with different load cases/combinations.
7. Creating model, performing analysis and design a G+2 framed structure.

Software needed:

1. STAAD Pro V8i
2. ETABS
3. SAP 2000

Reference:

1. STAAD.Pro V8i Technical Reference Manual – Bentley Communities.
2. Web reference: https://www.csiamerica.com/products/etabs/watch-and-learn
3. Web reference: https://www.csiamerica.com/products/sap2000/watch-and-learn

Course Outcomes (COs): Students will be able to create and analyze framed structures elements in a design software.

CE16203 CIVIL ENGINEERING SOFTWARE LABORATORY I

L	T	P	C
0	0	2	1

Prerequisites: CE14104Water Supply and Solid Waste Management
Total hours: 28

Course Objectives:

1. To familiarize with different kind of softwares for analyze, design and modelling of water distribution network.
2. To familiarize with different kind of softwares for analyze, design and modelling of sewerage and drainage network.
3. To gain knowledge regarding waste management and life cycle assessment model.

List of Experiments

1. Analyze, design and modelling of water distribution network.
2. Analyze, design and modelling of sewerage and drainage network.
3. Modelling of life cycle assessment.
4. Analyze, design and management of municipal solid waste.

Reference:

1. WaterGEMS, WaterCAD, SewerGEMS, SewerCAD
2. Simapro
3. Intelex

Course Outcomes (COs): Students will able to

1. Understand modern engineering tools for specification, design, implementation andtesting.
2. Realize design practically using an appropriate software engineeringmethodology.
3. Design the water supply, sewerage and drainage network.
4. Compute life cycle assessment.

CE16204 QUANTITY SURVEYING LABORATORY II

L	T	P	C
0	0	2	1

Prerequisites: CE13203 Building Drawing, CE14102 Building Construction and CE15102Design of Reinforced Concrete Structures
Total hours: 28

Course Objectives:

1. To know the procedure of estimation of quantities for a road project.
2. To understand the procedure of rate analysis of various items of construction.
3. To know the procedure of writing a technical specification for an item work.
4. To know the procedure for preparing a tender.
5. To understand the procedure of CPM and PERT.

List of Experiments

1. Estimation of quantities for a road project.
2. Analysis of rate for brick work.
3. Analysis of rate for concrete work.
4. Methodology for writing a technical specification.
5. Preparation of Bill of Quantity
6. Methodology for preparing a tender.
7. CPM and PERT

References:

1. Estimating, costing, Specification and Valuation in Civil Engineering by M.Chakroborty
2. Estimating and Costing in Civil Engineering by B.N.Dutta, USB Publishers &Distributers
3.S. C. Rangwala, Estimating and Costing, Charotar Publishing House, Anand
4. G. S. Biridi, Textbook of Estimating & Costing, Dhanapat Rai & Sons. Delhi.
5. Delhi Schedule of Rates
6. DSR Analysis of Rates
7. CPWD Specifications Manual Vol I and II.

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

1. To perform the procedure of estimation and find out the quantities for a road project.
2. To prepare a bill of quantity.
3. To carry out the procedure of rate analysis of various items of construction.
4. To write a technical specification for an item work.
5. To prepare a tender.
6. To perform the procedure of CPM and PERT.

CE17201 CIVIL ENGINEERING SOFTWARE LABORATORY II

L	T	P	C
0	0	2	1

Prerequisites: CE15102Design of Reinforced Concrete Structures, CE16102 Design of Steel Structures and CE 16103 Highway Engineering
Total hours: 28

List of Exercises

1. Introduction to software used for analysis of structures
2. Create and analyze models for solving problems related to structural analysis
3. Introduction to software used in the field of highway engineering
4. Create and analyze models for solving problems related to transportation engineering

Software needed:

1. ANSYS
2. Abaqus CAE
3. Max Road

Reference:

1. User manual of ANSYS
2. User manual of Abaqus CAE
3. User manual of Max Road

Course Outcomes (COs): Students will be able to create and analyze models for solving problems related to structural analysis and transportation engineering.

CE17202 STRUCTURAL DESIGN LABORATORY II

L	T	P	C
0	0	2	1

Prerequisites: CE15102 Design of Reinforced Concrete Structures, CE16102 Design of Steel Structures
Total hours: 28

List of Experiments

1. Introduction to the general principles for earthquake design.
2. Calculation of the lateral force by manual method as well as by analytical method.
3. Dynamic Analysis using Response Spectrum Method using design software
4. Analysis and design of multistoried building.
5. Design of steel truss.

Software needed:
1. STAAD Pro V8i
2. ETABS
3. SAP 2000

Reference:
1. Code provision - IS 1893 (Part 1): Criteria for Earthquake Resistant Design of Structures
2. Code provision - IS 13920 (1993): Ductile detailing of reinforced concrete structures subjected
to seismic forces.
3. STAAD.Pro V8i Technical Reference Manual – Bentley Communities.
4. Web reference: https://www.csiamerica.com/products/etabs/watch-and-learn

Course Outcomes (COs): Students will be able to understand the design guidelines and create and analyze both RC and Steel structures in software.

CE17203 COMPUTER AIDED DRAWING LABORATORY

L	T	P	C
0	0	2	1

Prerequisites: CE13203 Building Drawing, CE14102 Building Construction, CE15102 Design of Reinforced Concrete Structures
Total hours: 28

List of Experiments

1. Introduction to AUTOCAD software – exploring the application menu – workspaces.
2. Configuring object property – managing layers.
3. Drafting the basic accessories of the building like windows, doors, etc.
4. Drafting the plan for G+2 building comprising elevation and sectional views.
5. Drafting the detailing of RC slab as per SP:34.
6. Drafting the detailing of beam as per SP:34.
7. Drafting the detailing of column as per SP:34.
8. Drafting the detailing of various types of footings as per SP:34.
9. Drafting the ductile detailing of beam – column joint as per IS:13920.
10. Drafting the plan and detailing of Retaining Wall using AUTOCAD.

Software Requirement: AUTOCAD

Reference:

1. https://thesourcecad.com

Course Outcomes (COs): Students will be able tounderstand the concept of building plan and they can draft in AUTOCAD.

CE18201 CIVIL ENGINEERING SOFTWARE LABORATORY III

L	T	P	C
0	0	2	1

Prerequisites: CE16104Foundation Engineering and CE15105Water Resource Engineering II
Total hours: 28

List of Exercises

1. Introduction to software used in the field of geotechnical engineering
2. Create and analyze models for solving problems related to geotechnical engineering
3. Introduction to software used in the field of water resource engineering
4. Create and analyze models for solving problems related to water resource engineering

Software needed:

1. GeoStudio
2. Abaqus CAE
3. MIDAS GTS
4. StormCAD
5. HAMMER

Reference:

1. User manual of GeoStudio
2. User manual of Abaqus CAE
3. User manual of MIDAS GTS
4. User manual of StormCAD
5. User manual of HAMMER

Course Outcomes (COs): Students will be able to create and analyze models for solving problems related to geotechnical engineering and water resource engineering.

CE18202 COMPUTATIONAL TECHNIQUES

L	T	P	C
0	0	2	1

Prerequisites: All subjects up to and including VII semester
Total hours: 28

List of Experiments

1. **Introduction to Advanced Computing:** Basic features of the language. Development of arrays and matrices. Importing, exporting and saving data. Creating and executing function files. Error in computation. Number representation. Development of algorithms and pseudo codes.
2. **Interactive Computation:** Matrix and vector operations. Character string operations. Command-line function. Usage of in-built functions. Loops, branches and control-flow. Interactive input. Introduction to advanced data objects – multidimensional matrices, structures, and cell.
3. **Advanced Applications:** Linear algebra – solving linear system, Gaussian elimination, LU decomposition, eigenvalue problems, ill-conditioned system of equations. Curve fitting and interpolation – polynomial surface and least square curve fitting. Data analysis and statistics. Numerical differentiation and integration. Solving ordinary differential equation – Runge-Kutta method for initial value problems. Nonlinear algebraic equations. Solving optimization problem – Linear programming and applications. Introduction to nonlinear programming and search methods. Application of the above methods in civil engineering.
4. **Post-processing:** Plotting data – 2D, 3D, multiple plots, handling graphics.

Reference Books:

1. Pratap, R., Getting Started with MATLAB, Oxford University Press, New York, USA, 2010.
2. Hanselman, D., Littlefield B., Mastering MATLAB® 7, Pearson Education, Inc., India, 2011.