

Syllabus for B.Tech.

CEL205: STRENGTH OF MATERIALS I (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Simple Stresses and Strains: Concept of stress and strain in three dimensions and generalized Hook's law; Young's modulus; Tension test of mild steel and other materials; true and apparent stress, ultimate strength, yield stress and permissible stress;	4
Elastic constants: Stresses in prismatic & non prismatic members, Stresses in composite members, Compatibility conditions, Thermal stresses, Shear stress, shear strain, modulus of rigidity, complementary shear stress; poisson's ratio, Volumetric strain, Bulk modulus, relation between elastic constants;	5
Compound Stress: Two dimensional stress system: stress resultant, principal planes and principal stresses, state of pure shear, maximum shear stress, Mohr's circle & its applications. Moment of Inertia: Polar and product moment of inertia, Principal axes and principal moment of inertia	6
Columns: Short and long columns, slenderness ratio, crushing and buckling of column, short column subjected to axial and eccentric loads; Euler's theory and its limitations, concepts of effective length of columns; Rankine & Secant formulae.	5
Membrane Analysis: Stress and strain in thin cylindrical & spherical shells under internal pressures.	2
Bending of Beams: Types of supports, support reactions, determinate and indeterminate structures, static stability of plane structures. Bending moment, Shear force and Axial thrust diagrams for statically determinate beams subjected to various types of loads and moments, Point of Contra-flexure, relation between load, SF and BM	7
Analysis of perfect frames: Introduction; perfect frames; types of support and reactions; analysis of perfect frames using method of joints and method of sections	3
Stress distribution in beams: Theory of simple bending, Distribution of bending and shear stresses for simple and composite sections	7
TOTAL	40

Suggested Readings:

1. Mechanics of Structures Vol. I & II by S.B Junarkar, Charotar Publishing House, Anand.
2. Strength of Materials & Mechanics of Structures: Vol. I, II by Dr. B.C. Punmia Laxmi Publications (p) Ltd.
3. Strength of Material by Singer and Pytel, Harper Collins Publishers.
4. Elements of Strength of Materials by Timoshenko & Young, Mc Graw Hill Book Co.
5. Mechanics of Structures by Timoshenko & Gere, CBS Publishers and Distributers
6. Structural Analysis by T. S. Thandavamoorthy, Oxford University press

CEL203: FLUID MECHANICS (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Fluids: Definition, Ideal fluids, real fluids, Newtonian and non-Newtonian fluids.	2
Properties of Fluids: Units of measurement, Mass density, Specific weight, Specific volume, Specific Gravity, Viscosity, Surface tension and Capillarity, Compressibility and Elasticity.	4
Hydrostatics : Pressure at a point in a static fluid; pressure variation in an incompressible static fluid; atmospheric pressure, Gauge pressure, vacuum pressure, absolute pressure, Manometers Bourdon pressure gauge.	4
Buoyancy: Forces acting on immersed plane surface. Centre of pressure, forces on curved surfaces. Conditions of equilibrium for floating bodies, meta-centre and met centric height experimental and analytical determination of met centric height.	4
Equilibrium of Fluid Particles and Flow: Fluid mass subjected to horizontal and vertical acceleration and uniform rotation.	2
Hydro-kinematics: Types of Flows: Steady and unsteady, uniform and non-uniform, stream lines, path lines, stream tubes, principles of conservation of mass, equation of continuity, acceleration of fluid particles local and connective, Rotational and irrotational motions, free and forced vortex, circulation and vorticity velocity potential and stream function, elementary treatment of flow net. Euler's equations of motion and integration of Euler's equations, Bernoulli's equation for incompressible Fluids, assumptions in Bernoulli's equation, Energy correction factor.	7
Applications of Bernoulli's Equation: Pitot tube, Venturimeter, orifice meter, orifices & mouth pieces, time of emptying of tanks by orifices, sharp edged rectangular, triangular and trapezoidal notches, Francis formula. Velocity of approach. End contractions Cippoletti Weir, time of emptying reservoirs by weirs.	4
Momentum Equation and its Application: Development of momentum equation by control volume concept, Momentum correction factor, applications – Borda's mouth pieces, sudden enlargement of flow, pressure on flat plates, Nozzles.	4
Flow Through Pipes: Laminar flow, Reynolds experiment, transition from laminar to turbulent flow. Turbulent Flow: Laws of fluid friction, friction factor Moody's diagram, loss of head due to friction and other causes. Hydraulic gradient, total energy line Chezy's, Darcy's and Manning's formula, flow through parallel pipes and pipes in series, flow through branched pipes. Flow along a bypass. Power transmission through pipe, condition for maximum power. Elementary water hammer concept.	8
TOTAL	40

Suggested Readings:

1. *Fluid Mechanics by Modi & Seth, Standard Publishers, Delhi.*
2. *-Fluid Mechanics by Dr. K.R. Arora, Standard Publishers and Distributors, Delhi.*
3. *Fluid Mechanics by Dr. R.K. Bansal, Laxmi Publication (P) Ltd.*
4. *Fluid Mechanics by H.M.Raghunath, CBS Publishers and Distributors.*
5. *Fluid Mechanics & Machinery by C.S.P.Ojha, R.Berndtsson and P.N.Chandramauli, Oxford Publishers, Delhi*

CEL201: CIVIL ENGINEERING MATERIALS (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	
Stones: Source and types of stones, various standard test on building stones including compressive strength, water absorption, durability, impact value, tensile strength. Identification, Selection criteria and uses of common building stones. Dressing of stones.	8
Clay Products: Manufacturing of Bricks. Types and properties of bricks and their determination as per IS code such as water absorption, compressive strength, effloresces, dimension and tolerance test. Types of Tiles, Standard tests for tiles as per IS code such as water absorption, tolerance, impact value, glazing. Fly Ash: Properties, classification, use of fly-ash in manufacturing of bricks & cement.	8
Cement & Lime: Raw materials, chemical composition and manufacturing process of cement. Basic compounds (Bouge's compounds) of cement and their role, types of cement. Setting and hardening of cement, physical properties of cement, Various standard tests on Portland cements, as per IS code including consistency, setting time, fineness, soundness and strength.	5
Lime: Classification as per IS, Manufacturing process, properties, standard tests of lime. Use of lime in construction. Gypsum, properties and use, Plaster of Perris.	3
Mortar and Plaster: types of sand, bulking of sand, tests for sand, classification, mortar preparation methods: Functions and tests & their uses in various types pointing & plastering.	3
Timber & Steel: Definitions of related terms, classifications and properties, defects in wood, conversion of wood, seasoning, preservation, fire proofing, Ply woods, fiber boards,. Steel: properties, types mild steel and HYSD steel and their use, common tests on steel. various types of paints and Varnishes; white wash and distempers and their application. .	5
Environmental Friendly Building Material: Concept of embodied energy of materials, energy used in transportation and construction process. Natural material like bamboo, rammed earth, stones, stabilized blocks; supplementary cementitious materials like blast furnace slag, silica fume, rice husk ash; building materials from agro and industrial wastes.	5
Miscellaneous: Properties, types and uses of glass, aluminium, Asbestos, G.I., plastics in construction.	3
TOTAL	40

Suggested Readings:

1. *Building Materials by Prabin singh; S.K.Kataria & Sons., 2012*
2. *"Affordable Housing" by B.N. Moolchandani, Published by Indian Building Congress, Delhi.*
3. *Building Materials: Products, Properties and Systems by Ghambir, Tata Mc Graw Hill, Delhi*
4. *Construction Materials: Their nature & Behaviour by J.M. Illston; E& FN Spon*
5. *Building Materials by S. Duggal; New Age International Publishers.*
6. *Materials for Civil and Construction Engineers, by Michale, S.Mamlouk and Jhon P.Zaniewski, Pearson Noida.*

CEL202: CONSTRUCTION TECHNOLOGY (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course. Building Requirements & Construction System: Building components, their functions and requirements, types of construction, load bearing construction and framed structure construction. Lift slab construction. Prefabricated/precast construction; advantages & disadvantage of prefabrication.	2
Temporary structures: Types & methods of shoring, underpinning and scaffolding.	1
Foundation & Site Preparation: Purpose, types of foundation, depth of foundation, Sequence of construction activity and co-ordination, site clearance, marking, foundation plan,	2
Brick and Stone Masonry: Basic principle of sound masonry work, different types of bonds, relative merits merit and demerits of English, single Flemish and double Flemish bond. Comparison between stone and brick masonry. General principles, classification of stone masonry	4
Damp Proofing: Causes of dampness, effects of dampness methods and material for damp proofing DPC treatment in buildings, methods and materials for anti-termite treatment. Joints: Requirements, types and material used, construction details. Grouting of Joints of Precast Reinforced Concrete Structures.	3
Arches and Lintels: Terms used, types of arches and their construction detail, types of lintels and constructions. thin precast RCC lintels in Brick walls. Partition Wall : Types, purpose and use of partition wall.	3
Stairs : Terms used, requirements of good staircase, classification, construction details and suitability of different types of stairs, lifts and lamps.	3
Fabrication and Erection Work: Fabrication of Structural steel at slopes and sites, Handling and transportation of units to be erected, Erection of Fabricated steel structures, Prefabricated/precast construction; relative advantages & disadvantage and various precast units & Erection of Precast Reinforced Concrete Structures.	2
Ground & Upper Floor: Floor components and their junctions, selection of flooring and floor types, construction details of ground and upper floors, merits and demerits	3
Roof and Roof Covering: Purposes, classification of roofs, terms used, types of pitched roofs, trussed roofs especially king port, queen port, steel roof trusses, details of steel roof trusses, method of construction, roof covering materials for pitched roofs. Thin R.C. ribbed slab for floors & roofs. Precast R.C. plank flooring/roofing.	4
Advance Construction Equipment: Different types of construction equipment viz. Earth moving equipment & their outputs, Dewatering equipment, Pumping equipment, Grouting equipment, Pile Driving equipment, Compaction equipment, Concreting equipment.	6
Equipment Management in Construction Projects: Forecasting equipment requirements, Output and capacity of equipment, Selection of equipment, Spare-parts management, Owning Costs-investment costs, depreciation, major repair cost, Operation Cost & Its types. Investment Cost, Cost of Repairs, Overheads Cost accounting, Break-even point theory, Replacement of equipment. Maintenance management-types of maintenance, breakdown maintenance, preventive maintenance & its functions.	7
TOTAL	42

Suggested Readings:

1. *Construction Equipments & Management* by R.L. Purifoy, Tata Mc Graw Hill.
2. "Affordable Housing", Published by Indian Building Congress, Delhi.
3. *Construction Technology* by Subir K. Sarkar & Subhajit Saraswati, Oxford University Press
4. *Building Construction* by Bindra & Arora; Dahnpat Rai & Sons.
5. *Construction Equipments* by Mahesh Verma, Metropolitan Book Co.
6. *Construction Equipments and its Management* by S.C.Sharma, Prentice Hall of India (PHI).

CEL204: ENGINEERING GEOLOGY (L-2)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 2

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
General Geology: Branches and Scope of Geology, Types of Weathering & Geological work of natural agencies like River & Wind. Geological Time Scale. Physical Properties of Minerals.	6
Petrology: Formation, Texture, Structure and Classification of Igneous, Sedimentary and Metamorphic Rocks. Engineering Properties of Rocks for Building & Road Material. Laboratory and Field & in-situ Test for Site Construction.	6
Structural Geology: Causes, Terminology, Classification, Recognition, Effects and Engineering consideration of Fold, Fault, Joints and Unconformities.	5
Engineering Geology: Geophysical methods as applied to Civil Engineering for Subsurface Analysis (Electrical and Seismic methods). Terminology, Types and Geological consideration for site selection of Dam & Tunnel.	6
Remote Sensing & GIS: Application of Remote Sensing and GIS in Various fields of Civil Engineering.	4
TOTAL	28

Suggested Readings:

1. Parbin Singh-*A Text Book of Engineering & General Geology*- S.K.Kataria & sons
2. S.K.Garg- *Physical & Engineering Geology*- Khanna Publishers
3. N Chenna Kesavulu- *A Text book of Engineering Geology*- Macmillan India Ltd.
4. M.T.Maruthesha Reddy- *A Text book of Applied Engineering Geology*- New Age International Publisher
5. *Remote Sensing and GIS*: B.Bhatta- Oxford Publishers.

CEP202: BUILDING DRAWING LAB (P-2)

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

Building Components – To study and draw the labelled sketch of different Building Components on sheets with exposure to CAD

1. Drawing of walls
 - a. Brick and Stone masonry
 - b. Partition wall, cavity wall and cross section of external wall
2. Pointing, Arches, Lintels and Floors
3. Doors and Windows
4. Stairs, Cross section of Dog legged stairs
5. Roofs: Flat and Inclined (Steel)
6. Foundations for Masonry Structures and Framed Structures, Provision of Damp Proof Course

Building Planning –

1. Development of Front Elevation and Sectional Elevation from a given plan
2. Development of Plan, Front Elevation and Sectional Elevation from line diagram

CEP204: ENGINEERING GEOLOGY LAB (P-2)

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

1. Physical Properties of Minerals
2. Physical Properties of Rocks
3. Identification of Minerals in Hand Specimen
4. Identification of Rocks in Hand Specimen
5. Identification of Geological features through wooden Models
 - a) Structural Geological Diagrams
 - b) Petrological Diagrams
 - c) Engineering Geological Diagrams
6. Interpretation of Geological Map (10 Nos.)
7. Dip & Strike Problems (8 Nos.)

CEP203: FLUID MECHANICS LAB. (P-2):

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

1. To verify the Bernoulli's theorem.
2. To calibrate the Venturimeter.
3. To calibrate the Orificemeter.
4. To determine Metacentric Height.
5. To determine C_c , C_v , C_d of an orifice.
6. To determine C_d of a mouthpiece.
7. To determine C_d of a V-notch.
8. To determine viscosity of a given fluid.
9. Bye Pass.

CEP201: MATERIAL TESTING LAB. (P-2):

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

1. Water absorption, Compressive Strength and Tolerance Test – Bricks
2. To Determine Compressive Strength of Timber Parallel and Perpendicular to Grain
3. Modulus of Rupture of Wooden Beam
4. Tensile strength Test – Mild Steel and HYSD bar
5. Compressive Strength of Cast Iron
6. Hardness Test – Rockwell Hardness and Brinell Hardness
7. Impact Test – Izod and Charpy
8. Fatigue Test
9. Spring Test
10. Torsion Test
11. To Study the Properties and Uses of Kota Stone and Fly Ash
12. Identification of Building Materials by Visual Inspection like sand, aggregate, lime, cement, bricks, stone

CEL206: CONCRETE TECHNOLOGY (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Ingredients of Concrete: Cement: hydration of cement and its basic compounds, structure of hydrated cement, C-S-H gel, heat of hydration and its significance. Aggregates: types, physical properties and standard methods for their determination.	3
Concrete: Grade of concrete, proportioning of ingredients, water content and its quality for concrete, water/cement ratio and its role, Properties of fresh concrete including workability, air content, Flow ability, Segregation, Bleeding and Viscosity etc. - Factors affecting, methods of determination.	4
Properties of Hardened Concrete: strengths, permeability, creep, shrinkage, factors influencing, Standard tests on fresh and hardened concrete as per IS code. Aggregate-cement interface, Durability of concrete: factors affecting	6
NDT: Introduction and their importance. Application & use of Rebound Hammer, Ultra-sonic pulse velocity meter, Rebar & Cover meter, half- cell potential meter, corrosion resistivity meter, core sampling.	4
Concrete Handling in Field: Batching, mixing, placing and transportation of concrete, equipment for material handling, various methods their suitability and precautions. Compaction of concrete: methods & equipment. Curing of concrete: various methods their suitability.	5
Concrete Mix Design: IS method, quality control for concrete.	3
Admixture in Concrete: Chemical and mineral admixtures, their types and uses: water reducers, accelerator, retarders, water-proofing, super plasticizers etc. Use of fly ash, GGBFS, micro silica etc in concrete, their properties and effect.	6
Form Work: Requirements, their types. Typical formworks and shuttering/ centering for Columns, beams, slabs, etc. Slip and moving formwork.	3
Special Types of Concrete: Introduction to high strength concrete, high performance concrete, sulphate resisting concrete, under water concreting, self-compacting concrete, pumpable concrete: their salient properties and applications with case studies.	5
TOTAL	40

Suggested Readings:

1. *Concrete Technology by Neville & Brooks, Pearson Education.*
2. *Concrete: Microstructure, Properties & Materials by Mehta P.K, Tata Mc Graw Hill.*
3. *Concrete Technology by M.S.Shetty, S.Chand & Co.*

CEL207: HYDRAULICS AND HYDRAULIC MACHINES (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Dimensional Analysis & Models: Dynamical Similarity and Dimensional Homogeneity Model experiment, geometric, Kinematic and Dynamic similarity. Reynold's, froudes, Weber's, Euler and Mach numbers. Distorted river models and undistorted models, proper choice of scale ratios. Scale effect.	3
Principle of dimensional analysis Rayleigh method, Buckingham theorem, applications of dimensional analysis to pipe Friction problems, resistance to motion of partially and fully submerged bodies and other simple problems. Ship model experiments.	4
Laminar Flow: Relation between shear & pressure gradient. Flow between plates & pipes. Equations for velocity distribution, pressure difference.	3
Turbulent Flow in pipes: Theories of Turbulence, Nikuradse's Experiments. Hydro dynamically smooth & rough boundaries. Laminar, Sub layer, Equations of velocity distribution and friction coefficient. Stanton Diagram, Moody's diagram.	5
Flow through Channels: Uniform, Non-Uniform and variable flow. Resistance equations of Chezy, Mannring and Bazin. Section factor for uniform flow. Most Efficient rectangular, triangular and trapezoidal sections.	3
Equations of gradually varied flow in Prismatic channels. Limitation of its applicability and assumption made in its derivation. Specific energy of flow. Critical depth in prismatic channels. Alternate depths. Rapid, critical and sub critical Flow Mild, steep and Critical Slopes. Classification of surface curves in prismatic channels and elementary computation	5
Rapidly Varied Flow: Hydraulic jump or standing wave in rectangular channels. Conjugate or sequent depths Losses in jump, location of jump. Broad crested weirs for channel flow: Measurement, velocity distribution in open channels, parshall flume.	5
Impact of Free Jets: Impact of a jet on a flat or a curved vane, moving and stationary vane, flow over radial vanes.	3
Centrifugal Pumps and Turbines: Volute and whirlpool chambers, Loses of head due to variation of discharge Manometric and Hydraulic efficiencies, Description of single and multistage pumps. Specific speed, characteristic curves. Model Test. Reaction and Impulse turbines, specific speed, Mixed flow turbines. Pelton wheel turbine, Francis turbine, propeller turbine and Kaplan turbine Efficiency, Characteristics of turbines. Basic principles of governing of turbines, Draft-tube, Selection of turbines, model tests.	8
TOTAL	40

Suggested Readings:

1. *Fluid Mechanics & Hydraulics* by Dr. K.R, Arora, Standard Publishers & Distributers, Delhi.
2. *Fluid Mechanics & Hydraulics* by John F.Douglas & Lynne B. Jack, Prentice Hall Inc.
3. *Fluid Mechanics & Hydraulics* by Dr. R.K. Bansal, Laxmi Publications (P) Ltd.
4. *Fluid Mechanics & Hydraulics* by Modi & Seth, Standard Publishers & Distributers, Delhi.
5. *Fluid Mechanics & Machinery* by C.S.P.Ojha, R.Berndtsson and P.N.Chandramauli, Oxford Publishers, Delhi

CEL208: BUILDING PLANNING (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Introduction: Types of buildings, criteria for location and site selection, site plan and its detail.	3
Sun Consideration : Different methods of drawing sun chart, sun shading devices, design of louvers.	4
Climatic and Comfort Consideration: Elements of climate, global climate, climatic zones of India, thermal comfort, bi-climatic chart,	4
Orientation: Meaning, factors affecting orientation, orientation criteria for tropical climate.	2
Building Bye Laws and NBC Regulations: Objective of by-laws, regulation regarding; means of access, lines of building frontages, covered area, floor area ratio, open spaces around buildings, height & sizes of rooms, plinth regulation.	4
Principles of Planning: Different factors affecting planning viz-aspect, prospect, furniture requirement, roominess, grouping, circulation, elegance, privacy etc.	5
Vastu Shastra in Modern Building Planning: Factors considered in Vastu, site selection, orientation, planning and design of residential buildings, school/hospital	4
Functional Design and Accommodation Requirements of Non Residential Buildings: viz-school buildings, rest house, primary health centers, post office etc.	5
Services in Buildings (A) Lighting and ventilation, doors and windows, lifts. (B) Acoustics, sound insulation and noise control. (C) Fire-fighting provisions	8
TOTAL	40

Suggested Readings:

1. *Manual of Tropical Housing and Buildings* by Koenigs Berger Orient and Longman.
2. *Building Drawing* by M.G.Shah, C.M. Kala, S.Y.Patki , Tata Mc Graw Hills.
3. *SP.41 (S&T)- Handbook on functional Requirements of Buildings Part-I*
4. *National Building Code, BIS.*
5. *Architecture Drafting and Design* by Donald E. Helper, & Paul I Wallach.
6. *Time Saver Standards for Housing and Residential Development* by DE Chiara, Tata Mc Graw Hill, Delhi.

CEL305: STRENGTH OF MATERIALS–II (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Torsion: Elementary concepts of torsion, shear stress in solid and hollow circular shafts, angle of twist, power transmitted by a shaft, combined bending and torsion; Stiffness of springs, springs in series and parallel, close coiled helical springs.	5
Deflection of Beams: Differential relation between load, shear force, bending moment, slope deflection. Slope & deflection in determinate beams using double integration method, Macaulay's method, area moment method and conjugate beam method.	8
Analysis of prop cantilever structures, Analysis of Indeterminate Structure using Area moment method, Conjugate beam method	5
Introduction to Indeterminate Structures: Degrees of freedom per node, Static and Kinematic indeterminacy (i.e. for beams, frames & portal with & without sway etc.), Releases in structures, Maxwell's reciprocal theorem and Betti's theorem,	4
Fixed Beams & Continuous Beams: Analysis of fixed beams & continuous beams by three moments Theorem and Area moment method.	8
Introduction to Energy Methods: Strain energy for gradually applied, suddenly applied and impact loads, Strain energy due to axial loads, bending, shear and torsion;. Castiglione's theorems & their applications in analysis of determinate and redundant frames up to two degree of redundancy and trussed beams; Stresses due to temperature & lack of fit in redundant frames; deflection of determinate beams, frames using energy methods	6
Unit Load Method & its Applications: deflection of determinate beams and frames, analysis of determinate and redundant frames up to two degree of redundancy, lack of fit in redundant frames.	4
TOTAL	40

Suggested Readings:

1. *Strength of Materials & Mechanics of Structures: Vol. I* by Dr. B.C. Punmia Laxmi Publications (P) Ltd.
2. *Strength of Material* by Singer and Pytel, Harper Collins Publishers.
3. *Elements of Strength of Materials* by Timoshenko & Young, Mc Graw Hill Book Co.
4. *Mechanics of Structures* by Timoshenko & Gere, CBS Publishers and Distributors.
5. *Mechanics of Structures Vol. I & II* by S.B Junarkar, Charotar Publishing House.

CEP206: CONCRETE LAB (P-2)

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

1. Test on Cement
 - a. Fineness of Cement by Air Permeability (Blaine Fineness)
 - b. Standard Consistency, Initial & Final Setting Time
 - c. Specific Gravity
 - d. Compressive Strength
 - e. Soundness of cement by Le-chatelier apparatus
2. Test on Aggregates:
 - a. Specific gravity of fine aggregate by Pycnometer.
 - b. Bulking of fine aggregate
 - c. Specific gravity of Coarse aggregate
 - d. Sieve Analysis of Coarse and Fine Aggregates
3. To design concrete mix of M-20 grade without admixture in accordance with IS recommendations along with determination of the workability of given concrete mix by slump test and casting of specimens for properties in hardened state.
4. To determine the optimum dose of super plastisizers by Flow table test.
5. To design concrete mix of M-50 Grade with chemical and mineral admixtures in accordance with I S recommendations along with determination of rheological properties for pumpable concrete and casting of specimens for properties in hardened state.
6. To determine the properties of concrete in a hardened state (Compressive Strength, Flexural Strength , E etc) of the samples made in experiment 3 and 5.
7. To study the tests of water permeability and rapid chloride permeability of concrete.
8. Study of NDT equipment with case study.

CEP207: HYDRAULICS LAB (P-2)

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

1. To determine the minor losses.
2. To determine the friction factor.
3. To determine Cd of Broad crested wier.
4. To verify the momentum equation.
5. To determine the discharge of venturimeter.
6. To determine Manning's & Chezy's coefficient of roughness for the bed of a given flume.
7. To plot characteristics curve of hydraulic jump.
8. To plot characteristics curve of Pelton Wheel.
9. To plot characteristics curve of Centrifugal Pump.

CEP208: BUILDING PLANNING LAB-II (P-2)

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

- 1- To plan and draw working drawing of a Residential building with following detail.
 - (a) Site plan
 - (b) Foundation plan
 - (c) Plan
 - (d) Two sectional elevations
 - (e) Front elevation
 - (f) Furniture plan
 - (g) Water supply and sanitary plan
 - (h) Electric fitting plan
- 2- To plan and draw a Primary Health Centre
- 3- To plan and draw a Primary School
- 4- To plan and draw a Rest House
- 5- To plan and draw a Post Office
- 6- To plan and draw a Bank
- 7- To plan and draw a College Library
- 8- To plan and draw a Cinema Theatre

OPEN ELECTIVE

CEL209: DISASTER MANAGEMENT (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Introduction to scope, objective and outcome of subject.	1
Introduction: Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Natural and Manmade Disasters, Disaster and Development, and Climate Change. Professional ethical aspects.	5
Types of Disasters, their occurrence/ causes, impact and preventive measures: Geological Disasters: earthquakes, liquefaction, landslides, tsunamis, volcanoes Hydro-Meteorological Disasters: floods, cyclones, avalanches, droughts.	10
Biological Disasters: Epidemics, Pandemic Technological Disasters: chemical, industrial, radiological, nuclear.	7
Manmade Disasters: building collapse, rural and urban fire, wild fire, road and rail accidents. Disaster profile of Indian continent: Mega Disasters of India and Lessons Learnt. Risk mapping	8
Disaster Management Cycle: Disaster Management Cycle and its components: Pre disaster and post disaster, Paradigm Shift in Disaster Management.	5
Disaster management system in India: Disaster Management Act 2005, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter- Governmental Agencies	4
TOTAL	40

Suggested Readings:

1. Coppola D P, 2007. *Introduction to International Disaster Management*, Elsevier Science (B/H), London
2. *Dynamics of Structures* by Clough & Penzin, Mc Graw Hill Book Co.
3. *Manual on natural disaster management in India*, M C Gupta, NIDM, New Delhi.
4. *Earthquake Tips* by C.V R. Murthy, IIT Kanpur.
5. *An overview on natural & man-made disasters and their reduction*, R K Bhandani, CSIR, New Delhi
6. *Encyclopedia of disaster management, Vol I, II and III* Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
7. *Disasters in India Studies of grim reality*, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur
8. *Management of Natural Disasters in developing countries*, H.N. Srivastava & G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
9. *Disaster Management Act 2005*, Publisher by Govt. of India
10. *Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management*
11. *National Disaster Management Policy, 2009, GoI*

CEL405: THEORY OF STRUCTURES (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Analysis of Structures: Analysis of Statically Indeterminate Structures using Slope-deflection method. Moment-distribution method applied to continuous beams and portal frames with and without inclined members	11
Column Analogy Method for indeterminate structures, determination of carry over factor for non-prismatic section.	6
Approximate Methods for Lateral Loads: Analysis of multi-storey frames by portal method, cantilever method & factor method.	5
Influence Line Diagram & Rolling Load: ILD for beams & frames, Muller-Breslau principle and its application for drawing ILD, Rolling load, maximum stress resultants in a member/section, absolute maximum stress resultant in a structure.	11
Unsymmetrical Bending: Definition, location of NA, computation of stresses and deflection, Shear centre and its location	6
TOTAL	40

Suggested Readings:

1. *Strength of Materials & Mechanics of Structures: Vol. I* by Dr. B.C. Punmia Laxmi Publications (P) Ltd.
2. *Advanced Structural Analysis* by Dr. A.K. Jain, Nem Cahnd and Brothers, Roorkee.
3. *Mechanics of Structures* by Timoshenko & Young, Mc Graw Hill Book Co.
4. *Mechanics of Structures Vol.-I* by Junarkar & Shah, Charotar Publishing House.
5. *Theory of Structures* by Jangid & Negi, Tata Mc Graw Hill.
6. *Structural Analysis* by Ghali & Neville, E&FN,Spon.
7. *Structural Analysis* by Hibbler R.C., Pearsons

CEP301: SURVEYING (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENT	Hrs.
Objective, Scope and Outcome of the Course.	1
Linear and Angular Measurements: Method of linear measurements, Correction to length measured with a chain/tape, Ranging a survey line; direct and indirect Angular measurement by compass, Designation of bearing, Traversing with tape and compass, Correction to measured bearing, Angular measurement by theodolite; Temporary adjustments, Method of horizontal angle measurement and vertical angle, Traverse computation, plotting of traverse and determining the closing error, Balancing traverse.	10
Levelling: Measurements of elevations methods of levelling; direct/ differential, Indirect/ Trigonometrical, and Profile/Cross sectional levelling. Digital and Auto level, Errors in levelling, contours and contour lines; methods of contouring; direct and indirect, characteristics, uses, area and vol. measurements.	8
Curve Surveying: Elements Of Simple And Compound Curves, Types Of Curves, Elements Of Circular, Reverse, And Transition Curves. Method Of Setting Out Simple, Circular, Transition And Reverse Curves, Types Of Vertical Curves, Length Of Vertical Curves, Setting Out Vertical Curves. Tangent Corrections.	5
Tacheometry and Photogrammetry Surveying: Different systems of tacheometric measurements, Stadia system of tacheometry, Determination of tacheometric constants, distance and elevation formulae for normal and inclined sights with staff vertical. Introduction to basic concepts perspective geometry of aerial photographs, relief and tilt displacements, Terrestrial Photogrammetry	7
Setting Out Works & Modern Field Survey Systems: Instruments and methods for laying out buildings, setting out culverts, setting out sewer lines. Principle of E.D.M. (Electronic Distance Measurements), Modulation, Types of E.D.M., Distomat, Total station, parts and principle of total station, advantages and application.	6
DGPS survey, drone and LIDAR survey: Introduction, concept and applications	3
Total	40

Suggested Readings:

1. *Surveying Volume I* by Dr. B.C. Punamia Laxmi Publications (P) Ltd.
2. *Plane Surveying* by Dr. A.M. Chandra, New Age International.
3. *Surveying Volume –I & II* by Dr. K.R. Arora Standard Book House Delhi
4. *Surveying & Leveling* by Subramanian Oxford University Press.
5. *Surveying Vol.1* by S.K.Duggal Tata Mc Graw Hill, Delhi.

CEL302: GEOTECHNICAL ENGINEERING (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Soil and Soil-mass Constituents: water content, specific gravity, void ratio, porosity, degree of saturation, air void and air content, unit weights, density index etc. Inter-relationships of the above. Determination of index properties of soil: water content, specific gravity, particle size distribution, sieve and sedimentation analysis, consistency limits, void ratio and density index. Classification of soil for general engineering purposes: particle size, textural, H.R.B. Unified and I.S. Classification systems.	8
Clay Mineralogy: Soil structure; single grained, honeycombed, flocculent, and dispersed, structure of composite soils, clay structure; basic structure, mineral structures, structures of Illite Montmorillonite and kaolinite and their characteristics.	4
Soil Compaction & Stabilization: Principles of soil compaction, Laboratory compaction tests; Proctor's test Modified Proctor tests, Measurement of field compaction, field methods of compaction and its control, dry and wet of optimum, factors affecting compaction, compaction equipment. Soil stabilization, Mechanical Stabilization. Stabilization with cement, lime and bitumen.	6
Mohr's Circle of Stress: shearing strength of soil, parameters of shear strength, Coulomb's failure envelope, determination of shear parameters by Direct Shear Box. Tri-axial and unconfined compression test apparatuses. Typical stress-strain curves for soils. Typical failure envelopes for cohesion less soils and normally consolidated clay soils.	8
Stresses in Soil-mass: total, effective and neutral pressure, calculation of stresses, influence of water table on effective stress, quicksand phenomenon	4
Bearing Capacity of Soils: Terminology related to bearing capacity, Common types of foundations. Terzaghi and Meyehoff's theory for bearing capacity. Rankine's method for minimum depth of foundation. Skempton's method. Effect of eccentricity and water table on bearing capacity. IS code method, Plate load and penetration tests for determining bearing capacity. Introduction to pile, Site Investigations: Methods of explorations. Planning of Investigations, Depth of exploration, Number of boreholes, Undisturbed and Disturbed samples. Types of samplers. Brief description of procedures of sampling, Transportation and Storage of samples.	9
TOTAL	40

Suggested Readings:

1. *Basic and applied Civil Mechanics by Rajan & Rao, New Age International Publishers.*
2. *Soil Mechanics & Foundation Engineering by Arora K.R, Standard Publishers and Distributers, Delhi.*
3. *Soil Engineering in Theory & Practice by Alam Singh, CBS Publishers and Distributers, Delhi.*
4. *Geotechnical Engineering—Principles and Practices, Coduto PHI Publisheres.*
5. *Principles of Geotechnical Engineering by Braja M. Das, CENAGE Learning New Delhi.*

CEL303: DESIGN OF CONCRETE STRUCTURES (L-3)**Exam Hours: 3****Max. Marks: 150 (IA: 50, ETE: 100)****Credit: 3**

CONTENTS	Hrs.
Introduction: Objective, scope and outcome of the course.	1
Fundamental concepts of design of RC members, assumptions. Types and function of reinforcement. Introduction to various related IS codes, Characteristic load and characteristic strength. Working Stress Method: Working stress design philosophy. Analysis and Design of singly reinforced rectangular beam section for flexure.	5
Limit State Design: Limit state design philosophy. Assumptions, Analysis and design of singly reinforced, doubly reinforced rectangular beams and flanged beams for flexure using codal provisions for simply supported, cantilever, fixed and continuous beams.	10
Limit state of serviceability for deflection: control of deflection as per codal provisions of empirical coefficients. Limit state of collapse in shear: Types of shear reinforcement and its detailing, analysis and design of shear reinforcement for prismatic sections. Limit state of collapse in bond: concept of bond stress, anchorage length and development length. Detailing and curtailment of reinforcement as per codal provisions.	6
Slabs: Analysis and design of one way and two way slabs using LSM, Detailing of reinforcement. Check for shear and deflection.	6
Columns: Short and long columns, their structural behaviour. Analysis and design of axially loaded short columns, using LSM. Analysis of eccentrically loaded short columns. Introduction to Pu- Mu interaction curves and their use for eccentrically loaded columns.	5
Footings: Analysis and design of Isolated column footing for axial load. Introduction to combined footing for two columns (without central beam) for axial loads using LSM.	4
Torsion: Analysis and Design of beams for torsion as per codal method	3
TOTAL	40

Suggested Readings:

1. *Illustrated Reinforced Concrete Design* by Karve & Shah; Standard Publishers, Delhi.
2. *Limit State Design of Reinforced Concrete* by Verghese P.C.; PHI Delhi.
3. *Limit State Design* by Dayaratnam; Oxford and IBH Publishing House.
4. *Reinforced Concrete : Limit State Design* by A.K.Jain; Nem Cahnd and Brothers, Roorkee.
5. *Reinforced Concrete Structural Elements* by P Purushothaman; Mc Graw Hill
6. *Reinforced Concrete Fundamentals* by Phil M. Ferguson; Prentice Hall
7. *Design of reinforced Concrete* by Jack C. Cormac & James K. Nelson; C.H.I.P.S.
8. *Reinforced Concrete Design* by Wang & Salmon; Harper & Row.
9. *Design of Concrete Structures* by Nilson & Winter; Mc Graw Hill

CEL304: MODERN CONCRETE TECHNOLOGY (L-3)

Exam Hours: 3 Max. Marks: 150 (IA: 50, ETE: 100) Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course	1
Concrete Production: Difference in mix proportioning for vibrator compacted concrete, pumpable and roller compacted concrete. Considerations in a plant operation in ready mixed concrete (RMC). Different types of mixers, transportation systems and pumps in RMC, their selection criterion	4
Rheology of Concrete: Flow ability, Segregation, Bleeding and Viscosity etc. - Factors affecting, related standards including slump flow test, v funnel test, U box test, J Ring test, Stability test, L Box test etc.	3
Chemical admixtures in Concrete: Chemical: Applications of accelerators, importance of chloride free admixtures, applications, Case studies. Application of Retarders in RMC applications, hot weather concrete etc. High range water reducing admixtures: Naphthalene and PCE based. Mechanism, Shelf life, etc.	2
Flyash in Concrete: Fly-ash: Physical and chemical properties, IS 3812 specifications for use in cement and concrete. Graded fly- ash.	2
Ground Granulated Blast Furnace Slag (GGBFS): As admixture in concrete -Properties, Indian standards, Applications. Ultra fine powders: Micro Silica, Metakaolin, Limestone, Calcium carbonate powders etc: Properties, role in cement concrete, IS specifications, and applications.	3
Strength of Concrete: Factors affecting compressive strength, behaviour of concrete under uniaxial, biaxial and tri-axial stress states, Split Tensile strength and modulus of rupture -test methods and empirical formulae for their estimation. Related stipulations of IS.	4
Microstructure of Concrete: Interfacial transition zone, hydration kinetics, hydrated cement paste (hcp), ettringite, calcium hydroxide, micro-cracks. Penetrability of Concrete: Permeability, sorptivity and diffusion in concrete- test methods and significance.	4
Durability of Concrete: Physical and chemical processes, Methods of tests like Resistivity, RCPT, etc - case studies of performance based design including parameters like RCPT, permeability etc.	4
Specific purpose concretes and cement based composites: Self Compacting Concrete: Mix proportioning, EFNARC guidelines. Fibre reinforced cement-based composites, including High performance fibre based cementitious composites. Mass concrete and polymer concrete etc. - materials, production and application areas.	6
High performance concrete - performance characteristics in fresh and hardened states, production precautions - case studies of use of HPC in India: Metro construction, Mumbai – Worli Sea link project, atomic power projects, Hydro-electric power projects etc.	3

Green and Sustainable Concrete: Objectives, alternate aggregates- M sand, Slag as fine aggregate. Means to reduce carbon foot print, embodied energy, in concrete practices. Recycled aggregates- properties and processing. Properties of concretes with recycled aggregates.	4
TOTAL	40

Suggested Readings:

1. *Properties of Concrete* by A.M. Neville, Longman Publishers.
2. *Concrete Technology* by M.S. Shetty, Dahnpat Rai & Sons.
3. *Concrete Technology* by Neville & Brooks, Pearson Education.
4. *Concrete Microstructure* P.K. Metha, Tata Mc Graw Hill.
5. *Concrete Technology-* A. S. Santhakumar, Oxford University Press
6. *Handbook of Concrete Science and Engineering-* V. S. Ramchand

CEL306: (L-3) SOCIAL ASPECTS IN CIVIL ENGINEERING

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course	1
Introduction: What are Social Aspects of Engineering; Development Processes: Inter relationship between social, economic, scientific and technological factors for development. Development criteria; gross national product, energy consumption. Thermal comfort aspects of housing	7
Technology Assessment and Transfer: Criteria for assessment and selection of technology, appropriate technology concept, technology transfer and development. Project Planning, Appraisal and Feasibility: Techno economic feasibility studies, Project planning and control, life cycle costing. Software applications in life cycle cost analysis. Development of Science and Technology: Information technology application in Project Designing, Project evaluation programme, implementation and monitoring.	8
Rural economy, poverty, unemployment, exodus to urban areas. Technology for rural and Desert Areas, Characteristic of desert areas, Thar desert ,desertification and its control, sand dunes stabilisation. Rural energy needs, Modern Solar appliances, Challenges in Solar Power and Wind Power Generation and their Connection to Grid. Rural industries, Transport in rural and desert areas, Drought, Famine and Disaster management.	8
PMGSY Project. Right to Information act-its provisions. Land acquisition act Financing methods of infrastructure projects-BOT, PPP etc., Case studies of recent projects in Rajasthan-Refinery, IIIT, NHAI Highway, Dedicated Freight Corridor, Metro Rail Project; Human Relations in Industry and Industrial Laws: Application of social sciences to industry; Labour relations, Trade unions,. MNREGA project.	8
Environmental degradation due to energy production, transport, industries, mining and intensive agricultural practices, control of air and water pollution. Hazards of environmental pollution. Health problems, challenges and their remedies. Depletion of natural resources due to population explosion and continuously rising standards of living. Environment impact analysis of projects, green technologies, Concept of sustainable development. National environmental laws. Carbon footprint of technologies, carbon credit system. Dumping of Radioactive waste-methods and monitoring. Effect on health.	8
TOTAL	40

Suggested Readings:

CEL307: SOLID AND HAZARDOUS WASTE MANAGEMENT (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Introduction to scope, objective and outcome of subject.	1
General: Problems associated with Solid Waste Disposal. Generation of Solid Waste: Goals and objectives of solid waste management, Classification of Solid Waste. Solid Waste Generation, Factors Influencing Generation of Solid Waste, Characteristics of Solid Waste, Analysis of Solid Waste.	7
Onsite Handling, Storage and Processing: Public Health and Aesthetics, Onsite Handling, Onsite, Storage, Dust bins, Community Containers, Container Locations, On-site Processing Methods.	8
Solid Waste Collections, Transfer and Transport: Collection Systems, Equipment and Labor requirement, Collection Routes, Options for Transfer and Transport Systems.	8
Processing and Disposal Methods: Processing Techniques and Methods of Disposal, Sanitary land filling, Composting and Incineration, Bioremediation.	8
Recovery of Resources, Conversion, Products and Energy: Material Recovery, Energy Generation and Recovery Operation, Reuse in other industry. Industrial Solid Waste: Nature, Treatment and Disposal Methods.	8
TOTAL	40

Suggested Readings:

1. *Solid Waste Engineering Principles and Management Issues* by G. Technobanogious H.Theisen & R.Blssen, Mc Graw Hill Book Co.
2. *Solid Waste Management* by C.L.Mantell, Mc Graw Hill Book Co.
3. *Solid Waste Management in Developing Countries* by Bhide& Sunrashen PHI.

CEP405: STRUCTURAL ENGINEERING LAB (P-2)

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

1. Study of friction, screw jacks, winch crabs etc.
2. Deflection of a truss

3. Clark-Maxwell reciprocal theorem with truss

4. Funicular polygon for flexible cable
5. Analysis of redundant frame
6. Deflection of curved members
7. Buckling of columns

8. Clark-Maxwell reciprocal theorem with simply supported beam

9. ILD for deflection in a steel beam using unit load method

10. ILD for support reaction using Muller-Breslau Principle

11. Unsymmetrical bending.
12. Two hinged and three hinged arches.

CEP301: SURVEYING LAB (P-2)

Credit:1

Max. Marks: 75 (IA:50, ETE:25)

1. Linear Measurement by Tape:
 - a. Ranging and Fixing of Survey Station.
 - b. Plotting Building Block by offset with the help of cross staff.
2. Compass Survey: Using Surveyor's and Prismatic compass
 - a. Measurement of bearing of lines
 - b. Adjustment of included angles of compass traverse.
3. Levelling: Using Tilting/ Dumpy/ Automatic Level
 - a. To determine the reduced levels in closed circuit.
 - b. To carry out profile levelling and plot longitudinal and cross sections for road.
4. Theodolite Survey: Using Vernier Theodolite
 - a. To carryout temporary adjustment of Theodolite & Measurement of horizontal and vertical angle: by method of repetition and method of Reiteration.
 - b. To measure and adjust the angles of a braced quadrilateral.
5. Trigonometric Levelling: To determine the Height of an object by trigonometric levelling:
 - a. By using Instruments in same vertical plane.
 - b. By using Instruments in different vertical planes.
6. Tachometry Survey:
 - a. To determine the tachometric constant.
 - b. To determine the horizontal and vertical distance by tachometric survey.
7. Distance and angular measurements by total station.
8. To study the various electronic surveying instruments like EDM, DGP, Drone with case studies etc.

One-week Survey Camp for topographic/ project survey/Contouring be arranged before or after Term End Exam.

CEP302: GEOTECHNICAL ENGINEERING LAB (P-2)

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

1. Grain size distribution by Sieve Analysis
2. Determination of water content and specific gravity by Pycnometer.
3. Determination of liquid limit by Casagrande's apparatus.
4. Determination of plastic limit
5. Determination of shrinkage limit
6. Determination of field density by core-cutter
7. Determination of compaction properties by standard Proctor Test Apparatus
8. Determination of C- ϕ values by Direct Shear Test Apparatus
9. Determination of Compressive Strength by unconfined compression Test Apparatus
10. Determine the CBR of soil.

CEP303: CONCRETE STRUCTURES DESIGN LAB(P-2)

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

Analysis and Design Problems as per syllabus of theory.

OPEN ELECTIVE

CEL317: REMOTE SENSING ESSENTIALS (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Introduction to scope, objective and outcome of subject.	1
Rudiments of remote sensing and advantages, Historical Perspective of development of remote sensing technology, EM spectrum, solar reflection and thermal emission, Interaction of EM radiation with atmosphere including atmospheric scattering, absorption and emission, Interaction mechanisms of EM radiation with ground, spectral response curves	8
Laws of Radiation and their relevance in Remote Sensing, Basis of remote sensing image representation, Various Remote Sensing Platforms, Multi-spectral scanners and imaging devices, Significant Characteristics of LANDSAT, SPOT, Sentinel sensors	7
Prominent characteristics of IRS, Cartosat, ResourceSat sensors, Unmanned Aerial Vehicle / Drone, Passive & Active Remote Sensing, Image characteristics and different resolutions in Remote Sensing, Different techniques of Image acquisition	8
Importance of digital image processing, Digital Image Processing Software, Basic image enhancement techniques, Colour representations and transforms, Image Histograms and statistics, Spatial Filtering Techniques, Band rationing and PCA, Unsupervised image classification and density slicing techniques, Supervised image classification techniques and limitations, LiDAR Technique and applications	8
Image interpretation of different geological landforms, rock types and structures, Google Earth and its Applications, Applications of Remote Sensing in Earthquake Studies, Different sources of free satellite images, Limitations of Remote Sensing Techniques	8
TOTAL	40

Suggested Readings:

1. *Introduction to Remote Sensing*, (5th Ed.), The Guildford Press, New York, 2012.
2. Lillesand, T.M., Kiefer, R.W. and Chapman, J.W., "Remote Sensing and Image Interpretation", (5th Ed.), John Wiley & Sons, 2007.
3. Gupta, R. P., "Remote Sensing Geology", 2nd Ed., Springer, 2003.
4. Drury, S. A., "Image Interpretation in Geology", 2nd Ed, Allen & Unwin, 1993.
5. Cracknell, A.P., "Introduction to Remote Sensing", (2nd Ed.), Tylor & Francis, London, 1991.
6. Gonzalez, Rafael C. and Richard E. Woods "Digital Image Processing", (3rd Edition) Pearson Education, London.

CEL308: DESIGN OF STEEL STRUCTURES (L-3)

(Design procedure shall be conforming to IS 800-2007)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Introduction: Objective, scope and outcome of the course.	1
Types of Steels and their broad specifications. Structural steel forms- hot rolled, tubular, light gauge etc and their applicability. Classification of cross sections as per IS 800-2007- Plastic, compact, semi compact and slender- characteristics	2
Plastic analysis of steel structures, fundamentals, shape factor, static and mechanism method of analysis, bending of beams of uniform cross sections (any shape)	3
Connections: Types of bolts, load transfer mechanism, prying action. Design of bolted and welded connections under axial and eccentric loadings with IS provisions	3
Tension Members: Design strength in gross section yielding, net section rupture and block shear. Design of axially loaded members.	3
Compression Members: Types of buckling, Imperfection factor, Buckling curves for different cross sections as per IS. Design of compression members: Axially loaded members including made up of angle section: single and in pair; built up columns including design of lacings and battens as per IS.	6
Beams: Design of beams: simple and compound sections. Design of laterally supported and unsupported beams including for web buckling, web crippling, lateral torsional buckling.	6
Member design under combined forces: Compressive load and uniaxial moment. tension and uniaxial moment	3
Column Bases: Design of column bases for axial and eccentric compressive loads: Slab and gusseted base.	2
Design of plate girder: Design of welded and bolted sections including web and flange splicing, horizontal, intermediate and bearing stiffeners. Shear strength determination by post critical and tension field action methods. End panel design options and procedure as per IS 800. Curtailment of flange plates. Connections for flange plate to flange angles and flange angles to web, etc. Design of welded connections	7
Design of gantry girder	4
TOTAL	40

Suggested Readings:

1. *Design of Steel Structures* by N. Subramanian, Oxford University Press.
2. *Limit state Design of Steel Structures: S K Duggal*, TMH publication
3. *Design of Steel Structures* by S. Bhavikatti, I.K. International Pvt. Ltd.

4. *Design of Steel Structures by V.L. Shah, Structures Publications.*

CEL309: QUANTITY SURVEYING & VALUATION (L- 3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
I Objective, Scope and Outcome of the Course.	1
Introduction: Purpose and importance of estimates, principles of estimating. Methods of taking out quantities of items of work. Mode of measurement, measurement sheet and abstract sheet; bill of quantities. Types of estimate, plinth area rate, cubical content rate, preliminary, original, revised and supplementary estimates for different projects.	8
Rate Analysis: Task for average artisan, various factors involved in the rate of an item, material and labor requirement for various trades; preparation for rates of important items of work. Current schedule of rates. (C.S.R.)	8
Estimates: Preparing detailed estimates of various types of buildings, R.C.C. works, earth work calculations for roads and estimating of culverts, Services for building such as water supply, drainage and electrification.	10
Cost of Works: Factors affecting cost of work, overhead charges, Contingencies and work charge establishment, various percentages for different services in building.	5
Valuation: Purposes, depreciation, sinking fund, scrap value, year's purchase, gross and net income, dual rate interest, methods of valuation, rent fixation of buildings.	8
TOTAL	40

Suggested Readings:

1. *Estimating & costing by B.N.Dutta, UBS Publishers & Distributers.*
2. *Estimating Costing Specification & Valuation in Civil Engg. M .Chakroborty, Bhakti Vedanta, Book Trust, delhi.*
3. *Quantity Surveying and Valuation by S.C. Rangawala , Charotar Publishing House.*

CEL310: ENVIRONMENTAL ENGINEERING-I (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
General: Environment and its components, Importance of water, Role of an Environmental Engineer, Historical overview.	2
Water Demand: Design flow, design periods, design population, factors affecting water consumption, variation in water demand, design capacities for various water supply components.	5
Source of Water and Collection Works: Alternative sources i.e. rain, surface and ground water, Assessment of yield and development of the source.	4
Quality of Water: The hydrological cycle and water quality, physical, chemical and biological water quality parameters, water quality requirements, Indian Standards.	4
Transmission of Water: Hydraulics of conduits, selection of pipe materials, pipe joints, pumps, pumps station.	3
Preliminary Treatment of Water: Historical overview of water treatment, water treatment processes (theory and application): aeration, solids separation, settling operations, coagulation, softening,	5
Advanced Treatment of Water: filtration, disinfection, other treatment processes, dissolved solids removal, treatment plant design, preparation of hydraulic profiles.	8
Distribution of Water: Method of distributing water, distribution reservoirs, distribution system, distribution system components, capacity and pressure requirements, design of distribution systems, hydraulic analysis of distribution systems, pumping required for water supply system.	5
Plumbing of Building for Water Supply: Service connections, fixture units, simultaneous flow, design of plumbing system.	3
TOTAL	40

Suggested Readings:

1. *Water Supply* by S.K. Garg, Khanna Publishing Co.
2. *Environmental Engineering* by Peavy, H.S., Rowe D.R. and Techobanoglous, Mc Graw Hill, Book Company.
3. *Manual of Water Supply and Water Treatment*, Ministry of Urban Development, Govt. of India.

CEL311: HIGHWAY AND TRAFFIC ENGINEERING (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Introduction: Importance and Role of Transportation Systems, Technological and Operating Characteristics of Transportation Systems, Components of transportation Systems, Transportation Coordination, Transportation Modes and their comparison. Highway Planning: Highway Planning Process, specifically in India, Transport or Highway related Agencies in India, Classification of Roads and Road Development Plans, Road Patterns, Controlling Factors and Surveys for Highway Alignment.	7
Highway Geometric Design: Cross Sectional Elements, Sight Distances – definition and analysis of SSD and OSD, Design of Horizontal Alignments, Design of Vertical Alignments – Gradients, Vertical curves. Recommendations Related Indian Road Congress publications.	6
Highway Materials and Construction: Desirable Properties, Testing Procedures, Standards and standard values relating to Soil, Aggregates and Binders, Bituminous Emulsions and Cutbacks, Bituminous mix design and specifications, Methods of constructing different types of roads, Equipment for highway construction of rigid and flexible pavements	7
Structural Design of Highway Pavements: Design of Flexible Pavements by CBR method. Design as per guidelines of relevant Indian Road congress code of Practice, Maintenance of roads.	7
Traffic Engineering: Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems	7
Road safety: Road Safety under heterogeneous traffic, Audit: necessity, fundamentals with norms	3
TOTAL	40

Suggested Readings:

1. *Highway Engineering* by Khanna SK & CG Justo, Nem Chand and Brothers, Roorkee.
2. *Highway Engg.* by L.R. Kadiyali, Khanna Tech Publications, Delhi.
3. *Specification for Roads & Bridges* by Ministry of Road Transports & Highways and Indian Road Congress.
4. *Railway Engineering* by Satish Chandra and M.M Agarwal, Oxford University Press, Delhi.
5. *Railway Engineering* by Sexena S.C. and Arora S.P, Dahnpat Rai Publishers, Delhi.
6. *Airport Engineering* by Rangwala, Charotar Publishing House.

CEL312: GIS AND REMOTE SENSING (L -4)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

CONTENTS	Hrs.
Photogrammetry: Definition of Photogrammetric Terms, Geometry of aerial and terrestrial photographs, Aerial camera and photo-theodolite, Scale of a Photograph, Tilt and Height displacements, Stereoscopic vision and stereoscopes, Height determination from parallax measurements, Flight planning, Maps and Map substitutes and their uses.	10
Remote Sensing: Introduction and definition of remote sensing terms, Remote Sensing System, Electromagnetic radiation and spectrum, Spectral signature, Atmospheric windows.	10
Different types of platforms, sensors and their characteristics, Orbital parameters of a satellite, Multi concept in Remote Sensing.	10
Image Interpretation: Principles of interpretation of aerial and satellite images, equipments and aids required for interpretation, ground truth – collection and verification, advantages of multirate and multiband images. Digital Image Processing concept.	10
Geographic Information System (GIS) : Introduction & applications of GIS in map revision, Land use, Agriculture, Forestry, Archaeology, Municipal, Geology, water resources, Soil Erosion, Land suitability analysis, change detection.	10
TOTAL	50

Suggested Readings:

1. *Basics of Remote Sensing & GIS* by Dr. S.Kumar , Univertsity Sc. Press.
2. *Geographic Information System* by Kang Tsung Chang, Tata Mc Graw Hills.
3. *Remote Sensing and GIS* by Legg.C.A., Ellis Horwood, London.
4. *Remote sensing and GIS* by Bhatt Oxford University Press

CEL313: FOUNDATION ENGINEERING (L -4)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course	1
Shallow Foundation: Methods of estimation of bearing capacity, computation of bearing capacity factors, Effect of eccentric and inclined loads, effect of water table on bearing capacity, Terzaghi, Vesic, Hansen, Moyerhof's analysis, Bearing capacity of stratified soils. IS code recommendations for minimum depth, factor of safety, design for local shear and general shear failure.	10
Settlement Under Foundation: Methods of estimation of settlement of footings. Limits of settlements for various structures, Indian Standard Code Provisions (IS: 1904, 6403, 8009). Determination of allowable bearing capacity as per IS code. Schemartman's method, Dee beer's and Mortin method of finding out settlement from static cone penetration test. Methods of finding out bearing capacity from plate load test, standard penetration test data.	10
Pile Foundation: types of pile and their use, modes of failure. Bearing capacity and settlement of pile foundation. Types of piles, Allowable load, Pile load test, Dynamic and static formulae. Bearing Capacity factors. Pile group bearing capacity and settlement. Negative skin friction.	10
Expansive soils: Behaviour of expansive soil, foundation practices, under-reamed piles. Methods of finding out load carrying capacity of under reamed piles in clayey and sandy soil. Provision of IS 2911 Part III-1980 for design of under-reamed pile foundations.	10
Well foundations: design and construction. Bearing capacity, settlement and lateral resistance. Tilts and shifts, IS and IRC codes methods.	9
TOTAL	50

Suggested Readings:

1. *Basic & Applied Soil Mechanics -by Ranjan & Rao, New Age International Publishers.*
2. *Geotechnical Engineering by Gulhati & Dutta , Tata Mc Graw Hills, Delhi.*
3. *Design Aids in foundation Engineering by Kaniraj, Tata Mc Graw Hills, Delhi.*

CEL314: WIND AND SEISMIC ANALYSIS (L -4)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course	1
Design Loads: Design loads for different types of buildings. (IS-875 part 1 & 2). Load distribution & concept of load flow to different structural components.	4
Structural Systems: Assumption of integrity aspect ratios & over turning resistance, strength & stiffness of buildings, symmetry and Asymmetry in building forms, Vertical and lateral load resting elements, shear walls, framed tubes and various multistory configurations.	5
Wind loads: Wind loads & calculation of wind load on structures (IS: 875-Part 3).	10
Seismic loads: Earthquake loads & calculations of earthquake loads on buildings: masonry & framed structures. (IS: 1893 – Part 1).	10
Masonry and Framed Buildings: Design of masonry buildings and framed buildings, Earthquake resistant construction of buildings, and various provisions as per IS codes; IS-4326, IS-13827, IS-13828, IS-13920, IS-13935.	10
Mass Housing: Prefabricated construction for mass housing.	
Special Roofs: Introduction to folded plates, cylindrical shells, north-light shell roofs, grid and ribbed floors.	10
TOTAL	50

Suggested Readings:

Suggested Readings:

Latest IS : 875, Part I, II & III

Latest IS : 1893

Latest IS : 4326

Latest IS : 13920

CEP308: STEEL STRUCTURES DESIGN LAB(P-2)

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

Analysis and Design Problems as per syllabus of theory.

CEP304: Software in Civil Engineering (P-2)

Credit: 1

Max. Marks: 75 (IA: 50, ETE:25)

1. Introduction to Programming in MS EXCEL as a tool for solving Civil engineering problems.
2. Solution of structural Engg problems using STADDPRO/ETABS/SAP with import and export of data files from AUTOCAD.
3. Use of GIS software for landuse planning etc.
4. Use of PLAXIS and PRIMAWARE for Civil Engg problems

CEP310: ENVIRONMENTAL ENGINEERING LAB - I (P-2)

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

1. To determine the pH of the given sample of water.
2. To determine the turbidity of the given sample of water
3. To determine Total Solids of the given water sample.
4. To determine the Total Dissolved Solids of the given water sample.
5. To find out conductivity of the given water sample.
6. To determine hardness of the given water sample.
7. To find out chloride of the given water sample.
8. To determine alkalinity of the given water sample.
9. To find out acidity of the given water sample.
10. To determine hardness of the given water sample.
11. To determine the optimum dose of alum by Jar test.
12. To study various water supply Fittings.

CEP311: ROAD MATERIAL TESTING LAB (P-2)

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

1. Aggregate Impact test
2. To determine the flakiness index and elongation index test of given sample of aggregate.
3. To determine fineness modulus of a given sample of coarse aggregate.
4. Los angles abrasion test
5. Aggregate crushing value test
6. Specific gravity and water absorption test of aggregate.
7. Standard tar viscometer test
8. Ductility test
9. To determine the softening point for give sample of bitumen.
10. Marshall stability test

OPEN ELECTIVE

CEL315: GREEN BUILDING TECHNOLOGY (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Concept of Green Buildings: Green building Definition. Features, Necessity, Initiatives, Green buildings in India, Green building Assessment- Green Building Rating Systems (BREEAM.USGBC.LEED,IGBC.TERIGRIHA, GREEN for rating, Energy efficient criteria ,environmental benefits economic benefits. health and social benefits . Major energy efficiency areas for building, Contribution of buildings towards Global Warming. Life cycle cost of buildings, Codes and Certification Programs	10
Sources Of Energy: Renewable and Non-renewable sources of energy ; Coal, Petroleum, Nuclear, Wind, Solar, Hydro, Geothermal sources; potential of these sources, hazards, pollution; Global scenario with reference to demand and supply in India. Global efforts to reduce carbon emissions, Performance testing (new and existing): Building modeling Energy analysis. Commissioning, Metering, Monitoring. Carbon emission: Forecasting, Control of carbon emission, Air quality and monitoring carbon foot print; Environmental issues, Minimizing carbon emission, Energy retrofits and Green Remodels.	10
Green Building Materials: Sustainably managed Materials, Depleting natural resources of building materials; renewable and recyclable resources; energy efficient materials: Embodied Energy of Materials, Green cement, Biodegradable materials, Smart materials, Manufactured Materials, Volatile Organic Compounds (VOC's). Natural Non-petroleum Based Materials, Recycled materials, Renewable and Indigenous Building Materials. Engineering evaluation of these materials. Green Building Planning Methods, Energy Conservation Measures in Buildings, Waste & Water management and Recycling in Sustainable Facilities, Heating, Ventilation and Air Conditioning, Passive Solar & Daylight. Plumbing and its Effect on Energy Consumption	9
Design of Green Buildings; Sustainable sites, Impact of building on environment, Life cycle assessment, Principles of sustainable development in Building Design, Design on Bioclimatic and Specifications: Environment friendly and cost-effective Building Technologies, Integrated Life cycle design of Materials and Structures, Green Strategies for Building Systems, Alternative Construction and solar passive architecture. Considerations of energy consumption, water use, and system reliability, indoor air quality, noise level, comfort, cost efficiency in building design, Advanced Green building technologies and Innovations.	10
Construction Of Green Buildings: Energy efficient construction, Practices for thermal efficiency and natural lighting. Eco- friendly water proofing: ECB codes building rating, Maintenance of green buildings, Cost and Performance Comparisons and Benchmarking, Green Project Management Methods and Best Practices, Cost/ benefit analysis of green analysis of green buildings, Case studies Of rated buildings (new and existing)	10
TOTAL	50

Suggested Readings:

1. *Alternative Building Materials and Technologies* — By K S Jagadeesh, B V Venkatta, Rama Reddy & K S Nanjunda Rao — New Age International Publishers
2. *Integrated Life Cycle Design of Structures* — By Asko Sarja — SPON Press
3. *Non-conventional Energy Resources* — By D S Chauhan and S K Sreevasthava — New Age International Publishers
4. *Green Buildings (McGraw hill publication): by Gevorkian*
5. IGBC reference guide

OPEN ELECTIVE

CEL316: SAFETY MANAGEMENT IN CONSTRUCTION (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Introduction to Construction Industry- Safety issues in construction- Human factors in construction safety management. Roles of various groups in ensuring safety in construction industry. Framing Contract conditions on safety, and related matters. Relevance of ergonomics in construction safety.	10
Safety in various construction operations - Excavation- under- water works- under- pinning & shoring Ladders & Scaffolds- Tunneling- Blasting- Demolition- Pneumatic caissons- confined Space Temporary Structures. Indian Standards on construction safety- National Building Code Provisions on construction safety.	10
Safety in material handling and equipment - Safety in storage & stacking of construction materials.	10
Safety in these of construction equipment - Vehicles, Cranes, Tower Cranes, Lifting gears, Hoists & Lifts, Wire Ropes, Pulley blocks, Mixers, Conveyors, Pneumatic and hydraulic tools in construction. Temporary power supply.	10
Industrial Safety - Definitions, Preliminary, Inspecting staff, Health, Safety, Provisions relating to hazardous processes, Welfare, Working hours of adults, Employment of young persons, Special provisions. Dock workers (Safety, Health and Welfare)Act and Regulations - Definitions, Powers of Inspectors, Power of Govt. to direct Inquiry, Obligation of dock workers. Duties of Safety Officers, Reporting of accidents, Emergency Action Plan, Safety Committee.	9
TOTAL	50

Suggested Readings:

1. L.M.Prasad, Principles and Practice of Management, Sultan Chand and Sons.
2. V.P.S.Rao and P.S.Narayana, Principles of Management.
3. Construction equipments and management by SC Sharma; Khanna Publishers
4. Construction, Planning, Equipment and Methods by R.L.Peurifoy
5. Building Construction By Dr. Jha & S.K. Sinha
6. Hand book of Heavy construction: O'Brien, Havers & Stubb
7. Construction Engineering and Management By S.Seetharaman
8. FactoriesAct,1948 with amendments of 1976 & 1987.
9. Dock Workers (SHW)Act,1986; Rules,1990 & Regulations,1990.

CEL401: WATER RESOURCE ENGINEERING (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course	1
Regulation of works: Falls, Classification of falls, Design of falls, Distributory head regulator and cross-head regulator, Escape, bed bars. Cross-Drainage Structure: Necessity of Cross-drainage structures, their types and selection, comparative merits and demerits, design of various types of cross-drainage structure-aqueducts, siphon aqueduct, super passage siphon, level crossing and other types.	8
Diversion Head works: Design for surface and subsurface flows, Bligh's and Khosla's methods. Selection of site and layout, different parts of diversion head works, types of weirs and barrages, design of weirs on permeable foundation, silt excluders and different types of silt ejectors. Energy dissipation.	8
Embankment Dams: Suitable sites, causes of failures, stability and seepage analysis, flownet, slope stability analysis, precautions of piping, principles of design of earth dams. Gravity Dams: Force acting on a gravity dam, stability requirements, Instrumentation.	8
Spillways: Spillway capacity, flood routing through spillways, different types of spillways and gates, energy dissipation below spillways. Hydro Power Plant: General features of hydroelectric schemes, elements of power house structure, selection of turbines, draft tube and setting of turbine, cavitations.	8
Reservoirs: Evaluation of impact of water projects on river regimes and environment. Reservoir sedimentation and water shed management. Optimization: Introduction to optimization techniques and system approach. Introduction to G.I.S. and Computer aided irrigation design.	8
TOTAL	40

Suggested Readings:

1. *Theory and Design of Irrigation Structures by Varshney Gupta and Gupta, Nem Chand & Brothers, Roorkee.*
2. *Irrigation Water Power and Water Resource Engineering By KR Arora, Standard Publishers and Distributors, Delhi.*
3. *Water Resources Engineering by Modi ,Standard Publishers.*
4. *Fundamentals of Irrigation Engineering by Bharat Singh, Nem Chand Brothers, Roorkee.*

CEL402: ENVIRONMENTAL ENGINEERING – II (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course	1
General: Terms: sewerage, domestic sewage, sewage treatment, disposal scope, Role of an Environmental engineer, historical overview. Sewage Characteristics: Quality parameters: BOD, COD, TOC, Solids, DO, Nitrogen, Phosphorus, Standards of disposal into natural watercourses and on land, Indian standards.	8
Collection of Sewage: Systems of sewerage, Separate, combined, and partially separate, components of sewerage systems, systems of layout, quantity of sanitary sewage and variations, quantity of storms water, rational method, shapes of sewer, Hydraulic design of sewers: diameter self cleansing velocity and slopes, construction and testing of sewer line, Sewer materials, joints and appurtenances, Sewage pumping and pumping stations, maintenance of sewerage system.	8
Sewage Treatment: Various units: their purpose, sequence and efficiencies, preliminary treatment, screening and grit removal units, oil and grease removal, primary treatment, secondary treatment, activated sludge process, trickling filter, sludge digestion and drying beds, stabilization pond, septic tank, soakage systems, recent trends in sewage treatment, advanced wastewater treatment :nutrient removal, solids removal.	8
Wastewater Disposal and Reuse: Disposal of sewage by dilution, self-purification of streams, sewage disposal by irrigation sewage farming, waste waters reuse. Plumbing for Design of Buildings: Various systems of plumbing – one pipe, two pipes, single stack, traps, layout of house drainage.	8
Air and Noise Pollution: Air quality, Emission standards, vehicular pollution, Effect of air pollution on human health, Noise Pollution, global effect of air and noise pollution, green house effect, acid rain etc.	7
TOTAL	40

Suggested Readings:

1. *Environmental Engineering II* by B.C. Punmia, Arihant Publishers, Jodhpur.
2. *Sanitary Engineering* by SK Garg, Khanna Publishing Co.
3. *Manual on Sewage and Sewage Treatment* Ministry of Urban Development Govt. of India.
4. *Water and Waste Water Engineering* by Fair, G.M., Geyer G.C. and Okun D.A, Ann Arbor Sc.Publishing.

CEL403: GROUND IMPROVEMENT TECHNIQUES (L -4)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

CONTENTS	Hrs.
Introduction to scope, objective and outcome of subject.	1
Introduction: Formation of soil, major soil types, collapsible soil, expansive soil, reclaimed soil, sanitary land fill, ground improvements; objective, potential.	5
General Principles of Compaction: Mechanics, field procedure, quality control in field.	4
Ground Improvement in Granular Soil: In-place densification by (a) Vibro-floatation (b) Compaction piles in sand(c) Vibro compaction piles (d)Dynamic compaction (e) Blasting	10
Ground Improvement in Cohesive Soil: Preloading with or without vertical drains. Compressibility vertical and radial consolidation, Rate of consolidation, Preloading methods. Types of drains, Design of vertical drains, Construction techniques.	6
Stone Column: Function, Design principles, load carrying capacity, construction techniques, settlement of stone column foundation.	4
Ground Improvement by Grouting & Soil Reinforcement: Grouting in soil: Types of grout, desirable characteristics, Grouting pressure, Grouting methods.	5
Soil Reinforcement: Mechanism, Types of reinforcing elements, Reinforcement- Soil interaction, Reinforced soil application beneath roads, foundation and retaining walls.	5
Soil Stabilization: Lime Stabilization – Base Exchange Mechanism, Pozzolonic Reaction, Lime-soil Interaction, Lime Columns, Design of Foundation on Lime Column; Cement Stabilization- Mechanism, amount, Age and curing; Fly Ash-Lime Stabilization; Soil Bitumen Stabilization	10
TOTAL	50

Suggested Readings:

1. *Ground Improvement Techniques by Purushottam Raj, Tata Mc Graw Hills, Delhi.*
2. *Text book of Geostatic Engineering by Gulhati & Dutta, Tata Mc Graw Hills, Delhi.*
3. *Principles of Foundation Engg by B.M. Das, Thomson, Books/Cole.*
4. *Foundation Design Manual By N.V Nayak, Dhanpat Rai and Sons.*
5. *Soil Engineering in Theory and Practice Vol. III by Alam Singh CBS Publishers*

CEL404: BRIDGE ENGINEERING (L -4)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course	1
Introduction: Type of bridges & classification of road & railways bridges. IRC & Railway loadings for bridges, loads and forces considered on bridges.	4
Steel bridges Design of through type & deck type steel bridges for IRC loading. Design of deck type & through type truss bridges for railway loadings.	10
Reinforced Concrete Culverts & Bridges: Reinforced concrete slab culvert, T-beam bridges-courbons & Hendry-Jaegar methods. Design of a bridge as per IRC 112, basic design concept of balanced cantilever bridge, segmental, extradosed and integral bridges, voided slab, cable stay and suspension bridges	10
Prestressed Concrete Bridges: Prestressed concrete bridges as per relevant code	9
Bearings: Bearings for slab bridges and girder bridges. Elastomeric and pot PTFE bearings, design concepts, testing, placements and maintenance as per relevant codes	10
Joints: Expansion joints.- Types, design, placement and maintenance as per relevant codes	6
TOTAL	50

Suggested Readings:

1. *Design of Bridge Structures* by T.R. Jagadeesh & M.A. Jayaram, Prentice Hall Of India (PHI).
2. *Bridge Engineering* by Victor, Oxford and IBH Publishers.
3. *Design of Bridges* by Krishna Raju, Oxford and IBH Publishers.
4. *Bridge Super Structures* by Raj Gopalan, Standard Publishers & Distributers.
5. *Goncrete Bridge Practice* by Raina V.K., Tata Mc Graw Hill Co.
6. *Bridge Engineering* by Ponnuswamy, Tata Mc Graw Hills

CEL406: RAILWAY AND AIRPORT ENGINEERING (L -4)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course	1
Introduction and Permanent Way Components: Types and Selection of Gauges, Selection of Alignment, Ideal Permanent Ways and Cross-sections in different conditions, Drainage, Salient Features and types of Components viz. Rails, Sleepers, Ballast, Rail Fastenings.	10
Study of Specific Aspects: Coning of Wheels, Creep, Wear, failures in Rails, Rail Joints, Length of Rail, Sleeper Density and Spacing, Stations, Yards and Sidings, Turn-Table, Signaling. use.	
Points and Crossings: Types of Turnouts, Points or Switches, layout Plans of different types of Crossings, Design calculations of turnouts. Railway Systems Specific to Urban Movements: Surface railways (sub urban railway system of Mumbai, Chennai and Delhi), Underground system (Metro of Kolkata/ Delhi), Elevated Systems (as Proposed for Jaipur, Delhi, Mumbai), Light Rail System (MRTS, Thane). Recent Developments in Railway Networking.	10
Geometric Design: Gradient and Grade Compensation, Super elevation and cant, cant deficiency, Types of Curves, Transition curves, their designs, Widening of Gauges.	10
Airport Engineering:- Introduction: Requirements to Airport Planning, Airport Classifications, Factors in Airport Site Selection, Airport Size, Obstructions, Zoning.	
Planning and Design of Airport: Requirements of Airport, Planning of Terminal Area, and different Layouts, Location of Gates, Types of Runway patterns, Runway Layout, Runway Length, Geometric Design of Runways, Layout of Taxiways, Geometric Standards, Exit or Turnaround Taxiways, Apron and Hangers.	10
Airport Pavement Design: Factors Affecting Pavement Design, Design methods of Flexible Pavements, Design methods of Rigid Pavements.	9
TOTAL	50

Suggested Readings:

1. *Railway Engineering* by Saxena S.C. and Arora S.P, Dhanpat Rai Publishers, Delhi
2. *Airport Engineering* by Rangwala, Charotar Publishing House.
3. *Transportation Engineering* by A.K. Upadhyay, S.K.Kataria and Sons.
4. *Railway Engineering* by Satish Chandra and M.M Agarwal, Oxford University Press, Delhi

CEL407: PAVEMENT DESIGN (L -4)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

Syllabus	Hrs.
Objective, Scope and Outcome of the Course	1
History of Pavements, Pavements types, Advantages and Dis advantages Components of pavement structure, importance of sub-grade soil properties on pavement performance. Functions of sub-grade, sub-base, base course and wearing course.	5
Pavement Mix Analysis: Aggregate blending, bituminous mix design – Marshall Stability approach, concrete mix design for roads.	5
Stresses in Flexible Pavements: Stresses in homogeneous masses and layered systems, deflections, shear failures, equivalent wheel and axle loads	5
Elements in Design of Flexible Pavements: Loading characteristics-static, impact and repeated loads, effects of dual wheels and tandem axles, area of contact and tyre pressure, modulus or CBR value of different layers, equivalent single wheel load, equivalent stress and equivalent deflection criterion, equivalent wheel load factors, climatic and environmental factors.	6
Design Methods for Flexible Pavements: California bearing ratio (CBR), U.S. Navy method. Triaxial method, Mcleod method, Boussinesq's and Burmister's analysis and design method, IRC method for Flexible Pavement Design	6
Rigid Pavements: Wheel load stresses, Westergaard's analysis, Bradbury's approach Arlington test, Pickett's corner load theory and charts for liquid, elastic and soil of finite and infinite depths of subgrade. IRC Method of rigid pavement design	6
Temperature Stresses: Westergaard's and Thomlinson's analysis of warping stresses, Combination of stresses due to different causes, Effect of temperature variation on Rigid Pavements.	6
Reinforced Concrete Slabs: Prestressed concrete slabs-general details. Design of Tie Bars and Dowel Bars	6
Pavement in special conditions: Rigid and Flexible Pavement in difficult conditions and waterlogged areas	2
Defects in pavements: Common reasons of failures in flexible and rigid pavements and remedial measures	2
TOTAL	50

Suggested Readings:

- 1 Y oder, E.J. and Witzak, M.W., "Principles of Pavement Design 2nd Ed", John Wiley & Sons, Inc.
- 2 O'Flaherty, A. Coleman, "Highways : the Location, Design, Construction and Maintenance of Road Pavements", 4th Ed., Elsevier
- 3 O'Flaherty, A. Coleman, "Highways : the Location, Design, Construction and Maintenance of Road Pavements", 4th Ed., Elsevier
- 4 Fwa, T.F., "The Hand Book of Highway Engineering", CRC Press Taylor & Francies Group
Khanna, S.K. and Justo, C.E.G., "Highway Engineering Nem Chand Jain & Bros
- 5 Papagiannakis, A.T. and Masad, E.A., "Pavement Design and Materials, John Wiley & Sons Inc.
- 6 Related IS codes and IRC publications

CEL408: REPAIR AND REHABILITATION OF STRUCTURES (L-4)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

Max. Marks: 100

Exam Hours: 3

Contents	Hrs.
Objective, Scope and Outcome of the Course	1
Deterioration of Concrete Structures: Penetrability of concrete- permeability, sorptivity, diffusion. Physical processes- abrasion, erosion. Chemical- carbonation, chloride and sulfate attack. Alkali – Aggregate Reaction. Corrosion- mechanism.	5
Factors affecting and Preventive measures for all the above, including water – proofing techniques for various conditions, sacrificial anode, corrosion resistant steel, corrosion inhibitors, protective coatings etc.	5
Cracks in Concrete and Masonry Structures- Types, patterns, measurement and preventive measures	4
Assessment of Risk /Damage in Structures: <i>Preliminary investigation-</i> visual, history collection etc. <i>Detailed Investigation:</i> core cutting, rebar locator, corrosion meter, penetration resistance, pull out tests, half-cell potential, concrete resistivity etc. Interpretation of non destructive test data from all the above tests as well as rebound hammer number and ultra sonic pulse velocity. Destructive and chemical tests- on material samples from site. Illustrations through case study/ies/field study	9
Materials for Repair: polymers and resins, self curing compounds, FRP, ferro-cement- properties, selection criterion, cement based and polymer modified mortars etc	8
Repair Techniques: Grouting, Jacketing, External bonded plates- processes, limitations, design computations etc. including numerical problems. Under Water Repair: Processes	8
Case Studies: related to rehabilitation of bridge piers, heritage structures, masonry structures etc./field studies	8
Conservation and restoration of heritage structure: Materials, methods and case studies	2
TOTAL	50

Suggested Readings:

1. *Properties of Concrete* by A.M. Neville, Pearson.
2. *Concrete Technology* by M.S. Shetty, S.Cahnd & Comp.
3. *Hand book of Analytical Techniques in Concrete Tech* by V.S.. Ram Chandran, Standard Publishers.

CEL409: FIRE AND SAFETY ENGINEERING

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

Contents	Hours
Objective, Scope and Outcome of the Course Basic concepts of Fire Engineering: Classification of fire, causes of fire, detection, prevention, extinguishing methods, first aid, fire-Fighting equipment.	5
Fixed fire-fighting Installations using Water: Hydrant or fire water system, Classification of hydrant system, Sprinkling system, Major foam pourer system, Steam drenching system, Emulsification	5
Fixed fire-fighting Installations without using water: Complete CO ₂ flooding system, Complete DCP spraying system, Complete Halon flooding system	5
Fire Control Technology: Hose, Types of hose, Characteristics, Rope, Lines, knots and ladders, Pumps, primers, tenders and water relays	5
Hazardous Materials/Chemicals: their properties, transportation and storage, threshold limits of chemicals, limits of flammability, PPE's usage – respiratory and non-respiratory, handling and storage of high-pressure gas cylinders, work in confined places – risks and hazards,	8
Fire Resistant Construction: General requirement, fire resistance rating of different materials, factors affecting means of escape and structural fire safety, compartmentation, smoke extraction systems, fire separation wall	9
Fire Safety Design of Buildings: Aims, Principles, technical requirements, passive and active fire protection, Emergency and escape lighting, Fire detection and alarm systems, Signage, Fire-fighting shafts, Fire hydrants, Norms and standards as per National Building Code	9
Safety Management and Legislation: Functions of safety management, Factories Act 1948, Workmen compensation Act 1923	4
TOTAL	50

Suggested Readings:

1. *Fire Protection and Prevention* by Brendra Mohan San, UBS Publishers & Distributors Pvt Ltd. Edition: 1st Edition 2008
2. *Hand Book of Fire Technology* by R.S. Gupta, Orient Longman Publishers, 2nd Edition 2005
3. *Hand Book of Fire and Explosion Protection Engineering* by Dennis P Nolan, Crest Publishing House, 1st Edition 2007
4. *National Building Code*, Bureau of Indian Standards.

CEP401: WATER RESOURCE ENGINEERING DESIGN LAB(P-2)
Credit: 1 **Max. Marks: 75 (IA:50, ETE:25)**

Analysis & Design Problems as per syllabus of theory.

CEP402: ENVIRONMENTAL ENGINEERING LAB-II (P-2)

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

1. To determine the pH of the given sample of sewage.
2. To determine Total Solids of the given sewage sample.
3. To determine the Total Dissolved Solids of the given sewage sample.
4. To find out Total Settle-able Solids of the given sewage sample.
5. To determine Total Suspended Solids of the given sewage sample.
6. To find out the Quantity of Dissolved Oxygen present in the given water sample by Winkler's Method.
7. To determine Biochemical Oxygen Demand exerted by the given wastewater sample.
8. To find out Chemical Oxygen Demand of the waste water sample.
9. To study various Sanitary Fittings.

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CEL410: PROJECT PLANNING & CONSTRUCTION MANAGEMENT (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course	1
Financial Evaluation of Projects and Project Planning: Capital investment proposals, criterions to judge the worth whileness of capital projects viz. net present value, benefit cost ratio, internal rate of return, Risk cost management, main causes of project failure. Categories of construction projects, objectives, project development process, Functions of project management, Project management organization and staffing, Stages and steps involved in project planning, Plan development process, objectives of construction project management.	7
Project Scheduling: Importance of project scheduling, project work breakdown process – determining activities involved, work breakdown structure, assessing activity duration, duration estimate procedure, Project work scheduling, Project management techniques – CPM and PERT networks analysis, concept of precedence network analysis.	8
Project Cost and Time Control: Monitoring the time progress and cost controlling measures in a construction project, Time cost trade-off process: direct and indirect project costs, cost slope, Process of crashing of activities, determination of the optimum duration of a project, updating of project networks, resources allocation.	8
Contract Management: Elements of tender operation, Types of tenders and contracts, Contract document, Legal aspects of contracts, Contract negotiation & award of work, breach of contract, determination of a contract, arbitration.	8
Safety and Other Aspects of Construction Management: Causes and prevention of accidents at construction sites, Safety measures to be followed in various construction works like excavation, demolition of structures, explosive handling, hot bitumen work. Project Management Information System – Concept, frame work, benefits of computerized information system. Environmental and social aspects of various types of construction projects.	8
TOTAL	40

Suggested Readings:

1. *Project Management with CPM /PERT* by B.C. Punmia, Laxmi Publication (P) Ltd.
2. *Construction Project Management* by K.K. Chitkara, Tata Mc Graw Hills.
3. *Project Management* by Modder & Phillph, CBS Publishers.

CEL411: AIR AND NOISE POLLUTION AND CONTROL (L -3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course	1
Introduction to Air Pollution: Air and its composition, Air Pollution, Sources of air pollution and its classification, Major air Pollutants and their characteristics, Specific group pollutants such as CFC, GHG etc. Air Pollutants from various industrial sectors. Impact of air pollution on human health and vegetation. Introduction to Noise: Difference between sound and noise, Pitch and Frequency, Sound Pressure, Sound Pressure level (Decibel), Leq, sources of noise and harmful effects of noise and noise measurement.	7
Pollutant Dispersion and Meteorology: Atmospheric meteorology, wind profiles, turbulent diffusion, topographic effects, separated flows, temperature profiles in atmosphere, stability, inversions, plume behaviour. Concept of atmospheric stability. Adiabatic and Environmental Lapse rate. Plume behavior. Concept of maximum mixing depth and ventilation coefficient. Plume rise and effective stack height.	8
Air Quality: Introduction to Air quality index and Comprehensive Environmental Pollution Index etc. and its application. Sampling and measurement of air pollutants. Introduction to National Ambient Air Quality Standards. Air Quality Monitoring: Objectives, time and space variability in air quality; air sampling design, analysis and interpretation of air pollution data, guidelines of network design in urban and rural areas. Stack monitoring.	10
Impacts of Air Pollution: Extreme air Pollution scenarios: Acid Rain, Global Warming, Smog, Ozone layer depletion etc. Various treaties and protocols: Kyoto Protocol and Montreal Protocol etc. Control methods and equipment: Introduction to control methods and equipment for Particulate matter and gases. Design and working of scrubbers, Electrostatic Precipitator, Gravity settlers, Cyclone separator, Filter bags etc. Other mechanisms of air pollution control such as Biochemical Processes, catalytic processes etc.	10
Noise standards and limit values: Noise instrumentation and monitoring procedure. Noise indices, Methods of abatement of noise pollution. Guidelines and laws Governing air and noise pollution.	4
Total	40

Suggested Readings:

1. L Theodore, *Air Pollution Control Equipment Calculations*, John Wiley and Sons, 2008.
2. De Nevers, N., *Air Pollution Control Engineering*, 3rd edition Waveland Press Inc 2016.
3. Sagar Pal Singal, *Noise Pollution and Control Strategy*, Alpha Science International Ltd; 2005 2nd Edition.
4. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, *Environmental Engineering*, McGraw-Hill, 1985.
5. A Tiwari and J Colls, *Air Pollution: Measurement, Modeling and Mitigation*, Taylor & Francis, 2010.
6. Richard W. Boubel et al "Fundamentals of Air pollution", Academic Press, New York, 1994

CEL412: ROCK ENGINEERING (L -3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course	1
Engineering Classification of Rocks: Objectives, Intact rock classification, Rock mass Classification. Terzaghi's, Rock load classification, Austrian classification, Deere's rock quality classification, rock structure rating concept, RMR classification, Q classification. Inter relation between Q and RMR, prediction of ground condition and support pressure. Effect of Tunnel size on support pressure.	7
Engineering Properties and Laboratory Tests on Rocks: Porosity, Density, Moisture content, Degree of saturation, Co-efficient of permeability, Durability, Compressive strength, Tensile strength, Shear strength, elasticity, Plasticity Deformability. Sampling and Samples Preparations, Uniaxial Compressive strength, Tensile Strength – Brazilian test, Shear strength test – Direct Shear test and Punch shear test, Triaxial Test, Flexural strength.	8
Insitu Tests on Rocks: Necessity of Insitu test, Plate load test for deformability, Shear test, Test for internal stresses – flat Jack, pressure meter test.	4
Jointed Rocks: Rocks Joint properties, Joint properties, Joint Roughness Co-efficient, Scale effects, Dilation, Orientation of Joints, Gouge, Joint Intensity, Uniaxial Compressive strength of Jointed Rocks.	5
Strength of Rocks in Unconfined Condition: Ramamurthy Strength Criteria, Singh and Rao Strength Criteria, Kulatilake Methodology, Hoek Criteria, Barton Methodology.	5
Strength of Rocks in Confined Condition: History of Hoek and Brown Failure Criteria and latest methodology, Parabolic Strength Criteria.	5
Bearing Capacity of Rocks: Bearing capacity of intact rocks, jointed rocks, IS Code methodology, Singh and Rao Method and latest methodologies.	5
TOTAL	40

Suggested Readings:

1. *Rock Engg. For Engineers* by B.P. Verma , Khanna Publishers.
2. *Rock Engg. By Bhawani Singh, Elsevier Science Ltd.*
3. *Foundation on Rocks* by Duncan C.Wyllie, Spon Press.
4. *Engineering in Rock for Slopes, Foundation and Tunnels*, by Ramamurthy, PHI Delhi.
5. *Latest IS Codes on Rocks*

CEL413: PRESTRESSED CONCRETE (L -3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

S. N.	Course Content	Hrs.
1	Objective, Scope and Outcome of the Course	1
2.	Introduction: Basic concepts of Pre-stressing and its advantages. Materials for pre-stressed concrete. Categories of Tensioning devices. Pre-tensioning & Post-tensioning: Principle. Method and systems of pre and post tensioning.	4
3.	Analysis of Pre-stress and Bending Stresses: Assumptions, Flexural analysis of pre-stressed rectangular and unsymmetrical T section for eccentric straight tendon, bent tendon and tendon with parabolic profile. Concept of load balancing.	6
4.	Losses of Pre-stress: Losses due to - elastic deformation of concrete, successive tensioning of curved cable, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip.	4
5.	Design of Pre - stressed Concrete Sections: preliminary and final design of sections, design of pre and post tensioned flexural members; simply supported and continuous members.	7
6.	Flexural, Shear and Torsion Resistance of Members: simplified code procedure (IS-1343-2012);	4
7.	Pre - stressing techniques: transfer of pre - stress, code provisions for bond and transmission length.	4
8.	Cable profiles: Concordant and non - concordant cable profile and associated factors in continuous members. Modern cable laying: materials & practices, precautions etc.	4
9.	Deflection: Factors affecting deflection; Effect of tendon profile on deflection; Computation of deflection in pre - stressed concrete members.	6
TOTAL		40

Suggested Readings:

1. *Design of Pre stressed Concrete* by N.Krishnan Raju, Tata Mc Graw Hills.
2. *Design of Pre stressed Concrete* by T.Y. Lin, Wiley Eastern International.
3. *Design of Pre stressed Concrete Structures* by N.Sinha Ray, S.Chand Co.
4. *Prestressed concrete structures* by Praveen Nagrajan, Pearson

CEP410: PROJECT PLANNING AND CONSTRUCTION MANAGEMENT LAB (P-2)

Credit: 1

Max. Marks: 75 (IA:50, ETE:25)

1. **Estimates:** Methods of building estimates, types; site plan, index plan, layout plan, plinth area, floor area; Technical sanction, Administrative approval; estimate of buildings, roads, earthwork and R.C.C. works.
2. **Analysis of Rates:** For earthwork, concrete work, D.P.C., stone masonry,, plastering, pointing and roadwork.
3. **Specifications:** For different classes of building and Civil Engineering works.
4. **Types of contracts:** Tenders, tender form, submission and opening of tenders, measurement book, muster roll, piecework agreement and work order.
5. **Arbitration**
6. **Valuation of Real Estate.**

CEL209: DISASTER MANAGEMENT (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Introduction to scope, objective and outcome of subject.	1
Introduction: Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Natural and Manmade Disasters, Disaster and Development, and Climate Change. Professional ethical aspects.	5
Types of Disasters, their occurrence/ causes, impact and preventive measures: Geological Disasters: earthquakes, liquefaction, landslides, tsunamis, volcanoes Hydro-Meteorological Disasters: floods, cyclones, avalanches, droughts.	10
Biological Disasters: Epidemics, Pandemic Technological Disasters: chemical, industrial, radiological, nuclear.	7
Manmade Disasters: building collapse, rural and urban fire, wild fire, road and rail accidents. Disaster profile of Indian continent: Mega Disasters of India and Lessons Learnt. Risk mapping	8
Disaster Management Cycle: Disaster Management Cycle and its components: Pre disaster and post disaster, Paradigm Shift in Disaster Management.	5
Disaster management system in India: Disaster Management Act 2005, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter- Governmental Agencies	4
TOTAL	40

Suggested Readings:

1. Coppola D P, 2007. *Introduction to International Disaster Management*, Elsevier Science (B/H), London
2. *Dynamics of Structures by Clough & Penzin*, Mc Graw Hill Book Co.
3. *Manual on natural disaster management in India*, M C Gupta, NIDM, New Delhi.
4. *Earthquake Tips* by C.V R. Murthy, IIT Kanpur.
5. *An overview on natural & man-made disasters and their reduction*, R K Bhandani, CSIR, New Delhi
6. *Encyclopedia of disaster management, Vol I, II and III* Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
7. *Disasters in India Studies of grim reality*, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur
8. *Management of Natural Disasters in developing countries*, H.N. Srivastava & G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
9. *Disaster Management Act 2005*, Publisher by Govt. of India
10. *Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management*
11. *National Disaster Management Policy, 2009*, GoI

CEL317: REMOTE SENSING ESSENTIALS (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Introduction to scope, objective and outcome of subject.	1
Rudiments of remote sensing and advantages, Historical Perspective of development of remote sensing technology, EM spectrum, solar reflection and thermal emission, Interaction of EM radiation with atmosphere including atmospheric scattering, absorption and emission, Interaction mechanisms of EM radiation with ground, spectral response curves	8
Laws of Radiation and their relevance in Remote Sensing, Basis of remote sensing image representation, Various Remote Sensing Platforms, Multi-spectral scanners and imaging devices, Significant Characteristics of LANDSAT, SPOT, Sentinel sensors	7
Prominent characteristics of IRS, Cartosat, ResourceSat sensors, Unmanned Aerial Vehicle / Drone, Passive & Active Remote Sensing, Image characteristics and different resolutions in Remote Sensing, Different techniques of Image acquisition	8
Importance of digital image processing, Digital Image Processing Software, Basic image enhancement techniques, Colour representations and transforms, Image Histograms and statistics, Spatial Filtering Techniques, Band rationing and PCA, Unsupervised image classification and density slicing techniques, Supervised image classification techniques and limitations, LiDAR Technique and applications	8
Image interpretation of different geological landforms, rock types and structures, Google Earth and its Applications, Applications of Remote Sensing in Earthquake Studies, Different sources of free satellite images, Limitations of Remote Sensing Techniques	8
TOTAL	40

Suggested Readings:

1. *Introduction to Remote Sensing*, (5th Ed.), The Guildford Press, New York, 2012.
2. Lillesand, T.M., Kiefer, R.W. and Chapman, J.W., "Remote Sensing and Image Interpretation", (5th Ed.), John Wiley & Sons, 2007.
3. Gupta, R. P., "Remote Sensing Geology", 2nd Ed., Springer, 2003.
4. Drury, S. A., "Image Interpretation in Geology", 2nd Ed, Allen & Unwin, 1993.
5. Cracknell, A.P., "Introduction to Remote Sensing", (2nd Ed.), Tylor & Francis, London, 1991.
6. Gonzalez, Rafael C. and Richard E. Woods "Digital Image Processing", (3rd Edition) Pearson Education, London.

CEL315: GREEN BUILDING TECHNOLOGY (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Concept of Green Buildings: Green building Definition. Features, Necessity, Initiatives, Green buildings in India, Green building Assessment- Green Building Rating Systems (BREEAM.USGBC.LEED,IGBC.TERI.GRIHA, GREEN tor rating, Energy efficient criteria ,environmental benefits economic benefits. health and social benefits . Major energy efficiency areas for building, Contribution of buildings towards Global Warming. Life cycle cost of buildings, Codes and Certification Programs	5
Sources Of Energy: Renewable and Non-renewable sources of energy ; Coal, Petroleum, Nuclear, Wind, Solar, Hydro, Geothermal sources; potential of these sources, hazards, pollution; Global scenario with reference to demand and supply in India. Global efforts to reduce carbon emissions, Performance testing (new and existing): Building modeling Energy analysis. Commissioning, Metering, Monitoring. Carbon emission: Forecasting, Control of carbon emission, Air quality and monitoring carbon foot print; Environmental issues, Minimizing carbon emission, Energy retrofits and Green Remodels.	5
Green Building Materials: Sustainably managed Materials, Depleting natural resources of building materials; renewable and recyclable resources; energy efficient materials: Embodied Energy of Materials, Green cement, Biodegradable materials, Smart materials, Manufactured Materials, Volatile Organic Compounds (VOC's). Natural Non-petroleum Based Materials, Recycled materials, Renewable and Indigenous Building Materials. Engineering evaluation of these materials. Green Building Planning Methods, Energy Conservation Measures in Buildings, Waste & Water management and Recycling in Sustainable Facilities, Heating, Ventilation and Air Conditioning, Passive Solar & Daylight. Plumbing and its Effect on Energy Consumption	9
Design of Green Buildings; Sustainable sites, Impact of building on environment, Life cycle assessment, Principles of sustainable development in Building Design, Design on Bioclimatic and Specifications: Environment friendly and cost-effective Building Technologies, Integrated Life cycle design of Materials and Structures, Green Strategies for Building Systems, Alternative Construction and solar passive architecture. Considerations of energy consumption, water use, and system reliability, indoor air quality, noise level, comfort, cost efficiency in building design, Advanced Green building technologies and Innovations.	10
Construction Of Green Buildings: Energy efficient construction, Practices tor thermal efficiency and natural lighting. Eco- friendly water proofing: ECB codes building rating, Maintenance of green buildings, Cost and Performance Comparisons and Benchmarking, Green Project Management Methods and Best Practices, Cost/ benefit analysis of green analysis of green buildings, Case studies Of rated buildings (new and existing)	10
TOTAL	40

Suggested Readings:

1. *Alternative Building Materials and Technologies — By K S Jagadeesh, B V Venkatta, Rama Reddy & K S Nanjunda Rao — New Age International Publishers*
2. *Integrated Life Cycle Design o! Structures — By AskoSarja — SPON Press*
3. *Non-conventional Energy Resources — By D S Chauhan and S K Sreevasthava — New Age International Publishers*
4. *Green Buildings (McGraw hill publication): by Gevorkian Publisher.*
5. IGBC reference guide

CEL316: SAFETY MANAGEMENT IN CONSTRUCTION (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100) Credit: 4

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Introduction to Construction Industry- Safety issues in construction- Human factors in construction safety management. Roles of various groups in ensuring safety in construction industry. Framing Contract conditions on safety, and related matters. Relevance of ergonomics in construction safety.	8
Safety in various construction operations - Excavation- under- water works- under- pinning & shoring Ladders & Scaffolds- Tunneling- Blasting- Demolition- Pneumatic caissons- confined Space Temporary Structures. Indian Standards on construction safety- National Building Code Provisions on construction safety.	8
Safety in material handling and equipment - Safety in storage & stacking of construction materials.	6
Safety in these of construction equipment - Vehicles, Cranes, Tower Cranes, Lifting gears, Hoists & Lifts, Wire Ropes, Pulley blocks, Mixers, Conveyors, Pneumatic and hydraulic tools in construction. Temporary power supply.	8
Industrial Safety - Definitions, Preliminary, Inspecting staff, Health, Safety, Provisions relating to hazardous processes, Welfare, Working hours of adults, Employment of young persons, Special provisions. Dock workers (Safety, Health and Welfare)Act and Regulations - Definitions, Powers of Inspectors, Power of Govt. to direct Inquiry, Obligation of dock workers. Duties of Safety Officers, Reporting of accidents, Emergency Action Plan, Safety Committee.	9
TOTAL	40

Suggested Readings:

1. L.M.Prasad, Principles and Practice of Management, Sultan Chand and Sons.
2. V.P.S.Rao and P.S.Narayana, Principles of Management.
3. Construction equipments and management by SC Sharma; Khanna Publishers
4. Construction, Planning, Equipment and Methods by R.L.Peurifoy
5. Building Construction By Dr. Jha & S.K. Sinha
6. Hand book of Heavy construction: O'Brien, Havers & Stubb
7. Construction Engineering and Management By S.Seetharaman
8. FactoriesAct,1948 with amendments of 1976 & 1987.
9. Dock Workers (SHW)Act,1986; Rules,1990 & Regulations,1990.

DS-TRANSPORTATION ENGINEERING

CEL415: TRANSPORTATION PLANNING (L-3)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Urban Transportation System Planning : Describe the role of transportation in urban development, transportation planning process in urban areas, factors affecting the transportation system planning, factors affecting travel demand, process of urban transport forecasting.	8
Planning of Low volume roads: Introduction to planning of low volume roads, concepts of network planning, selection of roadway alignment, factors affecting route selection, engineering surveys for new road location.	7
Transportation Surveys: Describe the concept of study area, zoning, Compare the strengths and limitations of different types of transportation survey, Prepare inventory of transport facilities.	8
Trip Generation and Distribution: Concept and purpose of trip generation, factors affecting the trip generation and attraction rates, concept and methods of trip distribution.	8
Transportation Plan Preparation: Various terms regarding transportation plan preparation, Transportation plan for urban mass rapid transit system, Salient features of the rail-based transit systems, Salient features of the road-based transit systems.	8
TOTAL	40

Suggested Books:

- 1 Traffic Engineering and Transportation Planning Kadiyali, L. R. Khanna Publishers, New Delhi
- 2 Introduction to Transportation Engg and Planning Hutchison, B. G. McGraw-Hill Book Co.
- 3 Introduction to Transportation Engg. and Planning Morlok, Edward K. McGraw-Hill Book Co.
- 4 Urban Public Transit System and Technology Vuchic, Vukan R. PHI Learning, New Delhi
- 5 Metropolitan Transportation Planning Dickey, John W. McGraw-Hill Book Co.

DS-TRANSPORTATION ENGINEERING

CEL416: TRAFFIC ENGINEERING AND FIELD STUDIES (L-4)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Traffic characteristic: Review of road user characteristics and vehicular characteristics. Spot speed studies-data analysis and interpretations, Speed and delay studies- Purpose, course of delay, various methods of speed and delay studies, Traffic volume studies and characteristics, Various methods of O and D studies and sampling.	12
Traffic capacity studies- Volume and density relationships, critical density, basic, possible and practical capacities. Factors affecting possible and practical capacities.	10
Parking studies and characteristics – Public interest in parking studies, cordon count, space inventory, parking practices. Evaluation of parking controls.	9
Accident studies and characteristics – Course of accidents, accident studies and records, reports, application of accident studies, preventive measures.	9
Traffic controls and operations a) Traffic regulations and various means of traffic control, traffic islands, rotaries & singles. b) Traffic management- Techniques and applications. c) Roadway Lighting-Design and layout.	9
TOTAL	50

Suggested Books:

1. Traffic Engineering: Ross Blundon
2. Traffic Engineering: Matson.
3. Highway Engineering: G.V. Rao
4. Traffic Engineering- By L.R. Khadyali

DS-TRANSPORTATION ENGINEERING

CEL417: ADVANCED HIGHWAY MATERIAL CHARACTERIZATION

(L-3, Credit 3)

Exam Hours: 3 Max. Marks: 150 (IA: 50, ETE: 100) Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Aggregates: Classification, gradation, physical properties test, blending of aggregate by triangular chart and trial and error proportioning methods, IRC/MORT&H specifications.	6
Soil: Soil, classification, nomenclature, desirable properties, laboratory and field test, IRC/MORT&H standards, materials for low cost roads, stabilized soil, lime, fly ash, and cement and soil-bitumen stabilization.	6
Bitumen: Bitumen, origin, extraction, physical properties test, various terms used related to tar and bitumen, uses and application of different bituminous material in highway construction, bitumen chemistry, constituents structure, ageing, rheology of bituminous binders, Adhesion, failures, weathering of bituminous road materials	8
Asphalt concrete: bituminous mixes, requirements of bituminous mixes, Marshall and other methods of bituminous mix design, IRC/ MORT&H specifications (clause 500), bitumen modification.	8
Cement Concrete: Cement, constituents, environmental issues concrete, properties of cement in fresh and hardened state, test methods, durability properties, mineral admixtures, material specifications, Concrete Mix Design.	12
TOTAL	40

Suggested Readings:

1. Krebs, Robert D. And Walker, R. D. (1971), "*Highway Materials*", McGraw Hill Book Co., New York.
2. Her Majesty's Stationery Office (1966), "*Soil Mechanics for Road Engineers*", Ministry of Transport, Road Research Laboratory, UK.
3. Her Majesty's Stationery Office (1966), "*Bituminous Materials in Road Construction*", Ministry of Transport, Road Research Laboratory, UK.
4. Her Majesty's Stationery Office (1966), "*Concrete Roads Design and Construction*", Ministry of Transport, Road Research Laboratory, UK.
5. Read, J. And Whiteoak, D. (2003), "*The Shell Bitumen Handbook*", Fifth edition, Shell Bitumen, Thomas Telford Publishing, London.
6. Relevant IRC and IS codes

DS-TRANSPORTATION ENGINEERING

CEL417: ADVANCED HIGHWAY MATERIAL CHARACTERIZATION LAB

(P-2, Credit 1)

Exam Hours: 3 Max. Marks: 75 (IA: 50, ETE: 25) Credit: 1

DS-TRANSPORTATION ENGINEERING

CEL418: HIGHWAY PAVEMENT MAINTENANCE (L-4)

Exam Hours: 3 Max. Marks: 150 (IA: 50, ETE: 100) Credit: 4

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Pavement Inventories and Evaluation : Serviceability Concepts ;Visual Rating ;Pavement Serviceability Index; Roughness Measurements ;Distress Modes – Cracking, Rutting etc; Pavement Deflection – Different Methods, Skid Resistance, Roughness, Safety – Aspects; Inventory System – Assessment of Deficiencies.	13
Pavement Quality Control : Causes of Deterioration, Traffic and Environmental Factors, Methods of Maintaining WBM, Bitumen and Cement Concrete Roads, Quality Assurance; Quality Control – ISO 9000 , Sampling Techniques – Tolerances and Controls related to Profile and Compaction.	13
Drainage: Assessment of drainage requirements for the road, design of various drainage components, drainage materials, surface and sub-surface drainage system for roads, drainage of urban roads.	11
Maintenance: Routine and periodic maintenance, preventive and reactive maintenance for drainage and pavements, Preparation of existing pavement for patching, profile correction, special measures to deal with reflection cracks in pavement overlays, requirements for rehabilitation, recycling.	12
TOTAL	50

Suggested Books:

1. Haas and Hudson , W. R. Pavement management systems –McGraw Hill publications
2. Sargious, M. A. – Pavements and surfacing for highways and airports – Applied Science Publishers ltd
3. Bridge and Pavement maintenance- Transportation Research Record no.800, TRB 4. Shahin M.Y, 1994- Pavement management for airports, roads and parking lots Bent Thagesan, 1996- Highway and Traffic engineering for developing countries

DS-TRANSPORTATION ENGINEERING

CED414: MINI - PROJECT

Max. Marks: 150 (IA: 100, ETE: 50)

Credit: 5

**CEL411: CONSTRUCTION EQUIPMENTS AND IT'S
MANAGEMENT (L-3)**

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 3

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Equipment for Earthwork Fundamentals of Earth Work Operations - earth moving operations - types of earth work equipment - tractors, motor graders, scrapers, front end loaders, earth movers.	8
Other Construction Equipment: equipment for dredging, trenching, tunneling, drilling, blasting - equipment for compaction - erection equipment - foundation and pile driving equipment - equipment for demolition.	6
Materials Handling Equipment forklifts and related equipment - portable material bins - conveyors - hauling equipment.	5
Equipment for Production of Aggregate and Concreting Crushers - feeders - screening equipment - handling equipment - batching and mixing equipment - hauling, pouring and pumping equipment - transporters.	5
Hauling and Conveying Equipment: Belt conveyor system; Terminology, Classification, Components, Power requirement estimation and design. Pile boring/ driving equipment, Concrete batching plant, Tunnel Boring Machines, Crushers, Air compressor, Drilling and blasting equipment	8
Construction Equipment Management: Identification - Planning - Equipment Management in Projects - Maintenance Management - Replacement- Cost Control of Equipment - Depreciation Analysis - Safety Management.	7
TOTAL	40

Suggested Readings:

1. L.M.Prasad, Principles and Practice of Management, Sultan Chand and Sons.
2. V.P.S.Rao and P.S.Narayana, Principles of Management.
3. Construction equipments and management by SC Sharma; Khanna Publishers
4. Construction, Planning, Equipment and Methods by R.L.Peurifoy
5. Building Construction By Dr. Jha & S.K. Sinha
6. Hand book of Heavy construction: O'Brien, Havers & Stubb
7. Construction Engineering and Management By S.Seetharaman

CEL412: MATERIALS MANAGEMENT (L-4)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
ABC Analysis: Meaning, Advantages, Objective, Purpose and Limitations, Simple Numerical of ABC Analysis.	10
Purchasing Management: Objectives and Functions of Purchasing Department, Purchase Policy and Procedure, Negotiations, Purchase of High Capital Equipment and their Feasibilities. Supply Chain Management, Implementation of Supply Chain Principles within a Company.	10
Inventory Management: Different Costs of Inventory, Optimal Order Quantity, EOQ, Inventory Models with Purchase Discounts, Buffer Stocks, Fixed Order Period Model, Safety Stocks, Optimum Level of Safety Stock, Inventory Control, Elements of Effective Inventory Control.	10
Value Analysis: Purchasing Research, Price Forecasting, Forward Buying, Make or Buy Decision. Stores Management: Purpose of Store Management, Location and Layout, Cost Aspects and Productivity, Problems and Developments.	10
Evaluation of Materials Management: Organization, Difficulties, Process and Criteria, Reporting and Purchasing. Computers in Material Management Electronic Computer, Integrated Computer System for Materials Management, Material Planning.	9
TOTAL	50

Suggested Readings:

1. Ramakrishnan. R V, Tony Arnold. J R (2007). "Introduction to Materials Management". Pearson.
2. K. Shridhar Bhat, "Production and Materials Management". Himalaya Publishing House
3. Chary. S.N., "Production and Operations Management". Tata McGraw Hill
4. Gopalkrishnan. P, Sundaresan. M, "Materials Management: An Integrated Approach". PHI Learning Pvt. Ltd.

CEL413: CONTRACT MANAGEMENT AND LABOUR LAWS (L-4)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Contracts: Different types of contracts, notice inviting tenders, contract document, departmental method of construction, rate list, security deposit and earnest money, conditions of contract, arbitration, administrative approval, technical sanction.	10
Claims and Arbitration: Indian contract act and arbitration act. Variations in work and conditions. Claims and disputes. Liquidated damages. Rights. Responsibilities and duties of client (Owner). Architect. Engineer. Contractor etc. Purchase order as contracts insurance contract and claims.	10
Legal Frame Work of Construction: Contract labors act 1970 and other acts and laws relating to labors management. Wages. Bonus and Industrial disputes	10
Contract Conditions: Important contract clauses. Terms of payments. Retention. Acceptance and final payment. Time of completion. Extension of time. Maintenance period etc.	10
Construction Contracts: BOT projects, Variation in BOT projects. Infrastructural projects, international contract rules and regulation.	9
TOTAL	50

Suggested Readings:

1. Construction Engineering and Management by S. Seetharaman, Publisher Umesh Pub.
2. Construction Planning and Management by B. Sengupta, Pub. Tata McGraw-Hill Education
3. Construction and Project Management Theory and Practices by N.K. Jha, Pub. Pearson Education India
4. Construction Contracts by Jimmie Hinze, Publisher Tata McGraw-Hill Education
5. Estimating and Costing by B.N. Datta

CEL414: PROJECT ECONOMICS AND FINANCIAL MANAGEMENT (L-4)

Exam Hours: 3

Max. Marks: 150 (IA: 50, ETE: 100)

Credit: 4

CONTENTS	Hrs.
Objective, Scope and Outcome of the Course.	1
Basic Economic Theories: Principles of managerial economics. Economic theories. Demand analysis and forecasting. Demand elasticity. Cost and production analysis. Production function. Pricing decisions. Policies & practice.	10
Money: Time value of money. Different methods & comparisons. Cash flow, discounted cash flow, cash flow forecasting. Financial ratios and statements. Cost of Capital.	10
Capital Budgeting: Working capital. Capital budgeting and performance budgeting. Break even analysis. Project selection. Project appraisals	10
Project Financing: Means of Finance, Financial institutions in India, Policies of financial institutions, Financial assistance, Special schemes, Project risk	8
Financial Accounting: Book keeping processes of construction industry. Accountancy cycle. Journals. Forms and ledgers etc. for accounting and monitoring labour, equipment and material costs. PWD accounting procedure and types of financial statements in Government.	9
Building Information Modelling (BIM): Concept and case studies	2
TOTAL	50

Suggested Readings:

1. Project Planning, Analysis, Selection, Financing, Implementation & Review by Prasanna Chandra, Publisher Tata McGraw-Hill Education.
2. Engineering Economics & Analysis, by Donald G Newnan, Publisher Oxford University Press.
3. Economic Theory and The Construction Industry by P. Hillebrandt, Publisher Palgrave Macmillan UK
4. Construction Economics: A New Approach by Danny Myers, Publisher Routledge
5. Construction and Project Management Theory and Practices by K.N. Jha, Publisher Pearson Education India
6. Construction Project Management: Planning, Scheduling and Controlling by K.K. Chitkara, Publisher Tata McGraw-Hill Education

DS-CONSTRUCTION MANAGEMENT

CED413: MINI - PROJECT

Max. Marks: 150 (IA: 100, ETE: 50)

Credit: 5