1. Subject Code: **CE201** Course Title: **Civil Engineering Basics and Applications**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (Hrs.): Theory: 3 Practical: 2
4. Relative Weight**:** CWS: 15 PRS: 25 MTE: 20 ETE: 40 PRE: 0
5. Credits: 4
6. Semester: I
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts Civil Engineering and related applications.
10. Details of Course:

S. No.	Contents	Contact Hours
1	**Building Materials :** Bricks, stone, lime, timber, plywood, glass, plastics, steel, aluminum; classification properties and selection criteria, introduction to new materials.	8
2	**Building Construction :** Importance of building byelaws, loads on buildings. types of foundations and selection criteria, brick masonry, stone masonry & bonds. Types of walls, partition and cavity walls, design criteria.	12
3	**Cement** : Manufacturing & types, compositions, uses and specifications, aggregates, classifications and properties, admixtures: types properties and selection criteria. Mortar : Lime and cement mortars, types and classifications. Concrete mix design : as per IS code.	10
4	Introduction to Engineering Geology : Dynamics of earth, study of minerals and rocks, structural features of rock, weathering processes, geological time scale, structural features and classification of rocks.	10
	Total	40

Experiments : The students would conduct experiments for some of the following aspects.
1. Normal consistency, initial and final setting time of cement.
2. Fineness and soundness of cement.
3. Heat of hydrations of cement, specific gravity of cement, fine and course aggregates.
4. Sieve analysis and fineness modulus of fine and course aggregates.
5. Water absorption fine and coarse aggregates and impurities tests on aggregates.
6. Compressive strength, workability of lime and cement mortars.
7. Proportioning of aggregates and mix design.
8. Work ability by slump test, compaction factors and Vee-bee consistometer test along with compressive and tensile strength of concrete.
9. Non-destructive tests on concrete (Rebound hammer and UPVT).

11. **Suggested Books:**

S.N.	Title, Author, Publisher and ISBN No.	Year of publication
1.	Building Materials, Duggal, S. K. New Age International Publishers (ISBN 81-224-1435-4).	2005
2.	Building Construction, B.C. Punmia,, Laxmi Publications Pvt. Ltd., New Delhi (ISBN-81-7008-053-3).	2008
3.	Concrete Technology, AM Neville and J. J. Brooks. Dorling Kindersley (India) Pvt. Ltd. (ISBN 978 -81-317-0536-0)	2012
4.	Engineering & General Geology, Parbin Singh, S. K. Kataria and Sons (ISBN-13-9788188458516).	2004
5.	Surveying Vol. I, B C Punamia, Laxmi Publications Pvt. Ltd., New Delhi (ISBN-81-7008-054-1).	2005

1. Subject Code: **CE203**   Course Title: **Engineering Mechanics**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 2
4. Relative Weight**:**   CWS: 15 PRS: 25 MTE: 20 ETE: 40 PRE: 0
5. Credits: 4
6. Semester: II
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts Civil Engineering and related applications.
10. Details of Course:

S. No.	Contents	Contact Hours
1	**Fundamental concepts**: System of units, scalar and vector quantities, characteristic of force, fundamental laws of mechanics, system of forces, two force systems, three force system, equilibrium of a body, equilibrium equations for plane force and space force system	5
2	**Co-planar concurrent forces**: Composition of force, resolution of forces, concurrent and non concurrent forces, non concurrent force, couple, moment, Varignon's theorem, resultant of coplanar force systems and reaction of supports.	5
3	**Analysis of pin jointed frames:** Perfect, deficient and redundant frames, method of Joints, method of sections, tension co-efficient method and graphical method for plane and space frames.	7
4	**Friction and lifting machines**: Law of friction, angle of friction, angle of repose and cone of friction, wedges, law of machines, mechanical advantage and velocity ratio, efficiency, self-locking and reversibility of machines, pulley, wheel and axle.	7
5	**Centroid and moment of inertia:** Centre of gravity, Theorem of Pappus and Guldinus, moment of inertia, parallel axis theorem, polar moment of inertia, radius of gyration and moment of inertia of composite sections, mass moment of inertia and product moment of inertia.	8
6	**Kinematics and kinetic:** Rectilinear and curvilinear motion, projectile, relative motion, kinetics of particle, Newton's laws, work, energy and power, conservation of energy, impulse and momentum, impact.	8
	Total	40

11. **Suggested Books:**

S.N.	Name of Books/ Authors	Year of Publication
1	Rajshekharan & Sankarsubramanian, 'Computational Structural Mechanics', Prentice Hall of India, (ISBN 978-81-203-1734-3)	2007
2	Meriam, 'Engineering Mechanics: Dynamics", Volume 2, 5th ed. (ISBN 9971512998)	2009
3	Hibbeler, "Mechanics of Materials', (ISBN 8131708020)	2012

1. Subject Code: **CE205** Course Title: **Fluid Mechanics**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (Hrs.): Theory: 3 Practical: 2
4. Relative Weight**:** CWS: 15 PRS: 25 MTE: 20 ETE: 40 PRE: 0
5. Credits: 4
6. Semester: II
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts Civil Engineering and related applications.
10. Details of Course:

S. No.	Contents	Contact Hours
1	**Introduction**: Properties of fluids, types of fluids and continuum principle.	3
2	**Fluid Statics:** Basic definition, hydro statics law, Pascal's law, manometers, hydro statics forces on submerged surfaces, buoyancy.	6
3	**Kinematics of flow:** Types of flow, streamline, pathline, principle of conservation of mass, velocity, acceleration, velocity potential and stream function, vorticity and circulation.	5
4	**Fluid dynamics:** Euler;s equation, Bernoulli's equation, and its application, Pitot tube, venturimeter, Orifices and mouth pieces.	5
5	**Laminar and turbulent flow in pipe:** Laminar flow through pipes, velocity distribution, turbulent flow, Reynolds equation, prandtl's mixing length theory, velocity distribution in pipe flow and plate flow, Darcy's weisbach equation, friction factor, water hammer.	7
6	**Dimensional analysis and models:** Dimensional homogeneity, Rankines and Buckingham'a pie theorem, dimensionless numbers, Types of models and model analysis.	5
7	**Boundary layer theory:** Concept of boundary layer, laminar and turbulent boundary layers, boundary layer thickness, laminar sub-layer, hydrodynamically smooth and rough boundaries, cavitations.	6
8	**Drag and lift:** Forces exerted by flowing fluid on rest body, drag and lift, streamlined body and bluff body, skin friction, drag on sphere, cylinder and flat plate.	4
	Total	41

11. **Suggested Books:**

S.N.	Name of Books/ Authors	Year of Publication
1	Bansal, R.K. "Fluid Mechanics and hydraulics machines", Laxmi Publications(P) Ltd. (ISBN 81 7008 311 7)	2008
2	Garde, R.J. and Mirajgaoker, A.G. "Engineering fluid Mechanics", Nem Chand & Bros. (ISBN 81 88429 01 5)	2000
3	Som, S.K. and Biswas, G., "Fluid Mechnics" Tata pMcGraw Hill. (ISBN 21 345 24561)	2004
4	Kumar, K.L., "Engineering fluid Mechanics", Eurasia Publishing House (P) LTD. (ISBN 81 219 0100 6)	2000
5	Ojha, C.S.P., "Fluid Mechanics and Machinery, OXFORD, University Press. (ISBN 01 19 569963 7)	2010
6	Rajput, R. K., "Fluid Mechanic", S. CHAND & COMPANY LTD. (ISBN 81 219 1667 4)	2004

1. Subject Code: **CE207**   Course Title: **Engineering Analysis and Design**
2. Contact Hours: L: 3   T: 1   P: 0
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight**:**   CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits: 4
6. Semester: I
7. Subject Area: EAD
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts Civil Engineering and related applications.
10. Details of Course:

S. No.	Contents	Contact Hours
1	**Structural Engineering:** Various infrastructural projects, types of structures (1 D, 2 D & 3 D), equations of equilibrium, analysis and design, stress-strain characteristics of concrete and steel, design philosophies.	7
2	**Geotechnical Engineering :** Introduction to soil and rock, foundations for different type of structures, earth retaining structures, stability analysis of slopes such as embankments, levies, dams and canals. Introduction to underground structures like tunnels, shafts, caverns and some important ground improvement techniques.	7
3	**Water Resources Engineering** : Hydrological cycle, types of flow, flows in pipes and channels, types of dams, introduction to hydro power engineering.	7
4	**Transportation Engineering** : Modes of transportation, transportation system, role of traffic engineers, design concepts in transportation engineering, pavement/runway materials, introduction to railway systems.	7
5	**Environmental Engineering** : Sources of water, Quantitative and qualitative analysis, water and waste water design, concepts of water and waste water treatment plants, mode of conveyance of waste water.	7
6	**Surveying** : Classification of survey, types of equipment for surveying, importance and application of survey, introduction to GIS & GPS and their applications	5
	Total	**40**

11. **Suggested Books:**

S.N.	Title, Author, Publisher and ISBN No.	Year of publication
1.	Elementary Structural Analysis, Wilbur, Norris and Utku, Mc Graw Hill College, (ISBN 10-0070659338).	1990
2.	Reinforced concrete Limit State Design , A. K. Jain, Nem Chand and brothers, Roorkee, (ISBN 10-8185240663).	2000
3.	Basic and Applied Soil Mechanics, Gopal Ranjan and Rao, New Age International Delhi, (ISBN 978-81-224-1223-9).	2000
4.	Water Resources and Water Power Engineering, N. Subramanyam, New Age International Delhi, (ISBN 13-978-818-940-1290).	2001
5.	Water & Waste Water Technology, Hammer & Hammer, Prentice-Hall of India, New Delhi, (ISBN 81-203-2108-1)	2003
6.	Highway Engineering, Khanna & Justo, Nem, Chand & Brothers, Roorkee, (ISBN 81-85240-77-9).	2005

1. Subject Code: EN-252 Course Title: Environmental Engineering
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 3
6. Semester: Autumn & Spring 7. Subject Area: DCC 8. Pre-requisite: Nil
7. Objective:
8. To introduce basic concepts of water engineering and design.
9. To understand the characteristics of water & waste water.
10. To introduce the definition, principle, types and design of sedimentation tank.
11. To introduce the definition, principle, types and design of trickling filter, septic tanks, anaerobic sludge digestion, stabilization ponds and aerated lagoons..
12. To introduce the Solid waste management.
13. To introduce basic concepts of Noise pollution

Details of Course

S. No.	Contents	1.	Contact Hours
1	UNIT I:- Water demand, domestic, industrial and municipal, variations in demand. Population forecasting. Physical, Chemical and Microbiological quality parameters. Drinking water quality criteria and standards. Surface, subsurface, selection and development of sources. Quality of sources and their treatment requirements. Design of the component of water distribution systems. Leakage and control, Conveyance: Pipes and conduits for water, rising main, types and capacity of pumps, pipe joints, specials, fittings and valves.	2.	8
2	UNIT II:- Coagulation, common coagulants and coagulant aids and their reactions. Mixing and flocculation basin design. Sedimentation, design principles, discrete and flocculation suspensions, sedimentation tank details. Maintenance treatment unit, Filtration, gravity and pressure filters, single and multimedia filters. Water softening by chemical precipitation and ion exchange. Aeration of water to remove iron and manganese and taste and odour. Disinfectants, chlorination of water supplies.	3.	8
3	UNIT III: Wastewater sources and flow rates, domestic, industrial and municipal, variations in flow. Hydraulics of storm sewers, sewer appurtenances. Design of Wastewater collection system. Physical, Chemical and Microbiological characteristics of waste water. Effluent disposal and re-use, surface disposal, Disposal into rivers, self purification, oxygen sag curve, regulations for disposal into sewer/land/stream/sea.	4.	8
4	UNIT IV: Physical Treatment, screening, activated sludge, trickling filter, septic tanks, anaerobic sludge digestion, stabilization ponds and aerated lagoons.	5.	8
5	UNIT V: Solid waste management, sources and composition. Principal industrial and hazardous solid waste, collection, characteristics and disposal. Major air pollutants, sources and effects, measurement of air quality, criteria and standards, Atmospheric cleansing processes (Natural). Noise pollution standards effects and abatement.	6.	8

Books Suggested:
Peavy, Rowe and Tchobanoglous: Environmental Engineering
Garg: Water Supply Engineering (Environmental Engineering Vol.-I)
Punmia: Water Supply and Wastewater Engineering
Steel and McGhee: Water Supply and Sewerage.
Birdie: Water Supply and Sanitary Engineering.
Wastewater Engg. by Metcalf and Eddy (McGrow Hill)

1. Subject Code: CE 202   **Course Title: Mechanics of Solids**

2.	Contact Hours:	L: 3 T: 0 P: 2			
3.	Examination Duration (Hrs.):	Theory: 3 Practical: 0			
4.	Relative Weight:	CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 0			
5.	Credits:	4			
6.	Semester:	4			
7.	Subject Area:	DCC			
8.	Pre-requisite:	NIL			
9.	Objective:	To familiarize the students with the concepts of the subject and its related applications in Civil Engg.			

10. Details of Course:

S. N.	Contents	Contact Hours
1	Review of basic concepts in mechanics, classification of materials, introduction to tensors, their representation, study of kinematics : Motion field, displacement field, strain measures, principal strains, transformation of strains, compatibility conditions, concept of traction, Cauchy's stress theorem, traction on arbitrary planes, extreme normal and shear traction, octahedral shear stress	8
2	Equilibrium equations in Cartesian and cylindrical polar coordinates, constitutive relations: restrictions on constitutive relations, general relationship between cauchy's stress and Cauchy green strain for isotropic materials, generalised Hooke's law and its reduction for isotropic and orthotropic materials	8
3	Formation of boundary value problems: displacement method, stress method, Airy stress functions for plane stress and strain problems, uniaxial tension, thick walled annular cylinder subjected to uniform boundary pressure, infinite medium with a stress free hole under far field tension loading	8
4	Bending of prismatic straight beams: pure bending, bending due to uniform transverse loading and bending due to transverse sinusoidal loading of a beam, asymmetrical bending of straight beams, shear center, shear stresses in thin walled open sections, torsion of circular and other sections	8
5	Pure bending of curved beams, curved cantilever under end loading, derivation of beam bending equation for pure bending of beams, beams on elastic foundations Appropriate experiments would be taken up.	8
	Total	40

11. Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of Publication
1.	Popov E.P., 'Engineering Mechanics of Solids', Prentice Hall of India Pvt. Ltd., (ISBN-81-213-2139-4)	1997
2.	Timoshanko S.P., 'Elements of Strength of Materials', Tata McGraw-Hill Publishing Company Ltd. (ISBN 88-03-0404-4)	1997
3.	Kazimi SMA, 'Solid Mechanics', Tata McGraw-Hill Publishing Company Ltd. (ISBN 69-56-9563-72)	1981

1.	**Subject Code: CE 204**	**Course Title: Engineering Survey**

1. **Subject Code: CE 204**   **Course Title: Engineering Survey**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.): Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 4
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

S. No.	Contents	Contact Hours
1	**Introduction:** Importance of Surveying to Engineers; Plane and Geodetic surveying, Classification of surveys, Basic Principles of Surveying, Type of maps, scales and uses, plotting accuracy, map sheet numbering, coordinate and map projection. Organization of field and office work	6
2	**Survey Instruments**, **Measurement of Distances, Angles, Azimuths**: Introduction to surveying equipments, chains, tapes, compass, theodolites, tacheometer, EDM, total Stations and other instruments, types of errors, source of errors and precautions	6
3	**Chain, Compass and Plane Table Surveys :** Chain survey procedures, errors and corrections, planning and carrying out chain survey. Compass survey, types of compass and various terms related to magnetic compass, computing and plotting a traverse. Plane table surveys and mapping	6
4	**Leveling, Triangulation and Trilateration and Contouring**: Leveling and measurement of elevations, different methods of leveling. Methods of control establishment, traversing, triangulation, trilateration, computation of coordinates, trigonometrical leveling, theodolite surveying and tachometry, contouring, **Curves:** curve layout, horizontal, transition and vertical curves.	8
5	**Project Surveys, Hydrographic Survey, Astronomy and Map making in India:** General requirement and specifications of Engineering project surveys, Reconnaissance, Principles and practices, construction surveys, location and layout surveys. Hydrographic survey, shoreline, tidal and river surveys, soundings in hydrographic survey, Terms in astronomical survey, basics of spherical trigonometry. Map in the making-survey of India publication, conventional symbol charts and different types of maps. Appropriate experiments would be taken up.	6
	Total Contact Hours	**32**

S.N.	Name of Books/ Authors	
1	Agor, R, "Surveying", Vol. II & III, Khanna Publications, Delhi (ISBN 89-24-0594-7)	2000
2	Arora, K. R., "Surveying", Vol. II & III, Standard Book House, Delhi(ISBN 644-23-0774-4)	1999
3	Bannister, A. and Baker, R., "Solving Problems in Surveying", Longman Scientific Technical, U. K. (ISBN 19-45-2494-7)	2000
4	Kennie, T. J.M. and Petrie, G., "Engineering Surveying Technology", Blackie & Sons Ltd, London. (ISBN 39-12-6050-8)	1998
5	Punmia, B. C., "Surveying", Vol. II & III, Laxmi Publications, New Delhi(ISBN 69-85-0743-2)	2000

1. **Subject Code: CE 206**   **Course Title: Soil Mechanics**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 4
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

S. No.	Contents	Contact Hours
1	**Introduction**: Introduction to soil mechanics and geotechnical engineering, importance in civil engineering, nature of soil, soil formation and soil type. **Simple Soil Properties:** Basic definitions, phase relations, index properties, basic concepts of clay minerals and soil structure.	06
2	**Soil Classification and Identification:** Field identification, Textural Classification, Unified Soil Classification System, Indian Standard Soil Classification system, Group Index. **Hydraulic Conductivity:** hydraulic conductivity or permeability, Darcy's law, Discharge and Seepage velocities, Laboratory methods of determination, Factors affecting hydraulic conductivity, Hydraulic conductivity of layered soils, Field determination of hydraulic conductivity, Neutral and effective stresses, Critical hydraulic gradient, Capillary water in soils.	08
3	**Seepage:** Laplace's equation for simple flow problems, Flow nets, Seepage calculation from flow nets, Flow nets in anisotropic soil, Seepage pressure, Uplift pressure, Seepage through earth dams, Exit gradient, Piping, Criteria for design of filters. **Compaction:** General principals, Laboratory determination, Factors affecting compaction, Field compaction, Compaction of cohesionless and cohesive soils, Field control of compaction.	08
4	**Stress Distribution:** Elastic constants of soils and their determination, Boussinesq equation for vertical stress, The Westergaard equation, Stress distribution under loaded areas, Concept of pressure bulb; Newmark's influence chart, contact pressure. **Shear Strength:** Introduction, Mohr's circle of stress, Mohr-Coulomb failure theory, Shear strength parameters, Various Laboratory tests for measurement of shear strength, UU, CU and CD tests and their relevance to field problems, Plotting of test data, Shear strength characteristics of Normally consolidated and over consolidated clays, shear strength characteristics of sands.	08
5	**Compressibility and Consolidation:** Importance of compressibility, Effect of soil type, stress history and effective stress on compressibility, Factors affecting consolidation and compressibility, Normally consolidated and over consolidated soils, Void ratio-pressure relationship, Coefficient of compressibility and Volume change, Mechanism of consolidation, Terzaghi's theory of consolidation, Laboratory consolidation tests and analysis of data, Determination of Cofficient of Consolidation.	
	Total	40
List of experiments: To determine water content of the soil by oven drying method To determine specific gravity of soils by pycnometer. To determine omc and mdd of soil by Proctor's test. To determine bulk density of soil by core cutter method. To determine bulk density of soil by sand replacement method. To determine gradation of soil by sieve analysis. To determine gradation of soil by hydrometer analysis. To perform liquid limit and plastic limit test. To perform shrinkage limit test.		

11. **Suggested Books:**

S.N.	Title, Author, Publisher and ISBN No.	Year of publication
1.	Basic and applied soil mechanics by Gopalranjan and Rao, ASR (revised edition), New Age International, New Delhi. (ISBN 785-45-7080-1)	1995
2.	Introduction to geotechnical engineeringby Holtz R and Kovacs, WD, John Wiley New York. (ISBN 63-77-7894-5)	2007
3.	Soil Mechanics: TW Lambe and RV Whitman , John Wiley New York. (ISBN 85-17-0454-7)	2004
4.	Soil Mechanics and Foundation engineering by VNS Murthy, Sai Kripa(ISBN 78-91-0441-3)	2000
5.	Soil testing for engineers by Lambe, TW John Wiley New York. (ISBN 48-92-7454-2)	2009

1. **Subject Code: CE 208**   **Course Title: Hydraulics & Hydraulic Machines**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 4
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its
                                    i.   related applications in Civil Engg.
10. Details of Course:

S. No.	Contents	Contact Hours
1	**Introduction**: Types of flow in channel, Geometrical properties of channel section, velocity distributions and pressure distributions in open channel flows, continuity equation; super critical flows and unsteady flows. Uniform flow in channels: Chezy's equation, Manning's formula, Manning's roughness coefficients, Equivalent roughness, Hydraulically efficient different channel sections, Computation of uniform flow.	7
2	**Energy depth relationships:** Specific energy, critical depth, concept of specific force, alternate depths, specific energy diagram.	6
3	**Gradually varied flows:** Differential equation of GVF, Different types of flow profiles, Flow controls.	6
4	**Rapidly varied flows: H**ydraulic jump in different types of channels, properties of jumps. Broad crested weirs, sharp-crested weir, ogee spillway, sluice gate flow and critical depth flumes & their applications.	6
5	**Hydraulic Turbines:** Introduction, Dynamics forces on curved and bends, Elements of hydroelectric power plants, head and efficiencies of hydraulic turbines, classification of turbines, Pelton wheel turbine, working proportions of Pelton wheel, Design of Pelton wheel runner, study and design of Francis turbine, Draft tube theory, Cavitation, Kaplan turbine, working proportions of Kaplan turbine, Efficiency, specific speed, unit quantities and velocity triangles.	10
6	**Hydraulic Pumps:** centrifugal pumps, types, performance parameters, scaling, pumps in parallel; reciprocating pumps air vessels, performance parameters; and hydraulic ram. Appropriate experiments would be taken up.	6
		41

11. **Suggested Books:**

S.N.	Name of Books/ Authors	Year of Publication
1	Bansal, R.K. "Fluid Mechanics and hydraulics machines", Laxmi Publications(P) Ltd. (ISBN 81 7008 311 7)	2008
2	Subramanya, K., "Theory And Application of Fluid mechanics including Hydraulic Machines", TMH New Delhi (ISBN 0-07-460369-8)	1997
3	Subramanya, K., "Flow in Open Channels", TMH New Delhi. (ISBN 0-07-462446-6)	2006
4	Srivastava Rajesh," Flow Through Open Channels", Oxford University Press. (ISBN-10-019-569038-9)	2008
5	Garde, R.J. "Fluid Mechanics Through Problems", New Age International (P) Limited, Publishers (ISBN 81-224-1131-2)	1997
6	Ojha, C.S.P., "Fluid Mechanics and Machinery, OXFORD, University Press. (ISBN 10: 19 569963-7)	2010

Subject Code: CE 301   **Course Title: Analysis of Determinate Structures**

2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 5
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

S. N.	Contents	Contact Hours
1	Classification of Structures, Stress Resultants, Degree of Freedom per node, Static and Kinematic degrees of indeterminacy. Work and Energy. Strain energy of deformable systems, Betti's theorem of reciprocal work and Maxwell's theorem. Principle of virtual work and complementary virtual work, Principle of total minimum stationary potential energy, Stable and unstable equilibrium, Castigliano's Theorem I and II.	10
2	Analysis of determinate beams and plane frames. BM, SF and Axial thrust diagrams, Rolling loads, Influence lines diagrams Reaction, SF, BM, for determinate beams. Floor beams. ILD for Slope and Deflections in simple beams.	08
3	Classification of pin jointed determinate trusses. Analysis of plane, complex, compound and simple space trusses. Method of tension coefficient, graphical method of substitution. Maxwell's diagram to analyse simple trusses.	08
4	Deflection due to bending: The moment curvature relation, Macaulay's method, Moment area and Conjugate beam method, Deflection of determinate plane frames using strain energy and unit load method, Elastic curve sketch).	08
5	Analysis of arches: Linear arch, Eddy's theorem, three hinged parabolic arch, Spandrel braced arch. Influence line diagrams for Horizontal thrust, BM RSF,NT. Stability of Columns: Study of ideal rigid columns,two bar and three bar systems. Euler's formula for long columns, Columns with eccentric axial loads, Rankine's formula. Appropriate experiments would be taken up.	10
	Total	44

1. **Suggested Books:**

S.N.	Title, Author, Publisher and ISBN No.	Year of Publication
1.	Theory of Structures, Stephen P. Timoshenko and D. H. Young McGraw-Hill international book editions (ISBN 10: **0070648689** ISBN 13: **9780070648685**)	1965
2.	Structural Analysis a unified classical and matrix approach, A.Ghali, A M Neville and T G Brown, SPON PRESS (In India by Replika Press Pvt. Ltd.) (ISBN 13-978-0-415-28092-1)	2003
3.	Intermediate Structural Analysis, C K Wang,Tata McGraw-Hill Education Pvt. Ltd., 2014 ISBN 10: 0070702497 / ISBN 13: 9780070702493	2014
4.	Elementary Structural Analysis, J B Wilbur, C H Norris, S Utku, Tata McGraw-Hill Publishing Company Limited, New Delhi, ISBN 0-07-058116-9	2003
5.	Strength of Materials, Vol. I: Elementary Theory and Problems Paperback – 2004 ,S. Timoshenko CBS Publishers & Distributors Pvt. Ltd., New Delhi	2004
6.	Strength Of Materials,3E, Vol II **Timoshenko S.** CBS Publishers & Distributors Pvt. Ltd., New Delhi (2002) ISBN 10: 8123910770 ISBN 13 : 9788123910772	2002
7.	Mechanics of Materials 8th Edition by *James M. Gere and Stephen P. Timoshenko* CBS Publishers Pvt. Ltd., New Delhi (2004)ISBN 10: 8123908946 ISBN 13: 978812390894	2004

Subject Code: CE 303 **Course Title: Design of RCC Structures**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (Hrs.): Theory: 3 Practical: 0
4. Relative Weight: CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 0
5. Credits: 4
6. Semester: 5
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

S. N.	Contents	Contact Hours
1	Material Properties, properties of concrete and reinforcing steel, Design philosophies: working stress method and limit state method; characteristic strength, stress-strain curve of steel and concrete.	08
2	Nominal Mix Concrete, Mix Design, I.S. specifications, exposure conditions, nominal cover, Analysis and design by Limit State Method of singly reinforced rectangular beam section.	08
3	Doubly reinforced rectangular beam section, flanged beams. Design for flexure, shear and bond check for serviceability, detailing of reinforcement and design of beam for torsion.	08
4	Design of columns by Limit State method, short columns, long columns, eccentrically loaded columns and design of square footing.	08
5	Design of one way and two way slabs, placement of steel reinforcement, shear behaviour of slabs, openings in slabs and circular slabs supported on circumference. Appropriate experiments would be taken up.	08
	Total	40

1. **Suggested Books:**

S.N.	Title, Author, Publisher and ISBN No.	Year of Publication
1.	Limit State Design-Reinforced Concrete Structure, Ram Chandra, Rajsons Publications Pvt. Ltd., (ISBN-13: 978-8189401399)	2011
2.	Reinforced Concrete Design, Pillai & Menon, Tata McGraw-Hill Publishing Company Ltd. (ISBN 07-47-0964-7)	2005
3.	Limit State Design of Reinforced Concrete, P.C. Verghese, Prentice Hall of India Pvt. Ltd., (ISBN-81-203-2039-5)	2005

1. **Subject Code: CE 305**   **Course Title: Mechanics of Materials**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 5
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

S. N.	Contents	Contact Hours
1	Rigid and deformable bodies, strength, stiffness and stability, stresses, tensile, compressive and shear, deformation of simple and compound bars under axial load, thermal stresses, strain energy	8
2	Types of beams, supports and loads, shear force and bending moments in beams, cantilever, simply supported and overhang beams, stresses in beams, theory of simple bending, stress variation along the length and in the beam section, effect of shape of beam section on stress induced, shear stresses in beams, shear flow	8
3	Analysis of torsion in circular bars, shear stress distribution, bars of solid and hollow circular sections, stepped shaft, compound shafts, application to close coiled springs, maximum shear stress in spring section, deflection of helical close coiled springs	8
4	Elastic curve of neutral axis of the beam under normal loads, evaluation of beam deflection and slope, double integration method, Macaulay's method, Moment area method, end conditions, equivalent length of a column, Euler's load, other expressions	8
5	Biaxial state of stresses, thin cylindrical and spherical shells, deformation in thins cylindrical and spherical shells, principal stresses and principal planes, Mohr's circle for stresses Appropriate experiments would be taken up.	8
	Total	40

1. **Suggested Books:**

S.N.	Title, Author, Publisher and ISBN No.	Year of Publication
1.	Popov E.P., 'Engineering Mechanics of Solids', Prentice Hall of India Pvt. Ltd., (ISBN-81-213-2139-4)	1997
2.	Timoshanko S.P., 'Elements of Strength of Materials', Tata McGraw-Hill Publishing Company Ltd. (ISBN 88-03-0404-4)	1997
3.	Kazimi SMA, 'Solid Mechanics', Tata McGraw-Hill Publishing Company Ltd. (ISBN 69-27-0494-7)	1981

Subject Code: CE 307   **Course Title: Advanced Geotechnical Engineering**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 5
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

S. No.	Contents	Contact Hours
1	Clay mineralogy, clay-water electrolyte system, soil structure and fabric.	06
2	Effective stress, pore pressure, hydraulic conductivity and its directional variations, electro-osmosis	08
3	Seepage behaviour of soil- flownet constructions by various technique, seepage in layered soils, filter design, seepage through dam body	08
4	Consolidation: one-dimensional and generalised consolidation theories, primary and secondary consolidation,determination of C_v by various methods,visco elastic models, sand drains,effect of smear,numerical solutios, consolidation settlements.	08
5	Shear behaviour of soils, pore pressure parameters, UU, CU&CD tests, stress path method for settlement analysis. Total & effective stress-path, water content contours, stress history, Anisotrppy of strength, Thixotropy, Creep, Determination of in situ undrained shear strength, stress-strain characteristics of soils,Determination of modulus values	10
	Total	**40**

List of experiments:
To perform XRD and SEM test on the soil
To determine compaction characteristics of soils by various methods and their comparison.
To determine of hydraulic conductivity of soil theoretically and verification by experimental method.
To determine coefficient of consolidation by rectangular hyperbola method.
To determine pore pressure parameters A and B of soil.
To determine shear strength parameters of soil in UU condition.
To determine shear strength parameters of soil in CU condition.
To determine shear strength parameters of soil in CD condition.
To determine shear strength parameters of soil by direct shear test at various rates of loading.
To determine shear strength parameters of soils UCS test
 To perform vane shear test and to find sensitivity of the soil.

11. **Suggested Books:**

S.N.	Title, Author, Publisher and ISBN No.	Year of publication
1.	Soil Mechanics: Principle and Practice: GE Barnes (ISBN 9-03-088753-7)	2000
2.	Advanced Soil Mechanics: BM Das (ISBN 0-77-04915-8)	1997
3.	Soil Mechanics: TW Lambe and RV Whitman (ISBN 0-71-6059714-1)	1987
4.	Fundamentals of Soil Behaviour: James K. Mitchell (ISBN 7-83-4697512-6)	1993
5.	Principles of Soil Mechanics: RF Scott (ISBN 9-54-3564799-8)	1963

2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 5
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course:

S. No.	Contents	Contact Hours
1	Design of Intake structures. Site investigations for subsurface water sources and design of Infiltration wells, galleries / Ranney wells.	4
2	Design of Water distribution network . Use of EPA NET & WATER GEMS in distribution network design . . Size and Cost Optimization of Rising main . Introduction to Linear Programming ,dynamic programming and Non Linear Programming . Their application to optimization problems in design of Environmental Engineering Works.	8
3	**Detailed design of Water treatment train** that include Screens, Plain sedimentation, Mixing, Flocculators, Clarifiers , Filtration units and Disinfector units. **Design of different types of Aerators, filters, Clariflocculators, Softeners, Sludge processing units etc**	10
4	**Planning and Design of storm and sanitary sewers. Computation** - flow, cross section size and grade**.** Hydraulic modeling and design **using SEWER GEMS,/ CAD,STORM CAD/ CIVIL STORM**	6
5	**Detailed Design and arrangement of Sewage Treatment Plant:** Preliminary/ Primary treatment - Screens , Grit chamber, Skimming tank, Primary sedimentation etc; Physico- chemical & Chemical treatment systems; Biological treatment systems- Activated Sludge process, Fixed Film (Trickling Filter), Oxidation Ditch, Oxidation Pond , UASB ; Disposal/ treatment of sludge-Anaerobic digestion, sludge drying beds. Design of Septic/ Imhoff Tank. Design of low cost in situ/ onsite Sanitation systems Emerging Technologies for Waste Water Treatment and their design	13
		41
	Design Lab Work : The students would design. Water distribution network using EPA NET & WATER GEMS Storm and sanitary sewers network using SEWER GEMS/ CAD,STORM CAD/ CIVIL STORM Water treatment Plant using CPHEEO Manual on Water Supply & treatment Design and arrangement of Sewage Treatment Plant units using CPHEEO Manual on Sewerage and Sewage treatment Linear Programming ,dynamic programming and Non Linear Programming application to optimization problems in design of Environmental Engineering Works.- Individual / Group assignment.	

11. **Suggested Books:**

S.N.	Name of Books/ Authors	Year of Publication
1	Garg, S.K, "Water Supply Engineering, Vol 1", Khanna Publishers, New Delhi. (ISBN 0-07-6080479-3)	200 7
2	Garg, S.K, "Sewage Disposal and Air Pollution Engineering, Vol 2", Khanna Publishers, New Delhi(ISBN 0-74-7458244-7)	200 7
3	Qasim, SR;Motley, EM and Zhu, G. "Water Works Engineering.: Planning, design and operation, Prentice Hall NJ, USA(ISBN 0-72-579462-7)	2000
4	Metcalf & Eddy. " Waste Water Engineering: Treatment and reuse, TMH,New Delhi. (ISBN 3-87-824967-8)	2003
5	CPHEEO Manual on Water Supply & treatment, Min of Urban GOI	1999
6	CPHEEO Manual on Sewerage and Sewage treatment ,Min of Urban GOI	2013
7	Arceewala SJ , Waste water treatment for Pollution control, TMH,,New Delhi	2000

1. **Subject Code: CE 311**   **Course Title: Photogrammetriy and Astronomy**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 5
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course:

S. No.	Contents	Contact Hours
1	**Photogrammetry :** Basic concepts, Photogrammetry, aerial and terrestrial, applications of photogrammetry, types and geometry of aerial photograph, flying height and scale, relief (elevation) displacement	6
2	**Stereoscopy and Photogrammetric Mapping :** Stereoscopy, Monocular, binocluar and stereoscopic visions, stereoscopes, Parallax, parallax formula for height determination, corrections to elevation. Introduction to photogrammetric mapping, advantages and disadvantages, Mapping, Mosaics and map substitutes. ground control extension for photogrammetric mapping, aerial and radial triangulation	6
3	Remote Sensing, Digital Image Processing and Visual Image Interpretation : **Introduction to remote sensing, EMR, active passive remote sensing types of resolutions and data products, platforms and sensors, atmospheric windows and basic atmospheric and earth interaction mechanisms, digital image, digital image processing steps viz preprocessing, enhancement and classification, basics of visual image interpretation**	6
4	**Field Astronomy** : Introduction, a point on earth, solar system and celestial sphere, astronomical terms, astronomical coordinate system, astronomical triangle, astronomical corrections, astronomical triangle problems related	8
5	**Astronomical Time,** sidereal and slar time, interconversion of time systems, determination of time azimuth and latitude Appropriate experiments would be taken up.	6
	Total Contact Hours	**32**

11. Suggested Books:

S.N.	Name of Books/ Authors	Year
1	Church V F, 1980 Manual of Photogrammetry, American society of Photogrammetry(ISBN 8-06-698745-4)	1980
2	Hallert B 1960, Photogrammetry : Basic principles of Survey, McGraw Hills(ISBN 9-87-264895-1)	1960
3	Lillesand, T.L., and Kiefer, R.W., "Remote Sensing and Image Interpretation", 4th Ed., John Wiley and Sons. 2005(ISBN 7-96-125491-6)	2005
4	MuellerI, 1968, Spherical and Practical Astronlmy as Applied to Geodesy, Freidrick Ungar Publishing Co, Newyork USA(ISBN 2-97-73681-1)	1968

Subject Code: CE 313   **Course Title: Earthquake Technology**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 5
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

S.N.	Contents	Contact Hours
1	Introduction of structural dynamics, types of prescribed loads,. Coordinates and coordinate transformation, Principles of Dynamics: DAlembert's principle, Principle of Virtual Work, Hamilton's principle, mathematical and analytical models., Free body diagram and equation of motion Single degree freedom systems, Simple problems on un-damped and damped free vibration, frequency, period and amplitude, Logarithmic decrement, , Types of damping system,	10
2	Response of SDOF System to Harmonic excitation, Dynamic excitation, Vibration of un-damped two degrees of freedom system, Simple problems, Free vibration of MDOF System, Natural Frequencies & Mode shapes Rayleigh"s method, Stodola method	10
3	Modal response of MDOF systems, Mathematical model of MDOF Systems, Seismic coefficient and response spectrum method of analysis as per IS 1893 Code Provision. Simple problems on response of MDOF systems to earth quake excitation.	10
4	Strong ground motion measurements, Seismic hazard analysis, Measurement of dynamic soil properties, One dimensional ground response analysis, Liquefaction: Susceptibility and effects, Simple problems.	10
5	Concept of Earthquake Resistant Design, IS 1893: Part I 2002; Provisions for Seismic Design: Ductile reinforcement detailing as per IS 13920 Code., Provisions of IS 4326: 1993,IS 13827 1993,IS 13828 1993 Appropriate experiments would be taken up.	8
	Total	48

1. **Suggested Books:**

S.N.	Title, Author, Publisher and ISBN No.	Year of Publication
1.	Dynamics of Structures A K Chopra Published by Prentice Hall. ISBN 10: 013156174X ISBN 13: 9780131561748	2003
2.	Dynamics of structures, Ray W. Clough and Joseph Penzien, McGraw-Hill, New York, 1993. ISBN 0-07-011394-7.	1993
3.	Elements of Earthquake Engineering Jai Krishna, Brijesh Chandra South Asian Publishers ISBN-10: 8170031834 ISBN-13: 978-8170031833	2000
4.	Structural Dynamics: Theory and Computation Mario Paz CBS Publishers & Distributors Pvt. Ltd New Delhi (2004) ISBN 10: 8123909780 ISBN 13 : 9788123909783	2004
5.	Geotechnical Earthquake Engineering, Steven L. Kramer, Pearson Education Inc. Dorling Kindersley (India) Pvt. Ltd. Delhi ISBN 81-317-0718-0	2007
6.	Theory of Vibration with Application, William T. Thomson, Marie Dillon Dahleh, Pearson Education Inc. Dorling Kindersley (India) Pvt. Ltd. Delhi ISBN 81-317-0932-9	2007
7.	IS 1893 Part I : 2002 BIS New Delhi	2002
8.	IS 13920,: 1993 BIS New Delhi	1993
9.	IS 4326: 1993 New Delhi	1993
10.	IS 13827, IS13828: 1993 BIS New Delhi	1993

1. **Subject Code: CE 315**   **Course Title: ROCK ENGINEERING**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 5
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

Sl. No.	Contents	Contact Hours
1	**Introduction**, Classification and index properties of rock, Stress in rock mechanics and rock engineering, stress component and stress matrix, principal stress, in situ stress, method of stress determination, Strain, strain tensor.	8
2	**Rock strength and failure criteria**, laboratory testing of rocks, Griffith's theory, Coulomb's theory, in-situ tests on rock mass; deformation characteristics, mechanical, thermal and electrical properties of rock mass.	8
3	**Rock exploration**, site investigation, preliminary, detail and geophysical investigation, exploratory drilling methods and their utility, Exploration planning,Foundation on rocks; bearing capacity of intact and jointed rocks; general consideration for design of foundation, treatment of rock defects.	8
4	**Openings in rock mass** and stresses around openings; pressure tunnels, development of plastic zone; rock support needed to avoid plastic deformation; lined and unlined tunnels; support pressure and slip of the joint; underground excavation and subsidence.	8
5	**Rock slopes;** types of rock slope failure, rock slope analysis- conventional and numerical method, rock slope stabilization, rock bolt and anchors, methods of construction; problems associated with tunnels, tunnelling in various subsoil conditions and rocks. Appropriate experiments would be taken up.	8
	Total	40

11 Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of publication
1	Rock Mechanics Design in Mining and Tunellig, by Z.T. Bieniawski(ISBN 0-01-736419-3)	2000
2	Engineering Rock Mass Classification by Z.T. Bieniawski(ISBN 3-78-070891-8)	1999
3	Introduction to Rock Mechanics by R.E.Goodman(ISBN 0-07-754621-7)	2001
4	Design and Construction of Tunnels by Pietro Lunardi(ISBN 7-70-764812-7)	2005
5	Engineering Rock Mechanics an Introduction to the Principles by Hudson and Harrision(ISBN 0-74-7482613-9)	2000
6	Engineering in Rocks for Slopes, Foundations and Tunnels by TRamammurthy(ISBN 0-071-75961248)	1998
7	Engineering properties of Rock by Lianyang Zhang(ISBN 8-80-8546681-7)	2008

Subject Code: CE 317   **Course Title: Solid Waste Management and Air Pollution Control**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.): Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 5
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

S. No.	Contents	Contact Hours
1	Generation rates and Characteristics / composition of Municipal waste, Bio-Medical Waste, Plastic Waste ,e-waste and hazardous wastes.Solid waste in Industries and Agricultural sector.Municipal Solid Waste Management and Handling Rules 2015 , Ministry of Environment, Forests and Climate Change applicable to Collection, segregation, Storage and Transportation of Municipal Solid waste. Solid waste handling methods, Treatment and Disposal of wastes	11
2	**Solid waste handling methods :** Segregation - material Recycle ,reuse **;**Sanitary Land fill concept and Design of Engineered Sanitary Land fill, Lechate problem; Biomethanation ; Composting- type of composting, theory, design of conventional compost/ Vermi compost plant; Thermal methods-Incineration, Pyrolysis & its by-products etc . Cost Economics studies: Transportation route & cost optimization	10
3	Air Pollution : regulations in India,Chemistry, meterology, plume rise and dispersion, Effects on human health and environment. Measurement and analysis of pollutants such as CO, HC, SPM, SO_x, NO_x, and ozone etc	11
4	**Basic principles and Design of Air Pollution Control:** Cyclones ,Bag filters, particulate chambers, Electrostatic precipitator, Scrubbers, catalytic converters	08
		41
Design Lab Work : The students would design. Analysis of Solid waste and sludges: Particle size,moisture, Composition, C:N:P ratio,Calorific value Measurements of meteorology parameters: humidity, pressure Wind speed and direction, Field monitoring of air pollutants such as CO, HC, SPM , PM-10, PM-2.5, SO_x, NO_x, and ozone etc by high volume / handy sampler. Introduction to stack monitoring		

11. **Suggested Books:**

S.N.	Name of Books/ Authors	Year of Publication
1	Rao, Environmental Pollution and Control Engineering, New Age International pub(ISBN 0-07-05245745-6)	latest
2	Garg, S.K, "Sewage Disposal and Air Pollution Engineering, Vol 2", Khanna Publishers, New Delhi(ISBN 4-97-8145632-7)	2007
3	Rao , Air Pollution, TMH(ISBN 0-70-744826-8)	2000
4	Peavy , Rowe and Tchobanoglous , Environmental Engineering, Mcgraw Hill(ISBN 0-75-76812-6)	1999

Subject Code: CE 319   **Course Title: Applications of Geoinformatics and GIS in Engineering**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 5
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

S. No.	Contents	Contact Hours
1	**UNIT 1** : **Introduction to Geoinformatics, Remote Sensing, GIS and GPS:** Definitions of Geoinformatics, Remote Sensing, GIS and GPS, sources of energy, electromagnetic spectrum, electromagnetic radiation, reflection, transmission and absorption, black body radiation, Stefan-Boltzmann law, Wein's displacement law, emissivity, Kirchoff's law, thermal emission, Planc's formula. Platforms and sensors, active and passive sensors, PAN, Multi and hyperspectral remote sensing data acquisition systems in optical wavelength region, basic principles of data acquisition and measurement in natural scenes, multi and hyperspectral data statistics, digital data file formats. GPS satellite network	6
2	**Optical, Thermal and Microwave Remote Sensing**. Brief review of Optical, thermal and microwave remote sensing, their utility, merit and demerits, Interaction of EMR with atmosphere, scattering, refraction, absorption, transmission, atmospheric windows, interaction of EMR with earth surface, spectral characteristics of remote sensing data, optical radiation models, summary of visible to shortwave region models, spectral reflectance curves, radiation calculation. thermal sensors and their characteristics. Thermal infrared region models, radiation components – surface-emitted component, surface-reflectance, atmospheric emitted component, path-emitted component, total at-sensor, emitted radiance, interpretation of thermal images – day and night images, emissivity consideration, thermal inertia considerations. factors affecting analysis of thermal images, data models for thermal image analysis.	6
3	**Basic Photogrammetry and Digital Image Processing:** Photogrammetry, aerial and terrestrial, applications of photogrammetry, types and geometry of aerial photograph, flying height and scale, relief (elevation) displacement. Stereoscopy, measurement and parallax and height determination, photogrammetric mapping. Digital data bank, digital image, digital image processing introduction to, preprocessing, enhancement, classification, visual image interpretation, Introduction to software - MATLAB, ENVI, ERDAS, AutoCAD etc	6
4	Maps, Datums, Projections Systems and spatial data analysis - **Plane and Geodetic surveying, Classification of surveys, Basic Principles of Surveying, Type of maps, scales and uses, plotting accuracy, map sheet numbering. Datums, coordinates and map projection systems. Data retrieval and querying, measurements in GIS, classification, accuracy.**	8
5	**Applications of Geoinformatics, Remote Sensing, GIS and GPS:** Land cover classification survey and Mapping, Digital elevation model (DEM), GPS surveys, Introduction to SAR data processing and SAR interferometry, Applications in Disaster management, geology, forest security and military projects. Appropriate experiments would be taken up.	6
	Total contact Hrs	32 Hrs

11. Suggested Books:

S.N.	Name of Books/ Authors	
1	Agarwal, C.S. and Garg, P.K., "Remote Sensing in Natural Resources Monitoring and Management", Wheeler Publishing House(ISBN 6-74-268173-4)	2000
2	Bossler, J.D., "Manual of Geospatial Science and Technology", Taylor and Francis. (ISBN 0-74-68914355-7)	2002
3	Burrough, P.A. and McDonnell, R.A., "Principles of Geographic Information System", Oxford University Press. (ISBN 0-07-985256-4)	2000
4	Chandra, A.M. and Ghosh, S.K., "Remote Sensing and Geographical Information Systems", Alpha Science. (ISBN 0-07-8452567-1)	2005
5	Gopi, S., "Global Positioning System: Principles and Applications", Tata McGraw Hill. (ISBN 0-07-7691528-1)	2005

1.	**Subject Code: CE 302**		**Course Title: Analysis of Indeterminate Structures**			

1. **Subject Code: CE 302** **Course Title: Analysis of Indeterminate Structures**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (Hrs.): Theory: 3 Practical: 0
4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits: 4
6. Semester: 6
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

S. N.	Contents	Contact Hours
1	Theorem of Least work, Concepts of Symmetry. Analysis of fixed beams, continuous beams, simple rigid and pin jointed indeterminate frames using method of consistent deformation, strain energy methods. Müller Breslaü principle and its application in drawing influence lines for indeterminate beams.	10
2	Analysis of continuous beams, simple frames with and without translation of joints using slope deflection method and moment distribution method. Analysis of symmetric structures.	10
3	Flexibility and stiffness matrix method of analysis of beams, rigid and pin jointed plane frames.	08
4	Analysis of two hinged arches. Influence line diagrams for BM, SF and thrust in two hinged arches. Analysis of cables with concentrated and continuos loading. Basics of Suspension bridges with two and three hinged stiffening girders. Influence line diagrams for BM SF in stiffening girders.	08
5	Basics of plastic analysis. Theorems of plastic collapse. Plastic analysis of beams, plane frames using statical and mechanism methods. Minimum weight design methods.	08
	Total	44

1. **Suggested Books:**

S.N.	Title, Author, Publisher and ISBN No.	Year of Publication
1.	Theory of Structures, Stephen P. Timoshenko and D. H. Young McGraw-Hill international book editions (ISBN 10: **0070648689** ISBN 13: **9780070648685**)	1965
2.	Structural Analysis a unified classical and matrix approach, A.Ghali, A M Neville and T G Brown, SPON PRESS (In India by Replika Press Pvt. Ltd.) (ISBN 13-978-0-415-28092-1)	2003
3.	Matrix analysis of framed Structures, W Weaver Jr and J M Gere, CBS Publishers Delhi . (ISBN 10: 8123911513 ISBN 13: 9788123911519)	2004
4.	Intermediate Structural Analysis, C K Wang,Tata McGraw-Hill Education Pvt. Ltd., 2014 ISBN 10: 0070702497 / ISBN 13: 9780070702493	2014
5.	Indeterminate Structural Analysis, J S Kinney, Addison-Wesley Educational Publishers Inc, 1957 ISBN 10: 0201036959 ISBN 13: 9780201036954	1957
6.	Elementary Structural Analysis, J B Wilbur, C H Norris, S Utku, Tata McGraw-Hill Publishing Company Limited, New Delhi, ISBN 0-07-058116-9	2003
7.	Computer Methods of Structural Analysis, BEAUFAIT, F.W., ROWAN, W.H., Jr., HOADLEY P.G. and HACKETT R.M., Computer Methods of Structural Analysis, Prentice-Hall, Inc. Englewood Cliffs; New Jersey, 1970.	1970
8.	Plastic design of Frame Vol I, Sir J Baker & J Heyman, Cambridge University Press (1969) ISBN 10: **0521075173** ISBN 13: **9780521075176**	1969
9.	Structural Analysis, T S Thandavamoorthy, Oxford University Press. Oxford University Press, ISBN 10- 0198069189,ISBN 13- 9780198069188	2011
10.	Basic Structural Analysis, C S Reddy, Tata McGraw-Hill Education Pvt. Ltd., 2010 ISBN 10: 0070702764 / ISBN 13: 9780070702769	2010
11.	Analysis of Structures Vol II V N Vazairani, M M Ratwani, Khanna publishers. Delhi ISBN 10: 81-7409-205-6/ISBN 13: 978-81-7409-205-6	1967
12.	Advanced Structural Analysis, Devdas Menon, Narosa Publishing House Pt. Ltd. ISBN 978-81-7319-939-4	2009

11. Subject Code: CE 304   **Course Title: Geotechnical Engineering**

12. Contact Hours: L: 3   T: 0   P: 2
13. Examination Duration (Hrs.):   Theory: 3   Practical: 0
14. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
15. Credits: 4
16. Semester: 6
17. Subject Area: DCC
18. Pre-requisite: NIL
19. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

20. Details of Course:

S. No.	Contents	Contact Hours
1	**Soil Exploration:** Purpose; Planning and reconnaissance; Various methods; Bore holes and depth of exploration; Sampling and samplers; Standard penetration test; Correlations between penetration resistance and strength parameters; Static cone test; Dynamic cone test; Plate Load test; Interpretation of test results; Indirect methods of soil exploration.	06
2	**Earth Pressures and Retaining Structures:** Lateral earth pressure problems; Plastic equilibrium in soils, active and passive states; Earth pressure at rest; Rankine's theory of active and passive earth pressures; Active and passive earth pressure of cohesive soils; Coulomb's earth pressure theory; Graphical constructions to evaluate earth pressures; effect of surcharge and earthquake loading; earth pressure due to inclined backfills; Stability Analysis of retaining walls, choice of backfill material and importance of drainage; Bracings for open cuts, recommended design diagrams of earth pressure for typical soils; Earth pressure on cantilever and anchored sheet pile walls; Arching and its practical implications.	08
3	**Stability of Slopes:** Factor of safety; Stability of infinite slopes; Stability of finite slopes; The Swedish circle method; Bishop's simplified method; Friction circle method; Taylor's stability number; Acceptable values of factor of safety; Critical conditions for the stability of earth dams; Road and earth dam embankments; Modes of failure and the usual protective measures; Slope inclinations usually adopted.	08
4	**Shallow Foundations:** Common types with illustrations of situations where each one of them is adopted; Terminology; Rankine's analysis; Terzaghi's bearing capacity theory; Types of failures; Bearing capacity computations in cohesionless and cohesive soils; General bearing capacity equation, Meyerhof's analysis, Effect of water table on bearing capacity; Bearing capacity on layered soil; Use of field test data; Foundation settlements; Components and limits of settlements'; Estimation of settlement of footings / rafts by using field and laboratory test data; Corrections for rigidity and 3-dimensional consolidation effects. **Pile Foundations:** Classification and uses of piles; Selection and installation of piles; Load carrying capacity of piles, dynamic and static formulae; Single pile and group actions; Pile load tests; Negative skin friction, Settlement of pile groups; Laterally loaded piles.	08
5	**Well Foundations:** Situations where adopted; Types of wells or caissons; Elements of wells; Methods of construction; Tilt and shifts; Remedial measures; Depth and size of wells on the basis of scour depth; Bearing capacity and settlement; Terzaghi's lateral stability analysis. **Introduction to Machine Foundations:** Types of machines and their foundations; Terminology; Design criteria; Field methods of determining design parameters-Cyclic plate load test; Block vibration test; Response of block foundations under vertical vibrations. **Foundation on Expansive Soils:** Identification of expansive soil; problems associated with expansive soils; Design considerations of foundations on expansive soils; Under-reamed piles.	10
	Total	**40**

List of experiments:
1. To determine shear strength parameters of soil direct shear test.2. To determine shear strength parameters of soil triaxial shear test.3. To determine shear strength parameters of soil vane shear test.4. To determine shear strength parameters of soil unconfined compressive shear test.5.To perform modified Proctor's test6.To determine coefficient of consolidation of the soil 7.To determine permeability of soil by constant head permeameter. 8.To determine permeability of soil by falling head permeameter

11. Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of publication
1.	Basic and applied soil mechanics by Gopalranjan and Rao, ASR (revised edition), New Age International, New Delhi. (ISBN 0-17-946826-2)	2000
2.	Introduction to geotechnical engineering by Holtz R and Kovacs, WD, John Wiley New York. (ISBN 0-07-04452-2)	1999
3.	Foundation analysis and design by Bowles,, McGraw Hill (ISBN 0-07-037154-6)	1998
4.	Soil Mechanics and Foundation engineering by VNS Murthy, Sai Kripa (ISBN 0-071-0498722-1)	
5.	Scott, R.F., Foundation Analysis, Prentice Hall (ISBN 0-07-05429-5)	1981

1.	**Subject Code: CE 306**	**Course Title: Transportation Engineering**

2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (Hrs.): Theory: 3 Practical: 0
4. Relative Weight: CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 0
5. Credits: 4
6. Semester: 6
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course:

Sl. No.	Contents	Contact Hours
1	**Introduction:** Role of Transportation, Modes of Transportation, their importance and limitations. Planning and Engineering surveys. Basic requirements of alignment. Controlling factors for alignment.	8
2	**Highways:** Geometric design of highways, highway materials, highway construction, design of highway pavements, traffic studies, traffic control devices, highway drainage and maintenance.	8
3	**Railways:** Elements of Permanent way, wear and creep of rails, geometric design, track resistance and tractive power, points and crossings, design of turnout, stations and yards, signaling and interlocking, modernization of railways.	8
4	**Airports:** Classification of airports, obstruction and zoning laws, typical layout of airport, design of runway, design of taxiway, airport marking and lighting, air traffic control.	8
5	**Tunnel, harbor and docks:** Types of tunneling, methods of tunneling, classification of harbors, breakwaters, types of docks and their merits and demerits.	8
	Total	40
	Experiments: Students would conduct the following experiments	
	1. Aggregate Impact Value test. 2. Los Angles Abrasion test on aggregates. 3. Shape test on aggregates. 4. Specific gravity of aggregates. 5. Water absorption test on aggregates. 5. Penetration Value test on bitumen. 6. Ductility test on bitumen. 7. Softening point test on bitumen. 8. Specific gravity test on bitumen. 9. Marshall Stability Test.	

11. Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of Publication
1.	Khanna, S. K. amd Justo, CEG, "Highway Engineering", Nem Chand & Bros., Roorkee, U.K (ISBN 0-07-7448564-9)	1997
2.	Kadiyali, L. R., "Traffic Engineering and Transportation Planning", Khanna Publishers, New Delhi (ISBN 0-05-748162-1)	1997
3.	Saxena, S. C. and Arora, S. P., "A Text Book of Railway Engineering", Dhanpat Rai & Sons, Delhi (ISBN 0-07-05584-5)	1981

2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.): Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 6
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

S. N.	Contents	Contact Hours
1	**Unit 01: Understanding disaster** Concept of disaster, Different approaches, Concept of Risk, Levels of disasters, Disaster phenomena and events *(Global, national and regional)*	8
2	**Unit 02: Hazards and Vulnerability** Natural and man-made hazards; response time, frequency and forewarning levels of different hazards, Characteristics and damage potential of natural hazards; hazard assessment, Dimensions of vulnerability factors; vulnerability assessment, Vulnerability and disaster risk, Vulnerabilities to flood and earthquake hazards	8
3	**Unit 03: Disaster management mechanism** Concepts of risk management and crisis management, Disaster management cycle, Response and Recovery, Development, Prevention, Mitigation and Preparedness, Planning for relief	8
4	**Unit 04: Capacity building** Capacity building: Concept, Structural and nonstructural measures, Capacity assessment; strengthening capacity for reducing risk, Counter-disaster resources and their utility in disaster management, Legislative support at the state and national levels, BIS guidelines	8
5	**Unit 05: Planning for disaster management** Coping strategies; alternative adjustment processes, Changing concepts of disaster management, Industrial safety plan; safety norms and survival kits, Mass media and disaster management, Strategies for disaster management planning, Steps for formulating a disaster risk reduction plan, Disaster management Act and Policy in India, Organisational structure for disaster management in India, Preparation of state and district disaster management plans Appropriate experiments would be taken up.	8
	Total	40

2. **Suggested Books:**

S.N.	Title, Author and Publisher	Year of Publication
1.	Alexander, D. *Natural Disasters,* ULC press Ltd, London (ISBN 0-07-74852-4)	1993
2.	Carter, W. N. *Disaster Management: A Disaster Management Handbook,* Asian Development Bank, Bangkok (ISBN 6-70-09735-6)	1991
3.	Chakrabarty, U. K. *Industrial Disaster Management and Emergency Response,* Asian Books Pvt. Ltd., New Delhi (ISBN 4-9764824-6)	2007
4.	Goswami, S. C. *Remote Sensing Application in North East India,* Purbanchal Prakesh, Guwahati (ISBN 7-94-948521-9)	1997
5.	*Manual on Natural Disaster Management in India,* NCDM, New Delhi	2001
6.	*Disaster Management in India,* Ministry of Home Affairs, Government of India, New Delhi (ISBN 7-90-748152-6)	2011

2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 6
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: importance and history of ground improvement. Mechanical Modifications: properties of compacted soil, compaction control tests, field compaction, applications. Precompression: technique, procedure, and applications. Sand Drains: method, procedure and applications.	8
2.	Prefabricated vertical drains: method of installation and design. Soil Stabilisation: shallow stabilisation with additives like lime, fly ash, cement and other materials. Chemical modifications and Grouting. Hydraulic modification: dewatering systems, filtration, drainage and seepage control with geosynthetics.	8
3.	Vibroflotation technique, stone columns, sand compaction piles, dynamic compaction technique, ground freezing, and electro-osmosis.	8
4.	Ground modification by soil reinforcement: reinforcement techniques, use of flexible geosynthetic reinforcement in bearing capacity improvement, slope stability, erosion control, retaining walls and pavements.	8
5.	Difficult soils: collapsible soils, physical parameters and identification, collapse settlement, improvement techniques; expansive soils, general nature, swell test and swelling pressure tests, classification, improvement of expansive soils.	8
	TOTAL	40

List of experiments:
To determine compaction characteristics of soils of various particle size distributions.
To determine in-situ compaction parameters of soils.
To determine variation of hydraulic conductivity with compactive effort and moisture content.
To determine precompression parameters of a clayey or silty soil.
To determine soil stability parameters by using lime.
To determine soil stability parameters by using fly-ash.
To determine soil stability parameters by using cement.
To determine soil stability parameters by using chemicals.
To determine soil stability parameters by using some industrial waste.
To demonstrate the use of geosynthetics in filtration, drainage and seepage control.
To carry out minor projects by experimental works on vobroflotation, stone columns, compaction piles, ground freezing, and electroosmosis.
To determine shear strength parameters of soils by using geotextile reinforcements.
To carry out minor projects by experimental works on soil reinforcement in slope stability, erosion control, retaining walls and pavements.
To evaluate geotechnical parameters for collapsible soils.
To determine geotechnical parameters for expansive soils.

11.Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1	Das, B. M. (2011). *Principles of Foundation Engineering.* Cengage Learning. (ISBN 0-07-525486-7)	200 7
2	Koerner, R. M. (2012). *Designing with Geosynthetics, Vol. 1 & 2.* Xlibris Corporation. (ISBN 0-254-755246-7)	200 7
3	Moseley, M. P., Kirsch, K. (2004). *Ground Improvement. Spon Press.* (ISBN 0-07-678125-74	2000

1.	**Subject Code: CE 312**		**Course Title: Water Power System and Design**			
2.	Contact Hours:	L: 3	T: 0	P: 2		
3.	Examination Duration (Hrs.):	Theory: 3	Practical: 0			
4.	Relative Weight:	CWS: 15	PRS: 15	MTE: 30	ETE: 40	PRE: 0
5.	Credits:	4				
6.	Semester:	6				
7.	Subject Area:	DEC				
8.	Pre-requisite:	NIL				
9.	Objective:	To familiarize the students with the concepts of the subject and its related applications in Civil Engg.				

10. Details of Course:

Sl. No.	Contents	Contact Hours
1	**Introduction:** Development of water power, Estimation of Hydropower potential, Comparison of Hydro, thermal and nuclear power,Flow duration curve, firm power, secondary power, Load and Load duration curves, Load factor, etc.	8
2	**Types of Hydropower Plants:** Classification of hydropower plants, Run-of-river plants, Valley dam plants, High head diversion plants, Diversion Canal plants, Pumped storage plants, Tidal power plants.	8
3	**Water Conveyance System:** Power canals, Alignment, Design of power canals, Flumes, Covered conduits and tunnels , Drainage and ventilation in tunnels. Penstocks:- Alignment, types of penstocks, economic diameter of penstocks, Anchor blocks. Forebay, Intakes, Balancing Reservoir, Ecsape , Surge Shafts/ Inclined Shafts. General Layout of power house and arrangement of hydropower units. Underground Power Stations.	8
4	**Dams:** Selection of site, preliminary investigations, Final investigations, Types of dams:- Rigid dams, Gravity dams, Arch and buttress dams, Basic principles of design and details of construction. Earthen dams, rockfill dams, Design considerations.**Spillways:** Types, spillway gates, Design of stilling basins.	8
5	**Types of Turbines and their utility:** Hydraulic Turbines, Classification Based on Head, Discharge, Turbines, Differences between Impulse and Reaction Turbines, choice of Type of Turbine-Specific Speed. Component Parts & Working Principles of a Pelton Turbine and Francis Turbine.	8
	Total	40
	Experiments: Students would do the following Design based Problems and experiments	
	1. To study the working & constructional details of Hydro Power Plant 2. Design of Penstocks. 3. Design of Gravity Dam. 4. Design of Earthen Dam. 5. Design of stilling basins. 6. To Study the construction of Pelton turbine and draw its fluid flow circuit. 7. To Study the construction of Francis turbine and draw its fluid flow circuit. 8. To Study the construction of Kaplan turbine and draw its fluid flow circuit. 9. Draw Performance Characteristic Curves of pelton Francis & Kaplan Turbine. 10. To study the working & constructional details of Pumped Storage Plant.	

11. Suggested Books:

S.N.	Name of Books/ Authors	Year of Publication
1	Barrows, H.K."Water Power Engineering", Tata McGraw Hill Publishing Company Ltd., New Delhi, (ISBN 0-07-759612-1)	1999
2	Deshmukh, M.M. "Water Power Engineering", Danpat Rai & Sons, Nai Sarak, Delhi, (ISBN 0-07-0578951-6)	1978
3	Varshney, R.S. "Hydropower Structures", Nem Chand Brothers, Roorkee, (ISBN 0-07-768942-6)	2001
4	Arora, K.R. "Irrigation water power and Water Resources engineering", Standard Publishers Distributors, Delhi, (ISBN 0-02768427-4)	2002

1. **Subject Code: CE 314**　　　　　**Course Title: Tunnel, ports and harbor engineering**
2. Contact Hours:　　　　　　　　L: 3　　T: 0　　P: 2
3. Examination Duration (Hrs.):　　Theory: 3　　　Practical: 0
4. Relative Weight:　　　　　　　CWS: 15　　PRS: 15　　MTE: 30　　ETE: 40　　PRE: 0
5. Credits:　　　　　　　　　　4
6. Semester:　　　　　　　　　6
7. Subject Area:　　　　　　　DEC
8. Pre-requisite:　　　　　　　NIL
9. Objective:　　　　　　　　　To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

s. no.	Contents	Contact hours
1	Tunneling: tunnel alignment and grade, size and shape of tunnel, methods of tunneling in soft soil, compressed air and shield tunneling, shafts in tunnels ,safety measures, ventilation, lighting and drainage in tunnels.	10
2	Introduction and planning of harbor: historical development of water transportation in india and policy, classification of harbours, major port in india and administrative set up, harbor economics. Harbor classification, characteristics of good harbor, and principles of harbor planning, site selection criteria and lay out of harboures.	10
3	Natural phenomena: wind, waves tides and currents phenomena, their generation characteristics and effects on marine structures, silting, erosion and littoral drift.	6
4	Design aspect and consideration for dock and harbor: marine structures; general design aspects, breakwaters – function, types, general design principles, wharves, quays, jetties, piers, pier heads, dolphin, fenders, mooring accessories- function, types, suitability, design and construction features, docks and locks; tidal basin, wet docks, design consideration, operation of lock gates and passage, repair docks, graving docks, floating docks, marine railway. Port amenities; ferry, transfer bridge, floating landing stages, transit sheds, ware houses, cold storage, aprons, cargo handling equipments, purpose and general description.	8
5	Harbor maintenance: navigation aids; channel and entrance demarcation, buoys, beacons, light house electronic communication device. Harbor maintenance; costal protection – purpose and devices, dredging, purpose, methods. Dredgers- types, suitability, disposal of dredged material. Appropriate experiments would be taken up.	6

11. Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of publication
1	Engineering in Rocks for Slopes, Foundations and Tunnels by TRamammurthy(ISBN 0-07-0768249-5)	2002
2	Engineering properties of Rock by Lianyang Zhang(ISBN 0-07-749682-4)	2000

1.	**Subject Code: CE 316**		**Course Title: Matrix Methods of Structural Analysis**			
2.	Contact Hours:	L: 3	T: 0	P: 2		
3.	Examination Duration (Hrs.):	Theory: 3	Practical: 0			
4.	Relative Weight:	CWS: 15	PRS: 15	MTE: 30	ETE: 40	PRE: 0
5.	Credits:	4				
6.	Semester:	6				
7.	Subject Area:	DEC				
8.	Pre-requisite:	NIL				
9.	Objective:	To familiarize the students with the concepts of the subject and its related applications in Civil Engg.				

10. Details of Course:

S. N.	Contents	Contact Hours
1	Types of skeletal structures, conditions of equilibrium, static and kinematic indeterminacy, conditions when law of superposition is valid, stiffness and flexibility.	5
2	Various matrices and matrix operations, methods for solution of equations, stiffness and flexibility methods of analysis, inclined supports, use of symmetry and anti-symmetry.	5
3	Basic steps of stiffness method, stiffness matrix in local axis system of beam and plane frame members, transformation of stiffness matrix from local axis system to global axis system, equivalent load vectors, assembling of load and stiffness matrices of various members, solution of equations, determination of support reactions and member end actions.	10
4	Stiffness matrix in local axis system of grid and plane truss members, transformation of the stiffness matrix from local axis system to global axis system, equivalent load vectors, assembling of load and stiffness matrices of various members, solution of equations, determination of support reactions and member end actions.	10
5	Stiffness matrix in local axis system of space truss and space frame members, transformation of stiffness matrix from local axis system to global axis system, equivalent load vectors, assembling of load and stiffness matrices of various members, solution of equations, determination of support reactions and member end actions. Appropriate experiments would be taken up.	10
	Total	40

1. Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of Publication
1.	Matrix Methods of Structural Analysis, P.N. Godbole, R.S. Sonparote and S.U. Dhote, PHI Learning Pvt. Ltd., Delhi (**ISBN-**978-81-203-4984-1)	2014
2.	Matrix Analysis of Framed Structures, William Weaver Jr. and James M. Gere, CBS Publishers and Distributors, New Delhi (ISBN: 81-239-1151-3)	2004
3.	Elementary Structural Analysis, Charles Head Norris, John Benson Wilbur and Senol Utku, Tata McGraw-Hill Publishing Company Limited, New Delhi (ISBN:0-07-058116-9)	2005

1.	**Subject Code: CE 318**		**Course Title:** ANALYSIS AND DESIGN OF UNDERGROUND STRUCTURES			
2.	Contact Hours:	L: 3	T: 0	P: 2		
3.	Examination Duration (Hrs.):	Theory: 3	Practical: 0			
4.	Relative Weight:	CWS: 15	PRS: 15	MTE: 30	ETE: 40	PRE: 0
5.	Credits:	4				
6.	Semester:	6				
7.	Subject Area:	DEC				
8.	Pre-requisite:	NIL				
9.	Objective:	To familiarize the students with the concepts of the subject and its related applications in Civil Engg.				

10. Details of Course:

Sl. No.	Contents	Contact Hours
1	**Introduction,**Types and classification of underground opening. Analysis: Stresses and deformation around opening, stress and deformation around tunnels and galleries with composite lining due to internal pressure, closed form solution, BEM and FEM.	8
2	**Openings in rock mass** and stresses around openings; pressure tunnels, development of plastic zone; rock support needed to avoid plastic deformation; lined and unlined tunnels; support pressure and slip of the joint; underground excavation and subsidence.	8
3	**Design of underground openings**, Fcators affecting design, design methodology, functional aspects, size and shapes, support systems, codal provisions.	8
4	**Design based on analytical methods**, empirical methods based on RSR, RMR, Q Systems, Design based on rock support interaction analysis, observational method, NATM, Convergence-confinement method.	8
5	**Design Based on wedge failure** and key block analysis. Design of shaft and hydraulic tunnels. Stability of excavation face and tunnel portals. Use of appropriate software packages. Appropriate experiments would be taken up.	8
	Total	40

11 Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of publication
1	Rock Mechanics Design in Mining and Tunellig, by Z.T. Bieniawski (ISBN 0-07-074828-2)	2000
2	Engineering Rock Mass Classification by Z.T. Bieniawski(ISBN 0-58-9687445-1)	1999
3	Introduction to Rock Mechanics by R.E.Goodman(ISBN 0-07-0468752-4)	1998
4	Design and Construction of Tunnels by Pietro Lunardi(ISBN 0-07-074965-1)	2005
5	Rock Mechanics and the Design of structures in Rock by bert and Duvall(ISBN 0-07-985642-7)	2003

10. Details of Course:

S. No.	Contents	Contact Hours
1	**Introduction to Computational Fluid Dynamics (CFD) :** Introduction to Computational Fluid Dynamics, Applications of Computational Fluid, Advantages of Computational Fluid Dynamics. Governing Equations : Principles of Conservation: Continuity Equation, Navier Stokes Equation, Energy Equation . General Structure of Conservation Equations.	6
2	**Classification of Partial Differential Equations and Physical Behaviour :** Mathematical classification of Partial Differential Equation :, Illustrative examples of elliptic, parabolic and hyperbolic equations, Physical examples of elliptic, parabolic and hyperbolic partial differential equations.	6
3	**Discretization** Basics of discretization. Boundary conditions : Possible types of boundary conditions, Conservativeness, Boundedness, Transportiveness, boundary layer treatment; variable property; interface and free surface treatment. Well posed problem. Classification and Overview of Numerical Methods: Classification into various types of equation; parabolic elliptic and hyperbolic; boundary and initial conditions; over view of numerical methods.	6
4	**Discretization Methods : Finite Difference Methods** Finite Difference Technique: Finite difference methods; different means for formulating finite difference equation; Taylor series expansion. Implicit, fully explicit and Crank-Nicholson scheme. **Finite Volume Methods** Finite Volume Technique: Finite volume methods; different types of finite volume grids; approximation of surface and volume integrals; interpolation methods; central, upwind and hybrid formulations and comparison for convection-diffusion problem. **Finite Element Methods** Finite Element Methods: Finite element methods; Rayleigh-Ritz, Galerkin and Least square methods; interpolation functions; one and two dimensional elements; applications.	8
5	**Solution Methods** Methods of Solution: Solution of finite difference equations; iterative methods; matrix inversion methods; ADI method; operator splitting; fast Fourier transform. Time integration Methods: Single and multilevel methods; predictor corrector methods; stability analysis; Applications to transient conduction and advection-diffusion problems.	6
6	**Grid Generation** Numerical Grid Generation: Numerical grid generation; basic ideas; transformation and mapping.	2
7	**Unit 10 : Turbulence Modelling** Turbulence modeling: Reynolds averaged Navier-Stokes equations, RANS modeling, DNS and LES.	4
	Total Contact Hours	**38**

Lab Work : The students would be expected to gain hands on experience on simulation of some classical fluid dynamics problems using related software in the laboratory : Viscous flow across flat plate ,Flow past a sphere, Study of laminar flow through a pipe, Study of turbulent flow through pipe, Study of sudden expansion in a pipe, Study of steady and unsteady flow past a cylinder

11. **Suggested Books:**

S.N.	Name of Books/ Authors	
1	Computational Fluid Dynamics, John D Anderson Jr, McGraw Hill Publications(ISBN 0-07-07592-7)	2000
2	Computational Methods for Fluid Dynamics, John Freziger, Miloven Peric, Springer(ISBN 0-07-94562-6)	1999
3	Computational Fluid Dynamics for Engineers Bengt Andersson, Ronnie Andersson, Love Ka Kansson, Mikael Mrtensen, Rahman Sudiyo, Berend Van Wachem, Cambridge University Press (ISBN 0-07-146498-7)	1996
4	Computational Fluid Dynamics – A Practical Approach, Jiyuan Tu, Guan Heng Yeoh, Chaoqun Liu(ISBN 0-07-0228847-9)	2005

1. **Subject Code: CE 322**   **Course Title: Traffic and Transportation Planning**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 6
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

Sl. No.	Contents	Contact Hours
1	**Introduction:** Urban travel characteristics, transportation planning process, demarcation of traffic zones, collection of data.	10
2	**Trip generation analysis:** Identification of study area, types and sources of data, road side interview, home interview surveys, expansion factors, trip generation models, zonal models, category analysis, household models, trip attractions of work centers.	10
3	**Trip Distribution analysis:** Trip distribution models, Growth factor models, Gravity models, opportunity models.	10
4	**Mode Split analysis:** Mode choice behavior, mode split curves, probabilistic models	5
5	**Traffic Assignment:** Elements of transportation network, minimum path trees, all-or-nothing assignment. Appropriate experiments would be taken up.	5
	Total	40

11. Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of publication
1	Kadiyali L.R "Traffic Engineering and Transport Planning" Khanna Publications, New Delhi(ISBN 0-07-0648746-9)	1999
2	Hutchinson B.G. "Principles of Urbun Transportation System Planning" McGraw Hill. (ISBN 0-97-754824-1)	2000
3	Dicky J.W. "Metropolitan Transportation Planning" Tata McGraw Hill. (ISBN 0-07-794685-9)	1998

1. **Subject Code: CE 405**   **Course Title**: **Design of Steel Structures**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.): Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 7
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course:

S. N.	Contents	Contact Hours
1	Fasteners, Connections for transmitting axial forces, eccentric load and beam reactions including moments, Analysis and design of semi-rigid connections.	10
2	Tension members, compression members including built-up, column splice and column bases.	08
3	Design of beams (laterally restrained & unrestrained) including built up, un-symmetrically bending, grillage beams and Beam-column.	10
4	Buckled and un-buckled design of plate girder and gantry girders.	08
5	Roof trusses and steel Tanks. Appropriate experiments would be taken up.	06
	Total	42

11. Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of Publication
1.	Design of Steel Structures, A.S. Arya and Awadhesh Kumar, Nem Chand & Bros. Roorkee, ISBN 978-81-85240-73-2.	2014
2.	Limit State Design of Steel Structures, S. K. Duggal, McGraw Hill Education (India) Pvt. Ltd., New Delhi, ISBN-13: 978-93-5134-349-3.	2014
3.	Design of Steel Structures, N. Subramanian, Oxford University Press, New Delhi, ISBN-13: 978-0-19-567681-5.	2008

1. **Subject Code: CE 407**   **Course Title**: **Water Resources Engineering**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 7
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

S. No.	Contents	Contact Hours
1	**Irrigation and Drainage works:** Necessity and types of irrigation, soil moisture and crop water relations, consumptive use of water, water logging, design concepts of surface and sub surface drainage system. **Rivers and River training works:** Rivers of different types, river behavior, meanders, cut offs, river training works and their design. **Canal irrigation :** Types of reservoirs, reservoir yield, reservoirs losses, multi-purpose river valley projects. **T**ypes of canal, parts of canal irrigation system, assessment of water requirements, estimation of channel losses, design of lined and unlined channels, regime and semi-theoretical approaches (Kennedy's theory and Lacey's theory). Modular and non-modular outlets.	8
2	**Regulation works and Cross-Drainage structures:** Classification of falls and their suitability, design of notch falls, Sharda falls and Montague falls, distributary head regulators and escapes. Necessity of cross-drainage structures, their types and selection, comparative merits and demerits, design of aqueduct and siphon aqueduct.	7
3	**Diversion Head works:** Selection of site and layout, different parts of diversion head works, types of weirs and barrages, design of weirs on permeable foundation barrage by Bligh's and Khosla's methods. Silt excluders and silt ejectors. **Dams and Spillways:** Introduction, suitable sites, types of dams, forces acting on a gravity dam, stability requirements, arch dams, buttress dams, earth and rock-fill dams, design of gravity dams. Introduction, types of spillways, design of spillways, energy dissipation below spillways.	8
4	**Hydrology**: Hydrologic cycle, rain gauge, measurement of rainfall, rain fall analysis, infiltration, runoff estimation; Stream flows and their measurement, Stage-discharge curves, Unit & Synthetic hydrographs and their applications, flood hydrograph. Peak flows estimation and flood frequency analysis. Reservoir routing and channel routing.	13
6	**Ground water engineering:** **A**quifers, movement of ground water, steady and unsteady flow towards wells in confined and unconfined aquifers, well losses.	5
	Total	**41**

Design Lab Work : The students would design some of the following hydraulic structures
    River training works, Lined and unlined regime channels, Canal falls, Cross drainage works, Diversion head works, Gravity dams and Ogee spillway with Energy dissipaters, Analysis of design floods based on hydrologic data

11. **Suggested Books:**

S.N.	Name of Books/ Authors	Year of Publication
1	Subramanya, K., "Engineering Hydrology", Tata McGraw Hill Education Private Limited(ISBN 0-07-75158-4)	2015
2	Patra, K, C, "Hydrology and Water Resources Engineering", Narosa Publishing House(ISBN 0-07-06472-59-8)	2002
3	Viessman Jr. W. and Lewis G. L. "Introduction to Hydrology", Prentice- Hall of India Pvt Ltd. India (ISBN 0-07-478214-1)	2008
4	Garg, S.K, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi. (ISBN 0-07-06487-1)	2014
5	Modi ,P.N., "Irrigation Water Resources and Water Power Engineering", Standard Book House, Delhi. (ISBN 0-07-078546-7)	1990
6	Asawa, G. L. "Irrigation and Water Resources Engineering",New Age International Publishers. (ISBN 0-07-795568-3)	1993

1. **Subject Code: CE 409**   **Course Title**: **Advanced Design of Concrete Structures**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 7
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course:

S. N.	Contents	Contact Hours
1	Design of staircase supported at ends, staircase supported at side of going, design of flat slab, analysis and design of slab by yield line method.	08
2	Design of continues beams, cantilever beams, design of isolated rectangular footing, design of rectangular and trapezoidal Combined columns footing.	08
3	Design of cantilever retaining wall and design of counterfort retaining wall.	08
4	Design of circular and rectangular water tanks on ground and under-ground, forrocement water tanks, introduction to Intz tank and I.S. specifications for water tanks.	08
5	Introduction to folded plates & shells and introduction to portal frames. Appropriate experiments would be taken up.	08
	Total	40

11. Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of Publication
1.	Limit State Design of Reinforced Concrete, P.C. Verghese, Prentice Hall of India Pvt. Ltd., (ISBN-81-203-2039-5)	2005
2.	Design of Concrete Structures, Nilson, Darwin and Dolan, McGraw-Hill Higher Education, (ISBN-13: 978-0073293493)	2009

Subject Code: CE 411   **Course Title: Interaction Behavior of Soil Structure**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 7
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course:

Sl. No.	Contents	Contact Hours
1	**General soil-structure interaction problems:** Contact pressures and soil-structure interaction for shallow foundations. Concept of sub grade modulus, effects/parameters influencing subgrade modulus. Analysis of foundations of finite rigidity Beams on elastic foundation concept, introduction to the solution of beam problems.	12
2	**Curved failure surfaces:** Their utility and analytical/graphical predictions from Mohr-Coulomb envelope and circle of stresses. Earth pressure computations by friction circle method. Earth pressure distribution on walls with limited/restrained deformations, Dubravo's analysis. Earth pressures on sheet piles, braced excavations. Design of supporting system of excavations. Arching in soils. Elastic and plastic analysis of stress distribution on yielding bases. Analysis of conduits. Design charts for practical use.	18
3	**Modern concept of analysis of piles and pile groups:** Axially, laterally loaded piles and groups. Interaction analysis. Reese and Matlock's Tunneling solution. Elastic continuum and elasto-plastic analysis of piles and pile groups. Hrennikoff's analysis. Ultimate lateral resistance of piles by various approaches. Non-linear load-deflection response. Uplift capacity of piles and anchors.	16

1.   Suggested books:

Sl. No.	Name of Books/ Authors	Year of Publication
1	Selvadurai, A.P.S., Elastic analysis of Soil Foundation Interaction, Elsevier, (ISBN 0-07-054859-7)	1979
2	Poulos, H.G., & Davis, E.H., Pile Foundation Analysis & Design, John Wiley, (ISBN 0-07-35965469-1)	1980
3	Scott, R.F., Foundation Analysis, Prentice Hall (ISBN 0-07-066554-8)	1981
4	Structure Soil Interaction-State of Art Report, Institution of Structure Engineers (ISBN 0-07-0956674-9)	1978
5	Kramer, S.L., Geotechnical Earthquake Engineering(ISBN 0-07-07899867-8)	2006
6	ACI 336, Suggested Analysis and Design Procedure for Combined Footings & Mats, American Concrete Institute, Delhi, (ISBN 0-07-0585665-1)	1988
7	Bowles, Foundation analysis and design, McGraw Hill(ISBN 0-07-0/8564-1)	1998

1.	**Subject Code: CE 413**		**Course Title: Water Resources Management**			
2.	Contact Hours:	L: 3	T: 0	P: 2		
3.	Examination Duration (Hrs.):	Theory: 3	Practical: 0			
4.	Relative Weight:	CWS: 15	PRS: 15	MTE: 30	ETE: 40	PRE: 0
5.	Credits:	4				
6.	Semester:	7				
7.	Subject Area:	DEC				
8.	Pre-requisite:	NIL				
9.	Objective:	To familiarize the students with the concepts of the subject and its related applications in Civil Engg.				

10. Details of Course:

S. No.	Contents	Contact Hours
1	**Introduction**: <u>Water conservation</u>: Rain water harvesting techniques, water shed development, ground water recharging, check dams, reservoirs and aquifers, control of infiltration, seepage and evaporation, <u>Soil Conservation:</u> Introduction to soil erosion, mechanisms and its causes and control, sheet erosion, rill erosion, gully erosion, control of erosion by bunding, terracing, contour trenching, gully stabilizing, check dams.	9
2	**Floods and flood Routing:** Stream flows and their measurement, stage-discharge curves. Unit hydrograph, instantaneous unit hydrograph and synthetic unit hydrograph theories; and their applications. Flood estimation; flood frequency, risk and reliability analysis. Reservoir and channel routing. Flood forecasting and flood management.	12
3	**Principles of engineering economics:** discounting techniques, un-certainty, planning horizon. Selection of optimal alternatives .Application of linear, non linear and dynamic programming in water resources. Optimal sequencing and scheduling of resources.	12
4	Planning of water resources projects, factors affecting irrigation and power development, cost – benefit analysis for irrigation, water power and floods control projects. Computer applications in the designs of water resources systems**.**	8
		41

11. **Suggested Books:**

S.N.	Name of Books/ Authors	Year of Publication
1	Das Ghanshyam, "Soil and Water Conservation Engineering" (ISBN 0-07-074204-1)	2004
2	Vedula, S and Majumdar,P.P."Water Resources Systems", Tata McGraw Hill Education Private Limited (ISBN 0-07-047334-1)	2007
3	Subramanya, K., "Engineering Hydrology", Tata McGraw Hill Education Private Limited (ISBN 0-07-082404-1)	2008
4	Kumar, D. Nagesh,"Water Resources Systems Planning and Management", (ISBN 0-07-047821-1)	2014

1. **Subject Code: CE 415**   **Course Title: Transportation safety and environment**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.): Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 7
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course:

S. N.	Contents	Contact Hours
1	Road accident situation in India, international comparison of road accident. Multidisciplinary approach to planning for traffic safety and injury control, causes of road accidents, control measures, roles of vehicle, roadway traffic, driver, and environment, crash and injury causations; accident analysis, pre crash and post crash models, conflict points.	10
2	Safety auditing: road safety audit, stages of auditing, methods involved; case studies. Mixed traffic flow, traffic calming measures, strategies adopted in various countries, case studies.	10
3	Transportation related pollution: road transport related air pollution, sources of air pollution, effects of weather conditions, vehicular emission parameters, urban and non urban traffic noise sources, noise pollution, noise barriers, pollution standards measurement and analysis of vehicular emission, imitative measures.	10
4	EIA: EIA requirements of highways projects, procedure, MoEF, UK guidelines; EIA practices in India.	10
	Total	40

11. Suggested books:

S.N	Title, Author ,Publishers	Year of publication
1	Traffic Engineering and Transport planning, Dr. L.R.Kadiyali, Khanna Publishers,ISBN No. :81-7409-220-X	2007
2	Highway engineering, , Dr. L.R.Kadiyali, Khanna Publishers, ISBN No: 81-7409-165-3	2006
3	Principles of Traffic and Highway Engineeering,Nicholas J. Garber and Lester A. Hoel,Cengage Learning,ISBN-13:979-81-315-1246-3	2010
4	Transportation Engineering and Planning, C.S.Papacostas, PHI, ISBN-81-203-2154-5	2002
5	Highway engineering, Dr. S. K. Sharma ,S CHAND, ISBN 81-219-0131-6	2012

1.	**Subject Code: CE 417**	**Course Title: Finite Element Method for 2-D Structures**
2.	Contact Hours:	L: 3 T: 0 P: 2
3.	Examination Duration (Hrs.):	Theory: 3 Practical: 0
4.	Relative Weight:	CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 0
5.	Credits:	4
6.	Semester:	7
7.	Subject Area:	DEC
8.	Pre-requisite:	NIL
9.	Objective:	To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course:

S. No.	Contents	Contact Hours
1	Basic concepts, Discretistion, Displacement, Force and Hybrid Models.	02
2	Interpolation functions for General Element Formulations, Compatibility and completeness, Polynomial forms, One Dimensional Elements, Geometric Isotropy, Triangular Elements, Rectangular Elements, Isoperimetric Formulations, Axisymmetric Elements, Numerical Integration.	08
3	Plane Stress/Strain, Finite Element Formulation, Constant Strain Triangle(CST), Linear Strain Traingle(LST), Stiffness Matrix and Load Matrix Formation, Rectangular Element Isoperimetric Formation, Plate Elements and Shell Elements, Axisymmetric Stress Analysis, Torsion, Interface Elements	08
4	Application in Structural Dynamics and Vibrations: Mass (Consistent and Diagonal) and Damping Matrices, Modal Analysis, Time History Analysis, Explicit Direct Integration/Implicit Direct Integration and Mixed Methods.	06
5	Introduction to Nonlinear Problems: Geometric and Material (Elasto-plastic), Newton Ralphson Method, Modified Newton-Ralphson Method, Arc Method.	08
6	Stationary Principles, Rayleigh Ritz Method and Interpolation, Weighted Residual Methods and Variational Methods, Numerical Errors and Convergence	06
	Total	**42**

11. **Suggested Books:**

S.N.	Title, Author, Publisher and ISBN No.	Year of publication
1.	O.C. Zienkiewicz, "The Finite Element Method", Tata McGraw-Hill Company Ltd. (ISBN-0-07-099694-6).	1987
2.	Y.M. Desai, Eldho and Shah, "Finite Element Method", Pearson (ISBN-978-81-317-2464-4).	2011
3.	K.J. Bathe and E.L. Wilson, "Numerical Methods in Finite Element Analysis", PHI Pvt. Ltd. (ISBN -0-87692-243-4)	1987
4.	P.N. Godbole, "Introduction to Finite Element Method", I.K. International Publishing House Pvt. Ltd. (ISBN-9789382332206).	2013

1. **Subject Code: CE 419**   **Course Title: Soil Dynamics**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (Hrs.): Theory: 3 Practical: 0
4. Relative Weight: CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 0
5. Credits: 4
6. Semester: 7
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course:

Sl. No.	Contents	Contact Hrs.
1	Introduction, fundamentals of vibrations, dynamical systems, vibration of elementary systems-mass, spring, dashpot systems, degree of freedom, dynamic properties of geo-materials, propagation of wave in granular media;	8
2	laboratory and field tests for evaluation of dynamic soil properties; analysis and design of foundations for hammers, reciprocating engines and turbo generators; dynamic stiffness of single pile and pile groups;.	10
3	vibration isolation and damping; theories for vibration of foundations on elastic media; design procedures for foundations with dynamic load and construction features;	10
4	application of elastic homogeneous half space solution, lumped parameter solution;	6
5	large deformation problem, liquefaction of soils & cyclic mobility	6

1. Suggested Books:

Sl. No.	NAME OF BOOKS/ AUTHORS	Year of Publication
1	Soil Dynamics by Shamsher Prakash (ISBN 0-07-759614-1)	(1981)
2	An Introduction to Soil Dynamics by Arnold Verruijt (ISBN 0-07-057845-1)	(2006)
3	Geotechnical Earthquake Engineering by S.L. Kramer (ISBN 0-07-049504-1)	(1996)
4	Soil Dynamics and Machine Foundation by Swami Saran (ISBN 0-07-749805-1)	(1999)
5	Principles of Soil Dynamics by BM Das and GV Ramana (ISBN 0-07-744825-1)	(2010)

1. **Subject Code: CE 421** **Course Title: : Hydraulic Structures & Flood Control Works**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (Hrs.): Theory: 3 Practical: 0
4. Relative Weight: CWS: 15 PRS: 15 MTE: 30 ETE: 40 PRE: 0
5. Credits: 4
6. Semester: 7
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

S. No.	Contents	Contact Hours
1	**Introduction**:. Project planning, site investigations, choice of type of dams, cost benefit studies. **Dams and Spillways:** Design concepts of Earthen dams, Buttress and Arch dams. Non-overflow dams, design of various spillways and stilling basins.	8
2	Detailed design of diversion head works along with river training works, and their effects on river regime.	6
3	Morphological study of river behaviors and classification. Theories of river meandering, river regimes. Necessity principles and methods of river training. Local scour around hydraulic structures. Case history river training works and abroad. Levees, Groynes, Cut-offs and Guide bunds etc. River training works for different hydraulic structures.	11
4	Introduction, sediment properties, threshold conditions for uniform sediments, exposure and sheltering effects in non-uniform sediments, critical tractive stress of non-uniform cohesion-less sediments and cohesive soil, regimes of flow, analysis of ripples, dunes and anti-dunes, resistance to flow and velocity distribution in alluvial streams, Bed load, suspended load and wash load computation of bed load for uniform and non uniform sediments; Mechanism of suspension, distribution of suspended load, computation of suspended load and total load.	7
5	**Design of flood control structures:** Basic causes of flood, flood prone areas in India and their problems, case history of some important river basins of India. Engineering and administrative methods of flood plane regulation. Economic aspects of flood control schemes, cost benefit analysis. Flood forecasting, flood warning and flood fighting.	9
		41
Design Lab Work : The students would design some of the following hydraulic structures Earthen dams, Arch and Buttress 2 Spillways with Energy dissipaters **3** Diversion head works **4** Guide banks, Levys and Groynes 5 Flood control and management aspects 6 Sediment control and management aspects		

11. **Suggested Books:**

S.N.	Name of Books/ Authors	Year of Publication
1	Garg, S.K, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi. (ISBN 0-07-799852-1)	2014
2	Asawa, G. L. "Irrigation and Water Resources Engineering",New Age International Publishers. (ISBN 0-07-715846-1)	1993
3	Srivastava,Rajesh" Flow through Open Channels", Oxford University Press, New Delhi. (ISBN 0-07-982555-1)	2008
4	Verma,C.V.J. and Rao,M.K."River Behaviour Management and Training"Central Board of Irrigation and Power, New Delhi. (ISBN 0-07-985452-1)	1989

Subject Code: CE 423   **Course Title: : Advanced transportation engineering**

2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 7
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

11   Suggested books:

s. no.	contents	Contact hours
1	Transportation system planning: transportation policy, and types of surveys. OD matrix.travel demand forecasting, trip generation, model split analysis, trip distribution, route assignment analysis, transport network, network	6
2	Urban transport technology: classification mass and rapid transit system, introduction to intelligent transportation system(ITS), public transport policy, Intermediate transport, Introduction to BRT, Mono rail, sky bus, metro projects, grade separated interchanges such as flyovers, under passes, overpasses, concept of integrated inter model transit system	6
3	Transport economics and financing: vehicle operations cost, running cost, pollution cost, value of travel time, road damage cost, congestion cost, accident cost economic evaluation, various economic studies, transportation plans- benefit cost method, net present value method, first year rate of return method, internal rate of return method and comparision of various methods. Pavement management systems. Highway financing, pay as you go method, credit financing, private financing, BOT, BOOT, dedicated road funds, road pricing, tolls, private provisions, advantages and limitations.	8
4	Traffic systems: traffic impacts, traffic studies, level of service, traffic analysis process, basic traffic theory, intersection studies, turning movements, flow, delays, and queuing, singnal design, grade separated intersection, parking studies, traffic generation and parking, parking facilities.	8
5	Study of flexible pavement: IRC,AASHTO guide to design of pavement, pavement failure, strengthening of pavement- benkelmen beam method. Distress in pavements.	6
6	Study of rigid pavement: concept of rigid pavement, comparisons of rigid over flexible pavement, design as per IRC guidelines, design of joints, dowel bars, temperature reinforcement, pavement failure, overlay types and their design as per IRC.	6

11. Suggested books:

S.N.	Name of Books/ Authors	Year of Publication
1	Traffic Engineering and Transport planning, Dr. L.R.Kadiyali, Khanna Publishers,ISBN No. :81-7409-220-X	2014
2	Highway engineering, , Dr. L.R.Kadiyali, Khanna Publishers, ISBN No: 81-7409-165-3	1993
3	Principles of Traffic and Highway Engineeering,Nicholas J. Garber and Lester A. Hoel,Cengage Learning,ISBN-13:979-81-315-1246-3	2008
4	Transportation Engineering and Planning, C.S.Papacostas, PHI, ISBN-81-203-2154-5	1989

1. Subject Code: CE 404   **Course Title: Construction Technology and Management**

2. Contact Hours: L: 3   T: 1   P: 0
3. Examination Duration (Hours): Theory: 3   PH: 0
4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0
5. Credits: 4
6. Semester: 8
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To give concept of Project Management in Construction Projects

10. Details of Course:

Sl. No.	Contents	Contact Hours
1	**Introduction:** Organization for construction project, contracts, communication, motivation and labour welfare.	10
2	**Construction Management:** Objectives and functions of project management, Introduction to CPM/PERT methods and their use in construction planning, preparation of construction schedules for jobs, resources and project monitoring.	10
3	**Construction Equipment:** Different types of construction equipment viz., earth moving equipment, dewatering and pumping equipment, grouting equipment, pile driving equipment and other construction equipment such as conveyors, cranes, concrete mixers, vibrators, road construction machinery, rollers, compactors etc. Factors affecting the selection of construction equipment.	10
4	**Equipment Management:** Productivity, operational cost, owing and hiring cost and the work motion study.	5
5	**Specifications and Quality Control:** General and detail specification for important engineering works, quality control.	5
	Total	40

11. Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of publication
1	Punmia B. C., and Khandelwal K. K., "PERT and CPM", Laxmi Publications, New Delhi. (ISBN 0-07-23998904-1)	1999
2	R. L. Peurify, "Construction Planning: Equipment and Methods", Tata McGraw Hill, Inc. (ISBN 0-07-0476158-7)	2000
3	Satyanarayanan & Saxena, "Construction Planning and Equipment", Standard Publishers Distributors, New Delhi. (ISBN 0-01-257859-8)	1998

1. **Subject Code: CE 406**   **Course Title**: **Advanced Design of Steel Structures**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 8
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course:

S. N.	Contents	Contact Hours
1	Industrial buildings, towers and durability	08
2	Fire resistance and design of steel stacks	08
3	Fatigue design and design of bridges	08
4	Aluminium structures, light gauge constructions, design and detailing for earthquake loads	08
5	Parallel flange and tubular sections, structure of multi-storeyed buildings and their bracings.	10
	Total	42

11. Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of Publication
1.	Design of Steel Structures, A.S. Arya and Awadhesh Kumar, Nem Chand & Bros. Roorkee, ISBN 978-81-85240-73-2.	2014
2.	Limit State Design of Steel Structures, S. K. Duggal, McGraw Hill Education (India) Pvt. Ltd., New Delhi, ISBN-13: 978-93-5134-349-3.	2014
3.	Design of Steel Structures, N. Subramanian, Oxford University Press, New Delhi, ISBN-13: 978-0-19-567681-5.	2008

2. **Subject Code:** CE 408   **Course Title:** Computational Geo-mechanics
3. Contact Hours: L: 3   T: 0   P: 2
4. Examination Duration (Hrs.):   Theory: 3   Practical: 0
5. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
6. Credits: 4
7. Semester: 8
8. Subject Area: DEC
9. Pre-requisite: NIL
10. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
11. Details of Course:

Sl. No.	Contents	Contact Hrs.
1	Computational Geomechanics, Composition and description of granular media	8
2	Stress-strain space, 2D, 3D descriptors, elasticity, elasto-plasticity, plasticity, fracture and damage, strength theories, critical state	8
3	Excavations, earth pressure, cuts, embankment	8
4	Consolidation, 2D, 3D descriptors, evaluation of settlement	8
5	Applications in raft, piles, rock masses	8

12. Suggested Books:

Sl. No.	NAME OF BOOKS/ AUTHORS	Year of Publication
1	Soil Behaviour and Critical State Soil Mechanics by DM Wood (ISBN 78-42-448528-6)	1990
2	Critical State Soil Mechanics by A.N. Schofield and C.P. Wroth (ISBN 0-07-058856-87)	1968
3	Plasticity and Geotechnics by H.S.Yu (ISBN 0-25-574555-4)	1981

1.	**Subject Code: CE 410**	**Course Title: Advanced Fluid Mechanics**

2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 8
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

Sl. No.	Contents	Contact Hours
1	Basic Concepts and Fundamentals Definition and properties of Fluids, Fluid as continuum, Langragian and Eulerian description, Velocity and stress field, Fluid statics, Fluid Kinematics.	5
2.	Governing Equations of Fluid Motion Reynolds transport theorem, Integral and differential forms of governing equations: mass, momentum and energy conservation equations, Navier-Stokes equations, Euler's equation, Bernoulli's Equation.	5
3.	Exact solutions of Navier-Stokes Equations Couette flows, Poiseuille flows, Fully developed flows in non-circular cross-sections, Unsteady flows, Creeping flows.	5
4.	Potential Flows Revisit of fluid kinematics, Stream and Velocity potential function, Circulation, Irrotational vortex, Basic plane potential flows: Uniform stream; Source and Sink; Vortex flow, Doublet, Superposition of basic plane potential flows, Flow past a circular cylinder, Magnus effect; Kutta-Joukowski lift theorem; Concept of lift and drag.	8
5.	Laminar Boundary Layers Boundary layer equations, Boundary layer thickness, Boundary layer on a flat plate, similarity solutions, Integral form of boundary layer equations, Approximate Methods, Flow separation, Entry flow into a duct.	5
6.	Elements of Stability Theory Concept of small-disturbance stability, Orr-Sommerfeld equation, Inviscid stability theory, Boundary layer stability, Thermal instability, Transition to turbulence.	6
7.	Turbulent Flow Introduction, Fluctuations and time-averaging, General equations of turbulent flow, Turbulent boundary layer equation, Flat plate turbulent boundary layer, Turbulent pipe flow, Prandtl mixing hypothesis, Turbulence modeling, Free turbulent flows.	6
	Total	40 hrrs

11. Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of Publication
1.	Advanced Engineering Fluid Mechanics Hardcover – K. Muralidhar (Author), G. Biswas (Author) Alpha Science International Ltd (ISBN 0-07-748559-7)	2005
2.	Advanced Fluid Mechanics Hardcover – William P. Graebel (ISBN 1-78-48692524-8)	2009

1. **Subject Code: CE 412**   **Course Title: Construction and design aspects in transportation engineering**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 8
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course:

Sl. No.	Contents	Contact Hours
1	Principles of intersection design: basic considerations, simplicity, uniformity, maneuver elements, separation of conflict points, design elements , design speed, intersection curves, super elevation of curves at intersection, intersection sight distance.	6
2	Design of at grade intersections: capacity and LOS, design of rotary and signalized intersections, vehicle actuated signals, signal co-ordination, area traffic control system (ATCS), Pedestrian planning at grade intersections.	6
3	Design of grade separated inter sections :design of grade separators, principles, design criteria, layout design, GAD preparation, pedestrian food over bridge and subway design, pedestrian planning and grade separated intersections.	8
4	Parking facilities: parking, demand, characteristics, space inventory, accumulation, duration, turn over, design of multi storied and surface parking facility.	8
5	Design of terminal facilities: bus terminus, design principles, design elements, design and case studies of inter modal transfer facilities, case studies of bus and rail terminals	6
	Total	34

11. **Suggested Books:**

S.N.	Name of Books/ Authors	Year of Publication
1	Punmia B. C., and Khandelwal K. K., "PERT and CPM", Laxmi Publications, New Delhi. (ISBN 0-07-504049-8)	2015
2	R. L. Peurify, "Construction Planning: Equipment and Methods", Tata McGraw Hill, Inc. (ISBN 0-07-796845-3)	2002
3	Satyanarayanan & Saxena, "Construction Planning and Equipment", Standard Publishers Distributors, New Delhi. (ISBN 0-07-741859-01)	2008
4	Punmia B. C., and Khandelwal K. K., "PERT and CPM", Laxmi Publications, New Delhi. (ISBN 0-07-954504-1)	2014
5	R. L. Peurify, "Construction Planning: Equipment and Methods", Tata McGraw Hill, Inc. (ISBN 0-07-976432-1)	1990
6	Satyanarayanan & Saxena, "Construction Planning and Equipment", Standard Publishers Distributors, New Delhi. (ISBN 0-07-4646474-1)	1993

1. **Subject Code**: CE 414   **Course Title**: **Design of Bridges**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.): Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 8
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course:

S. N.	Contents	Contact Hours
1	Introduction, components of bridges, classification of bridges, related structures, classical examples of various types of bridges	2
2	Selection of site and initial decision process, survey and alignment, geotechnical investigations, collection of bridge design data, hydrological calculations, waterway calculations, scour, depth of foundation, freeboard considerations, vertical clearance	6
3	Standard loadings for bridge design as per different codes of practice, IRC, BS and AASHTO codes, various types of loads considered for design of bridges, impact factor, centrifugal force, wind and seismic considerations, width and roadway considerations, influence lines, load combinations, limit and working stress design considerations, pre-design considerations, roadway vs. railway bridges	8
4	Superstructure of bridge: selection of main bridge parameters, design methodologies, choice of superstructure type, load distribution in various types of superstructures, RCC and PSC superstructures, longitudinal analysis of bridges, transverse analysis of bridge, temperature analysis, effect of differential movements of supports, reinforced earth structures, box girder bridges	8
5	Substructure of bridge: pier, abutment, wing walls, importance of substructure soil interaction, open foundation, pile foundation, well foundation, simply supported and continuous bridges,	8
6	Bearings and deck joints: types of bearings, expansion joints, design of bearings and joints, parapets and railings for highway bridges, definitions, classifications of bridge parapets, related details	8
	Total	40

11. **Suggested Books:**

S.N.	Title, Author, Publisher and ISBN No.	Year of Publication
1.	M.J. Ryall, Parke G.A.R and Harding J.E.,'The manual of bridge engineering', Thomas Telford Publishers ASIN 8000Q91ZDY	1997
2.	Raina V.K., 'Concrete bridge practice – analysis, design and economics, Tata McGraw-Hill Publishing Company Ltd. (ISBN 8184043783)	2002
3.	Ponnuswamy S., 'Bridge engineering', Tata McGraw-Hill Publishing Company Ltd. ISBN: 9780070656956	2000

Subject Code: CE 416   **Course Title: Geo-environmental and Geo-hazard Engineering**

2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 8
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

Sl. No.	Contents	Contact Hrs.
1	**Geoenvironmental Engineering**: Waste generation; Sources of subsurface contamination, Effect of contamination on geotechnical properties, Waste disposal on land, Types of landfills, design and operation of landfills, subsurface contamination control and remediation, types of barrier materials, Design of ash ponds.	18
2	**Geo-Hazards Engineering**: Engineering seismology, Strong ground motion, Seismic hazard analysis, Local site effects and design ground motions, liquefaction hazard evaluations and remedial measures Landslides: Causes and Phenomenon associated with landslides, effect of rainfall on slope stability, earthquake triggered landslides, landslide prevention, control and remedial measures Other Hazards: ground subsidence, ground heave, erosion.	24
	Total	42

1. Suggested Books:

Sl. No.	NAME OF BOOKS/ AUTHORS	Year of Publication
1	Rowe R.K.,"Geotechnical and Geoenvironmental Engineering Handbook" Kluwer Academic Publications, London, (ISBN 0-07-874924-1)	2000
2	Reddi L.N. and Inyang, H. I.,"Geoenvironmental Engineering, Principles and Applications" Marcel Dekker Inc. New York, (ISBN 0-07-787889-5)	2000
3	Yong, R. I.,"Geoenvironmental Engineering, Contaminated Soils, Pollutant Fate, and Mitigation" CRC Press, New York. (ISBN 0-07-087467-1)	2001
4	Sharma H.D. and Reddy K.R., "Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies" John Wiley & Sons, Inc., USA. (ISBN 0-07-76982-1)	2004
5	Mitchell, J.K.,"Fundamentals of Soil Behavior" Wiley, 2005. 7. Hillel D.,"Introduction to Environmental Soil Physics" Academic Press, New York, (ISBN 0-07-741258-1)	2003
6	Sparks, D.L.,"Environmental Soil Chemistry" Academic Press, New York, (ISBN 0-07-976425-1)	2002
7	Bagchi,A.,"Design of landfills and integrated solid waste management" John Wiley & Sons, Inc., USA (ISBN 0-78-744852-1)	2004
8	Kramer, S.L.,"Geotechnical Earthquake Engineering"(ISBN 0-74-85245-1)	

1. **Subject Code: CE 418**   **Course Title: GROUND WATER AND SEEPAGE**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 8
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.

10. Details of Course:

Sl. No.	Contents	Contact Hours
1	**Introduction :** Origin and age of groundwater, Distribution of water on the earth, Groundwater resources in India, vertical distribution of groundwater, the hydrological cycle, utilization of groundwater..	6
2	**Groundwater Flow Equations:** Basics equations, Darcy's law, Hydraulic conductivity, ground flow rates, Ground flow directions, General flow equations and Unsaturated flow. Zone of aeration and saturation. Aquifers Aquiclude, Aquitard, Aquifuge, Groundwater flow in confined and unconfined aquifers, Theims'Equations for wells.	10
3	**Groundwater Modeling :** Prous media models, Analog modelia models, Electrical analog models and Digital computer models.	8
4	**Artificial Recharge of Groundwater :** Cocept of artificial recharge, Recharge methods, Artificial recharge on Long Island and Induced Recharge.	8
5	**Remote Sensing:** Introduction, Application of Remote sensing, Basics principles of Remote sensing, Energy balance equation for radiation, Data collected by Remote sensing, Analysis of Remote sensing data	8
	Total	40

11. Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of publication
1.	MacMillan,& M. E. Harr, " Groundwater and Seepage" - McGraw Hill (ISBN 0-078-92846-1)	1987
2.	Aggarwal V.C., "Ground water Hydrology" PHI Learning Pvt. Ltd (ISBN 0-07-986143-4)	2011
3.	David Keith Todd, " Ground water Hydrology" OHAN WOLEY & SONS (ISBN 0-27-648222-0)	1987

1. **Subject Code: CE 420**   **Course Title: : Traffic Engineering**
2. Contact Hours: L: 3   T: 0   P: 2
3. Examination Duration (Hrs.): Theory: 3   Practical: 0
4. Relative Weight: CWS: 15   PRS: 15   MTE: 30   ETE: 40   PRE: 0
5. Credits: 4
6. Semester: 8
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engg.
10. Details of Course:

Sl. No.	Contents	Contact Hours
1	**Traffic engineering studies and analysis:** Objectives of traffic engineering study, Components of road traffic and their effect on road traffic, Spot speeds, speed and delay study, traffic volume survey, O-D survey, Parking study.	10
2	**Theory of Traffic Flow:** Basic diagram of traffic flow, Vehicular stream equations and diagrams, shock waves in traffic, freeway capacity and level of service, probabilistic aspects of traffic flow.	10
3	**Traffic Control:** Traffic control through time sharing and space sharing concepts, traffic signs, traffic signals, road markings, islands, types of traffic signal systems, signal coordination, application of ITS.	10
4	**Traffic Safety:** Accident data collection, analysis of accident data, causes and prevention of accidents, pedestrian safety, road lights and Road safety audit.	10
	Total	40
	Experiments: Students would conduct the following experiments	
	1. Traffic volume count 2. Classified traffic volume count 3. Parking survey 4. Turning movement count 5. Spot speed study 6. Speed and delay study 7. O-D survey 8. Traffic noise survey 9. Driver test	

11. Suggested Books:

S.N.	Title, Author, Publisher and ISBN No.	Year of publication
1.	Kadiyali L.R "Traffic Engineering and Transport Planning" Khanna Publications (ISBN 0-07-573667-1)	1987
2.	Pignatyaro L., "Traffic Engineering-Theory and Practice", John Wiley (ISBN 0-07-760054-1)	2011
3.	McShane W.R. and Roess R.P., "Traffic Engineering" Prentice Hall (ISBN 0-75-986523-1)	1987