Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2014
3 to 8 Semester
Civil Engineering

Update on Nov. 2017

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Civil Engineering

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hours		MSE-I	MSE-II	TA	ESE	
THIRD SEMESTER												
1	GE1201	Engineering Mathematics-III	3	1	0	4	4	15	15	10	60	3
2	GE1202	Engineering Geology	4	0	0	4	4	15	15	10	60	3
3	GE1203	**Lab:** Engineering Geology	0	0	2	2	1			40	60	
4	CV1201	Strength of Materials	3	1	0	4	4	15	15	10	60	3
5	CV1202	**Lab:** Strength of Materials	0	0	2	2	1			40	60	
6	CV1203	Geotechnical Engineering-I	3	1	0	4	4	15	15	10	60	3
7	CV1204	**Lab:** Geotechnical Engineering-I	0	0	2	2	1			40	60	
8	CV1205	Fluid Mechanics-I	3	1	0	4	4	15	15	10	60	3
9	CV1206	**Lab:** Fluid Mechanics-I	0	0	2	2	1			40	60	
Total			**16**	**4**	**8**	**28**	**24**					

FOURTH SEMESTER

1	**GE1204**	Advanced Mathematical Techniques	4	0	0	4	4	15	15	10	60	3
2	CV1208	Concrete Technology	4	0	0	4	4	15	15	10	60	3
3	CV1209	**Lab:** Concrete Technology	0	0	2	2	1			40	60	
4	CV1210	Surveying-I	3	1	0	4	4	15	15	10	60	3
5	CV1211	**Lab:** Surveying-I	0	0	2	2	1			40	60	
6	CV1212	Environmental Engineering-I	3	1	0	4	4	15	15	10	60	3
7	CV1213	**Lab:** Environmental Engineering-I	0	0	2	2	1			40	60	
8	CV1214	Building Construction and Building Drawing	4	0	0	4	4	15	15	10	60	4
9	CV1215	**Lab:** Computer Aided Building Drawing	0	0	2	2	1			40	60	
10	CV1216	Engineering Hydrology	4	0	0	4	4	15	15	10	60	3
Total			**22**	**2**	**8**	**32**	**28**					

Chairperson	**Dean (Acad. Matters)**	**1.00**	**May 2015**	**Applicable for AY 2015-16 Onwards**
		Version	**Date of Release**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Civil Engineering

Sno	Sub Code	Subject	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total		MSE-I	MSE-II	TA	ESE	
FIFTH SEMESTER												
1	GE1311	Fundamental of Management	3	0	0	3	3	15	15	10	60	3
2	CV1301	Surveying -II	4	0	0	4	4	15	15	10	60	3
3	CV1302	**Lab:** Surveying -II	0	0	2	2	1			40	60	
4	CV1307	Structural Analysis-I	3	1	0	4	4	15	15	10	60	3
5	CV1308	**Lab:** Structural Analysis-I	0	0	2	2	1			40	60	
6	CV1304	Transportation Engineering –I	4	0	0	4	4	15	15	10	60	3
7	CV1305	**Lab:** Transportation Engineering –I	0	0	2	2	1			40	60	
8	**Open Elective I**		3	0	0	3	3	15	15	10	60	3
	CV1325	OE I : Environmental Management										
	CV1327	OE I : Building Services Engineering										
	CV1329	OE I : Construction Techniques										
	CV1330	OE I : Transportation Engineering Basic										
9	CV1331	Reinforced Concrete Structures	3	1	0	4	4	15	15	10	60	4
Total			**20**	**2**	**6**	**28**	**25**					
SIXTH SEMESTER												
1	GE1312	Fundamental of Economics	3	0	0	3	3	15	15	10	60	3
2	CV1310	Fluid Mechanics –II	3	1	0	4	4	15	15	10	60	3
3	CV1311	**Lab:** Fluid Mechanics –II	0	0	2	2	1			40	60	--
4	CV1332	Steel Structures	3	1	0	4	4	15	15	10	60	4
5	CV1333	Geotechnical Engineering II	4	0	0	4	4	15	15	10	60	3
6	**Professional Elective I**		3	0	0	3	3	15	15	10	60	3
	CV1315	PE I : Water Treatment										
	CV1316	PE I :Prestressed Concrete										
	CV1317	PE I :Building Services										
	CV1323	PE I :Pavement Design										
	CV1324	PE I :Geotechnical Investigation & Ground Improvement Techniques										
7	**Open Elective II**		3	0	0	3	3	15	15	10	60	3
	CV1341	OE II: Elements of Earthquake Engineering										
	CV1342	OE II: Air Pollution and Solid Waste Management										
	CV1343	OE II: Introduction to Finite Element Method										
	CV1344	OE II: Disaster Management										
	CV1345	OE II: Environmental Impact Assessment										
8	CV1314	Seminar	0	0	2	2	1			100		--
Total			**19**	**2**	**4**	**25**	**23**					

Chairperson	**Version**	**1.00**	**Applicable for AY 2016-17 Onwards**
Dean (Acad. Matters)	**Date of Release**	**May 2016**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

Civil Engineering

Sno	Sub Code	Subject	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total		MSE-I	MSE-II	TA	ESE	
SEVENTH SEMESTER												
1	CV1401	Water Resource Engineering	3	1	0	4	4	15	15	10	60	3
2	CV1402	Structural Analysis-II	3	1	0	4	4	15	15	10	60	3
3	CV1403	**Lab:** Structural Analysis-II	0	0	2	2	1			40	60	--
4	CV1422	Transportation Engineering –II	4	0	0	4	4	15	15	10	60	3
5	CV1441	Environmental Engineering -II	4	0	0	4	4	15	15	10	60	3
6	CV1442	**Lab :** Computer Applications in Civil Engineering	0	0	2	2	1			40	60	--
7	**Professional Elective II**		3	0	0	3	3	15	15	10	60	3
	CV1410	PE II: Traffic Engineering										
	CV1411	PE II: Advanced Hydraulics										
	CV1413	PE II: Natural Resources Management										
	CV1443	PE II: Optimization Techniques										
	CV1444	PE II: Structural Dynamics										
	CV1445	PE II: Soil Dynamics										
	CV1459	PE II: Computer Applications in Civil Engineering										
	CV1406	Industrial Training/ CRT	0	0	0	0	2			100		
8	CV1407	Project- Phase I	0	0	4	4	4			40	60	--
Total			**17**	**2**	**8**	**27**	**27**					
EIGHTH SEMESTER												
1	CV1421	Estimating & Costing	3	1	0	4	4	15	15	10	60	4
2	**Professional Elective III**		3	0	0	3	3	15	15	10	60	3
	CV1446	PE III: New Engineering Materials										
	CV1447	PE III: Advanced RCC										
	CV1448	PE III: Remote Sensing and GIS										
	CV1449	PE III: Earth and Earth Retaining Structures										
	CV1450	PE III: Watershed Management										
	CV1451	PE III: Urban Transportation Planning										
3	**Professional Elective IV**		3	0	0	3	3	15	15	10	60	3
	CV1427	PE IV: Wastewater Treatment										
	CV1428	PE IV: Earthquake Engineering										
	CV1429	PE IV: Matrix Analysis of Structures										
	CV1452	PE IV: Advanced Surveying										
	CV1453	PE IV: Foundation Engineering										
	CV1454	PE IV: Water Power Engineering										
4	**Professional Elective V**		3	0	0	3	3	15	15	10	60	3
	CV1432	PE V: Water Transmission and Distribution Systems										
	CV1433	PE V: Advanced Steel Design										
	CV1434	PE V: Maintenance and Rehabilitation Engineering										
	CV1455	PE V: Finite Element Method										
	CV1456	PE V: Advanced Geotechnical Engineering										
	CV1457	PE V: Design of Bridge Structures										
	CV1458	PE V: Advanced Foundation Engineering										
5	CV1424	Comprehensive Viva-voce	0	0	0	0	3				100	
6	CV1425	Project- Phase II	0	0	8	8	8			40	60	
7	CV1426	Extra / Co-curricular / Competitive Examination	0	0	0	0	2			100		
Total			**12**	**1**	**8**	**21**	**26**					

Add. Sub : 7-CV1459 PE: CAICE

Chairperso	**Version**	**1.02**	**Applicable for AY 2018-19 Onwards**
Dean (Acad. Matters)	**Date of Release**	**April 2018**	

III Semester

GE 1201	Engineering Mathematics-III		L= 3	T=1	P=0	Credits=4
Evaluation Scheme	**MSE-I**	**MSE-II**	**TA**	**ESE**	**Total**	**ESE Duration**
	15	**15**	**10**	**60**	**100**	**3 Hrs**

Objective	Outcome
The aim of this paper is to integral transform namely Laplace ,Z-transform and their methods of solution and partial differential equation with simple applications and to introduce the essential concepts of optimization techniques.	• With the completion of this syllabus students will be familiar with Laplace ,Z-transform and their methods of solutions and partial differential equation with simple applications and essential concepts of optimization techniques and use these mathematical techniques in variety of technical, business, industry optimization problems.

UNIT-1: : Finite Differences (a,e) **[8 hrs]**
Difference table; Operators E and Δ, Central differences, Factorials notation Numerical differentiation and integration, Difference equations with constant coefficients.

UNIT- 2 : Laplace Transform (a,e) **[7 hrs]**
Laplace Transforms: Laplace transforms and their simple properties(with proof), Unit step function Heaviside unit step function and inverse, convolution theorem, , Applications of Laplace transform to solve ordinary differential equations including simultaneous equations.

UNIT-3 : Z-transform (a,e) **[8 hrs]**
Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and redidue theorem, , Applications of Z-transform to solve difference equations with constant co-efficient.

UNIT-4 :Matrices (a,e) **[9 hrs]**
Inverse of matrix by adjoint method and its use in solving simultaneous equations, rank of a matrix (by partitioning method) consistency of system of equation, Inverse of matrix by partitioning method Linear dependence, Linear and orthogonal transformations. Characteristics equations, eigen values and eigenvectors.Reduction to diagonal form, Cayley Hamilton Theorem (without proof) statement and verification, Sylvester's theorem, Association of matrices with linear differential equation of second order with constant coefficient.

UNIT-5 : Fourier Series and Partial Differential Equation (a,e,h) **[8 hrs]**
Fourier Series – Periodic Function and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions.
Partial Differential Equations – PDE of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve forst and second order partial differential equations.

UNIT-6 : Fourier Transform (a,h) **[6 hrs]**
Definition : Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem.

Text books:

1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference books:

1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John wiley& Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John wiley& Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill.
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune VidyarthiGrihaPrakashan

III Semester

GE 1202	Engineering Geology	L=4	T=0	P=0	Credits = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study the origin, development and ultimate fate of various surface features of the earth 2. To understand the basic building units of which the solid crust of the earth 3. To understand the nature of geographic distribution of rocks and engineering properties of rock on the earth 4. To understand the nature of geological structures and their importance on the civil engineering structures 5. To know the importance of geology in civil engineering practices	**1.** An ability to understand various aspects of geological science and its application to engineering for the purpose of assuring that the geological factors affecting the location, design, construction, operation and maintenance of engineering works are recognized and adequately provided for. **2.** An ability to perform studies and opinions regarding geological hazards, erosion, flooding, dewatering and seismic investigations etc.
Mapped Program Outcomes: b,h,k	

UNIT-I:
Indian Geology: Principles of stratigraphy &eological time scale, Physiographic and tectonic divisions of India, Introduction to the stratigraphy of India.
Geomorphology: Geomorphologic processes and their external and internal agents, Geological action of wind, glaciers, running water and oceans and their resulting landforms, Geomorphic forms and their consideration in engineering structures.

UNIT-II:
Structural Geology: Deformation of rocks, folds, parts of fold, its classification and nomenclature, Identification joints, its definition, nomenclature and classification, Definition, nomenclature and classification of fault, Recognition of fault and fold in the field and its effect on outcrops, Outliner and inliers, Problems on dip, strikes, thickness and depth of rock strata.

UNIT-III
Mineralogy: Definition and classification of minerals, Isomorphism, polymorphism and pseudo orphism, General chemical and physical characters of the following mineral groups, Silica, Feldspar, olivine, Pyroxene, Amphibole, Mica, Feldpathoid and clay.
Petrology: Rock cycle, Magma and its composition, Igneous rocks: Formation of igneous rocks, Forms, textures and structures, Tabular classification of igneous rocks. Sedimentary rocks: Weathering, Erosion, Transportation and Deposition of sediments, Sedimentary Environments, Classification of sedimentary rocks. Metamorphic rocks: Definitions and agents of metamorphism, Types of metamorphism, Zones and grades of metamorphism, Ana taxis, Soils: soil profile and soil types.

UNIT-IV:
Engineering Geology: Applications of geology to Civil Engineering projects, Engineering properties of rocks. Engineering considerations of structures of rocks.Rock as a construction material, Building stone, Road metal and Ballast.Surface and sub-surface geotechnical investigation, Geological mapping, sampling, drilling, photogeology, geophysical methods. Application of geology for location, design and construction of dams, hydraulic structures, bridges and tunnels.

UNIT-V
General Geology: Definition and scopes of geology, Earth in relation to the Universe, Internal structures of the earth. Continental drift and plate tectonics.Isostasy and diastrophism, Volcanoes and their products.
Earthquake Engineering: Earthquake waves, causes and effects, magnitude and intensity. Tectonic zones of India. Landslides: causes of landslides and their prevention.

UNIT-VI:
Geohydrology: Hydrologic cycle, Occurrence and distribution of ground water, Water table and water table maps. Aquiclude, Acqifuge and aquifers, confined and unconfined aquifers, Springs and geysers, Importance of ground water studies in Civil Engineering Works.

III Semester

GE 1202	Engineering Geology	L=4	T=0	P=0	Credits = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

Text books:

1. Singh Parbin, “Engineering and General Geology”, 2009,S. K. Kataria& Sons
2. Kesavulu, “Textbook of Engineering Geology”,2009,Macmillan India Ltd

Reference books:

1. SenguptaSupriya, “Introduction to Sedimentology” 1994, A. A. Balkema
2. Park R. G., “Foundation of Structural Geology,” 2004 Routledge Publishing House

III Semester

GE 1203	Lab:- Engineering Geology		L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME						
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**	
--	--	40	60	100	--	

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand different types of minerals through megascopic study 2. To understand different types and species of rock through megascopic study. 3. To understand importance of geological mapping and its use to civil engineering.	1. An ability to identify different types of minerals. 2. An ability to identify different types of rocks 3. An ability to draw geological maps.
Mapped Program Outcomes: a ,d, h	

LABORATORY WORK

Practical work will include the following:

- **Megascopic study of the following minerals:**

Quartz, Orthoclase, Microcline and Plaqioclase feldspar, nepheline, galena, olivine, augite, hornblende muscovite biotite, serpentine, asbestos, chlorite, talc, zeolite, gypsum, calcite, dolomite, fluorite, apatite, topaz, corrundum, beryl, tourmaline garnet, epidote, braunzite, laterite, clay, coal, magnatite, hematite, limonite, ochre, , sphalerite, chalcopyrite, pyrite, Malachite, azurite, pyrrolucite, psilomelene.

- **Megascopic study of the following rocks:**

Igneous rocks: Granite, granodiorite, diorite, syenite, gabbro, anorthositeperiodotite, dunite pegmatite, aplite, rhyolite, andesite, basalt, pumice, obsidian.

- **Sedimentary rocks:** Conglomerate, brecceia, grit, arkose, sandstone, greywacks, shales, limestone.

- **Metamorphic rocks:** slate, phyllite, Schist, Gneiss, Granulite, eclogite, hornblende schist, Amphibolite, marble, quartzite.Microscopic studies of Igneous, Sedimentary and Metamorphic rocks.

- **Geological map reading:** strike, dip, outcrop, Construction or cross section of simple geological maps depicting structures like Unconformity, intrusive, folds, faults etc. and some maps with engineering problems – About 10 maps.

Field Work:
Use of clinometer – compass in geological mapping.
Local geological fieldwork to identify and interpret geomorphic and geological features.
Visits to site of engineering structures to study the bearing of geological features in them.

Excursion be conducted under the guidance and supervision of the teaching staff and preliminary report on geological excursion shall be submitted by the students.
The report shall be valued and the marks shall be included in the sessional marks for practicals.

III Semester

CV1201	Strength of Materials	L=3	T=1	P=0	CREDITS =4

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To determine the deflections in beams by various methods which is an important criteria in design 2. To analyze the structural elements and find stresses. 3. To investigate state of stress in three dimensions and various theories of failure in designing the structural members 4. To interpret failure pattern of metal under different action 5. 5. To compute quantities of S.F. and B.M. and principle stresses.	1. An ability to understand basic concepts and mechanical properties of materials. 2. An ability to analyze behavior of material under various types of loading pattern. 3. An ability to draw variation of shear force, bending moment and stresses.
Mapped Program Outcomes: a ,c, e, g	

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UNIT – I

Mechanical properties and uniaxial problems: Types of force distribution, concept of stress and strain, stress strain behavior of ductile and brittle material in uniaxial state of stress. Elastic, plastic and strain hardening zones.stress – strain relations, elastic constants, relation between elastic constants. Uniaxial loading and deformation of simple cases of statically indeterminate problems under axial loading. Stress due to variation of temperature.

UNIT - II

Shear force and bending moment diagram: Axial force, shear force and bending moment diagram. Concept of free body diagram, types of loads, determination of axial force, shear force and bending moment at a section. Axial force, shear force and bending moment diagram in beams and simple frames, differential relation between shear force, bending moment and load

UNIT- III

Stresses in beam: Bending stresses in simple beam. Assumptions and derivation of simple bending. Theory relation between bending moment bending stress and curvature. Homogeneous and composite beams. Shear stresses in simple beams and shear stress distribution, Shear stress in composite beams. Combined effect of BM and axial force.

UNIT – IV

Torsion of Shaft: Torsion of circular sections, assumptions and derivation of relation between torsional moment, shear stress and angle of twist. Torsional stress in solid and hollow circular sections.

UNIT – V

Deflection of Beams: Derivation of differential equation of moment curvature relation, Differential Equation relating deflection and moment shear and load. Deflection of simple beams by integration.

UNIT – VI

Compound stresses: State of stress in two dimensions, differential equation of equilibrium, transformation of stresses, principal stresses, maximum shear stresses, Mohr's circle, combined bending and torsion, combinedeffect of Torsion and Shear. Thin walled pressure vessel, cylindrical and spherical pressure vessel subjected to internal pressure.

Text Books:

1. Bhavikatti S. S., Strength of Materials, 3rd Edition, Vikas Publication House Pvt. Ltd., Noida, UP, 2008.
2. Timoshenko S. P., Strength of Materials (Vol. 1 & 2), 2nd Edition, D Van Nostrand Company, Inc, New York.

Reference Books:

1. Chakraborti, M., Strength of Materials, S. K. Kataria& Sons.
2. Pytel A., Kivsalaas J. Mechenics of Material, CENGAGE LEARNING, (INDIAN EDITION),2010.
3. Shah V.L., Ogale R.A., Strength of Materials and Machine Element, 2nd Edition, Jain Book Agency, New Delhi.
4. Popov E.P., Engineering Mechanics of Solids, 4th Edition, Printice Hall, 2002.
5. Junnarkar S.B., Shah H., J., Mechanics of Structures VoL–I (Strength of Materials), 27th Edition, Charotar Publishing House, Anand, Gujrat, 2008.

III Semester

CV1202	Lab:- Strength of Materials	L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
--	--	40	60	100	--

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study suitability of various materials for civil engineering construction. 2. To study the resistance offered by various materials against the external forces	1. An ability to understand basic concepts & mechanical properties of material. 2. An Ability to understand behavior of various materials.
Mapped Program Outcomes: a,b,k	

PRACTICALS:

Minimum **Ten** practical's to be performed from the list as below:-

1. To study the universal testing machine.
2. To study the extensometer.
3. To perform tension test on metal.
4. To determine compressive strength of brick.
5. To determine flexural strength of timber.
6. To determine modulus of rigidity of M.S. bar by torsion test.
7. To determine impact value of metal by Charpy Impact Test and Izod Impact Test.
8. To determine Rockwell hardness number for M.S. and Aluminium bar.
9. To determine Brinell hardness number for M.S. and Aluminium bar.
10. To determine the stiffness of spring and modulus of rigidity.
11. To determine percentage variation in dimension of brick.
12. To determine the percentage water absorption of brick, roofing tile and flooring tile.
13. To perform flexural test on flooring tile and roofing tile.
14. To perform shear test on metals.
15. To determine the compressive strength of metal.

III Semester

CV 1203	Geotechnical Engineering – I	L=3	T=1	P=0	CREDIT S = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To Provide the description, formation, classification and identification of soil and analysis of stresses in soils under different loading conditions. 2. To describe various index properties and their correlation with soil characterization and classification 3. To develop an understanding of the principles of effective stress in saturated soils, and its application to one dimensional compression and consolidation 4. Familiarize the students an understanding of permeability and seepage of soils	1. An ability to develop an appreciation soil as a vital construction material, and of soil mechanics in the engineering of civil infrastructure. 2. An ability to develop an understanding of the relationships between physical characteristics and mechanical properties of soils. 3. An ability to understand and experience experimental measurement of the physical and mechanical soil properties commonly used in engineering practice. 4. An ability to understand and can apply the modeling and analysis techniques used in soil mechanics (a) Darcy's Law and flow-nets for seepage; (b) consolidation models for load-time-deformation responses of soils; (c) Mohr-Coulomb models for shear strength behavior of soils. 5. An ability to develop good technical reporting and data presentation skills
Mapped Program Outcomes: a, b,e,h,i,j	

UNIT – I

Introduction: Formation of soil, residual & transported soil, soils generally used in practice such as sand, gravel, organic silt, clay, Bentonite, Hard pan, Celiche, Peat, Loess, Black cotton soil etc. Fields of Geotechnical engineering, Role of Geotechnical engineer in construction industry.

Phases of Soil: Soil as three-phase system. Various soil weight & volume inter–relationship.Density indices, methods of determining in situ density.

UNIT - II

Index Properties & Their Determination: Water content, specific gravity, sieve analysis, particle size distribution curve, sedimentation analysis, Differential and free-swell value. Consistency of soil – Attenberg'slimits, determination, significance of consistency limits and related indices.

Classification of Soil: Criteria of classification, particle size classification, Textural classification, Unified & I.S. classification system, field identification of soils, Expansive soil, their identification and related problems.

UNIT – III

Permeability: Darcy's law & its validity, Discharge & seepage velocity, factors affecting Permeability, Determination of coefficient of permeability by Laboratory and field methods, permeability of stratified soil.

Seepage: Seepage pressure, quick sand condition, flow nets, Laplace equation, method to draw flow nets, characteristics & uses of flow nets, preliminary problems of discharge estimation in homogeneous soils, Effective, neutral and total stresses in soil mass.

UNIT – IV

Stress Distribution: Stress distribution in soil mass, Boussinesq's point load theory, uniformly loaded rectangular & circular areas, Equivalent point load method, Newmark's charts.

UNIT - V

Consolidation: Consolidation of laterally confined soil, Terzaghi's 1–D consolidation theory, various terms associated with consolidation, Determination of pre-consolidation pressure, determination of coefficient of consolidation, degree of consolidation, settlement rate.

Compaction: Mechanics of compaction, factors affecting compaction, Standard & Modified Proctor Tests, Optimum Moisture Content, field compaction methods, Quality control

III Semester

CV 1203	Geotechnical Engineering – I	L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

UNIT – VI

Shear Strength: Introduction, Mohr's diagram, Mohr-Coulomb's failure theory, Measurement of Shear strength by Direct shear test, Triaxial test, Unconfined compression test, Vane shear test, sensitivity. Shear test under different drainage conditions. Shear characteristics of sands and clays.

Text Books:

1. Punmia B. C., Jain A.K., Jain A.K., Soil Mechanics & Foundations., 16th edition, Laxmi Publications, New Delhi, 2005.
2. Murthy V.N.S., Geotechnical Engineering – Principles and Practices of Soil Mechanics and Foundation Engineering, CRC Press, 2003.
3. Gopal R., Rao A.S.R., Basic and Applied Soil Mechanics, 2nd edition, New Age International Publishers, New Delhi.

Reference Books:

1. Purushothama Raj P., "Soil Mechanics and Foundation Engineering, 1st edition, Pearson Education India, 2008.
2. Datta M, Gulhati S. K., Geotechenical Engineering, 5th edition, Tata McGraw Hills Publications, New Delhi, 2005.
3. ShamsherPrakash, GopalRanjan, Problems in Soil Engineering, SaritaPrakashan Publishers, Meerut, U.P., 1976.

III Semester

CV 1204	Lab:- Geotechnical Engineering - I	L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
--	--	40	60	100	--

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study various Index properties of soil 2. To perform various test to determine engineering properties of soil 3. To perform the test for determination of compactness soil	1. An ability to understand the Index properties of soil 2. An ability to understand the Engineering properties of soil 3. An ability to test the compactness of soil
Mapped Program Outcomes: a, b, e, j, k	

PRACTICALS

Minimum **Ten** practicals out of following will be performed

1. To determine Moisture content of given soil sample.
2. To determine Specific gravity of soil.
3. To perform Grain size Analysis – (Dry Sieve Analysis)
4. To determine Attenberg's Limits.
5. To determine coefficient of Permeability by (i) Constant head, and (ii) Falling head.
6. To perform Standard Proctor compaction Test and to determine OMC.
7. Field Density determination by sand replacement method.
8. Field Density determination by core cutter method.
9. To perform Unconfined compression test.
10. To perform Direct shear Test.
11. To perform Triaxial Compression test (Demonstration)
12. To find F.S.W. and D.F.S. of soil. Identification of swelling Soil.
13. To study the Consolidation characteristics of soil.

Reference Books:

1. Mittal S., Shukla J.P., Soil Testing for Engineers, Khanna Publishers, New Delhi, 2006.
2. Head K. H., Manual of Soil Laboratory Testing, 3rd edition, Whittles Publishing, 2008.

III Semester

CV 1205	Fluid Mechanics – I	L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVES	COURSE OUTCOMES
1. To know the importance, application and inter-relationship of various properties of fluid. 2. To study the various pressure measuring devices. 3. To study theories those explain the behavior and performance of fluid at rest. 4. To study Lagrangian and Eularian approach to understand the behavior of fluid in motion without reference of force. 5. To study motion fluid with reference of force. 6. To study the various flow measuring devices in pipe, channel and tanks. 7. To understand the utilization of dimensional analysis as a tool in solving problems in the field of fluid mechanics.	1 An ability to understand various properties of fluid and its behavior when is at rest. 2. An ability to apply various flow measuring device in pipes and tanks 3. An ability tounderstand the different approaches of study of fluid flow by considering &without considering the forces causing the flow. 4. An ability to understand the utilization of dimensional analysis as a tool in solving problems in the field of fluid mechanics.
Mapped Program Outcomes: a, b, e,k	

UNIT – I

Fluids and Their Properties: Definition of fluid, Differences between solids, liquids and gases , fluid properties, mass density, specific weight and specific gravity, viscosity, Newton's equation, coefficients of dynamic and kinematic viscosity, Rheological Diagram, Ideal and real fluids. Compressibility and bulk modulus.Surface tension, capillarity, pressure inside a bubble and cylindrical jet, vapor pressure and cavitation.Effect of pressure and temperature on fluid properties.

UNIT – II

Fluids Pressure and its Measurement: Fluid pressure, law of fluid pressure, variation of fluid pressure with depth, pressure and head, Atmospheric pressure and vacuum. Gauge and absolute pressures.Pressure measurement by open and differential manometers.

Hydrostatics: Total pressure & center of pressure, Forces on a Horizontal, Vertical, Inclined, Curved, submerged surfaces.

UNIT – III

Kinematics of Flow: Lagrangian and Eularian approaches in fluid flow description. Velocity and its variation with space and time.Acceleration of fluid particles, Normal and tangential acceleration. Steady, unsteady, uniform, Non–uniform flow. One, two and three dimensional flow, Rotational &Irrotational flow.

Streamline, path line, streak line, Equation of continuity in Cartesian co-ordinates, stream functions, velocity potential function .Relationship between stream function and velocity potential, flow net

UNIT – IV

Kinetics of Flow: Forces influencing motion, Euler's equations of motion for one dimensional flow, Bernoulli's equation for ideal fluids, Assumptions, derivation, limitation and application, Kinetic energy correction factor.Momentum equation, forces on pipe bends and closed conduits, Momentum correction factor

Flow Measurement-I: Velocity measurement by Pitot tube, Pitot–static tube and Prandtl'sPitot tube. Discharge measurement by venturimeter, orifice meter and flow nozzles.

UNIT – V

Flow Measurement-II: Flow through Orifices and mouthpieces: Definition, types, hydraulic coefficients, factors affecting them and their experimental determination, time for emptying tank by orifices. Discharge through large and submerged orifices, external and internal mouth pieces, running free and running full, pressure at vena contracta, Discharge through a convergent- divergent mouthpiece

UNIT – VI

Dimensional analysis and theory of models: Dimensional analysis: Definition and use, fundaments and derived dimensions, dimensional analysis by Raleigh and Buckingham's Pi methods. Similitude,geometric, kinematic and

III Semester

CV 1205	Fluid Mechanics – I	L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

dynamic similarities. Predominant force, force ratio, dimensionless numbers and their significance, Introduction to hydraulic models.

Text Books:

1. Asawa, G.L., Fluid Flow in Pipes and Channels, 1st edition, CBS Publishers and Distributers, 2009.
2. Gupta V., Gupta S.K., Fluid Mechanics and Its Applications, John Wiley & Sons, 1984.
3. Modi P.N., Seth S.M., Hydraulics and Fluid Mechanics Including Hydraulics Machines, 14th edition, Standard Book House Publishers, New Delhi, 2009.

Reference Books:

1. White F.M., Fluid Mechanics, 6th Edition, McGraw-Hill, 2007.
2. Fox R.W., McDonald A.T., Introduction to Fluid Mechanics, 6th Edition, John Wiley & Sons, 2003.

III Semester

CV 1206		Lab:- Fluid Mechanics – I		L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME							
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**		**ESE DURATION**	
--	--	40	60	100		--	

COURSE OBJECTIVE	**COURSE OUTCOME**
1. To understand concept of equilibrium of floating bodies & position of metacenter. 2. To understand various forms of energy of flowing fluid. 3. To understand various flow measuring devices in pipe, tank, channel.	1. An ability to determine Metacentric height of ship model 2. An ability to verify Bernoulli's theorem 3. An ability to measure velocity or discharge in pipe, tank & channel & also determine hydraulic coefficients of devices.
Mapped Program Outcomes : a,b,k	

PRACTICALS

Minimum of **Ten** practicals from the list given below shall be performed.

1. Determination of metacentric height of a given ship models.
2. Verification Bernoulli's theorem
3. Velocity measurement by Pitot tube.
4. Discharge measurement by Venturimeter- determination of meter coefficient
5. Discharge measurement by pipe orifice, determination of Cd
6. Determination of hydraulic coefficient of a sharp edged circular orifice.
7. Determination of hydraulic coefficient of a rectangular orifice.
8. Determination of Cd of an external cylindrical mouth piece
9. Determination of Cd of a convergent-divergent mouth piece.
10. Flow over a rectangular notch: Determination of Cd
11. Calibration of triangular notch.
12. Determination of diameter of sharp edge Circular orifice at vena contracta by using micrometer contraction gauge.

Reference Books:

1. Asawa, G.L., Laboratory work in Hydraulic Engineering, New Age International Publishers,

IV Semester

GE 1204	Advanced Mathematical Techniques	L= 3	T=1	P=0	Credits=4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
The objective of this paper is to study numerical methods and their methods of solution and statistics and probability with simple applications and to introduced fuzzy sets and logics	With the completion of this syllabus students will be familiar with study numerical methods and their methods of solutions and fuzzy sets and logics with simple applications and essential concepts of probability and statistics and use these mathematical techniques to provide the solution to variety of technical, business, industry optimization problems.

UNIT-1: (a,e) **[9 hrs]**
NUMERICAL METHODS FOR ALGEBRAIC AND TRANSCENDENTAL EQUATIONS: Errors in numerical calculation, Errors in series approximation. Rounding of error solutions of algebraic and transcendental equations. Iteration method, Bisection method, False position method, Newton Rapphson method and their convergence
NUMERICAL METHODS SYSTEM OF ALGEBRAIC EQUATIONS: Solution of System of linear equation, Gauss elimination method, Gauss -Jordan method, Gauss- Seidel method, Crouts method & relaxation method.

UNIT-2: (a,e) **[8 hrs]**
NUMERICAL METHODS FOR DIFFERENIAL EQUATIONS: Numerical solution of ordinary differential equation by Taylor's series method, Picard's method, Runge's second and third order method, Runge-Kutta 4^{th} order method, Euler's method, Euler's modified method, Milne's Predictor and Corrector method. Numerical methods of solving 1^{st} order simultaneous ordinary differentials equations

UNIT-3 : Optimization Techniques (a,h) **[6 hrs]**
Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method,

UNIT-4 (a,h,k) **[7 hrs]**
Random variable and probability distribution: Random variable: discrete and continuous; probability density function; Probability distribution function for discrete, and continuous random variable Joint distributions, conditional distributions.

UNIT-5: (a,h,k) **[8 hrs]**
Mathematical Expectation: Definition of mathematical expectation, functions of random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.

UNIT-6 (a,h,k) **[6 hrs]**
FUZZY SETS AND FUZZY LOGIC ; Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.

Text books:

1	Computer based Numerical and Statistical Techniques	Paperback Firstedition 2003	M. Goyal	Laxmi Publication
2	Numerical Methods	Fourth Edition(2004)	S.S. Sastri	PHI Publishers
3	Fuzzy Engineering	Softcover edition (2005)	Bari Kosko	Prentice Hall PTR
4	Optimization Techniques	Year-2009.First Edition	C.Mohan and Kasum Deep	New Age International Publication

Reference books:

1	Advanced Engineering Mathematics	4th edition 2006	H.K.Dass	S. Chand Group
2	Advanced Engineering Mathematics	9th Edition-2007	Kreyszig	JOHN WILEY & SONS
3	Mathematics for Engineers	19th edition 2007	Chandrika Prasad.	JOHN WILEY & SONS
4	Advanced Mathematics for Engineers	4th edition 2006	Chandrika Prasad	JOHN WILEY & SONS
5	Higher Engineering Mathematics	40 edition 2010	B S Grewal	Khanna Publishers

IV Semester

CV 1208	Concrete technology	L=4	T=0	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1.To develop systematic knowledge of concrete constituents 2.To familiarize with the fundamentals of concrete 3.Principles involved for high performance concrete 4.To understand the basic concepts of special concretes 5. To introduce fundamentals of concreting methods	1. An ability to understand the properties of the constituent materials of concrete. 2. An ability to understand the properties of fresh concrete 3. An ability to understand the properties of hardened concrete and tests to determine them 4. An ability to design concrete mixes and apply statistical quality control techniques 5. An ability to understand admixtures and their role in concrete properties 6. An ability to understand the durability of concrete
Mapped Program Outcomes a ,c, e, f, j, k, m	

UNIT-1:
Constituents of cements, Hydration of cement. Water requirement, Physical properties and testing of cement. Effect of fineness, Initial, final and false setting of cement, Soundness test. Hardening and compressive strength, Grades and different types of cement,
Aggregates: Coarse and fine aggregate, normal, light and heavy weight aggregates. aggregate characteristics and their significance in properties of concrete. Sampling, Particle shape and texture, Bond of aggregate, size & grading of aggregate, strength of aggregate. Mechanical properties and tests as per IS, bulking of sand. Crushed sand.Alkali aggregate reaction. Introduction of IS: 383, water quality for mixing and curing, Acceptable water, pH value, Seawater chlorides content. Provisions in IS: 456.

UNIT-2:
Fresh Concrete: Batching, Mechanical mixers, automatic batching and mixing plants. Efficiency of mixing, Workability and its Measurement, Factor affecting workability, setting time, Significance of w/c ratio, cohesiveness of concrete, Segregation, bleeding, voids, permeability. Hot weather concreting, Conveyance of concrete, placing of concrete, compaction, vibrators, curing of concrete, significance and methods, temperature effects on curing and strength gain, IS provisions, Maturity of concrete, Formwork for concrete- IS provisions . Introduction to Ready mix, pumped and self-compacting concrete

UNIT-3
Strength of concrete: Strength gain, factors affecting compressive strength, Tensile and flexural strengths, relation between compressive and tensile strength. Failure modes in concrete, cracking in compression.Impact strength, fatigue strength, shear, elasticity, Poisson's ratio.
Testing of hardened concrete: Compression test, cube strength and cylinder strength and their relation, effect of aspect ratio on strength.Flexural strength of concrete, determination of tensile strength, indirect tension test, splitting test, abrasion resistance, accelerated curing test.
Non Destructive test: Significance, rebound hammer, ultra sonic pulse velocity test, Advanced concrete testing equipment.

UNIT-4:
Mix Design: Process, statistical relation between main and characteristic strength, variance, standard deviation, factors affecting mix properties, grading of aggregates, aggregate/cement ratio etc. Degree of quality control, design of mix by IS method, introduction to road Note No. 4 (BS) and ACI method.

UNIT-5
Additives and admixtures: Types of admixtures, natural products, diatomaceous earth, calcined clays of shales, volcanic glasses, byproducts–pozzolona, fly ash, silica fume, rice husk ash, metakaoline, G.G. blast furnace slag, admixtures- air entraining, water reducing, accelerators, retarders, plasticizers and superplasticizers, permeability reducing, grouting agents, surface hardeners.

IV Semester

CV 1208	Concrete technology	L=4	T=0	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

Shrinkage: Early volume changes, drying shrinkage, mechanism and factors affecting shrinkage, influence of curing conditions, differential shrinkage, carbonation, creep- factors influencing, relation between creep and time, nature of creep, effect of creep.

UNIT-6:

Durability of concrete: Significance, water as an agent of deterioration, permeability of concrete, sulphate attack and its control, sea water attack, acid attack, efflorescence, resistance to corrosion, abrasion and cavitation, process of rusting of steel.

Text books:

1. M.S. Shetty, “Concrete Technology”: S Chand & Co., 6th edition, S.Chand& Company, Limited, 2008
2. Gambhir M.L., “Concrete Technology”

Reference books:

1. PK Mehta and PJ Monterio, “Concrete Microstrucutres: Properties and materials.”
2. AM Neville, “Properties of concrete” ELBS, London
3. DF Orchard, “Concrete Technology”, Applied Sciences Publications

IV Semester

CV 1209	Lab:- Concrete Technology	L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
--	--	40	60	100	--

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the properties of various grades cement. 2. To study the behavior of concrete at its fresh and hardened state 3. To study about the concrete design mix 4. To know about the procedures in concreting 5. To understand special concrete and their use	1. An ability to outline the importance of testing of cement and its properties. 2. An ability to assess the different properties of aggregate 3. An ability to summarize the concept of workability and testing of concrete 4. An ability to describe the properties of fresh and hardened concrete 5. An ability to Ensure quality control while testing/ sampling and acceptance criteria
Mapped Program Outcomes: a, b, h, k	

LIST OF EXPERIMENT

Minimum **Ten** experiments out of following shall be conducted in the laboratory.

1. To determine the normal consistency and initial setting time and final setting time by Vicat's apparatus.
2. To determine the fineness of cement.
3. To perform soundness test of cement.
4. To determine fineness modulus for coarse and fine aggregates .
5. To determine the bulking of sand & plotting bulking curve.
6. To determine the compressive strength of cement.
7. To design the concrete mix of required characteristic strength according to I.S .method vide SP23
8. To determine the workability of concrete by slump cone, Vee bee apparatus,compaction factor and flow test.
9. To prepare and test the concrete cubes for compressive strength by Indian standard method.
10. Study of various Non-Destructive testing methods (NDT) in concrete Technology
11. To determine workability of cement mortar.
12. To determine the permeability of concrete.
13. To determine the permeability of mortar.

IV Semester

CV 1210	Surveying – I	L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVE	COURSE OUTCOME
1. To know the importance, application, division, classification & principle of survey in all kinds of Engineering field. ***2.*** To know the different land Surveying Equipment's Such as Chain, Compass, Theodolite, Plane table, Level etc. . ***3.*** To know the different kinds of Survey such as hydrographic Survey and underground Survey.	1. An ability to understand the basic concepts of surveying 2. An ability to understand the basic principles, operation, handling & uses of various surveying equipment. 3. An ability to draw the location of maps, contour map using various surveying equipment **4.** An ability to understand the basic method and equipment use for hydrographic and underground surveying.
Mapped Program Outcomes: a,b,d,e, ,j, k	

UNIT – I
Introduction, Chain and Compass Traversing
Introduction: - Classification, division of survey, Principle of survey,
Chain Traversing: - Basics, tape correction
Compass Surveying: Prismatic and Surveyor's Compass, true and magnetic bearing, local attraction, dip and magnetic declination, compass traversing.

UNIT – II
Leveling and Adjustment of Dumpy Level
Leveling: Definitions, Different types of Levels, Study of Dumpy Level, temporary adjustments, principles of leveling, reduction of levels, classification of leveling, Reciprocal leveling, Corrections for Curvature and Refraction, distance to visible horizon.
Permanent adjustment of Dumpy Level: Principle axes of Dumpy level, relationship, testing and adjustment of bubble axis and line of collimation.

UNIT – III
Contouring and Trignometrical Leveling
Contouring: Definitions, Characteristics, uses, and methods of locating contours, interpolation of contours
Trignometrical Leveling: Indirect leveling, elevation of a point with base of an object accessible and inaccessible (with instrument station in/not in the same vertical plane as the elevated object)

UNIT – IV
Theodolite Surveying
Theodolite: Introduction, Type of theodolite, temporary adjustment, Principle Axes and relationship, measurement of horizontal and vertical angles, magnetic bearings, prolonging a line, lining in.
Traverse Computation: Consecutive and independent co-ordinates, adjustment of closed traverse, Gale's traverse table, area calculation by co-ordinate.

UNIT – V
Plane Table Surveying & Computation of Area & Volume
Plane Table Survey: Equipments, advantages and disadvantages, orientation, methods of plane tabling, two point and three point problems in plane tabling.
Computation of Area and Volume: Trapezoidal and Simpsons Rule,

UNIT – VI
Hydrographic Surveying, Underground Surveying and Surveying Equipment:
Hydrographic Surveying: Shore line survey, River survey, Soundings, Equipments, Methods of locating soundings, three point problems.
Underground Surveying: Correlation of underground and surface survey, transferring the levels underground.

IV Semester

CV 1210	Surveying – I	L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

Surveying Equipments: Box Sextant, Abney level, Optical theodolite.Planimeter, its use, theory.

Text books:

1. Kanitkar T.P., Kulkarni S.V., Surveying and Leveling (Vol-I), Pune VidyarthiGrihaPrakashan, Pune.
2. Punmia B.C., Jain A.K., Jain A.K., Surveying and Leveling (Vol–I & II), 15th Edition, LaxmiPublication(P) Ltd. New Delhi, 2005.

Reference books:

1. Basak N. N., Surveying and Leveling, 1st Edition, Tat McGraw–Hill Publishing company Ltd. New Delhi.

IV Semester

CV 1211	Lab:- Surveying – I	L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
--	--	40	60	100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1. To understand the operation, principle, handling and uses of surveying equipment such as chain, compass, theodolite, level. 2. To recognize the role of the professional surveyor, and modern developments in surveying 3. To study map interpretation and public land systems 4. To determine the Distance between two inaccessible point by using trigonometric leveling.	1. An ability to work in a team to carry out a survey of a small area using appropriate methods 2. An ability to describe the observation, computation and adjustment of a Traverse to carry out basic survey computation and adjustment **3.** An ability to understand the angle and distance measurement; and differential, profile, cross-section, and topographic leveling procedures and apply them to field conditions
Mapped Program Outcomes: a,b,d,e,j,k,l	

PRACTICALS

Minimum **Ten** Practical's should be performed out of the following

1. Measurement of distance by ranging and chaining.
2. Locating various objects by chain and cross staff survey.
3. Determination of area of a given polygon by chain and cross staff survey.
4. Measurement of bearing of sides of traverse with prismatic compass and computation of correct included angles.
5. Locating given building by chain and compass traversing (1 full size drawing sheet)
6. Determination of elevation of various points with dumpy level by collimation plane method and rise and fall method.
7. Fixing the bench mark with respect to temporary bench mark with dumpy level by fly leveling and check leveling.
8. Measurement of horizontal angle with theodolite by method of repetition.
9. Measurement of vertical angle with theodolite.
10. Determination of horizontal distance between two inaccessible point with theodolite.
11. Locating given building by theodolite traversing. (One full size drawing sheet also showing Gale's traverse table)
12. Determination of elevation of point by trigonometric leveling.
13. Study of planimeter and Measurement of area by Digital Planimeter
14. Study of Box Sextant, Abney Level, optical theodolite.
15. To give layout for given plan of building.

IV Semester

CV 1212	Environmental Engineering – I	L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1. To study step by step method of designing a water supply scheme for a town. 2. To study characteristics of water and objectives of treatment of water. 3. To study working of various water treatments units and a few concept of design of these units. 4. 4. To study importance of solid waste management and methods of collection, treatment, disposal and reuse of solid waste.	1. An ability to understand significance of community water supply scheme and concept of design of water supply scheme. 2. An ability to design certain components of water supply system 3. An ability to understand significance of good quality of water and methods of treatment to achieve required quality of water. 4. An ability to understand methods of distribution of water. 5. An ability to understand the significance and concept of solid waste management.
Mapped Program Outcomes: a,b,c,d,e,h,j	

UNIT – I
Introduction, Importance and necessity of water supply scheme.
Water demand: Types of demand, empirical formulae, factors affecting per Capita demand, variation in demand, design period and methods of population forecasting.
Intake structures: Location types – river, lake, canal reservoir etc.

UNIT – II
Conveyance of water: Types of pipes, joints in pipes, valves and fittings.
Rising mains and pumps: Hydraulic design of rising mains, Classification, working, merits, demerits & selection of pumps.

UNIT – III
Water quality: General idea of water borne diseases, Physical, Chemical, and bacteriological characteristics of water, Standards of drinking water.
Water treatment: Objective of treatment, unit operations and processes, Flow sheet of conventional water treatment plant.
Aeration: Purpose, types of aerators.
Coagulation and Flocculation: Definition, Principles, types of coagulants and reactions , coagulant doses, types of mixing and flocculation devices.

UNIT – IV
Sedimentation: Principles types of settling basins, inlet and outlet arrangements.
Clariflocculators: Principles and operation.
Filtration: Mechanism of filtration, types of filters RSF, SSF, pressure filters, elements of filters UDS, design aspects filter sand specification, operational problems in filtration.

UNIT – V
Disinfection: Purpose, Mechanism, criteria for good disinfectant , various disinfectants and their characteristics, disinfection by chlorination using different forms of chlorine.
Distribution systems: Requirements for a good distribution system, methods of distribution, systems and their layouts, appurtenance in water distribution system. Leakage and leakdetector. Storage reservoirs for treated water: Types, capacity of reservoir, mass curve.

IV Semester

CV 1212	Environmental Engineering – I	L=3	T=1	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

UNIT – VI

Municipal solid waste management: Generation sources, composition, Quality, Methods of Collection, transportation, treatment and disposal, 3 R's of solid waste management.

Text Books

1. Modi P.N., Water Supply Engineering (Vol – I & II), 2nd Edition, Standard Book House / Rajsons Publication, New Delhi.
2. Punmia B. C., Wastewater Engineering, 2nd Edition, Laxmi Publication, New Delhi
3. Birdie G.S., Birdie J.S., Water Supply and Sanitary Engineering, 4th Edition, DhanpatRai Publication, New Delhi.

References:

1. Metcalf, Eddy, Wastewater Engineering Treatment & Reuse, 4th Edition, Metcalf & Eddy Inc.

IV Semester

CV 1213	Lab:- Environmental Engineering – I	L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
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COURSE OBJECTIVE	COURSE OUTCOMES
1. To study the water quality criteria & permissible standards 2. To study the characteristics of water and experimental procedure 3. To study the analysis of various parameters related to water quality	1. An ability to understand water quality criteria standards. 2. An ability to understand physical, chemical & biological characteristics of water. 3. An ability to understand the acceptable & permissible limits of drinking water.
Mapped Program Outcomes: a,b	

PRACTICALS

Any **TEN** of following practicals will be conducted:

1. Determination of pH.
2. Determination of turbidity.
3. To perform Jar test.
4. Determination of available chlorine.
5. Determination of residual chlorine.
6. Determination of dissolved oxygen.
7. Determination of Hardness.
8. Determination of acidity
9. Determination of alkalinity
10. M.P.N. Test.
11. Plate count test.
12. B.O.D. test
13. C.O.D. test

IV Semester

CV 1214	Building Construction and Building Drawing	L=4	T=0	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	4 hours

COURSE OBJECTIVE	COURSE OUTCOMES
1. To build awareness about the type of masonry, floors and roofs. 2. To understand types of doors and stairs and its uses. 3. Read, interpret and draw the building drawings. 4. Prepare submission drawings for the building. 5. Prepare working drawings for the building. 6. Plan various types of buildings considering the functional requirements. 7. Apply the building rules, regulations and byelaws**.**	1. An ability to understand various aspects related to foundation of structures such as types of foundation, bearing capacities and foundation lay outs. 2. An ability to understand various aspects of masonry constructions such as brick and stone masonry and damp proofing of masonry structures. 3. An ability to understand in details various building components like roof trusses, doors, windows, plastering, pointing, timbering, and painting. 4. An ability to understand and develop techniques of drawings of various structural components, detailed drawings, as per site requirements and drawings such as perspective drawing.
Mapped Program Outcomes: a,f,g,h**,i,j,**l	

UNIT – I

Foundation: Necessity and types of foundations, details of shallow foundations, bearing capacity of soils and its assessment. Presumptive bearing capacity values from codes. Loads on foundation, Causes of failures of foundation and remedial measures, Foundation on black cotton soils, setting out layout for foundation trenches, excavation and timbering of foundation trenches. Load bearing and framed structures.

UNIT – II

Brick Masonry: Qualities of good bricks, classification of bricks, tests on bricks as per IS codes.
Terms used in brickwork, commonly used types of bonds in brickwork, principles of construction.
Parapets, coping, sills and corbels, cavity walls, load bearing and partition walls. Masonry construction using cement concrete blocks and light weight blocks.
Stone Masonry: Stone, cutting and dressing, selection of stones, types of stone masonry, principles of construction, joints in masonry. Common building stones in India.
Damp Proofing: Causes and effects of dampness .Various methods of damp proofing and water proofing.

UNIT – III

Roofs and Trusses: Different types of flat and pitched roofs, different types of trusses.
Stairs: Types of stairs, functional design of stairs.
Doors and Windows: Purpose, materials and types.
Plastering and Pointing: Necessity, types and methods.
Temporary Timbering: Centering and formwork, shoring, underpinning and scaffolding.
Painting: White washing, colour washing and distempering, new materials & techniques.
Concept of Green Building, Mass housing practices.

UNIT – IV

Introduction: Importance of Building drawing as Engineers language in construction & costing.
Method of Drawing: Selection of scales for various drawings. Thickness of line Dimensioning, first angle and third angle method of projection, Abbreviations and conventional representations as per IS 1962. Free hand dimensioned sketches. Developing working drawings to scale as per IS 1962 from the givens sketch design and general specifications for terraced and pitched roofs. Developing submission drawings to scale with location and site plan.

UNIT – V

Site requirements: **R**equirements of owner and building byelaws. Climate and design consideration, recommendations of CBRI, Roorkee and general principles of planning with emphasis on functional planning. Graph paper design (line plans) based on various requirements for residential, public, education and industrial buildings.

IV Semester

CV 1214	Building Construction and Building Drawing	L=4	T=0	P=0	CREDITS = 4
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	4 hours

UNIT – VI

Perspective drawing, principles and uses, two point perspective of residential building neglecting small elements of building such as plinth offset,chajja projections etc.

Text Books:

1. Shah M.G., Kale C.M., Patki S. Y., Building Drawing, 4th Edition, Tata McGraw-Hill, New Delhi, 2002.
2. Sushil Kumar, Building Construction, 19th Edition, Standard Publisher Distributors 2001, New Delhi, 2001.

Reference Books:

1. National Building Code of India 1983, Bureau of Indian Standards, India, 2001

IV Semester

CV 1215	Lab:- Computer Aided Building Drawing	L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
--	--	40	60	100	--

COURSE OBJECTIVES	COURSE OUTCOMES
1 To be able to identify various building elements, and their requirements at necessary places. **2** To be able to develop line plans in to developed/ submission drawings using bye laws. **3** To be able to understand latest computational techniques and software used for building drawing. **4** To be able to understand the use of perspective drawing in field.	1. An ability to advice/ apply the various building elements as per the need 2. An ability to draw various building drawings. 3. An ability to understand the requirement of application of different norms and local bye laws for sanctioning of plan from governing authority. 4. An ability to understand latest computational techniques and software used for building drawing. 5. An ability to understand the representation of the object as it appears to the observer.
Mapped Programme Outcomes:- a,f,g,h,i,j,k,l	

PRACTICALS

I] Practical submission work:

A] Sketch book:

1. Minimum 30 free hand sketches of various building elements should be drawn on the sketch book.

The sketch book will be submitted for evaluation.

B] Drawing sheets on AUTOCAD:

Following drawing sheets should be drawn with the help of AutoCAD (A1 size).

1. Submission drawing for residential building including its planning and with area and parking statements and all other details as per the norms and local bye-laws by using AutoCAD. (Minimum two storied framed structure on A1 size sheet).
2. Submission drawing of multistoried Public / Educational / Health / Community building including its planning with area and parking statements and all other details as per norms and local bye laws, by using AutoCAD. (Framed structure. on A1 size sheet)..

All these drawings will be printed and submitted for evaluation.

II] Manual drawing:

1. Line Plans of Various types of buildings. (**Five** Assignments should be done on A4 size graph paper)
2. Developed plan for residential building (**One** assignment on A1 size sheet for single storied load bearing structure)
3. Developed plan for residential building (**One** assignment on A1 size sheet for two storied framed structure.)
4. Line plan for a public building on graph sheet. (**One** assignment on A1 size sheet)
5. Two point perspective of the single Residential building neglecting small building elements. (**One** assignment on A1 size sheet)

All these drawings will be drawn and submitted for evaluation

IV Semester

CV 1216	ENGINEERING HYDROLOGY	L=4	T=0	P=0	CREDITS = 4

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 hours**

Course Objectives	Course Outcome
1. To understand the atmospheric changes and hydrological cycle. 2. To understand details of various hydrological processes like Evaporation, Precipitation, Transpiration, etc. 3. To understand the cumulative accumulation of runoff and its analysis. 4. To understand occurrence of floods. 5. To understand probability of flood distribution and frequency analysis. 6. To understand concept of geo hydrology and ground water recharge.	1. An ability to understand the concept of hydrology. 2. An ability to interpret and analyze the hydrological processes. 3. An ability to understand need of water recharge and rain water harvesting. 4. An ability to understand different issues related with natural water resources.
Mapped Program Outcomes: **a, b, e, f, g, h, i, j**	

UNIT-1:
Introduction: Engineering hydrology, hydrological cycle, hydrological equation, Importance of temperature, wind and humidity in hydrological studies.
Precipitation: Definition, types and forms of precipitation, factors affecting precipitation, measurement of precipitation (using rainguages& analytical methods), optimum number of rain gauge stations, radar measurement of rainfall, mass curves, data missing records. Intensity-Duration-Frequency and Depth-Area- Duration analysis.
[07Hrs]

UNIT-2:
Infiltration: Definition, mechanism, factors affecting Infiltration, Infiltration indices,
Evaporation: Definition, mechanism, **f**actors affecting evaporation, estimation of evaporation (instrumental & analytical), evaporation control.
Transpiration: Definition, mechanism, **f**actors affecting transpiration, its measurement and control. Evapotranspiration & Its measurement.
[07Hrs]

UNIT-3
Runoff: Runoff, sources and component, classification of streams, factors affecting runoff, Estimation Methods. Measurement of discharge of a stream by Area-slope and Area-velocity methods.
Hydrograph: Flood hydrographs and its components, Base flow & Base flow separation, S-Curve technique, unit hydrograph, synthetic hydrograph. Instantaneous Unit hydrograph.
[07Hrs]

UNIT-4:
Statistical Methods: Statistics in hydrological analysis, probability and probability distribution.
Floods: Causes and effects, Factors affecting peak flows and its estimation, Flood routing and Flood forecasting. Frequency analysis. Economic planning for flood control.
[07Hrs]

UNIT-5
Geohydrology: Introduction, occurrence and distribution of groundwater, aquifers, specific yield, specific retention, porosity, permeability, water table, types and properties of aquifer, Darcy's law. Introduction to hydraulics of wells, Open wells safe yield test, Pumping Tests.
Groundwater quality, geomorphic and geological control on ground storage and movement. [07Hrs]

IV Semester

CV 1216	**ENGINEERING HYDROLOGY**	**L=4**	**T=0**	**P=0**	**CREDITS = 4**

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	**15**	**10**	**60**	**100**	**3 hours**

UNIT-6:

Ground water recharge: Introduction, selection of recharge sites, recharging methods, spreading method, Induced recharge method, Recharge well method, sub-surface dams, waste water recharge, recharge by urban storm runoff, recharge through rain water harvesting.

Project planning for water resources: Multipurpose projects, Inter basin water transfer and Inter state water disputes, Water resources planning through watershed management, Economic planning for domestic and industrial water supply.

[07Hrs]

Text books:

1] Ojha, C.S.P., Berndtsson, R., and Bhunya, P., Engineering Hydrology, Oxford University Press
2] Raghunath H.M., Hydrology, New Age International Publishers.
3] Reddy R., Hydrology, Tata McGraw-Hill New Delhi.

Reference books:

1] Linsley, R.K., Kohler, M.A. and Paulhas **,**Hydrology for Engineers **,** Tata McGraw-Hill Publishing Company Limited.
2] Todd, D.K., Ground Water Hydrology **,** John Wiley & Sons **.**
3] Subramnaya, K., Engineering Hydrology **,**Tata McGraw-Hill Publishing Company Limited **.**
4] Sharma R.K., Sharma T.K., Hydrology & Water Resources Engineering, DhanpatRai Publications.

V SEMESTER

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Objective	Outcome
Principle of Management	To familiarize the students with the basic concepts and principles of management. The students should clearly understand the definitions of different areas of management. This course will facilitate students to understand and describe specific theories related to perception, motivation, leadership. This will help the students to demonstrate effective management skill by knowing the various functions of management like planning, organising, directing, coordinating and controlling.
Legal Aspects of Management	The present course aims at familiarizing the students with various legal aspects of business, contract, partnership and companies. It aims at providing a rich fund of contemporary knowledge, time tested principles, basic concepts, emerging ideas and practices in the field of law in a comprehensive way.
Human Resource Management	The objective of this course is to endow the student with a broad perspective on themes and issues of Human Resource Management, Human Resource Development, Training and Development activities, Job Analysis, Performance Appraisal, disciplinary and grievance procedure. It will help the students to build up and refine decision making skills so that they can help organizations effectively manage employee relations.
Project Management	The course is intended to develop the knowledge of the students in the management of projects, special emphasis will be provided on project formulation as also on various tools and techniques for project appraisal and control so that they are able to draft the project proposal in any area of management and evaluate the projects.
Marketing Management	This course intends to provide an experienced-based approach to marketing concept and its practical application. The course is designed to enable the students to learn the basic of marketing, customer behaviour, marketing research & sales promotion. Topics of the syllabus shall be addressed and discussed from an application oriented perspective
Financial Management	The present course aims at familiarizing the participants with the skills related to basic principles, tools and techniques of financial management. This will help the students to demonstrate their skill in understanding the budgets and budgetary control, balance sheet, and profit and loss statement.

Mapped Program Outcomes:

UNIT-1: Principles of Management
Evolution of Management Thought : Scientific, Classical, Neo Classical and Modern Theory of Management, Defintion Meaning and Concept of Management, Functions of Managment : Planning, Organizing, Directing Coordinating and Controlling. Motivation Theory, Leadership

UNIT-2: Legal Aspects of Management
The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, Types of Partners, Right and Duties of Partners, Registration and Dissolution of firm, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Directors : Powers and duties, Winding up of the Company

V SEMESTER

GE1311	Fundamentals of Management	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-3: Human Resource Management
Human Resource Management-Meaning, Nature and Scope, Principles of HRD, Human Resource Planning, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Discipline and Grievance Procedure**.**

UNIT-4 Project management
Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Project Management, Tools and Techniques of Project Management, SWOT Analysis, Project Risk Analysis, Project cost, Project Planning, Project Control, Network techniques - Introduction and Use of CPM &PERT for planning.

UNIT-5 Marketing Management:-
Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Rural Marketing, Marketing Environment, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

UNIT-6 Financial Management:-
Definition & Functions of Finance department, Sources of finance , Financing organizations, Types of capital, Profit maximization vs. Wealth maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

TEXT BOOKS:

1. S.C.Saxena, Business Management and Administration, Sahitya Bhawan Publication
2. P. Subba Rao, Management -- Theory and Practice (Text and Cases) (Himalaya Publication)
3. Kuchhal M.C. - Business Law (Vikas Publication, 4 th Edition)
4. P.S Rao , Essentials of Human Resource Managemen & IR, Himalaya , Mumbai
5. Avraham Shtub and Jonathan F. Bard, Project Management: Processes, Methodologies, and Economics (2nd Edition)
6. Kotler, Keller, Koshy & Jha, Marketing Management, Pearson, New Delhi
7. R.K. Sharma, Shashi K Gupta, Management Accounting,. Kalyani Publishers.

TEXT BOOKS FOR REFERENCE:

1) **Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills**
2) **Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law**
3) **Dr. V.S.P.Rao - Human Resource Management - Text and Cases**
4) **C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,**

5) Lock, Gower - Project Management Handbook
6) Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7) Rajan Saxena: Marketing Management, Tata McGraw Hill.
8) Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9) Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10) Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11) Khan M Y - Financial Services (Tata Mc Graw Hill, 1998)

V SEMESTER

CV1301	Surveying – II			L=4	T=0	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 hours**

COURSE OBJECTIVE	COURSE OUTCOMES
1. To know the basic principle and operation of tachometric surveying 2. To Design different types horizontal and vertical curve. 3. To know the basic principle and application of different types survey such as geodetic, photographic and astronomical surveying. 4. To know the advance technique of surveying such as GIS, GPS and Remote sensing	1. An ability understands the modern technique of surveying. 2. An ability to understand and operate the modern Surveying equipment's 3. An ability to understand basic concepts of GIS, GPS & Remote sensing
Mapped Program Outcomes:a,b,d,k,	

UNIT – 1 :
Tachometric Surveying
Classification, Principle of stadia method, Theory of analytic lens, Distance and elevation formulae, tangential method, Errors in stadia surveying.

[08 Hrs.]

UNIT – 2 :
Simple and Compound Curves
a) **Simple Curves**: Elements of simple curves, Methods of Curve ranging, Obstacles in setting out curves.
b) **Compound Curves**: Elements of compound Curves, setting out the curve.

[09 Hrs.]

UNIT – 3 :
Transition and vertical curve
a) Transition Curves: Elements of transition curves, Super elevation, Length of transition curve, Ideal transition curve, characteristics of transition curve, Setting out the transition curve.
b) Vertical Curves: Elements of vertical curves, Types, Tangent Correction, Location of highest or lowest point.

[09 Hrs.]

UNIT – 4 :
Geodetic Surveying and Triangulation Adjustment
a) Geodetic Surveying: Classification of triangulation survey, Inter visibility of stations, Field work, reduction to centre.
b) Triangulation Adjustment: Definitions, Weighted observations, Laws of weights, Station adjustment.

[09 Hrs.]

UNIT – 5 :
Advanced surveying techniques
Photographic Surveying: Basic definitions, Terrestrial and aerial photography, Tilt and height displacements, Heights from parallax measurements, Flight planning, study of photo theodolite and stereoscope.

[09 Hrs.]

UNIT – 6 :
Remote Sensing: Introduction, definitions, Introduction to GIS, GPS and Total Station.
Astronomy Astronomy: Elements of spherical trigonometry, Napier's rule of circular parts, Celestial sphere, astronomical terms.

[08 Hrs.]

Text Books:
1. Punmia B.C., Jain A.K., Jain A.K, Surveying, (Vol. 2 & Vol. 3), Laxmi Publication, New Delhi. 1, 15th Edition.
2. Kanetkar T.P. & Kulkarni S. V, Surveying & Levelling (Vol.2 & Vol. 3), Pune Vidhyarthi Gruha Prakashan, Pune.
3. Reddy M. A., Remote sensing & GIS, B. S. Publication, Hyderabad.
4. Dr. A.M. Chandra, Higher Surveying, New age international publishers , New Delhi

Reference Books:
1. Thomas M. L., Ralph W. K., Jonathan W., Remote Sensing and Image Interpretation, Chipman Wiley & Sons, 5th Edition (2010).

V SEMESTER

CV1302	**Lab : Surveying – II**			**L=0**	**T=0**	**P=2**	**CREDITS = 1**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	--	**--**	**40**	**60**		**100**	**--**

COURSE OBJECTIVE	**COURSE OUTCOMES**
1. To understand the operation ,handling and principle of tachometry 2. To measure the RL of floor w.r.to BM 3. To Design basic horizontal alignment of a curve. 4. To use latest instruments like total station	1. An ability to measure distance by using tachometry 2. An ability to plot Horizontal curve by using theodolite 3. An ability to understand the rectangular coordinate system **4.** An ability to Understand (introductory level) geographic information systems and Global positioning system (GIS ,GPS)
Mapped Program Outcomes: a,b, d, k,l	

PRACTICALS

Any Eight Experiments out of the following in addition to one day Survey Camp at campsite:

1. Determination of constants of Tacheometer.
2. Determination of elevation of points by Tacheometric surveying.
3. Determination of elevation of points and horizontal distance between them by Tacheometrical survey.
4. Determination of gradient of given length of road by Tacheometric survey.
5. Setting out of simple circular curve by offsets from chord produced method
6. Setting out of simple circular curve by Rankine method of tangential angle.
7. Setting out of simple transition curve by tangential angle method.
8. Study of stereoscope
9. Study of Handling, Operation and Basic Concept of Total Station.(Compulsory)
10. Contour plan of given area. (One full size drawing sheet)
11. Locating given building by Plane table traversing. (One full size drawing sheet)
12. Three point problem in plane table surveying.
13. L-section and cross section of road (One full size drawing sheet each for L-section and cross section) for the survey work carried out in survey camp.
14. Study and application of GIS, GPS and Remote Sensing.
15. Setting out simple circular curve by offset from long chord.
16. To determine height of the building using total station.
17. To determine the location of various point using total station.

V SEMESTER

CV1307	Structural Analysis-I			L= 3	T= 1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide the student knowledge of rolling loads and its characteristics in structures 2. To provide the student knowledge of influence line diagrams for statically determinate structures 3. To provide the student knowledge about analysis of indeterminate structures (beams, frames and trusses) for internal forces, deflections etc. using energy methods. 4. To provide the student knowledge of Slope deflection method. 5. To provide the student knowledge of Moment distribution method.	1. An ability to understand the basic concept of structural analysis 2. An ability to understand the behavior of structural components subjected to various loadings. 3. An ability to understand various methods of analysis of structural elements.
Mapped Program Outcomes: a, e, l, m	

UNIT – 1 :
Analysis of strain, strain gauges, strain rosette, strain transformation.
Analysis of fixed and continuous beams by theorem of three moments, effect of sinking of support.
[09 Hrs.]

UNIT – 2 :
Analysis of continuous beams and simple portals (Non sway) using Moment Distribution method
[08 Hrs.]

UNIT – 3 :
Influence lines for reactions, bending moments and shear forces in simply supported beams, cantilevers, beams with overhangs and simple trusses subjected to different types of loadings.
[09 Hrs.]

UNIT – 4 :
Slope deflection method as applied to indeterminate beams & continuous beams, portal frames.
[08 Hrs.]

UNIT – 5 :
Buckling of Columns and beam-columns, Euler's and Rankine's formula. Analysis of Two and Three Hinged parabolic arches, shear force and normal thrust.
[09 Hrs.]

UNIT – 6 :
Strain energy method as applied to the analysis of redundant frames and redundant trusses up to two degrees. Determination of deflection of trusses, Willot Mohr's diagram, Castigliano's theorems, Maxwell's reciprocal theorem, Betti's theorem, Muller Breslauw Principle
[09 Hrs.]

Text Books:
1. Pandit G.S and Gupta S.P., Structural Analysis, Tata McGraw-Hill Publishing company LTD, New Delhi, 1997.
2. Timoshenko S.P. and D.H. Young; Theory of Structure, Tata Mc Graw Hill Publication, Delhi.
3. Sadhu Singh: Experimental Stress Analysis, khanna Publishers, Delhi,2009.

Reference Books:
1. Ramamruthum S.S. and Narayan R., Theory of structures, Dhanpat Rai and Sons, New Delhi,2010
2. Vazirani V.N and Ratwani M.M, Analysis of structures, Khanna Publishers, New Delhi, 1994.
3. Bhavikatti S.S, Structural Analysis (volume II) , Vikas publishing House LTD, Delhi,2011
4. Kinney J.S, Intermediate structural analysis, Oxford and IBH Publishing Co.PVT.LTD, New Delhi.

V SEMESTER

CV1308	Lab : Structural Analysis-I			L=0	T=0	P= 2	CREDITS = 1
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	----	**----**	**40**	**60**		**100**	**----**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study the basic concept of strain measurements. 2. To study the various methods for finding deflection in truss analytically and graphically. 3. To study the analysis of the aches 4. To study various properties of beam like flexural rigidity, slope, deflection, bending moment etc. 5. To study the behavior of column, curved member and portal frame.	1. An ability to understand various types of strain gauges and to measure the strain in beam. 2. An ability to find the defections in truss analytically and graphically. 3. An ability to determine the horizontal thrust of different types of arches. 4. An ability to understand the various properties of beam. 5. An ability to understand the behavior of the column, curved member and portal frame.
Mapped Program Outcomes: a, b, e, m.	

Any TEN experiments from the following are required to be conducted:

1. To study various types of electrical resistance strain gauges.

2. To measure the strain in the cantilever beam subjected to point load at tip and to check this value with theoretical value.

3. To determine slope and deflection at center of each span for a two span continuous beam subjected to point load W at center of each span and to check these values with theoretical values.

4. To verify Maxwell's Reciprocal Theorem for simply supported beam.

5. To determine the value of flexural rigidity of given beam and to compare it with theoretical value.

6. To determine the elastic displacements of the curved members experimentally and to check these values with theoretical values.

7. To study the behavior of different types of struts and to calculate the Euler's buckling load for each case.

8. To determine the horizontal thrust and to draw the influence line diagram for horizontal thrust of two hinged parabolic arch.

9. To determine the horizontal thrust and to draw the influence line diagram for horizontal thrust of three hinged parabolic arch.

10. To determine deflection of cantilever end of cantilever truss by Willot Mohr's diagram and to check this value with theoretical value.

11. To study the behavior of a portal frame under different end conditions.

12. To find the deflection of a pin-connected truss experimentally and to verify the result theoretically.

13. To obtain the influence line for bending moment of prismatic fixed beam for cases (a) one end hinged (b) both ends fixed.

14. To determine experimentally and analytically the reactions in the three suspension rods supporting an elastic beam with a concentrated load hung midway between two of the suspension rods when the suspension rods are attached at their upper end to rigid support.

V SEMESTER

CV1304	Transportation Engineering – I			L=4	T=0	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVE	COURSE OUTCOMES
1. To know about importance of transportation in Indian context. 2. To know about various transportation systems and their inter relations. 3. To know about highway, planning of highways, road materials and geometric design of roads. 4. To know about pavement types and pavement materials. 5. To know about bridge and its various components including bridge hydrology.	1. An ability to understand concept of Geometric design of roads and various aspects of traffic engineering. 2. An ability to understand various types of bridges and their design aspects. 3. An ability to understand various traffic characteristics and analysis and use the data for road design. 4. An ability to understand various Highway materials and their suitability under different conditions.
Mapped Program Outcomes : a, b, c, d, e, h, j, k	

UNIT – 1 :
Introduction and importance of transportation, History of transportation, interrelations of various modes of transportation.
Development & Planning: Road transport characteristics, Classification of roads, development plans, network patterns, data collection & Surveys, Principles of alignment.
Traffic Engineering: 3E's of traffic engineering, Various Traffic Surveys, Intersection-types, layouts, design principles, parking, lighting, Introduction to Traffic control Devices, marking, Signs, Signals, and Regulations.
[08 Hrs.]

UNIT – 2 :
Geometric Design: Road user & road vehicle characteristics, Factors affecting design standards. Cross Section elements, Stopping & overtaking sight distance overtaking zones. Horizontal alignment, Curves, design of super elevation, extra widening, transition curves, vertical alignments, I.R.C. Standards for geometric Design.
[09 Hrs.]

UNIT – 3 :
Introduction to pavement materials
Aggregates: physical & Mechanical properties, tests on aggregates, Bituminous materials; classification, sources, properties and tests. Cutback bitumen & Emulsions, IRC/IS standards, Introduction to Geotextiles.
Construction & Maintenance: IRC, MOST specifications for quality & quantity of materials, techniques, tools and plant for the Earthwork, sub base, base and wearing/ surface course of flexible pavements with gravel, WBM, stabilized Bitumen & Concrete as Construction materials, Drainage, shoulders, arboriculture maintenance & repairs, Choice of construction.
[09 Hrs.]

UNIT – 4 :
Bridges: Introduction, Components, classification and identification, Data Collection, site selection, Economic Span, Estimation of flood discharge, waterway, scours depth, depth of foundation, Afflux, clearance and free board.
[08 Hrs.]

UNIT – 5 :
Bridge Super Structure: Different structural forms-culverts, causeways, minor and major bridges, suitability and choice, precast, post-tensioned and segmental construction.Girder Launching operation systems, Bridge Bearings, and Bridge Architecture.
[09 Hrs.]

UNIT – 6 :
Loads, Forces and Stresses for Bridges: IRC Specification & codes of practice, Critical combinations.
Rating and Maintenance of Bridges: Methods & Techniques of rating for existing bridges- inspection, repairs, maintenance, corrosion-causes and prevention, Aesthetics.
[09 Hrs.]

V SEMESTER

CV1304	**Transportation Engineering – I**			**L=4**	**T=0**	**P=0**	**CREDITS = 4**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. Khanna& Justo, Highway engineering,Nem Chand & Bros.
2. K. L.Bhanot, Highway Engineering, S. Chand &Company (P) Ltd. New Delhi.
3. T. D.Ahuja, Highway Engineering, Standard Book House Delhi
4. S.P.Bindra, Bridge Enginnring, DhanpatRai Publication
5. J. Garber and L. A. Hoel, Traffic and Highway Engineering, Thomson Learning, Inc., 2002.

Reference Books:

1. Indian Road Congress, IRC handbooks ,International Code Council International Code Council
2. Ministry of surface/road transportation, MOST.

V SEMESTER

CV1305	**Lab : Transportation Engineering – I**			**L=0**	**T=0**	**P=2**	**CREDITS= 1**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	--	**--**	**40**	**60**		**100**	**--**

COURSE OBJECTIVE	**COURSE OUTCOMES**
1. To determine various properties of aggregates. 2. To determine various properties of bitumen. 3. To perform the CBR test on soil. 4. To determine the Marshall stability of bituminous mixture. 5. To conduct traffic volume survey. 6. To know about bridges and its various components.	1. An ability to conduct various tests on aggregates and study its desirable properties. 2. An ability to conduct various tests on bitumen and understand its properties. 3. An ability to perform the CBR value. 4. An ability to perform Marshall stability of bituminous mixture. 5. An ability to conduct traffic volume survey. 6. An ability to understand about bridges and various components.
Mapped Program Outcomes: a, b, e, f, h, j, k	

PRACTICALS

Any TEN experiments from the following are required to be conducted:

1. To determine specific gravity of aggregates.
2. To determine impact value of given aggregate sample.
3. To determine crushing value of given aggregate sample.
4. To determine flakiness index of given aggregate sample.
5. To determine abrasion value by Los Angeles test.
6. To perform water absorption test on given aggregate sample.
7. To find softening point of given bitumen sample.
8. To perform penetration test for given bitumen sample.
9. To perform flash and fire point for given bitumen sample.
10. To perform ductility test on given bitumen sample.
11. To perform viscosity test on bitumen.
12. To perform CBR test on given soil sample.
13. To perform Marshall Stability Test on bituminous concrete.
14. To conduct traffic Volume survey for select stretch of road.
15. Bridge site visit.

V SEMESTER

CV1325	OE I : Environmental Management			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. To understand the various organisation impacts on the environment. 2. To evaluate environmental problem define from natural and resource management. 3. To understand the principles and benefits of effective resources.	1. An ability to Identify the scientific and social aspects of environmental issues. 2. An ability to understand the procedure of environmental protection by legislation. 3. An ability to understand the role of environmental management system in protecting the resources.
Mapped Program Outcomes: a,c,d,e,f,g,h,j	

UNIT – 1 :
Sustainable development -carrying capacity based development planning process, assimilative and supportive capacity, Environmental Management in India. Concept of EIA, environmental attributes, nature of impact – directly & indirectly measurable impacts

[06 Hrs.]

UNIT – 2 :
Screening and scoping in EIA, terms of reference for conducting EIA, methodologies of EIA-checklists, matrices, overlays, cost benefit analysis & adaptive environment and management, networks.
Framework of EIA - baseline data collection, prediction of impacts, evaluation of impacts, Battelle environmental evaluation system, environmental quality monitoring budgetary provisions for implementing control measures.

[07 Hrs.]

UNIT – 3 :
Environmental appraisal of projects, MoEF questionnaire for environmental clearance, element of public participation & hearing, case studies on EIA, critical environmental issues and formulation of strategies of EMP, environmental management plan, development of action plans for critical environmental education programmes.

[07 Hrs.]

UNIT – 4 :
Environmental legislation – basic concepts, critical issues, civil liability, various enactment and their provisions –, Environmental Protection Act 1986, environmental tribunal & its functions. Implementation mechanism of environmental legislation, Role of State & Central boards of pollution control, local government social action groups, and environmental policies.

[07 Hrs.]

UNIT – 5 :
Environmental Audit- Concept of EA, environmental statement, procedural aspects of conducting environmental audit, pre-audit phase, on-site audit phase & post-audit phase, water audit, health & safety audit.

[06 Hrs.]

UNIT – 6 :
Resource Management: Biotic & Abiotic resources, renewable and non-renewable resources, bio-energy resource, depletion of resources – causes & effects, resource utilization, , optimal use of resources,.
Human Resources – importance of socio-economic studies in development projects.

[06 Hrs.]

Text Books :

1. Anand Bal, An Introduction to Environmental Management, Himalaya Publishing House.
2. John Rau & Wooten, Environmental Impact Assessment, Mc Graw Hill.
3. W.F. Canter, Environmental Impact Assessment, McGraw Hill.
4. Harry W. Gehm, Jacob I. Bregman, Handbook on pollution Control Acts, Central Pollution Control Board, New Delhi.
5. R.K. Sapra, S.Bhardwaj, The New Environmental Age, Ashish Pub. House, New Delhi.

References Books :

1. Rosencrannz, S. Divan, M.L. Nobal, Environmental Law and Policy in india, Cases, Materials And Statutes, Tripathi Pvt. Ltd. Bombay.

V SEMESTER

CV1327	OE I: Building Services Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
At the end of the course the student will be able to 1. Understand basic concepts of various building services. 2. Understand various aspects of natural light and ventilation. 3. Understand various methods of acoustics and sound insulation. 4. Understand various equipments and installations used in building services.	1.An ability to understand relevance of services related to lighting, ventilation & acoustics & understand the methodologies, materials & equipment in this regards. 2.An ability to understand special installations in buildings such as electrical, air conditioning, heating & mechanical ventilation & related practices. 3.An ability to understand specifications & usage of mechanical installations like lifts, security systems etc. & special features required as per need. 4.An ability to understand causes of fires in buildings & their preventive and protective strategies
Mapped Program Outcomes:a ,c, f ,h, i, j, k	

UNIT – 1 :

Lighting: Day lighting, Fenestration, Daylight Factor.
Ventilation: Functions of ventilation, supply of fresh air, convective cooling, Stack effect, physiological cooling, provision for air movement; wind effect, Air flow through buildings, cross-ventilation, position and size of openings, air flow around buildings, humidity control.

[07 Hrs.]

UNIT – 2 :
Acoustics, Sound Insulation and Noise Control: Basic terminology and definitions, Physics of sound. Behaviour of sound in an enclosed space. Requisites for acoustic environment, Acoustic design approaches for different building types, with reference to applicable standards. Selection of acoustic materials. Noise and its control, control of structure borne sound and noise from different mechanical equipment.

[06 Hrs.]

UNIT – 3 :
Electrical and Allied Installations: Different types of wiring need of earthing, comparison between fuse and MCB, substation, types of lightening fixtures, electricity distribution in multistoried building. Building protection against lightening, Planning and layout of electrical installations within a building complex.

[07 Hrs.]

UNIT – 4 :
Air Conditioning, Heating and Mechanical Ventilation: Requirement of air conditioning, air conditioning system, elements of air conditioning, Working and Pressure-Enthalpy (heat) diagram of vapour compression cycle, refrigeration effect, Thermodynamics of human body.

[06 Hrs.]

UNIT – 5 :
Mechanical Equipment & Installation: Installation of lifts and escalators, different types of Security and alarm systems. Hot Water Provision (Solar and Electrical), Special features required for physically handicapped and elderly, Conveyors, Vibrators, Concrete mixers.

[07 Hrs.]

UNIT-6
Causes of fire in buildings: Planning considerations in buildings using non-combustible materials, staircases and lift lobbies, fire escapes, A.C. systems, Fire detection and fire fighting systems. Heat and smoke detectors, Fire alarm system, Automatic sprinklers.

[06 Hrs.]

V SEMESTER

CV1327	**OE I – Building Services Engineering**			**L= 3**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. Building services, B.S. Patil, Orient Longman.
2. Building Services Engineering, Fred Hall, Roger Greeno, Butterworth-heinemann, 2007.
3. Building Services Engineering, David V. Chadderton, Taylor & Francis Group, 2007.

Reference Books:

1. E.R. Ambrose, “Heat Pumps and Electric Heating”, John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. R.G. Hopkinson and J.D.Kay, “The Lighting of buildings”, Faber and Faber, London, 1969.
4. William H. Severns and Julian R. Fellows, “Air-conditioning and Refrigeration”, John Wiley and Sons, London, 1988.
5. A.F.C. Sherratt, “Air-conditioning and Energy Conservation”, the Architectural Press, London, 1980.
6. National Building Code.

V SEMESTER

CV1329	**OE I:** Construction Techniques			**L=3**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 hours**

COURSE OBJECTIVE	**COURSE OUTCOMES**
1. To study and understand the construction techniques applied to engineering construction for sub structure, super structure. 2. To study and understand the Safety in Construction Operations. 3. To study and understand the construction Equipment used in Engineering	1. An ability to understand the construction techniques to be used in the construction of building and 2. An ability to understand the demolition techniques, Importance of rehabilitation, Strengthening etc.
Mapped Program Outcomes: a, d , i ,k	

UNIT – I :

Introduction to Cement and Concrete: Introduction to types of cement, grade of cement, mortar, concrete mix design, mix proportion and specification. Ready mix concrete, transit mixer, pumped concrete, self-compacting concrete, porous concrete, light weight concrete, asphalt etc., use of ecofriendly materials in construction.

[07 Hrs.]

UNIT – II :

Construction Equipment: Introduction To Various Construction Equipment Earth moving Machinery, Concreting Equipment, Compacting Equipment, Material Handling Equipment And Transportation Equipment.

[06 Hrs.]

UNIT – III :

Type of structure: load bearing, Frame & Composite. Components of structure.

Sub Structure Construction: - Types Of Foundation and Footings, Foundation in Black Cotton Soil,Underground and Underwater Construction, Dewatering In Shallow and Deep Excavations Using Different Methods, Introduction to Shuttering and Scaffolding and Types.

[07 Hrs.]

UNIT – IV :

Super structure construction: Stone Masonary: Uses & Types, Brick Masonary: Uses & Types, Partitions, arches, lintels, stairs, introduction to formwork for various components of structure, pointing and plastering, roofs, painting, varnishing and distempering etc.

[06 Hrs.]

UNIT – V :

Importance of rehabilitation repairs and retrofitting as a part of construction engineering. Difference between the terms.

Strengthening of existing structures - repairs to overcome low member strength, deflection, cracking,chemical disruption, weathering, wear, fire, leakage, marine exposure, use of nondestructive testing techniques for evaluation, load testing of structure.

[07 Hrs.]

UNIT – VI :

Safety in Construction Operations– Types of hazard, safety of accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, etc. safety in use of construction equipment e.g. vehicles, cranes, hoists and lifts etc. safety of scaffolding and working platforms. Safety while using electrical appliances. Explosives used.

[06 Hrs.]

Text Books.

1. M.S. Shetty, " Concrete Technology": S Chand & Co., 6th edition, S. Chand & Company, Limited, 2008
2. Rangwala, Building Construction, 32nd Edition,Charotar Publishing House Pvt. Ltd.2014

References Books :

Construction Planning, Equipment and methods – Peurifoy-Tata McGraw Hill Publication

1. Sankar, S.K. and Saraswati,S., Construction Technology, Oxford University Press, New Delhi, 2008
2. Sushil Kumar, Building Construction, 19th Edition, Standard Publisher Distributors 2001, New Delhi, 2001.
3. Elements of Civil Engineering: By S. S. Bhavikatti, Vikas Publishing House Pvt Limited, 2004
4. Basic Civil Engineering: By Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Firewall Media, 2003
5. SP 70 (2001): Handbook on Construction Safety Practices

V SEMESTER

CV1330	OE I: Transportation Engineering Basic			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. To expose the students to various modes of transportation systems and their interrelation, planning aspects, design, construction and maintenance 2. To Understand purposes, location and planning of various facilities.	1. On completing the course, the students will have the ability to Plan and Design various civil Engineering aspects of Railways, Airports and Harbour.
Mapped Program Outcomes: a, b, c, e,h,l	

UNIT – 1 :
Railway transportation and its development, Various organizations, Long term operative plans for Indian Railways. Classification of Railway lines and their track standards, Railway terminology, Traction and tractive Resistance, different Types of Tractions.

[06 Hrs.]

UNIT – 2 :
Permanent Way: Alignment Surveys, Requirement, gauges, track section, Coning of wheels, Stresses in railway track, high speed track. Geometric design of railway track, Gauge, Gradient, speed, super elevation, cant deficiency, Negative super elevation, curves.

[07 Hrs.]

UNIT – 3 :
Airports development of Air Transportation in India: Airport site selection. Modern aircraft's. Airport obstructions: Zoning Laws, Imaginary surfaces, Approach and Turning zone, clear zone, Windrose diagram, cross wind component.

[06 Hrs.]

UNIT – 4 :
Runway Orientation and configuration. Basic runway length and corrections, runway geometric design standards. Taxiway Layout and geometric design standards. Taxiway and other areas. Air traffic control: Need, Network, control aids, Instrumental landing systems.

[07 Hrs.]

UNIT – 5 :
Definition of Terms - Harbours, Ports, Docks, Tides and Waves, Littoral Drift, Sounding, Area, Depth, Satellite Ports - Requirements and Classification of Harbours - Site Selection & Selection Investigation – Speed of water, Dredging, Range of Tides, Waves and Tidal Currents, Littoral Transport with Erosion and Deposition,

[06 Hrs.]

UNIT – 6 :
Winds & Storms, Position and Size of Shoals - Shore Considerations- Proximity to Towns/Cities, Utilities, Construction Materials, Coast Lines - Dry and Wet Docks, Planning and Layouts - Entrance, Position of Light Houses, Navigating - Terminal Facilities – Port Buildings, Warehouse, Transit Sheds, Inter-modal Transfer Facilities, Mooring Accessories.

[07 Hrs.]

Text Books:
1. Railway Engineering, Saxena;, Dhanpat Rai Publication.
2. Airport Planning & Design, Goyal & Praveen Kumar, Galgotia Publication
3. Harbour, Dock And Tunnel Engineering, R. Srinivasan, Charotar publishing house.
4. Rangwala, Railway Engineering, Charotar Publishing House, 1995.
5. Rangwala, Airport Engineering, Charotar Publishing House, 1996.
6. Srinivasan R. Harbour, "Dock and Tunnel Engineering", 26th Edition 2013.

Reference Books:
1. Textbook on Transportation Engineering, S. P. CHANDOLA, 200, S. Chand Publishers, New Delhi
2. Planning and Design of Airports, Robert Horonjeff, Francis Mckelvey, William Sproule, Seth Young, Fifth Edition 2010, McGraw Hill Professionals

V SEMESTER

CV1331	Reinforced Concrete Structures			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**4 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To impart comprehensive knowledge on the design of reinforced concrete structural elements such as beams, columns, slabs and footings. 2. To bring about an understanding of the behavior of reinforced concrete. 3. To bring about an understanding of the design philosophies of RCC structures. 4. To introduce the Prestressed concrete.	1. An ability to understand the structural properties of steel and concrete and their applications in structural planning and design of various components of buildings. 2. An ability to understand the basic methods of structural design of RCC. 3. An ability to understand design and detailing of RCC structural elements required for building. 4. An ability to understand the concept and application of prestressed concrete
Mapped Program Outcomes a, b, c, e, k, l, m	

UNIT – 1 :
Properties of different grades of concrete and steel, Permissible stresses, load factors, Structural planning & understanding the behavior of R.C.C. members. Load distribution of frame structure for beam, Slabs, Column, and footing. Methods of frame analysis (brief introduction). Introduction to IS 456-2000, SP: 34, SP: 16 and specification for beam, slab, column.
Drawing in sketchbook about structural planning of building.

[09 Hrs.]

UNIT – 2 :
Working stress method: Behavior of beam under flexure, Stress distribution diagram, Basic concept in design for flexure, assumptions, design constant, analysis of rectangular sections, balanced, under reinforced section & over reinforced sections.
Limit state method : Characteristic values, partial safety factor, stress strain relationship, stress block parameters, failure criteria. Limit state of collapse in flexure, basic assumptions.
Drawing in sketchbook about stress-strain curve of steel and concrete, stress diagram and stress block

[09 Hrs.]

UNIT – 3 :
Analysis and design of singly reinforced rectangular section, under reinforced section & balanced section. Analysis and design of doubly reinforced rectangular section, Analysis and design of T & L beam for flexure.
Drawing in sketchbook about structural detailing of different types of beam.

[08 Hrs.]

UNIT – 4 :
Limit state of serviceability, deflection control of beam and slab.
Design for Shear and Bond.
Design of one way, two way, cantilever & staircase slabs.
Drawing in sketchbook about stirrups, zoning and detailing about one way, two way and cantilever slab.

[09 Hrs.]

UNIT – 5 :
Limit state of collapse in compression; basic assumptions.
Analysis and design of columns subjected to axial load, and uni-axial & biaxial moments.
Design of isolated footing for column subjected to axial loads.
Drawing in sketchbook about columns and footing.

[09 Hrs.]

UNIT – 6 :
Design of rectangular combined footing.
Introduction to under-reamed pile foundation.
Introduction to Prestressed Concrete(Basic Concept, Types of Prestressing, Advantages and limitations of Prestressing, Pre-tensioning Systems and Devices. Prestressing Steel, Forms of Prestressing Steel, Types and properties of Prestressing Steel, Codal Provisions.)
Drawing in sketchbook about combined footing, piles and prestressed concrete.

[08 Hrs.]

V SEMESTER

CV1331	**Reinforced Concrete Structures**			**L=3**	**T=1**	**P=0**	**CREDITS = 4**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**4 Hours**

Text Books:

1. P.C. Vergese, Limit State Design of Reinforced Concrete, Prentice Hall Publishers, 2nd edition, 2008
2. Shah and Karve, Reinforced Concrete Structures, Structures Publishers, Pune, 5th edition, 2015.
3. Sinha S.N, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Limited, New Delhi, 2007
4. Ashok K. Jain, Reinforced Concrete – Limit State Design, Nem chand and Brothers, 7th edition,2012

Reference Books:

1. P.C. Varghese, Advanced Design of Structures, Prentice Hall Publishers,2009
2. Punmia B.C., Jain A.K., Jain A.K, Reinforced Concrete Structures (Vol-I), Laxmi Publications Pvt Ltd, New Delhi, 2007
3. N. Krishana Raju, Prestressed Concrete, Tata McGraw Hill Publishing Company Limited, New Delhi, 5th edition 2012

VI SEMESTER

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

UNIT-1:Introduction to Economics and Consumers' Behaviors:

Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. Concept of supply, Supply curve, elasticity of supply-determinants and measurement, time element in determination of supply.

UNIT-2: Production and Costs

Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation.

UNIT-3: Market structures - equilibrium output and price

Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duolpoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination.

UNIT-4: National income accounting:

Concepts of GDP and GNP,Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation.

UNIT-5: Money, Banking and Public Finance

Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (Expenditure tax, Import duties, Excise duties), Revenue and capital expenditure.

UNIT-6: International Trade and Institutions

Definitions of closed vs open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions.

VI SEMESTER

GE1312	Fundamentals of Economics	L= 3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

Text Books:

1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher,2007

Reference Books:

1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
4. Economics: Samuelson,
5. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
6. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

VI SEMESTER

CV1310	Fluid Mechanics – II			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVE	COURSE OUTCOMES
1.To understand the concept of boundary layer theory and shear stress and velocity distribution in a pipe flow. 2. To understand the concept pipe flow and water distribution network analysis. 3. To understand the design of economical section of various channels, concept of uniform flow and critical flow in an open channel. 4. To understand the concept of various water surface profiles in non-uniform flows. 5. To understand the hydraulic jump and its importance in the field. 6. To understand the concept of model and variousmodel laws.	1. An ability to understand boundary layer theory and fluid flow around immersed bodies. An ability to understand different concepts in pipe flow, water distribution network analysis in field. 2. An ability to understand different concepts in pipe flow, water distribution network analysis in field 3. An ability to understand uniform flow and carry out design of economical section of channels for practical or field problems 4. An ability to understand the GVF profile in open channel flow. 5. An ability to understand the practical application of hydraulic jump. 6. An ability to understand model laws and apply in design of model and prototype
Mapped Program Outcomes: a,c,e, k	

UNIT – 1 :
Boundary layer theory: Laminar, Transition and Turbulent flows, Reynolds experiment, Critical Reynolds number, flow of viscous fluid in circular pipes, Velocity and shear stress distribution, maximum velocity, average velocity, Drop of pressure, Hagen – Poiseuille equation.

[09 Hrs.]

UNIT – 2 :
Flow Through Pipes: Hydrodynamically smooth and rough surfaces, Frictional resistance to flow of fluid, loss of energy in pipe, Darcy-Weisbach & Hazen William's equation for frictional head loss, Hydraulic gradient and energy gradient lines: Pipes in series and parallel, equivalent pipe, Siphon , Branched pipes, Hardy – Cross method for pipe networks, Water hammer pressure.

[08 Hrs.]

UNIT – 3 :
Flow Through Open Channel: Types of channel and their geometrical properties, Types of flow in open channel. Chezy's and Manning's equations for computations of normal depth of flow, conveyance of channel, section factor for uniform flow, Hydraulically most efficient rectangular, triangular, trapezoidal and circular sections.

[09 Hrs.]

UNIT – 4 :
Critical Flow and Rapidly Varied Flow: Specific energy and specific energy diagram, alternate depths, Computations of critical depth, section factor for critical flow, Conditions of critical flow, Definition of hydraulic jump, Classifications of jump, Belanger's equation for classical hydraulic jump, Expression for depth of hydraulic jump in terms of upstream Froude number, Length and height of jump, Energy loss in hydraulic jump.

[08 Hrs.]

UNIT – 5 :
Gradually Varied Flow: Mild, Steep, critical, Horizontal and Adverse slopes, Dynamic equation for GVF, Classification and characteristics of surface profiles, Direct Step method of computing profile length.

[09 Hrs.]

UNIT – 6 :
Hydraulic similitude and model investigation : Dimensionless numbers and their significance, Model investigation, similitude-types of similarities i.e. Geometric, Kinematics and Dynamic, Force ratio, model laws, types of model, merits and limitations of distorted and undistorted model, scale effect in models, application of dynamic similarity to specific model investigations: submerged objects, partial submerged objects. Introduction to hydraulic Machines.

[09 Hrs.]

VI SEMESTER

CV1310	**Fluid Mechanics – II**			**L=3**	**T=1**	**P=0**	**CREDITS = 4**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. Asawa, G.L, Fluid Flow in Pipes and Channels, CBS Publishers and Distributers.
2. Gupta, Vijay & Gupta, S.K., Fluid Mechanics, New Age International Publishers.
3. Modi & Seth, Fluid mechanics and Machineries, Standard Book House, Delhi.
4. Subramanya K., Theory and application of Fluid mechanics including Hydraulic machines, Tata McGraw-Hill publishing company ltd. New Delhi.
5. Van Te Chow, Open Channel Hydraulics, The Blackburn Press.
6. Streeter V.L., Wylie E.B., and Bedford K.W, Fluid mechanics, McGraw-Hill.
7. Flow through open channels by Ranga Raju K.G.Tata McGraw Hill.

Reference Books:

1. White, F.M, Fluid Mechanics, McGraw-Hill.
2. Fox R.W., McDonald A.T, Introduction to Fluid Mechanics, John Wiley & Sons.
3. Ramamrutham S, Hydraulics fluid mechanics & Fluid machines, Dhanpat Rai publishing company (P) ltd. New Delhi.
4. B. S. Massey, Mechanics of Fluids, Springer 6th edition.
5. Richard H. French, Open Channel Hydraulics, Water Resources Publication.

VI SEMESTER

CV1311	**Lab: Fluid Mechanics – II**			**L=0**	**T=0**	**P=2**	**CREDITS = 1**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	--	**--**	**40**	**60**		**100**	**--**

COURSE OBJECTIVE	**COURSE OUTCOMES**
1. To understand the flow around immersed bodies. 2. To study the various types of flow, major and minor losses in pipes. 3. To understand the analysis of water distribution pipe network 4. To study the various flows in channel 5. To study the various hydraulic machines.	1. An ability to determine the forces around the submerged bodies. 2. An ability to carry out the head loss in pipes for design of pipe network. 3. An ability to carry out analysis of water distribution network. 4. An ability to determine velocity and sketch various profiles, back water length, hydraulic jump, roughness, concept of specific energy in open channels. 5. An ability to determine the performance of hydraulic machines.
Mapped Program Outcomes: a, b, c, e ,g,h	

Practicals:

Minimum **TEN** Experiments from the following will be performed:

1. Study of flow around immersed bodies.
2. Determination of Darcy – Weisbach friction factor for given pipes.
3. Study of status of flow using Reynolds Apparatus.
4. Determination of Manning's or Chezy's constant for uniform flow in an open channel.
5. Study of hydraulic jump in a horizontal rectangular channel.
6. Development of specific energy diagram for rectangular channel.
7. Study of flow over horizontal contraction.
8. Determination of minor losses in pipes.
9. Determination of velocity in open channels flow by using current meter.
10. Design problems of pipe network analysis.
11. Sketch the various standard profiles in open channels flow
12. Sketch the various profiles in open channels flow by considering break in grade.
13. Computation of water surface length in open channel by using direct step method.
14. Study of performance of centrifugal pump.
15. Study of performance of pelton wheel turbine

Reference Books:

1. Laboratory work in Hydraulic Engineering, 2006, Asawa, G.L., New Age International Publishers.

VI SEMESTER

CV1332	Steel Structures			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**4 hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study the behavior and design of Structural steel components. 2. To study the fundamental design philosophies of steel structures. 3. To study the codal provision for design of steel structure. 4. To study the design of built-up section and column bases.	1. 1.An ability to understand effect of forces and its impact on structure 2. An ability to identify the type of structure and its design methodology 3. An ability to utilize the application of Indian Standard code for design purpose. 4. An ability to design the simple, built up section and column bases.
Mapped Program Outcomes: **a, c, e, i, k, l, m**	

UNIT – 1 :
Steel as a Structural Material: Physical and mechanical properties of Structural Steel, Merits and Demerits of Steel as a Structural Material, Grades of Structural Steel, Structural Steel Sections, Introduction to Indian Standards: IS 800:1984, IS 800:2007, Method of Design: Introduction to Working Stress Method, Introduction to Limit State Method. Drawing in sketchbook about different sections used.

[08 Hrs.]

UNIT – 2 :
Connection: Types and Failure of Connections, Simple Riveted Connection, Bolted Connection, Simple Welded Connection, Strength and Efficiency of Joint. Drawing in sketchbook about various connections

[09 Hrs.]

UNIT – 3 :
Tension Member: Types of Tension Member, Stresses , Design of axially loaded Tension Member
Compression Member: Effective length, Slenderness ratio, Built-up sections, Design of axially loaded Compression Member

[09 Hrs.]

UNIT – 4 :
Design of Beam: Types of Beams, Lateral Stability of beams, Types of section, Stresses on Beam, Design of Laterally Supported Beam, Design of Laterally Unsupported Beam, Built-up Beams. Drawing in sketchbook about built-up beam.

[08 Hrs.]

UNIT – 5 :
Column: Design of Axially loaded columns, Design of Laced and Battened Columns (Design of Built-up Columns) with Bolted and Welded End Connection. Drawing in sketchbook about built-up column

[09 Hrs.]

UNIT – 6 :
Column Bases and Footing: Types of Column Bases, Slab Base, Gusset Base, Foundation Bolt, Grillage Footing, Design of Slab Base and Gusseted Base. Drawing in sketchbook about column bases and footing.

[09 Hrs.]

Text Books:
1. Fundamentals of Structural Steel Design, By M. L. Gambhir, Mc Graw Hill Education, 2013
2. Design of Steel Structures, By N. Subramanian, OXFORD University Press, First Edition, 2008
3. Limit State Design of Steel Structures, By S. K. Duggal, Mc Graw Hill Education Private Limited, 2011

Reference Books:
1. Design of Steel Structures, LSM, By S. S. Bhavikatti, I. K. International Publication House Pvt. Ltd. 2009
2. Structural Steel Design, By Jack C. McCormac), Stephen F. Csernak, 5th Edition Pearson Education Limited, 2013

VI SEMESTER

CV1333	Geotechnical Engineering –II			L= 4	T=0	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students with basic understanding of geotechnical site investigation. 2. To understand the bearing capacity of soil & factors governing choice of foundation. 3. To understand the lateral earth pressure. 4. To study stability of sloyes. 5. To familiarize different methods of ground improvement.	1. An ability to understand & apply the fundamentals of earth pressure to earth retaining structure. 2. An ability to understand & apply knowledge of stability of slopes and ground improvement techniques 3. An ability to comprehend and utilize the geotechnical literature to establish the framework for foundation design. 4. An ability to plan and implement a site investigation including collection of soil sample for testing and observation of soil behavior and obtain necessary design parameter. 5. An ability to develop good technical reporting and data presentation skills
Mapped Program Outcomes: a, b, c, d, e, f, k	

UNIT – 1 :
GEOTECHNICAL EXPLORATION : Importance and objectives of field exploration, principal methods of subsurface exploration, open pits & shafts, types of boring, number, spacing and depth of boring for different structures, type of soil samples & samplers, collection & shipment of samples, bore logs and sampling record,

[08 Hrs.]

UNIT – 2 :
SHALLOW FOUNDATIONS:
Bearing capacity of soils (IS: 6403), types of shear failure in foundation soil, Terzaghi's theory, its validity and limitations, bearing capacity factors, effect of water table on bearing capacity, effect of water table on bearing capacity, correction factors for shape and depth of footings, Standard Penetration Test, corrections to N –values & correlation for obtaining design soil parameters, bearing capacity estimation from N-values.
Settlement Analysis of footings and Rafts: Causes of settlement, computation of elastic and consolidation settlement (IS-8009: Part I), differential settlement, control of excessive settlement, proportioning the footing for equal settlement, plate load test: procedure, interpretation for bearing capacity and settlement prediction.

[09 Hrs.]

UNIT – 3 :
PILE FOUNDATION: Classification and types of piles, constructional features of cast–in–situ &pre-cast concrete piles, pile driving methods, effect of pile driving on ground, load transfer mechanism of axially loaded piles. Pile capacity by Static formula & Dynamic formula, pile load test and interpretation of data, group action in piles, spacing of piles in groups, group efficiency, overlapping of stresses, settlement of pile group by simple approach, negative skin friction and its effect on pile capacity, general feature of under reamed piles, Introduction to well foundations, caissons and coffer dams.

[08 Hrs.]

UNIT – 4 :
LATERAL EARTH PRESSURE :Fundamentals of earth pressure at-rest, active & passive pressures, general & local states of plastic equilibrium in soil, Rankine's and Coulomb's theories of earth pressure, effects of soil type, surcharge, submergence, graphical solutions of Rebhan and Culmann for active case.

[09 Hrs.]

UNIT – 5 :
STABILITY OF SLOPES : Causes and types of slope failure, stability analysis of infinite slopes and finite slopes, effect of seepage, location of critical slip circle, method of slices for cohesive and C - Ø soil slopes, pore pressure considerations, Taylor's stability numbers & stability charts, methods of improving stability of slopes.

[09 Hrs.]

UNIT – 6 :
GROUND IMPROVEMENT : Method of soil stabilization – mechanical stabilization & chemical stabilization, use of admixtures (lime, cement, flyash) in stabilization, basic concepts of reinforced earth - use of geosynthetic materials-salient features, function and applications of various geosynthetic materials, deep compaction by impact, vibroflotation, pre-consolidation techniques by band drain installation, pre-loading and surcharging.

[09 Hrs.]

VI SEMESTER

CV1333	**Geotechnical Engineering –II**			**L= 4**	**T=0**	**P=0**	**CREDITS = 4**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books:

1. Design Aids in Soil Mechanics and Foundation Engineering,1988, Kaniraj R.,McGraw Hills, New Delhi.
2. Analysis and Design of Foundations and Retaining Structures, 1979, Shamsher Prakash, Gopoal Ranjan and Swami Sharan, Sarita Prakashan, Meerut.
3. Theory and Practice of Foundation Design, 2004, Som N.N. & Das S.C, Prentice Hall & Co., New Delhi.
4. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian Standards.

VI SEMESTER

CV1315	PE I : Water Treatment			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. Understand the layout of water treatment plant and its various units. 2. Understand the principle of working of each unit and its design. 3. Understand various water treatment processes for different quality requirements	1. An ability to understand importance of water treatment 2. An ability to analyse available data and design a water treatment unit.
Mapped Program Outcomes: b, c, e, h	

UNIT – 1 :
Introduction: Water treatment objectives, Water quality standards and regulations, Health and aesthetic aspects of water quality. Unit processes and unit operations. Site selection, synthesis of treatment flow sheet.
Aeration: Objectives, Principles, Various methods, Design of aerators.

[06 Hrs.]

UNIT – 2 :
Coagulation: History, need of coagulation, chemistry of coagulation, various coagulants used in the process, factors affecting efficiency of coagulation process. Operation of feeders. Type of rapid mixing devices, design of flash mixer
Flocculation: Theory of flocculation, slow mixing devices.

[07 Hrs.]

UNIT – 3 :
Sedimentation: Principle, Stoke's law, working of ideal sedimentation tank, Types of sedimentation tanks, design of rectangular sedimentation tank, working and design of clariflocculator. Operational problems in sedimentation tanks.

[06 Hrs.]

UNIT – 4 :
Filtration: Theory of filtration, Types of filters, Slow and rapid sand filters, Operation of rapid sand filters, Operational difficulties, Design of rapid sand filter.

[07 Hrs.]

UNIT – 5 :
Disinfection: History, Various methods of disinfection, Chemical disinfections, Kinetics of chemical disinfection, Chlorination, Chemistry of chlorination, Methods of chlorination.

[06 Hrs.]

UNIT – 6 :
Adsorption: Theory, Granular and powder activated carbon, Performance and reactivation. Adsorption of organic compounds. Deflouridation, Ion Exchange, Materials and reactions, Kinetics, Applications.

[07 Hrs.]

Text Books :
1. P.N. Modi, Water Supply and treatment, Standard Book House.
2. CPHEEO Manual on Water Supply and Treatment.

Reference Books :
1. Fair, Geyer and Okun, Water and wastewater engineering Vol. 2, John Wiley and Sons, New York
2. Franklin Burton, Stensel, Waste Water Engineering, Tata Mc Graw Hill.
3. Dr. B.C. Punmia, Waste Water Engineering, Firewall Media.

VI SEMESTER

CV1316	PE I : Prestressed Concrete			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the basic concepts of Prestressed concrete. 2. To understand the various devices used for prestressing. 3. To understand methods of analysis of Prestressed concrete structural element.	1.An ability to understand the basic concepts of prestressed concrete structures. 2.An ability to analyse the presstressed concrete structural elements. 3.An ability to design theprestressed concrete structural elements. 4.An ability to exercise the limit state of serviceability to prestressed concrete members.
Mapped Program Outcomes:a,b,c,e,k,l	

UNIT – 1 :

Introduction: Basic Concept, Types of Prestressing, Advantages and limitations of Prestressing, Pre-tensioning Systems and Devices. Post tensioning systems.

Prestressing Steel, Forms of Prestressing Steel, Types and properties of Prestressing Steel, Codal Provisions.

Losses in Prestress: Elastic Shortening, Friction, Anchorage Slip, Force Variation Diagram, Creep of Concrete, Shrinkage of Concrete, Relaxation of Steel, Total Time-dependent Loss.

[06 Hrs.]

UNIT – 2 :

Analysis at Transfer, Service, Ultimate Strength, Cracking Moment, Kern Point, Pressure Line Analysis for Ultimate Strength Variation of Stress in Steel, Condition at Limit State, Analysis of a Rectangular Section,

Design of Members, Design of Sections for Axial Tension, Design for Type 1 and type 2 Members, Determination of Limiting Zone, Post-tensioning in Stages, Design of Sections for Flexure.

[07 Hrs.]

UNIT – 3 :

Analysis for Shear, Stress in an Uncracked Beam, Types of Cracks, Components of Shear Resistance, Modes of Failure, Effect of Prestressing Force, Limit State of Collapse for Shear, Design of Transverse Reinforcement, Modes of Failure, Effect of Prestressing Force, Design of Longitudinal Reinforcement, Design of Transverse Reinforcement.

[07 Hrs.]

UNIT – 4 :

Deflection due to Gravity Loads, Prestressing Force, Total Deflection, Limits of Deflection, Limits of Span-to-effective Depth Ratio, Calculation of Crack Width, Limits of Crack Width

Transmission of Prestress in Pre-tensioned and Post-tensioned Members.

[06 Hrs.]

UNIT – 5 :

Cantilever Beams, Analysis, Determination of Limiting Zone, Cable Profile.

[07 Hrs.]

UNIT – 6 :

Principle of Linear Transformation, Concordant Tendon Profile, Tendon Profiles, Partially Continuous Beams, Analysis for Ultimate Strength, Moment Redistribution.

[06 Hrs.]

Text Books:

1. N. Krishana Raju, Prestressed Concrete, Tata McGraw Hill Publishing Company Limited, New Delhi.5th edition, 2012
2. N. Rajagopalan, Prestressed Concrete, Alpha Science International, 2nd edition 2005
3. Dayaratnam P, Prestressed Concrete, Oxford & IBH, 5th edition 2014

Reference Books:

1. Lin T.Y., Design of Prestressed Concrete structures, John Wiley & Son's, 3rd edition,1904
2. Edward G. Nawy, Prestressed Concrete, Pearson Education Limited, 5th edition 2005.

VI SEMESTER

CV1317	PE I: Building Services			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. Understand basic concepts of building services. 2. Understand various aspects of natural light and ventilation. 3. Understand various methods of acoustics and sound insulation. 4. Understand various equipments and installations used in building services	1. An ability to understand relivance of services related to lighting, ventilation & acoustics & understand the methodologies, materials & equipments in this regards. 2. An ability to understand special installations in buildings such as electrical, air conditioning, heating & mechanical ventilation & related practices. 3. An ability to understand specifications & usage of mechanical installations like lifts, security systems etc & special features required as per need. 4. An ability to understand facilities necessary for physically handicapped and aged people.
Mapped Program Outcomes: e, f, h, j	

UNIT – 1:
Lighting: Day lighting, Fenestration, Daylight Factor.
Advanced Daylight System: Sun tracking, day lighting system with Fresnell Collector.
Ventilation: Functions of ventilation, supply of fresh air, convective cooling, Stack effect, physiological cooling, provision for air movement; wind effect, Air flow through buildings, cross-ventilation, position and size of openings, air flow around buildings, humidity control.

[07 Hrs.]

UNIT – 2 :
Acoustics, Sound Insulation and Noise Control:
Basic terminology and definitions, Physics of sound. Behaviour of sound in an enclosed space. Requisites for acoustic environment,Acoustic design approaches for different building types with reference to applicable standards. Selection of acoustic materials, construction details and fixing. Noise and its control, control of structure borne sound and noise from different mechanical equipment.

[06 Hrs.]

UNIT – 3 :
Electrical and Allied Installations:
Different types of wiring, need of earthing, comparison between fuse and MCB, substation, types of lightening fixtures, sources for artificial illumination, power received and supplied in single storey buildings, electricity distribution in multistoried buildings. Building protection against lightening,
Calculation of luminaries required and their layout. Planning and layout of electrical installations within a building.

[07 Hrs.]

UNIT – 4 :
Air Conditioning, Heating and Mechanical Ventilation:
Requirement of air conditioning, air conditioning system, elements of air conditioning, load estimation, Working and Pressure-Enthalpy (heat) diagram of vapour compression cycle, refrigeration effect. Thermodynamics of human body, psychometric properties and process, Psychometric chart.

[06 Hrs.]

UNIT – 5 :
Mechanical Equipment & Installation: Installation of lifts and escalators, different types of Security and alarm systems, Fire detection and fire fighting systems.

[07 Hrs.]

UNIT – 6 :
Intelligent building, green building, smart concrete, smart materials. Facilities for aged and physically handicapped people.

[06 Hrs.]

VI SEMESTER

CV1317	**PE I : Building Services**			**L= 3**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. B.S. Patil, Building services, Orient Longman.
2. Fred Hall, Roger Greeno, Building Services Engineering, Butterworth-heinemann.
3. David V. Chadderton, Building Services Engineering, Taylor & Francis Group.

Reference Books:

1. E.R. Ambrose, “Heat Pumps and Electric Heating”, John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. R.G. Hopkinson and J.D.Kay, “The Lighting of buildings”, Faber and Faber, London, 1969.

VI SEMESTER

CV1323	PE I : Pavement Design			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
To understand 1. Different types of pavement design parameters for flexible and rigid pavements. 2. To establish pavement material characterization. 3. Analysis of flexible and rigid pavements. 4. Design of the flexible and rigid pavements by different methods for Highway and Airfields pavement. 5. Pavement testing and evaluation 6. Strengthening of the pavement, maintenance and rehabilitation	1. An ability to understand different design parameters for flexible and rigid pavements. 2. An ability to analysis flexible and rigid pavements. 3. An ability to design flexible and rigid pavements by different methods for Highways and Airfields 4. An ability to understand testing and evaluation of Pavement. 5. An ability to understand the techniques for strengthening of the pavement 6. An ability to understand cost evaluation and comparative study of pavements
Mapped Program Outcomes: a, b, c, f, j, k,	

UNIT – 1 :
Need and importance of pavement. Various types of pavement: Flexible, semi flexible and rigid pavements, composite pavement, Ultrathin thin white topping, Perpetual pavement. Characteristics of highway and airfield pavements.
Design Parameters: Standard Axle load, wheel assemblies for road vehicles, under carriage system for aircraft, Type and contact pressure, contact area imprints, Computations of ESWL for flexible and rigid pavements. Load repetitions and distribution of traffic for heavy and airfield pavement.

[06 Hrs.]

UNIT -2:
Materials Characteristics:
AASHO subgrade soil classification, CBR, North Dakota cone bearing value, plate load test for K, Marshal's method of Bituminous mix design, poison's ratio & coefficient of thermal expansion of concrete, layer equivalent concepts. Mechanistic Design Approach.
Analysis of Flexible and Rigid Pavements:
Stress, strain, deflection analysis for single, two, three and multi layered flexible pavement systems, stress and deflections for rigid pavements due to load and temperature, influence charts, ultimate load analysis, joints.

[07 Hrs.]

UNIT – 3 :
Specifications:
Review of IRC/MOST/ICAO/IAAI specification and standard for highway and airfield constructions. Analysis of Rigid Pavements, highway and airfield.

[06 Hrs.]

UNIT – 4 :
Highway Pavement Design:
Flexible: North Dakota cone, CBR, IRC-37, Brumister, TriaxialTest method, AASHO method of design.
Rigid : IRC 58, PCA, AASHO methods of design, Design of joints and reinforcement.
Cost Estimates: Cost evaluation and comparative study.

[07 Hrs.]

UNIT – 5 :
Airfield Pavement Design:
Flexible: US Corps of Engineering, CBR, FAA, Mcload
Rigid: PCA, FAA & LCN, ultimate load analysis, yield line pattern method.
Cost Estimates: Cost evaluation and comparative study.

[06 Hrs.]

UNIT – 6 :
Pavement Management System:
Systems management, case studies of highway and Airfield pavement projects.
Pavement testing and Evaluation: Field CBR test, plate load Test, Condition surveys and international roughness Index (IRI), rut depth, profilometers, Bump integrator, Benkalman Beam Deflection study.

VI SEMESTER

CV1323	PE I : Pavement Design			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Strengthening of Pavements:
Design of flexible, composite and rigid overlay design for flexible and rigid pavements, repairs, maintenance and rehabilitation of pavements. **[07 Hrs.]**

Text Books:
1. Pavement Design by R. Srinivasa Kumar
2. Principles And Practices Of Highway Engineering: (Including Expressways And Airport Engineering) by L. R. Kadiyali), N.B. Lal
3. N. J. Garber and L. A. Hoel, Traffic and Highway Engineering, Thomson Learning, Inc., 2002.
4. E. J. Yoder and M. W. Witczak, Principles of Pavement Design, John Willey, Inc., 1975.
5. F. L. Roberts, P. S. Kandhal, E. R. Brown, DY Lee, and T. W.Kennedy, Hot

References Books:
1. Association of State Highway and Transportation Officials (AASHTO) Specifications and Guides, 2002. Y. H. Huang, Pavement Analysis and Design, Prentice Hall, 1993.
2. Mix Asphalt Materials, Mixture Design and Construction, 2ndEdition, NAPA Research and Education Foundation, 1996.
3. R. Horonjeff and F. X. Mckelvey, Planning and Design of Airports, McGraw Hill, Inc., 4thEdition, 1994.
4. The Asphalt Institute (AI) Superpave Series No. 2 (SP 2), Superpave Mix Design, 1996.
5. The AI Manual Series No. 2 (MS 2), Mix Design Methods for Asphalt Concrete and Other Hot Mix Types, 1996.
6. The AI Manual Series No. 4 (MS 4), The Asphalt Handbook, 1989 Edition.

VI SEMESTER

CV1324	**PE I - Geotechnical Investigation & Ground Improvement Techniques**			**L= 3**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	**COURSE OUTCOMES**
1. To study important methods of soil exploration and interpretation of the results. 2. Understanding the methods of ground improvement. 3. Understand the use of geosynthetic materials.	idents will be able to understand 2. Various methods of soil exploration and interpretation of the results. 3. Various methods of ground improvement. 4. The use of geosynthetic materials in construction.
Mapped Program Outcomes: a, c, e, h, l,	

UNIT – 1 :

Importance and objectives of Geotechnical exploration: Planning of geotechnical exploration program: Methods of boring, location, number of boreholes, depth of boring. Sub-surface Investigation Report: Salient features and boring logs; Types of soil samplers& their suitability, precautions in sampling, preservation & shipment of samplers. Seismic refraction method, electrical resistivity method, qualitative and quantitative interpretation of test results.

[07 Hrs.]

UNIT – 2 :

Field investigations: Standard Penetration Test, static cone and dynamic cone penetration tests, interpretation of test results for obtaining design soil parameters for cohesive and cohesion less soils, Plate load test– purpose, procedure, interpretation for bearing capacity and settlement of foundation. Field vane shear test, design value of un-drained shear strength of clays, correction factor, pressure meter tests.

[06 Hrs.]

UNIT – 3 :

Introduction to ground improvement techniques - Need forground improvement, various ground improvement techniques, economic considerations and suitability. Grouting: Materials and methods of grouting, grout volume and grouting pressure, grout requirements and tests. Stone Column: Application, layout feature, procedures of installation, rammed & floated columns, quality control in construction, methods of improving the effectiveness of stone columns, skirted and cemented stone column techniques, geosynthetic encased stone columns.

[06 Hrs.]

UNIT – 4 :

Reinforced soil and Geo-synthetics: Basic theory of reinforced soil, concept of reinforced soil wall and reinforced slope, geo-synthetic types: applications in Civil Engineering, Applications of Geofoam & Geocell.

[07 Hrs.]

UNIT – 5 :

Ground Anchor and Soil Nailing: Concept, Design features, types, construction procedure, Functions, Applications, Advantages. Limitations of soil nailing system and ground anchors.

[07 Hrs.]

UNIT-6

Diaphragm wall: Construction sequence, cement slurry wall, Design features, Functions, applications, Case study on Diaphragm wall. Deep soil mixing.

[06 Hrs.]

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books:

1. Design Aids in Soil Mechanics and Foundation Engineering, 1988, Kaniraj R., McGraw Hill New Delhi.
2. Analysis and Design of Foundations and Retaining Structures, 1979, Shamsher Prakash, Gopoal Ranjan and Swami Sharan, Sarita Prakashan.
3. Theory and Practice of Foundation Design, 2004, Som N.N. & Das S.C., Prentice Hall and co New Delhi.
4. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.

VI SEMESTER

CV1341	OE II: Elements of Earthquake Engineering			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study geology of earth and interior. 2. To study causes of earthquakes and its characteristics. 3. To study behavior of different types of structures under earthquake loading. 4. To study about disaster management, mitigation and different retrofitting techniques.	1. An ability to understand the the necessity and importance of earthquake engineering 2. An ability to understand the provision of IS code used for earthquake resistance design of structure 3. An ability to understand provision for earthquake resistance design of structures as per Indian standard 4. An ability to study of damages caused due to past earthquake in & outside India and remedial measures
Mapped Program Outcomes: a, c, e, l, m,	

UNIT – 1 :
Introduction to earthquakes:
Geology of earth, configuration of tectonic plates in a globe, behavior of plates, their motion and effects, causes of earthquake and their characteristics, Earthquake parameters, magnitudes, intensity, Seismic waves.
[07 Hrs.]

UNIT – 2 :
Analysis and interpretation of earthquake data, determination of magnitude, location of epicenter, focal depth.
[06 Hrs.]

UNIT – 3 :
Recording earthquakes, seismicity of the world, history of earthquakes in India and abroad, case studies of effects of earthquakes, causes and sources of earthquake damage.
[06 Hrs.]

UNIT – 4 :
Non-engineered earthquake resistant structures, load bearing structures, masonry structures, seismic zoning of India (IS 1893:2002 Part I), seismic coefficients for different zones, definitions, irregularities in buildings, consequences of irregularities.
[07 Hrs.]

UNIT – 5 :
Strengthening, rehabilitation and retrofitting of earthquake damaged structures.
[06 Hrs.]

UNIT – 6 :
Earthquake disaster management, mitigation and social aspects, lessons from past earthquake: - study of damages caused due to past earthquake in & outside India and remedial measures.
[07 Hrs.]

Text Books :
1. Agrawal & Shrikhande, Design of Earthquake Resistant Structures, 3rd 2006, Prentice – Hall of India Pvt. Ltd.
2. Roberto Villaverde, Fundamental Concepts of Earthquake Engineering, 2009, CRC Press
3. Asadour H. Hadjian, Basic Elements of Earthquake Engineering, 2015, Wiley

Reference Books:
1. C.V.R. Murty, Earthquake Tips, 2005, NICEE, IITK
2. www.nicee.org / iaee / E_FrontCover.pdf, NICEE Guidelines for Earthquake Resistant Non-Engineered Construction, 2004, National information center of Earthquake engineering Indian Institute of Technology Kanpur Kanpur 208016, India
3. Robin K. McGuire, Seismic Hazard and Risk Analysis, 2004, Earthquake Engineering Research Institute; First edition

VI SEMESTER

CV1342	OE II: Air Pollution and Solid Waste Management			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. To provide general understanding of air pollution, air pollutants, their sources & their effects 2. To provide knowledge about meteorological parameters, air sampling & measurement of pollutants. 3. To provide knowledge of air pollution controlling technologies, air pollution due to automobiles & general Idea of noise pollution. 4. To study importance of solid waste management by processing, treatment, disposal & reuse of solid waste.	1. An ability to understand the type, sources & effect of air pollutants 2. An ability to understand the parameters affecting air pollution and various methods of measurement and estimation of pollutants 3. An ability to understand basics of noise pollution 4. An ability to understand various air pollution control equipments & pollution caused due to automobile exhaust 5. An ability to understand the concepts of solid waste management.
Mapped Program Outcomes: a, d, e, h, j,	

UNIT – 1 :
Introduction to air pollution: Air pollution episodes, Atmosphere and its zones, classification and sources of air pollutants, effects of air pollutants on man, plants animal & materials

[06 Hrs.]

UNIT – 2 :
Meteorological Aspects: Atmospheric stability, plume behaviour**,** Ambient air sampling and stack sampling, collection of particulates and gaseous pollutants, methods of estimation.

[07 Hrs.]

UNIT – 3 :
Air pollution control methods and equipment: Principle of control methods for particulates and gaseous pollutants, gravity settlers, electrostatic precipitators, bag filters cyclones, wet scrubbers, automobile exhaust: Pollution due to diesel and petrol engines, exhaust treatment and abatement, noise Pollution: Sources, ill effects, control measures.

[06 Hrs.]

UNIT – 4 :
Introduction to solid waste management, sources, quantification and characterisation, classification and components, sampling and analysis, Method of collection

[07 Hrs.]

UNIT – 5 :
Equipment used for collection and transportation, transfer stations, solid waste processing and management.

[06 Hrs.]

UNIT – 6 :
Treatment and disposal methods: composting, sanitary landfills, Incineration – concept, components and applications, leachate management.

[07 Hrs.]

Text Books:
1. M.N. Rao & H.V.N. Rao, 1988, Air Pollution, Tata McGraw Hill Publishing Co. Ltd.
2. C.S. RAO, 2007, Environmental Pollution Control Engineering, New Age International, Wiley Estern Ltd. New Delhi.
3. Stern A. C., 1973, Air pollution, Academic Press.
4. A.D. Bhide & Sunderesan B.B., 1983, Solid Waste Management in Developing countries, INSDOC, New Delhi.
5. Tohobanoglous, 1993, Intgrated Solid Waste Management Engineering Principle and Management Issues, McGraw-Hill publication Ltd.
6. K. V. S. G. Murlikrishna, 1995, Air Pollution, Kaushal& Company.

Reference books:
1. P. Aarne Vesilind, William Worrell & Debra Reinhart, 2002, Solid Waste Engineering, Cengage Learning India pvt. Ltd.
2. Dr. Y Anjaneyulu, 2002, Air Pollution and Control Technologies, Allied Publisher pvt. Ltd.
3. Waste Management: A Reference Handbook. Contributors: Jacqueline Vaughn - Author. Publisher: ABC-Clio

VI SEMESTER

CV1343	**OE II: Introduction to Finite Element Method**			**L=3**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	**COURSE OUTCOMES**
1. To provide the student with knowledge and analysis skills in applying basic laws and steps used in solving the problem by finite element method. 2. To provide the student the knowledge of various interpolation functions and elements to solve simple problems by finite element method. 3. To provide the student with some knowledge in is parametric formulation. 4. To provide students the knowledge of mathematical modeling techniques.	1. An ability to apply the steps required for FEM solution to variety of physical systems. 2. An ability to create models for simple structures. 3. An ability to extend the knowledge of the application of FE to solve engineering problems.
Mapped Program Outcomes: a, d, e, k,	

UNIT – I :
Introduction: Development, Historical background, Applications, Advantages and Disadvantages of FEM, General steps of FEM, direct equilibrium approach, Variational approach , weighted residual approach, local and global FEM, application to simple problems.

[07 Hrs.]

UNIT – II :
Shape functions: Introduction, requirement of Ideal displacement functions, Derivation of shape functions using Cartesian Coordinates, Lagrange and Serendipity elements.

[06 Hrs.]

UNIT – III :
Application of FEM to 1D problems: Derivation of element property matrix and influence vector, application, Application to bar, truss, steady state heat conduction, steady state flow through porous medium problems.

[06 Hrs.]

UNIT – IV :
Application of FEM to 2D problems: Equilibrium equations, Triangular and Rectangular element formulation using Cartesian Coordinates, Application to two-dimensional stress analysis.

[07 Hrs.]

UNIT – V :
Natural coordinates, Isoparametric elements, Application to 1D and 2D Problems.

[07 Hrs.]

UNIT – VI :
Numerical integration, Modeling, storage and solution techniques.

[06 Hrs.]

Text Books :
1. Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991
2. Godbole P. N. , . Introduction to Finite Element Method, I. K. International Publishing House Pvt. Ltd., New Delhi, 2013
3. Desai Y. M., Eldho T. I. and Shah A. H., Finite Element Method s and Application to Engineerimg, Pearson , 2011.

Reference Books :
1. Krishnamoorthy C S, “Finite Element Analysis – Theory and Programming”, Tata McGraw Hill Publishing Co., New Delhi, 1994.
2. Cook R D, Malkus D S, Plesha M E and Witt R J, “Concepts and Applications of Finite Element Analysis”, John Weily & sons inc, New York, Fourth Edition, 2003.
3. Rajasekaran S, “Finite Element Analysis in Engineering Design”. S Chand & Co., 2003.

VI SEMESTER

CV1344	OE II: Disaster Management			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

COURSE OBJECTIVES	COURSE OUTCOMES
rious objectives of the course will be 1. To understand the nature & types of disaster, 2. To understand role of different government & private agencies in disaster management 3. To understand disaster management cycle.	At the end of syllabus, students shall be able to 1. Understand the nature & types of disaster, 2. Understand its preparedness, role of different government & private agencies, act & other statute 3. Understand provisions, management of disaster, post disaster condition & its management.
Mapped Program Outcomes: a, b, d, e, f, g, k, l,	

UNIT – 1 :

Unit 1: Understanding Natural Disasters

natural disasters, which have been categorised as hydrological, wind-related, geo-physical, and climatic. Under each category, an attempt is made to discuss the causes and impacts, along with past illustrations and geographical distribution.

Flood, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic Eruptions, Heat and Cold Waves, Climate Change: Global Warming, Sea Level Rise, Ozone Depletion

[07 Hrs.]

Unit 2: Man-Made Disasters

Nuclear Disasters, Chemical Disasters, Biological Disasters, Building Fire, Coal Fire, Forest Fire, Oil Fire, Air Pollution, Water Pollution, Deforestation, Industrial Pollution, Road Accidents, Rail Accidents, Air Accidents, Sea Accidents

[06 Hrs.]

UNIT – 3 :

Risk & Cost Assessment:

Geographical conditions, Population, Living habits, Threats, Extent of damages to the lives, agricultural area, industrial units, Awareness & Safety Program. Relief arrangement & essential components, Shelters, Rescue & search tools &equipments, transport facilities. Cost assessment of each unit and funding.

[06 Hrs.]

Unit 4: DISASTER PREPAREDNESS

Disaster Preparedness: Concept and Nature, Disaster Preparedness Plan, Disaster Preparedness for People with Special Needs/Vulnerable Groups, Disaster Preparedness with Relevance to Housing, Infrastructure and Livestock, Community Based Disaster Preparedness Plan, Role of Information, Education, Communication, and Training, Disaster Preparedness: Role and Responsibilities of Central, State, District, and Local Administration, Role and Responsibilities of Armed Forces, Police, Para-military Forces, National Service Scheme and Scouts, Role and Responsibilities of International Agencies, Non-governmental Organisations, Community Based Organisations, Community, and Media

Information Technology: Role in Disaster Preparedness with Special Reference to Geographical Information System, Use and Application of Emerging Technologies in Disaster Preparedness

[07 Hrs.]

Unit 5: DISASTER RESPONSE

Disaster Response Plan, Communication, Participation, and Activation of Emergency Preparedness Plan, Logistics Management, Needs and Damage Assessment, Disaster Response: Central, State, District, and Local Administration, Armed Forces in Disaster Response, Police and Other Forces. Role of Multiple Stockholders in Disaster Response, Psychological Response, Trauma and Stress Management. Rumour and Panic Management, Minimum Standards of Relief, Managing Relief, Funding Relief, Recovery

[06 Hrs.]

VI SEMESTER

CV1344	OE II: Disaster Management			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

Unit 6: Reconstruction and Rehabilitation

Damage Assessment, Role of Various Agencies in Disaster Management and Development Information Management Structure, Parameters of Vulnerability, Development of Physical and Economic Infrastructure, Creation of Long-term Job Opportunities and Livelihood Options, Funding Arrangements for Reconstruction, Nature of Damage to Houses and Infrastructure due to Disasters, Disaster Resistant House Construction, Role of Housing/Building Authorities, Education and Awareness Role of Information Dissemination, Participative Rehabilitation Process: Some Case Studies Long-term Recovery.

[07 Hrs.]

Text Books:

1. Satish Modh: Introduction to Disaster Management, Macmillan, 2009
2. Amit Awasthy: Disaster Management: Warning Response and Community Relocation, Global India Publications, 2009
3. Jyoti Purohit :Disaster Management in India: Structure and Challenges, 2013
4. Prakash Singh: Disaster Response in India, www.MilitaryBookshop.Companyuk, 2011

Reference Books:

1. D.B.N. Murthy: Disaster Management: Text and Case Studies, Deep and Deep Publications, 2007
2. National Policy on Disaster Management, NDMA, New Delhi, 2009.
3. A Global Report - Reducing Disaster Risk, A Challenge for Development; UNDP Publication, 2004.
4. Disaster Management Act. (2005), Ministry of Home Affairs, Government of India, New Delhi, 2005.

VI SEMESTER

CV1345	OE II: Environmental Impact Assessment			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. To provide students with an overview of the principles and current practices of environmental impact assessment (EIA). 2. To learn and understand process, and necessary techniques for environmental impact assessment, mitigation and monitoring. 3. To introduce students to the legal, economic, administrative and technical process of preparing and/or evaluating environmental impact documents. 4. To relate the uses of scientific research to practical situations in project planning and decision making. 5. To provide experience and training in environmental planning and related professions	At the end of the course, students will be able to 1. Understand the EIA process, analyse major environmental issues for development projects. 2. Monitor and model tasks within an EIA cycle. 3. Prepare portions of environmental documents through administrative and legal requirements and standards of professional practice. .
Mapped Program Outcomes: b, d, e, f, h	

UNIT – I :
Evolution of EIA: Concepts, Nature & Type of impacts, Need of EIA, Participation in EIA, New concepts- Life cycle assessment.

[07 Hrs.]

UNIT – II :
Methods for impact assessment: Screening, Scoping, Base line studies, Check list, Mitigation, Matrices, Interaction of network methodologies, environmental setting various factors, environmental impact assessment methodology, documentation and selection process, environmental indices and indicators for describing affected environment.

[06 Hrs.]

UNIT – III :
Prediction and assessment of impact for air and noise environment: Basic information of air quality, identification of type and quantity of air pollutant, existing air quality and air quality standards, impact prediction and assessment, mitigation. Basic information of noise, existing noise levels and standards, prediction of noise levels and assessment of impact, mitigations.

[07 Hrs.]

UNIT – IV :
Prediction and assessment of impact for water and soil environment: Basic information of water quality (Surface water and ground water), water quality standards, identification of impact, prediction of impact and assessment, mitigations. Background information of soil environment, soil and ground water standards, prediction and assessment of impact for ground water and soil, mitigations.

[06 Hrs.]

UNIT – V :
Prediction and assessment of impact on cultural and socioeconomic environment:
Basic information on cultural resources, rules and regulations for cultural resources, Basic information of socioeconomic environment, description of existing socioeconomic environment, prediction and assessment of impact, mitigation, resettlement and rehabilitation.

[07 Hrs.]

UNIT – VI :
EIA notification by Ministry of Environment and Forest (Govt. of India): Provisions in the EIA notification, Categorization of Industries for seeking environmental clearance from concerned authorities, procedure for environmental clearance, procedure for conducting environmental impact assessment report, general structure of EIA document, Environmental management plan, post environmental monitoring. Case studies in EIA.

[06 Hrs.]

VI SEMESTER

CV1345	**OE II: Environmental Impact Assessment**			**L=3**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Book:

1. Anand Bal, An Introduction to Environmental Management, Himalaya Publishing House.
2. Canter L.W. 1977. Environmental Impact Assessment. McGraw Hill, Inc. Printed in the United States of America.
3. Peter Watten (Eds.) - `Environmental Impact Assessment Theory and Practice', Unwin Hyman, London (1988).

Reference Books:

1. John G. Rau and David C Hooten (Ed)., “Environmental Impact Analysis Handbook”, McGraw-Hill Book Company, 1990.
2. “Environmental Assessment Source book”, Vol. I, II & III. The World Bank, Washington, D.C., 1991.
3. Judith Petts, “Handbook of Environmental Impact Assessment Vol. I & II”, Blackwell Science, 1999.
4. Bass, Herson and K. Bogdon, 2001, The NEPA Book: A step-by-step guide on how to comply with the National Environmental Policy Act, Solano Press.
5. Shukla, S.K. and Srivastava, P.R., “Concepts in Environmental Impact Analysis”, Common Wealth Publishers, New Delhi, 1992.

VI SEMESTER

CV1314	**Seminar**			**L=0**	**T=0**	**P=2**	**CREDITS = 1**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	--	**--**	**40**	**60**		**100**	**--**

COURSE OBJECTIVES	**COURSE OUTCOMES**
1. To Recognize the principle of Information Literacy and its impact on research skills. 2. To aware students about importance of access to data, knowledge and results of scientific studies in Civil Engineering. 3. To promote and develop presentation skills and report Writing.	1. An ability to utilize technical resources. 2. An ability to understand information in detail for report writing. 3. An ability to write and present report of associated work effectively.
Mapped Program Outcomes: g, h, i, j	

The students are expected to deliver presentations related to the subjects of their choice. The topic of presentation will be related to Civil Engineering.

The evaluation will be based on the presentation skill and subject knowledge of the student.

VII SEMESTER

CV1401	Water Resources Engineering			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To know the importance, location, components and types of water resources structures. 2. To learn the procedure to design the water resources structures. 3. To get hand on experience in drawing of water resources structures.	1. An ability to understand water requirement for various crop pattern. 2. An ability to understand parameters and procedures adopted in reservoir planning 3. An ability to understand the design of water conveyance system like canal 4. An ability to understand the analysis and design of various water retaining structures like weirs and dams
Mapped Program Outcomes:a, c, e, f, g, h, i, k	

UNIT – 1 :
General: Irrigation, necessity, importance, benefits and ill effects of irrigation, types, methods of water distribution to the field.
Water requirement of crops : Crop seasons and major crops in India, crop rotation, suitability of soils for irrigation, standards of irrigation water, field capacity, wilting point, available moisture in soils for crops / plants, depth & frequency of irrigation, GCA, CCA, kor period, kor water depth, duty – delta relation, base period, outlet factor, PET-R method of crop water requirements.

[09 Hrs.]

UNIT – 2 :
Reservoir Planning: Selection of site for reservoirs, engineering surveys, geological and hydrological investigations, fixing of LWL, FTL/FRL, HFL, TBL, different storage zones in reservoirs, determination of storage capacity by mass curve method, reservoir sedimentation and its removal, life estimation of reservoir by Brunes method.

[08 Hrs.]

UNIT – 3 :
Canal Irrigation: types of irrigation canals, canal network, irrigation canals (cross section, longitudinal section and alignment), balancing depth, losses in canals
Canals In Alluvial Soils: Kennedy's silt theory – Design procedure, silt supporting capacity, drawbacks, Lacey's silt theory – definition of initial final and permanent regime channels, Lacey's Regime equations, channel design procedure, limitations
Lined Canals: design procedure, types of lining, relative merits and demerits of canal lining, economics of canal lining.

[09 Hrs.]

UNIT – 4 :
Diversion Head Works: Component parts of diversion headworks – fish ladder, divide wall, silt excluder and silt ejector, causes of failure of weirs on permeable foundation, Bligh's creep theory, Khosla's theory for design of weirs on permeable foundations

[08 Hrs.]

UNIT – 5 :
Introduction to Dams: Classification of dams, factors governing selection of type of dams
Gravity Dam: Definition; forces acting on gravity dam, stability requirements, theoretical & practical profile of gravity dam, low &high dam, galleries.

[09 Hrs.]

UNIT – 6 :
Earthen Dams: Types of earthen dams, failure of earthen dams, criteria for safety and design of earthen dam, seepage analysis, seepage control through embankment and foundation, stability analysis of slopes by swedish slips circle method, Spillways: Types of spillway only.

[09 Hrs.]

VII SEMESTER

CV1401	**Water Resources Engineering**			**L=3**	**T=1**	**P=0**	**CREDITS = 4**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. S.R. Sahastrabudhe, Irrigation Engineering and Hydraulic Structures, (1996), S.K. Kataria Publications New Delhi.
2. G.L. Asawa, Irrigation and Water Resources Engineering, 2005, New Age International Publishers, New Delhi.
3. Santosh Kumar Garg, Irrigation Engineering and Hydraulic Structures, 1998, Khanna Publisher New Delhi.
4. B.C. Punmia, Irrigation Engineering and Water power Engineering, 1993, Laxmi Publications, New Delhi.

Reference Books:

1. R.S. Varshney, S.C. Gupta, R.L. Gupta, Theory and Design of Irrigation Structures, Vol – II, 1979, Nem Chand & Bros. Publications Roorkee.
2. N.N. Basak, Irrigation Engineering, 1999, Tata McGraw-Hill Publications New Delhi.
3. S.K. Sharma, Principles and Practice of Irrigation Engineering, 1988, S. Chand Publications New Delhi.

VII SEMESTER

CV1402	Structural Analysis - II			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To develop an understanding, the basic principles of the matrix method of structural analysis	1 An ability to understand the matrix methods of structural analysis and its applications.
2. To analyze beam by flexibility method of structural analysis.	2 An ability to understand the flexibility matrix method and apply its application to beam structure.
3. To analyze structural elements (Beams, Frames, Trusses, etc.,) by stiffness method of structural analysis.	3 An ability to understand the stiffness matrix method and apply its application to pin jointed frame structure and beam structure.
4. To analyze non-prismatic structures (beams and frames) using column analogy method	4 An ability to understand the column analogy method and apply its application to beam and frame structure.
5. To analyze sway frames using moment distribution method.	5 An ability to understand the moment distribution method and apply its application to frames with sway.
6. To analyze multistoried frame structures using approximate methods	6 An ability to understand the approximate method of analysis and apply its application to multistoried frame structures
Mapped POs:- a, e, i, k, m	

UNIT – 1 :
Introduction to Flexibility Method, Analysis of Continuous Beam with and without Sinking of Supports with maximum **TWO** degree of Static Indeterminacy

[09 Hrs.]

UNIT – 2 :
Introduction to Stiffness Method, Development of Stiffness Matrix for Pin Jointed Structure, Analysis of Members for Temperature Loading, lack of fit and with Inclined Roller Support, Analysis of Pin Jointed Frame Structure with maximum **THREE** Degree of Kinematic Indeterminacy.

[09 Hrs.]

UNIT – 3 :
Development of Stiffness Matrix for a Beam Member without Axial Deformation, Analysis of Continuous Beam with and without Sinking of Support with maximum **THREE** Degree of Kinematic Indeterminacy.

[09 Hrs.]

UNIT – 4 :
Introduction to Column Analogy, Calculation of Stiffness Factors and Carryover Factor for Non-Prismatic Members, Analysis of Beams and Frame by Column Analogy Method

[09 Hrs.]

UNIT – 5 :
Moment Distribution Method Applied to Frames with Sway (upto Single Storey Two Bays)

[09 Hrs.]

UNIT – 6 :
Approximate Methods of Structural Analysis: Substitute Frame Method, Portal Frame Method, Cantilever Method, (maximum three bay three storey)

[08 Hrs.]

Text Books :

1. Pandit G.S and Gupta S.P, Structural Analysis (Matrix Approach), Tata McGraw-Hill Publishing company LTD, New Delhi. 27th Reprint 2006
2. C .S .Reddy, Basic structural Analysis, Tata McGraw Hill Publication, New Delhi .8th Edition
3. Timoshenko S.P. and D.H. Young; Theory of Structure, Tata Mc Graw Hill Publication, Delhi.2nd Edition
4. Gere and Weaver; Matrix Method of Structural Analysis, CBS Publication, 2004

Reference Books :

1. Bhavikatti S.S; Structural Analysis (volume II), Vikas publishing House LTD, Delhi, 2nd Edition (2011)
2. Meghre A.S. &Deshmukh S.K.; Matrix Method of Structural Analysis, Charotar publishing house, Anand, 1st Edition (2003).
3. P.N. Godbole, R.S. Sonparote, S.U. Dhote; Matrix Method of Structural Analysis, PHI Learning Pvt. Ltd, 2014 Edition.

VII SEMESTER

CV1403	Lab: Structural Analysis – II		L=0	T=0	P=2
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total
	--	--	**40**	**60**	**100**

COURSE OBJECTIVE	COURSE OUTCOME
1. To be able to analyze structural elements (Beams, Frames, Trusses, etc.,by matrix method of structural analysis. 2. To be able to analyse sway frames using moment distribution method. 3. To be able to analyse multistoried frame structures using approximate methods 4. To be able to develop models (Beam model, Plane truss model, Frame model) in the software package, apply the required properties, boundary conditions and forces in the developed models 5. To be able to execute the programme using standard software package without any error 6. To be able to understand the comparison of result between manual analysis and software analysis.	**1.**An ability to understand the effect of forces on structure. **2** An ability to develop and execute the Beam models in the software package without any error **3.** An ability to develop and execute the Plane truss models in the software package without any error **4.** An ability to develop and execute the Frame models in the software package without any error **5.** An ability to compare the result between hand calculation (manual analysis) and output result of the software. **6.** An ability to understand the application of software package and limitation of manual analysis
Mapped Program Outcomes: a, b, e, k, m:	

Any EIGHT, Analysis of Structures Using Standard Software Packages.

1. Analyze a **continuous beam** with maximum **two degree of static indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **Flexibility Matrix Method.** Conclude it from both the result.

2. Analyze a **continuous beam with sinking of support** with maximum **two degree of static indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **Flexibility Matrix Method.** Conclude it from both the result.

3. Analyze a **plane truss** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.

4. Analyze a **plane truss subjected to inclined roller support** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.

5. Analyze a **plane truss subjected to temperature effect and lack of fit** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.

6. Analyze a **continuous beam** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.

7. Analyze a **continuous beam with sinking of support** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.

8. Analyze a **rigid sway frame one bay one story** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **moment distribution method.** Conclude it from both the result.

VII SEMESTER

CV1403	Lab: Structural Analysis – II		L=0	T=0	P=2
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total
	--	--	40	60	100

9. Analyze a **rigid sway frame one bay one story with ONE leg incline** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **moment distribution method.** Conclude it from both the result.

10. Analyze a **rigid sway frame one bay one story with TWO leg incline** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **moment distribution method.** Conclude it from both the result.

11. Analyze a **multi storied frame structure** subjected to **vertical forces** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **substitute frame method.** Conclude it from both the result.

12. Analyze a **multi storied frame structure** subjected to **horizontal forces** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **cantilever method and portal frame method.** Conclude it from the result.

13. Analyze a **multi storied frame structure** subjected to **vertical and horizontal forces** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **approximate method.** Conclude it from the result.

Text Books:

1. Pandit G.S and Gupta S.P, **"Structural Analysis (Matrix Approach)"**, Tata McGraw-Hill Publishing company LTD, New Delhi. 27th reprint 2006

2. Meghre A.S. & Deshmukh S.K.; **"Matrix Method of Structural Analysis"**, Charotar publishing house, 1st edition (2003).

3. Gere and Weaver; **"Matrix Method of Structural Analysis",** CBS publication, 2004

Reference Books :

1. Bhavikatti S.S, **"Structural Analysis (volume II)",** Vikas publishing House LTD, Delhi, 2nd edition (2011)

2. Dr. S.R. Karve & Dr. V.L. Shah, **"Illustrated Design of Reinforced Concrete Buildings (Design of G+3 Storeyed Buildings + Earthquake Analysis & Design)",** Standard Publisher Distributors, 7th edition, 2014

VII SEMESTER

CV1422	Transportation Engineering – II			L=4	T=0	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To acquaint development of railway transportation in India. 2. To understand geometric design of railway tracks 3. To know zoning laws for development of air transportation in India 4. To study tunnel alignment and necessity of tunnels.	1. An ability to update and upgrade knowledge about transportation system in India 2. An ability to design railway tracks, crossings 3. An ability to avail information about development of air transportation in urban areas 4. An ability to understand the construction of tunnel and advances in tunneling
Mapped Program Outcomes: a, b, c, e, j, k, l,	

UNIT – 1 :
Railways: Transportation and its development, long term operative plans for Indian Railways, classification, lines and their track standards, Railway terminology, Administration & management, traction and tractive resistance, hauling capacity and tractive effort of locomotives, different types of tractions.

[08 Hrs.]

UNIT – 2 :
Permanent Way: Alignment surveys, requirement, gauges, track section, coning of wheels, stresses in railway track, high speed track, rail types and functions, selection for rails, test on rail wear & defects, corrugation and creep of rails, rail joints, short and long welded panels
Sleepers: Function, types, merits and demerits, sleeper density, ballast cushion, ballast section, rail fixtures and fasteners
Geometric design of railway track: Gauge, gradients, speed, super elevation, cant deficiency negative super elevation, curves, length of transition curves, grade compensation
Points and crossing: Left and right hand turnouts, turnouts & crossovers, railway track functions .

[09 Hrs.]

UNIT – 3 :
Station and Yards: Types, functions, facilities &equipments
Railway Signaling and interlocking: Objects and principles of signaling, classification and types of signals, control and movement of trains, track circulation, interlocking
railway track construction, inspection & modern techniques of maintenance, modern technology related to track & tractions, rolling stock, signaling & controlling

[09 Hrs.]

UNIT – 4 :
History of Air Transportation in India: Comparison with other transportation modes, aircraft components and characteristics, airport site selection, modern aircrafts
Airport obstructions: Zoning laws, imaginary surfaces, approach and turning zone, clear zone, vertical clearance for highway & railway
Runway And taxiway design: Windrose diagram, cross wind component, runway orientation and configuration, basic runway length and corrections, runway geometric design standards, taxiway layout and geometric design standards, exit taxiway.

[09 Hrs.]

UNIT-5:
Airport layout and classification: Terminal area, aircraft parking and parking systems, unit terminal concept, aprons, hangers, International airports layout, helipads and heliports
Visual Aids: Airport marking and lighting for runways, taxiways and other areas
Air traffic control: Need, networks, control aids, instrumented landing systems, advances in air traffic control

[08 Hrs.]

UNIT-6:
Tunnels: Alignment, surveys, cross section of highway & railway tunnels, tunneling methods in hard rock and soft grounds, tunnel lining, drainage, ventilation and lighting of tunnels, advances in tunneling techniques, tunnel boring machines, case studies.

[09 Hrs.]

VII SEMESTER

CV1422	**Transportation Engineering – II**			**L=4**	**T=0**	**P=0**	**CREDITS = 4**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

Text books:

1. A Text Book of Railway Engineering, S. C. Saxena and S. P. Arora, 2005, DhanpatRai Sons New Delhi.
2. Airport Planning and Design, S. K. Khanna, 1999,Nem Chand and Brothers, Roorkee.
3. Tunnel Engineering S.C. Saxena, 2012, DhanpatRai publication.

Reference books:

1. Textbook on Transportation Engineering, S. P. CHANDOLA, 200, S. Chand Publishers, New Delhi
2. Planning and Design ofAirports, Robert Horonjeff, Francis Mckelvey, William Sproule, Seth Young, Fifth Edition 2010, McGraw Hill Professionals.

VII SEMESTER

CV1441	Environmental Engineering – II			L=4	T=0	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVE	COURSE OUTCOMES
1. To study different methods of conveyance of sewage. 2. To study method of construction and maintenance of sewerage system. 3. To study treatment methods for sewage and industrial wastewater. 4. To study different causes of air pollution and methods to control it.	1. An ability to understand importance of effective collection and conveyance of sewage. 2. An ability to understand whole mechanism of construction and maintenance of sewerage system including house drainage system. 3. An ability to understand complete working of sewage treatment plant including difference with industrial wastewater treatment plant. 4. An ability to understand importance of air pollution control including methods to control it.
Mapped Program Outcomes: a, c, e, h, j,k	

UNIT – 1 :
Systems of sanitation: Conservancy and water carriage system. Patterns of sewage collection systems. Quantity of storm water and sanitary wastewater. Hydraulic Design of sewers - capacity, size, grade. Sewers – shapes and materials. Drains.

[08 Hrs.]

UNIT – 2 :
Sewer Appurtenances – manholes, street inlets, storm water overflows, inverted siphons, flushing and ventilation. Construction and Maintenance of sewers, equipment's for maintenance, safety equipment's. Sewage pumping.
House drainage systems, sanitary fitting and appliances, traps – function and types, anti-syphonage, inspection chambers. Storm water drainage.
Rain water harvesting for individual houses, Different Methods.

[09 Hrs.]

UNIT – 3 :
Characteristics of wastewater. Flow sheet of conventional sewage treatment plant.
Preliminary and primary treatment: Screens, Grit chambers, Primary settling tank. Design of bar screens, grit chambers and primary settling tanks**.**

[09 Hrs.]

UNIT – 4 :
Secondary Treatment: Principle of Biological Treatment. Activated sludge process, Trickling Filter – Concept, Functioning and Basic Load Calculations. Sludge digestion, Sludge drying beds.
Methods of disposal: Disposal on land and in water stream. Self-purification capacity of stream.

[08 Hrs.]

UNIT – 5 :
Rural sanitation: Pit Privy, Aqua Privy, Bio-gas Recovery, Eco-Sanitation. Septic tank including soak pit. Imhoff tanks.
Industrial Waste Water Treatment: Basic concepts of Industrial Waste Water Treatment, flow equalization, neutralization. Common treatment alternatives for industrial waste water.

[09 Hrs.]

UNIT – 6 :
Introduction to Air Pollution, Monitoring and Control. Meteorological Parameters. Monitoring methods. Techniques of air pollution control.

[09 Hrs.]

Text Books:
1. B.C. Punmia, Waste Water Engineering, Laxmi Publication
2. S.K. Garg, Environmental Engineering – Vol – II, Standard Publication
3. G.S. Birdie, Water Supply & Sanitary Engineering, Dhanpat Rai Pub Company
4. M.N. Rao & H.V.N. Rao, Air Pollution, McGraw Hill Publication.

Reference Books:
1. M.J. Machghee, Water Supply & Sewage, McGraw Hill Publication.

VII SEMESTER

CV1442	Lab: Computer Application in Civil Engineering			L=0	T=0	P= 2	CREDITS = 1
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	--	--	40	60		100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1. To translate numerical methods into simple, reusable program modules 2. To choose appropriate numerical methods for solutions to specific mathematical problems 3. To analyze the applicability and accuracy of numerical solutions to specific mathematical problems 4. To synthesize multiple program modules into larger program packages 5. To distill numerical results into a readable format that answers specific civil engineering analysis and design questions	1. An ability to understand the basic concepts of C Programming language. 2. An ability to develop computer programs for the solution of Civil Engineering problems. 3. An ability to translate numerical meyhods into simple, reusable program modules. 4. An ability to develop good technical reporting and data presentation skills.
Mapped Program Outcomes:: a,f,g,i,k,l	

At least **TEN** assignments are to be submitted on following topics using '**C Programming Language'**.

1. Determination of Bending Moment. Deflections for different loading conditions for a Simply Supported Beam and Cantilever Beam. Determination of fixed end moments for different loading conditions of a fixed beam.
2. Determination of Water demand, empirical formulae, variation in demand, design of period and population forecasting methods.
3. Determination of coefficient of permeability, Degree of Consolidation and Shear Strength. Estimation of Settlement of foundations in Cohesive Soil, Stability Analysis of Slopes. Estimation of Earth Pressures in Cohesive and Cohesionless soils.
4. Computation of water surface profiles in open channel flows. Estimation of Friction factor for Laminar and Turbulent flows, Minor losses in pipe flow. Application of problems in Hydraulics such as Hardy cross method in the Analysis of pipe network,
5. Geometric design of roads, stopping and overtaking distances, design of super-elevation, design of summit and valley curves, Horizontal and vertical curves.
6. Design of Slabs using I.S. Code method. Analysis and Design of Beams using Limit state method. Design of columns subjected to axial load and Uni-axial Moment. Design of Isolated Footing. Design of rolled steel columns, built up columns, Beams and built up Beams.
7. Interpolation & extrapolation methods, Solution of non Linear Equations (Newton Raphson Schemes), Solution of Linear Algebric Equations, Gauss Elimination method.
8. Numerical Integration (Simpson's method, Trapezoidal method) , Initial & Two point boundary value problem , Euler's Runge-kutta,Milnes etc.

Text Books:

1. Yeshwant Kanetkar, LET US C, BPB Publications.
2. S.K. Parikh, Computer Applications in Civil Engineering, Tata McGraw Hill, New Delhi.
3. M. K. Jain, Numerical Methods, New Age International.

VII SEMESTER

CV1410	PE II: Traffic Engineering			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the calculations of spot speed, journey time & running time. 2. To understand the different statistical methods such as Binomial, Normal Poission, Chisquare to know the probabilities at various levels. 3. To study the analysis and designs of rotary intersections 4. To study different traffic signs, methods of design of traffic signal, Queingtheory. 5. To study causes and remedial measures of accidents, analysis of accident data. 6. To study the methods and design of parking.	1. An ability to understand different methods for measurement of spot speed, journey speed & running speed, 2. An ability to understand different statistical methods which can be used in various analyses of traffic studies. 3. An ability to understand design rotary intersection in field. 4. An ability to understand design of signals at various intersections considering practical problems. 5. An ability to understand Accident Reduction through analyses of accident data. 6. An ability to understand design the on and off street parking for different situations.
Mapped Program Outcomes: a, b, c, d, e, h, i, j	

UNIT – 1 :
General: Road, road user &road vehicle characteristics.
Traffic Surveys: speed, journey time and delay studies, methods of measurement of spot speed, measurements of running and journey speeds, highway capacity, level of service. **[07 Hrs.]**

UNIT – 2 :
Traffic Events: Statistical method for interpretation, regression, application of binomial normal and Poisson's distributions, test of significance–Chi-square &'T' test **[07 Hrs.]**

UNIT – 3 :
Road geometry: Hierarchy of urban roads and their standards, diverging, merging, crossing, weaving, maneuver's and conflict points, types of road junction, traffic rotary design, drive ways. **[06 Hrs.]**

UNIT – 4 :
Traffic controlling devices: Traffic signs, traffic signals, design of signalized intersections & signalling systems, Queingtheory. **[06 Hrs.]**

UNIT – 5 :
Traffic Safety: Driver's error, collection and interpretation of accident data and recording in standard Format, speed and weather effects on accidents, analysis of accidents, pedestrian, 3E's of traffic management **[07 Hrs.]**

UNIT – 6 :
Parking: Parking surveys, on and off-street parking & parking systems, parking demand, design of off-street parking lot, underground & multi-storeyed parking, **[06 Hrs.]**

Text books:

1. Highway Engineering, Khanna S.K. and Justo C.E.G., 1991, Nem Chand & Bros.
2. Traffic engineering and transportation planning, Kadiyali, Khanna Publications, 1987
3. Transportation Engineering: An Introduction, C. JotinKhisty , B. Kent Lall
4. Transportation Engineering and Planning ,C.S. Papacostas, P.D. Prevedouros

Reference books:

1. Highway Engineering, Rangawala B.S. Charotar Publishing House, 2011
2. IRC Handbook and MOST Specifications, Indian Road Congress, 2012

Reference books:

3. Highway Engineering, Rangawala B.S. Charotar Publishing House, 2011
4. IRC Handbook and MOST Specifications, Indian Road Congress, 2012

VII SEMESTER

CV1411	PE II : Advanced Hydraulics			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
The students will learn the:- 1. Concept of uniform flow and critical flow in open channels. 2. Concept of gradually varied flow profile in open channels. 3. Computation of length of gradually varied flow by various method 4. Concept of rigid water column theory and time of flow establishment. 5. Concept of elastic water column theory and water hammer in pipe. 6. Importance of surge tanks in pipe systems.	1. An ability to understand the concept of uniform flow and critical flow in open channels 2. An ability to understand the concept of gradually varied flow profile in open channels 3. An ability to understand the computation of length of gradually varied flow by various method 4. An ability to understand the concept of rigid water column theory and time of flow establishment 5. An ability to understand the concept of elastic water column theory and water hammer in pipe. 6. An ability to understand the importance of surge tanks in pipe systems.
Mapped Program Outcomes:a, c, e & k	

UNIT – 1 :
Uniform flow, Critical flow, wide rectangular channel, conveyance of channel, section factor, Hydraulic exponent M & N. [06 hrs.]

UNIT – 2 :
Basic equation of GVF, Dynamic equation of GVF in terms of normal depth & critical depth, conveyance K & section factor Z, hydraulic exponent M & N Channel transitions for subcritical and supercritical flow: hump in channel, reduction in channel width, chocking conditions in channel. [07 hrs.]

UNIT – 3 :
Gradually varied flow, channel slope, back water curve, dropdown curve. characteristic of GVF profiles, break in grade, composite GVF profiles, Various gradually varied flow profiles in channel. [06hrs.].

UNIT – 4 :
Computation of gradually varied flow length in channel, direct step method, Bresse's method, Chow's method.
[06 hrs.]

UNIT – 5 :
Unsteady flow in a pipe, Bernoulli's Equation of unsteady flow in a pipeline for incompressible fluid flow, Time flow establishment, rigid water column theory of water hammer , computation of water hammer pressures. [07 hrs.]

UNIT – 6 :
Elastic water column theory, Bernoulli's equation of motion when compressibility of fluid and elasticity of pipe is considered, continuity equation, Computation of water hammer pressure, Allievis theory for water hammer pressure, Surge tank.
[07 hrs.]

Text Books:
1. Ven Te Chow, Open channel hydraulics, International Student Edition, 1959, McGraw Hill Publications.
2. Narasimhan S., Engineering Fluid Mechanics, Vol. II, Edition 1981, Orient Longman Publication.

Reference Books:
1. RangaRaju K.G., Flow through open channels, 1998, Tata McGraw Hill Publications.
2. Subramanya K., Flow in open channels, 2009, Tata McGraw Hill Publications.
3. U.S. Department of the interior, Bureau of reclamation, U.S.B.R. Earthen Dams, 1998, United States Government Printing Office.

VII SEMESTER

CV1413	PE II: Natural Resources Management			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. To Study the state of natural resources , their challenges , opportunities and prospects for sustainable development 2. To study the various resources and related governance. 3. To study the methodologies and adaptation programmes for conservation of resources. 4. To develop the understanding about social aspect of civil engineering students.	1..An ability to solve important natural resource management problems. 2.An ability to describe planning and responsibilities taken by professional authorities. 3. An ability to understand laws, policies & practice implementation for private and public resource owners and users. 4 An ability to work on multiple environmental issues for a sustainability.
Mapped Program Outcomes:a, d, f, h, i, j	

UNIT – 1 :
Introduction to Natural Resource Bases:
Concept of resource, classification of natural resources, Factors influencing resource availability, distribution and uses. Forest resources, Land resources, Food resources, Mineral Resources Marine Resources.

[06 Hrs.]

UNIT – 2 :
Overview of policies & Governance of Natural Resources: National Environment Policy of 2004, National Conservation Policy, National Action Plan on Climate Change of 2008, Environmental Protection Act.

[07 Hrs.]

UNIT – 3 :
Renewable and Non Renewable Energy
Rural energy/Biomass to energy: Wood energy/ fuel wood use, Biochemical conversion, sources of energy generation, agro residues, anaerobic digestion and biogas production, thermo-chemical conversions, gasification and types of gasifiers, ethanol, Bio-diesel.

[06 Hrs.]

UNIT – 4 :
Programmes for NRM
Rural development programmes, Rural Livelihood Programmes, Welfare Programmes, Environmental Impact Assessment (EIA), Social Impact Assessment (SIA), Human Development Index (HDI), Environmental Clearance Programme, Environmental Management Plan.

[07 Hrs.]

UNIT – 5 :
Sustainable Natural Resources Management and Development:
Industrialization, Infrastructure development, globalization, urbanization and privatization, sustainability of modern developments Applications and case studies in NRM: Coastal zone management, disaster management.

[07 Hrs.]

UNIT – 6 :
Climate change and carbon trading, watershed management, wetland management, Urban Forestry, Biodiversity, migration & Rehabitations, Urban poverty and livelihood. Environmental problems in urbanizing world.

[06 Hrs.]

Text Books :
1. Tom Tietenberg and lynne lewis, 2013, Environmental and natural resource economics, Pearson education incorporation, publishing as Addison-wesley
2. Knight, Richard L., editor, et al. 1995. A New Century for Natural Resources Management. Island Press.

Reference Books :
1. Francois Ramade 1984. Ecology of Natural Resources. John Wiley & Sons Ltd.
2. Singh, Rajvir. 2000. Watershed Planning and Management
3. Harris, J.M. 2006. Environmental and Natural Resource Economics: A Contemporary Approach, 2ndedition. Houghton Mifflin

VII SEMESTER

CV1443	PE II: Optimization Techniques			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	**15**	**10**	**60**	**100**		**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide the students the concepts of understand the need and origin of the optimization methods. 2. To provide the students the knowledge of various optimization methods and their applications in engineering. 3. To provide the students the knowledge of formulation of optimization problems.	1. An ability to understand the need of optimization techniques in engineering. 2. An ability to understand the various optimization techniques used in engineering design. 3. An ability to apply the optimization techniques and formulate the optimization problems in engineering.
Mapped Program Outcomes: a, c, e, k,	

UNIT – 1 :
Introduction, types of optimization problems, Statement of the problem, design vector, constraints, objective function. Classification of optimization problems.

[06 Hrs.]

UNIT – 2 :
Formulation of some structural problems as programming problems like Minimum weight and optimum cost considerations in Structural design, Minimum weight design of Trusses and Frames based on elastic and limit state criteria Optimum reinforcement design of reinforced and prestressed concrete beams and slabs.

[07 Hrs.]

UNIT – 3 :
Classical optimisation techniques: Single variable optimisation, multivariable optimisation, with no constraints. Multivariable optimisation with equality and the inequality constraints.

[06 Hrs.]

UNIT – 4 :
Linear Programming :
Introduction, Standard form of the problem, feasible, basic and optimal solution,Canonical form of system of equations.
Simplex method - Algorithm, two phases of the method, Identifying an optimal point, unbounded solution, degenerate solution.

[07 Hrs.]

UNIT – 5 :
Non - Linear Programming:
One dimensional minimization: Introduction, Unimodal function.
Elimination methods-Various search methods, Fibonacci and Golden section methods.

[06 Hrs.]

UNIT – 6 :
Non - Linear Programming:
Unconstrained Optimization Techniques: Introduction, Direct Search methods-Random search, Univariate method. Descent methods-Steepest descent method, Conjugate gradient method, Variable metric method.

[07 Hrs.]

Text Books :
1. Rao S.S, Engineering Optimization: Theory and Practice, New Age International (P) Ltd., New Delhi.
2. Arora J S., Introduction to Optimum Design, McGraw Hill.

Reference Books :
1. Fox R. L, Principles of Operation Research, Prentice Hall of India.
2. Wagner H.M., Principles of Operation Research, Prentice Hall of India
3. Stephen G. and Ariela Sofer Nash, Linear And Nonlinear Programming, McGraw Hill Book.Co.
4. Deb, K., Optimization for Engineering Design of Algorithms and Examples, Prentice-Hall of India Pvt. Ltd., New Delhi
5. Bhavikatti S.S., Structural optimization using sequential linear programming, Vikas publishing house, New Delhi

VII SEMESTER

CV1444	PE II Structural Dynamics			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 hours**

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students clear and thorough understanding of modeling of discrete single-degree and multiple-degree vibratory systems and calculate the free and forced response of these systems. 2. To provide the students clear and thorough understanding of Calculation of the mode shapes and frequencies for the free response of continuous vibratory systems and use modal methods to calculate the forced response of these systems. 3. To provide the students understanding of modeling continuous vibratory systems – vibration of strings, axial and torsional vibration of bars and beams. 4. To provide the student with a basic understanding of IS codes related to earthquake loading.	1. An ability to apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response. 2. Ability to identify, formulate and solve engineering problems having motions varying with time. This will be accomplished by having students model, analyze and modify a vibratory structure, in order to achieve specified requirements. 3. Understanding professional and ethical responsibilities. This will be accomplished by emphasizing the importance of understanding how structural vibrations may affect safety and reliability of engineering systems. 4. An ability to Understand IS codes related to earthquake loading.
Mapped Program Outcomes: a, e, f	

UNIT – 1 :
Introduction to structural dynamics, types of prescribed loadings, formulation of equations of motion
Single-Degree-of-Freedom (SDOF) System: Application of Newton's law to lumped parameter model, d' Alembert's principle, torsional vibration, undamped systems, free vibrations, general solution, numerical examples
[06 Hrs.]

UNIT – 2 :
SDOF system: damped free vibrations, damping coefficient, experimental determination of fundamental frequency and damping coefficient, general solution, numerical examples.
[07 Hrs.]

UNIT – 3 :
SDOF system: forced vibrations, equation of motion, harmonic load, periodic load,
resonance, vibration isolation, force transmissibility and base motion, numerical examples.
[06 Hrs.]

UNIT – 4 :
SDOF system: General load, impulse load, Duhamel integration, Runge-Kutta method, central difference method, dynamic relaxation, numerical examples
[07 Hrs.]

UNIT – 5 :
Two and three DOF systems: equations of motion, natural frequencies, introduction to mode superposition, numerical examples.
[07 Hrs.]

UNIT – 6 :
Introduction to earthquake engineering, response spectra, response of SDOF systems to earthquake excitation, numerical examples
[06 Hrs.]

Text Books:
1. J. M. Biggs, Introduction to structural Dynamics, McGraw-Hill, NY, 1964.
2. M. Paz and W. Leigh, Structural Dynamics - Theory and Computations, 5th Edition,2004
3. R. W. Clough and J. Penzien, Dynamics of Structures, McGraw-Hill, Singapore, 2003.

Reference Books:
1. R. R. Craig, Structural Dynamics – An Introduction to Computer Methods, J. Wiley & Sons, 1981.
2. L. Meirovitch, Elements of Vibration Analysis, 2nd edition, McGraw-Hill, Singapore, 1986.
3. A. K. Chopra, Dynamics of Structures – Theory and Applications to Earthquake Engineering, Prentice Hall. 2009.
4. J.L. Humar, Dyamics of structures, McGraw Hill, 1993

VII SEMESTER

CV1445	PE II : Soil Dynamics			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study vibration fundamentals. 2. Understand Dynamics Soil Properties. 3. Analysis and design of Machine Foundations.	Students will be able to understand the 1. Vibration theory. 2. Dynamic soil properties. 3. Analysis and design of Machine Foundations.
Mapped Program Outcomes: a, c, e, h, l	

UNIT – 1 :
Introduction :- Nature and types of dynamic loading; Importance of soil dynamics, Elastic properties of soils, applicability of Hook's law to soils, elastic constants of soil and their determination, Coefficient of elastic uniform compression and shear, cyclic plate load test.

[06 Hrs.]

UNIT – 2 :
Vibration theory :- Vibration of elementary systems; Degrees of freedom; Equation of motion for SDOF system; Types of vibrations; theory of forced & free vibrations; natural frequency, resonance, effect of soil inertia on forced vertical vibration of foundation, undamped and damped free vibrations; Torsional vibrations; Critical damping; Decay of motion; undamped and damped forced vibrations; Constant force and rotating mass oscillators, impact and other types of forced vibrations, Vibration isolation; Vibration measuring instruments.

[07 Hrs.]

UNIT – 3 :
Dynamic Soil Properties Stresses in soil element; Determination of dynamic soil properties; Field tests; Laboratory tests; Stress-strain behaviour of cyclically loaded soils; Estimation of shear modulus; Damping ratio; Linear, equivalent-linear and non-linear models; Ranges and applications of dynamic soil tests; Liquefaction: Simplified procedure for liquefaction estimation, Factor of safety.

[06 Hrs.]

UNIT – 4 :
Wave Propagation in soils: Longitudinal and torsional waves in infinitely long rod; Solution for one-dimensional and three-dimensional equations of motion; Waves in semi-infinite body; Waves in layered medium; Earthquake waves – P-wave, S-wave, Rayleigh wave and Love wave; Locating earthquake's epicenter.

[06 Hrs.]

UNIT – 5 :
Machine Foundations: Types of machines; Basic design criteria; Methods of analysis; Mass-Spring-Dashpot model; Elastic-Half-Space theory; Tschebotarioff's reduced natural frequency method; Types of foundations; Modes of vibrations; Vertical, sliding, torsional (yawing) and rocking (and pitching) modes of oscillations; Design guidelines as per codes; Typical design problems.

[07 Hrs.]

UNIT – 6 :
Dynamic Soil-Structure Interaction: Dynamic earth pressures; Force and displacement based analysis; Pseudo-static and Pseudo-dynamic analysis; Guidelines of various design codes; Dynamic analyses of various geotechnical structures like retaining wall, soil slope, railway subgrade and ballast.

[06 Hrs.]

Text Books:
1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books:
1. Design Aids in Soil Mechanics and Foundation Engineering, 1988, Kaniraj R., McGraw Hill New Delhi.
2. Analysis and Design of Foundations and Retaining Structures, 1979, Shamsher Prakash, Gopoal Ranjan and Swami Sharan, Sarita Prakashan.
3. Theory and Practice of Foundation Design, 2004, Som N.N. & Das S.C., Prentice Hall and co New Delhi.
4. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.

VII SEMESTER

CV1459	Computer Application in Civil Engineering	L=3	T=0	P=0	CREDITS = 3

Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration
	15	15	10	60	100	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
1. To impart the knowledge of C programming language 2. To develop computer programs for the solution of Civil Engineering problems. 3. To provide the knowledge of various numerical with their applicability and accuracy to specific mathematical problems 4. To translate numerical methods into simple, reusable program modules.	1. An ability to understand the basic concepts of C Programming language 2. An ability to develop computer programs for the solution of Civil Engineering problems . 3. An ability to translate numerical methods into simple, reusable program modules 4. To develop good technical understanding & application.
Mapped Program Outcomes: a, f, g, i, k, l	

UNIT –I

Introduction : C-Fundamentals , character set data type constant and variables , Declaration of constants & variables , Expression, Statements , Symbolic constants.Operator and Expression , Arthmetic operator , Unary operator , Relation and Logical operator , Assignment operators,the conditional operator,Library functions.Data input & output.

[6Hrs]

UNIT -II

Control Statements :-Control statement , the WHILE statements , do-while , for nested loop , if –else , switch break, continue , goto statement .

[07 Hrs.]

UNIT –III

Advance Topics :-Functions , Storage class , Arrays , Pointers , structures and Unions, Data files, File Handling .

[06 Hrs.]

UNIT-IV

Fundamental of Numerical Methods, Interpolation & extrapolation. Numerical Integration (Simpsons method , Trapezoidal method , Newtons Gauss Quadrature method) , Interactive Computer Program Development.

[07 Hrs.]

UNIT-V:

Computer programme based on Transportation Engineering,Geotechnical Engineering, Hydraulic Engineering, Irrigation Engineering, Surveying, Estimating & costing.

[06 Hrs.]

UNIT-VI

Computer programme based on Structural analysis, Structural Design,Environmental Engineering, Matrix algebra , Solution techniques.

[07 Hrs.]

Text books:

SN	Title	Edition	Authors
1	LET US C, BPB Publications.	15th Edition 2016	Yeshwant Kanetkar,
2	Computer Applications in Civil Engineering,	1th Edition 2012	V.K.Singhal
3	Numerical Methods, New Age International.	2th Edition 1996	M. K. Jain

Reference books:-

SN	Title	Edition	Authors	Publications
1	C programming language	2th Edition 1996	Dennis Ritchie	Pearson
2	C: The Complete Reference	4th Edititon 2017	Herbert Schildt	Mc Graw Hill

VII SEMESTER

CV1406	Industrial Training / CRT	L=3	T=0	P=4	CREDITS = 3

Evaluation Scheme	MSE – I	MSE – II	TA	ESE	TOTAL	ESE Duration
	--	--	--	--	100	--

COURSE OBJECTIVE	COURSE OUTCOMES
1) To get information about latest methodologies and techniques used in the field of civil engineering. 2) To understand current practices adopted in construction management.	1) An ability to prepare detail notes and reports. 2) An ability to communicate effectively.
Mapped Program Outcomes: d,g,i,j,k	

Student would be required to undergo a practical training for two months during the summer vacation after 6th semester. They would submit a report about the same and also make the presentation for evaluation.

VII SEMESTER

CV1407	**Project - Phase I**			**L= 0**	**T= 0**	**P= 4**	**CREDITS = 4**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	---	**----**	**40**	**60**		**100**	**---**

COURSE OBJECTIVES	**COURSE OUTCOME**
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning.	1. An ability to apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning.
2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data.	2. An ability to designed a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data.
3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively.	3. An ability to work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively.
4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.	4. An ability to apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.
5. To analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	5. An ability to analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.
Mapped Program Outcomes: a,b,c,d, e,f, g,h, I,,j, k,l,m,n	

Project will be allotted to a group of students, (preferably not more than 06) as per their choice and previous scores. The project work will be carried out by the students as directed by their guides. Evaluation will be done by continuous assessment and will be based on involvement of the student in the work.

VIII SEMESTER

CV1421	Estimating and Costing			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the importance of subject and definition involved in the estimation of various structures. 2. To understand the estimates of buildings (Load bearing and framed structure) culverts, Hydraulic structures water supply and sanitary works etc. 3. Earthwork estimates in road, hill roads and canals. 4. Detail estimates of steel in RCC works with bar bending schedule. 5. To understand the procedure of submitting the tenders and types of contracts. 6. To understand the writing and developing detailed specification of items and finding out quantities of various materials in different items. 7. To understand the concept of valuation, methods of valuation and rent fixation. 8. To understand the methods of accounting	1. An ability to understand the definitions in estimates of structures. 2. An ability to develop the specifications and find out the quantities of materials in different items to prepare the estimate 3. An ability to workout the valuation and rent of civil engineering structures 4. An ability to do accounting 5. An ability to workout the estimate and costing of building, road, hydraulic structures etc. [Field problems] 6. An ability to fill the tenders and carry out the construction of civil engineering structures
Mapped Program Outcomes: a, b, c, d, e, f, j, l, n	

UNIT – 1 :
General: Importance of the subject, purpose of quantity estimates, mode and unit of measurement as per I.S.1200, methods and stages of estimates, items of a work and their description, approximate estimation of Civil engineering works.
Proposal and Development of Project: Project Management Consultant & their role, various important terminologies required like work charged establishment, muster roll, contingencies, percentage charges, measurement book, overheads etc**.**

[09 Hrs.]

UNIT – 2 :
Specifications: Purpose and principles of specifications, types of specifications, writing and developing detailed specifications of important items.
Cost Build up: Purpose and principles, importance of Schedule of rates (CSR) in cost estimates, factors affecting analysis of rates, information from National Building Organization, task work, factors affecting task work, market rates, escalation.

[08 Hrs.]

UNIT – 3 :
Valuation: Purpose of valuation, factors affecting value of property price and cost, market value, potential value, sentimental value, scrap value etc. real estate, guide edged securities, net and gross return, tenure of land, valuation of land, free hold and leasehold, sinking fund, depreciation, capitalized value, methods of valuation, differed annuity, time cost relationship, valuation table and rent fixation.

[09 Hrs.]

UNIT – 4 :
Cost Accounting: Various methods, classification of cost, direct and indirect charges, distribution of overheads, M.A.S. Account, issue rates and store account. Earthwork estimates in road, hill roads and canals. Mass excavation and mass haul curves

[08 Hrs.]

UNIT – 5 :
Quantity and cost estimates: Methods of detailed estimates, forms used for detailed estimates, working out the quantities of various materials required for construction of different Civil Engineering works like building, road works etc., detailed estimates of steel in RCC works, bar bending schedule.

[09 Hrs.]

VIII SEMESTER

CV1421	Estimating and Costing			L=3	T=1	P=0	CREDITS = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 HOURS**

UNIT – 6 :

Arranging Works : Construction agencies, method of carrying out works, arranging contract works, pretender and contract planning, tender notice, acceptance of tender, essentials of contract, types of contracts, conditions of contract, contract documents, various schedules in the tender document, measurement and payment to contractor, arbitration

[09 Hrs.]

Text books:

1. Estimating, Costing, Specification & valuation in Civil Engineering, Chakraborti M. UBS Publication, Calcutta, 2010

Reference books:

1. Estimating & Costing, Chandola S.P. &Vazirani V.N, Khanna Publishers 2-B, Nath market, Naisarak, Delhi, 2010
2. Estimating & Costing in civil Engineering, Dutta B.N, UBS Publishers distributors ltd., 5 Ansari road, New Delhi, February 1999
3. Estimating, Costing and valuation, Rangwala S.C, Charotar Publishing house, opposite Amul diary, court road, Anand, 2011

VIII SEMESTER

CV1446	PE III - New Engineering Materials			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. Understand various civil engineering materials. 2. Understand various methods of testing of materials. 3. Understanding and use of various codes related to the civil engineering materials.	1. An ability to understand different high quality materials for Civil Engineering applications 2. An ability to use engineering materials for better and durable Civil Engineering Structures 3. An ability to utilize bionondegradbale materials for Civil Engineers 4. An ability to understand the use of Composite sections for effective utilization of materials
Mapped Program Outcomes: h, j, k	

UNIT – 1 :
Steel fiber reinforced concrete, Properties, Aspect ratio, strength and durability.
Fiber reinforced plastics, other types of fibers and their applications.

[07 Hrs.]

UNIT – 2 :
Light weight concrete, Ferro cement concrete, their types, foam concrete, workability, durability and composition, application.

[07 Hrs.]

UNIT – 3 :
Fly ash blended concrete, replacement procedures, effect of admixtures, adhesives, bond strength, durability, applications.

[06 Hrs.]

UNIT – 4 :
High-grade concrete, high strength performance concrete, tremieconcrete.

[06 Hrs.]

UNIT – 5 :
New engineering materials like light weight steel profile, aluminium profiles, pressed steel sections.

[06 Hrs.]

UNIT – 6 :
Introduction to steel concrete composite including infill, encased sections, properties of shear connectors, use of IS:11384, IRC 220.

[07 Hrs.]

Text Books:
1. Properties of Concrete, Neville A. M., Pearson Education Limited
2. Special Concretes, Rafatsiddhequi, Galgotia Publications
3. Concrete Technology, M Gambhir, Tata Mcgraw Hill Education Private Limited.

Reference Books:
1. Mehta P, Concrete Technology, Tata Mcgraw Hill Education Private Limited.
2. Shetty M. S, Concrete Technology, S. Chand Publisher.

VIII SEMESTER

CV1447	PE III: Advanced R.C.C.			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. Understand different methods design of specialized RCC structures. 2. Understand different methods of bridge design. 3. Understand design methods of water tank, 4. Understand design methods of retaining walls. 5. Understand design methods of multistoried building	1. An ability to understand the importance of various structures like multistoried buildings, bridges, water tanks and retaining walls. 2. An ability to analyse the structures for various types of loading conditions as per Codal provisions 3. An ability to design various structures such as bridges, tanks, and retaining walls.
Mapped Program Outcomes: a, c, e, l,	

UNIT – 1 :
Design of circular and rectangular water tanks resting on ground.
Design of overhead service reservoirs. Analysis and design of staging by cantilever method including wind forces as per relevant IS codes. Design of foundation- Annular raft, Full raft.

[10 Hrs.]

UNIT – 2 :
Design of flat slab, Grid slab, design for cutouts in slab. Introduction to design of bridge deck slab for IRC loadings.

[09 Hrs.]

UNIT – 3 :
Design of building frames up to two bay/four story, including design of foundation. Using Limit state Method including effect of lateral loads. Introduction to ductile detailing & provisions of IS 13920.

[10 Hrs.]

UNIT – 4 :
Design of retaining walls–cantilever and counterfort. Introduction to reinforced earth retaining wall.

[10 Hrs.]

Text Books:
1. Dr. S.S. Bhavikatti, Advance R.C.C. Design Volume II, New Age international (p) limitedpublishers NEW DELHI. 1st Edition
2. N. Krishana Raju, Advanced concrete structures, CBS Publishers and Distributors NewDelhi.2nd Edition-
3. T.R. Jagadeesh, M.A. Jayaram, Design of bridge strucures, prentice Hall of India private limited , M-97 connaught circus New Delhi 1stEdition
4. George Verghese, Advanced RCC, Prentice-Hall of India Pvt. ltd New Delhi-2nd Edition

Reference Books:
1. Jain and Jaikrishana, Plain and Reinforced Concrete Structures Vol-II., Indian Standards Institution. New Delhi.-2nd Edition
2. Johnson & Victor, Essentials of Bridge Engineering, IBH Publishing Co. Pvt. Ltd., New Delhi. Sixth edition
3. A K. Jain, -Reinforced Concrete Structures-published by Laxmi publication private limited, 22 Golden house, Daryaganj, New Delhi- 3rd Edition
4. Dr. V.L. Shah, Dr. S.R. Karve-structures publications Jal Tarang, 36 parvati pune411009, 5th Edition

VIII SEMESTER

CV1448	PE III: Remote Sensing & GIS			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. Understanding the Geoinformatics approach 2. Teach fundamental principles involved in RS and GIS 3. Understand the Fundamentals of Remote sensing Products 4. Know the Indian Remote Sensing Program 5. Role of Remote Sensing for various surveys and information extraction 6. Know about different software available in RS and GIS 7. Learn fundamental procedures in RS and GIS 8. Teach data integration and defining problems in digital format	The students should be able to 1. Identify, describe and explain the fundamental of principles of aerial photography and remote sensing. 2. Apply the basics of raster and vector data formats and able to interpret it. 3. Asses and compare spatial and non-spatial data, projection system, topology, geo referencing while using remote sensing data. 4. Collect logical information and apply digital image processing for supervised/un-supervised classification of given data
Mapped Program Outcomes: d, e, j,	

UNIT – I :
Definition and scope of remote sensing: electromagnetic energy and its wavelengths. Remote sensing systems, sensors and scanners, resolution of sensors, multi-spectral, thermal and radar scanners, radiometers spectral response curve and spectral signatures

[06 Hrs.]

UNIT – II :
Elements of sensing system: Terrestrial, airborne and space borne platforms, Sun-synchronous and geostationary satellites, advantages and disadvantages. Various earth Resources satellites, Indian remote sensing program. Remote-sensing data products and their types: analogues and digital data formats, Thermal and radar imageries.

[07 Hrs.]

UNIT – III :
Interpretation techniques: Elements of interpretation and methods, interpretation key, interpretation instruments. Relief displacement, image parallax and vertical exaggeration, Determination and calculation of elevation from RS data

[07 Hrs.]

UNIT – IV :
Digital image processing: image rectification and restoration, image enhancement-contrast manipulations, spatial feature manipulation, multi-image manipulation, image classification supervised and unsupervised classification, accuracy assessments and data merging.

[07 Hrs.]

UNIT – V :
Geographical Information System: Raster and vector data, concepts and basic characteristics of vectorization, topology generation, attribute data attachment, editing and analysis. Global Positioning System: Introduction to Global Positioning System (GPS) - Fundamental concepts, GPS system elements and signals, Classification of GPS receivers.

[06 Hrs.]

UNIT – VI :
Applications: Integrated approach of RS and GIS application: Application in Geological Investigations, water resources management, environmental studies, EIA based studies, Land use planning, soil studies and transportation planning. Application in civil engineering projects damns and bridges, site investigations, landslide studies.

[06 Hrs.]

Text Books:
1. Remote sensing Geology: Ravi P Gupta, Springer publication
2. Remote sensing and GIS: Anji Reddy ISBN publication.
3. Remote Sensing: Sabins, Floyd F
4. Higher surveying volume III: Dr B C Punmia

Reference Books:-
1. Concepts and Techniques of GIS 2005 C.P. Lo Albert PHI Learning
2. Remote Sensing Of the Environment – An Earth Resource Perspective 2004 John R. Jensen Pearson Education.

VIII SEMESTER

CV1449	PE III-Earth & Earth Retaining Structures			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. Students are expected to analyze and design rigid, flexible earth retaining structures, 2. To learn sheet piles and bulk heads. 3. To get knowledge of embankments, cofferdams and braced cuts.	1. Students will be able to analyze and design rigid, flexible earth retaining structures. 2. Students will be able to carry out stress analysis of sheet piles and bulk heads. 3. Students will understand the basics of compacted embankments, cofferdams and braced cuts.
Mapped Program Outcomes: a, b, c, d	

UNIT – 1 :
Earth Pressure on retaining wall
Rankine's and Coulomb's theories of earth pressure Poncelet's and Culmann's graphical constructions for active and passive pressures, Effects of wall movement, wall friction, type of slip surface, wall back angle, backfill slope angle, surcharge and line loads on earth pressure, Direction and point of application of earth thrust.

[07 Hrs.]

UNIT – 2 :
Stability of Earth retaining structures
Types of walls: gravity, cantilever walls, walls with counterforts and relief shelves, their typical dimensional details. Stability requirement of overturning, sliding, bearing capacity failure: overall stability against shear failure in backfill & foundation soil; application of geo-synthetics in earth retaining structure.

[06 Hrs.]

UNIT – 3 :
Sheet pileretaining structures
Sheet pile wall and bulk heads. Types of sheet piles, constructional features of cantilever and anchored sheet pile walls, their suitability, Analysis for design of cantilever walls in cohesionless and cohesive soils, Analysis for anchored sheet pile walls with free & fixed end support conditions, Blum's criteria, Deadman and anchored, design principles.

[06 Hrs.]

UNIT – 4 :
Embankments
Control of field compaction, placement moisture content during field compaction, effect of compactive effort on compaction of clayey and sandy soils, effect of lifts in deep compaction, correction for excluded grain size in laboratory compaction. Theories of compaction: water film and lubrication concept, microstructure concept.

[07 Hrs.]

UNIT – 5 :
Stability of slopes :
Friction circle method, factor of safety, Taylor's stability numbers & stability charts, base failure, stability of earthen slopes for steady seepage and sudden drawdown, approximate analysis for plain slip surface, Bishop's method of slope stability.

[07 Hrs.]

UNIT – 6 :
Cofferdams and Caissons:
Types, stability analysis of cellular and Diapharm type cofferdams and caissons, TVA method of interlocked stresses.
Braced cuts:
Sheeting and bracing system in shallow and deep vertical cuts in different types of soils. Failure modes; lateral pressure distribution on sheeting, stability of bottom of excavation.

[06 Hrs.]

VIII SEMESTER

CV1449	**PE III-Earth & Earth Retaining Structures**			**L= 3**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.
4. Basic applied Mechanics, Gopal Ranjan, New Age International.

Reference Books:

1. Design Aids in Soil Mechanics and Foundation Engineering, 1988, Kaniraj R., McGraw Hill New Delhi.
2. Analysis and Design of Foundations and Retaining Structures, 1979, Shamsher Prakash, Gopoal Ranjan and Swami Sharan, Sarita Prakashan.
3. Theory and Practice of Foundation Design, 2004, Som N.N. & Das S.C., Prentice Hall and co New Delhi.
4. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.

VIII SEMESTER

CV1450	PE III-Watershed Management			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 hours**

COURSE OBJECTIVE	COURSE OUTCOMES
rious objectives of the course will be: 1. To understand the watershed and its characteristics. 2. To understand the importance of watershed management. 3. To plan and design of Watershed protection, conservation elements. 4. To envisage the management plan of Watershed.	The students will be able to: 1. Understand the Watershed and its characteristics. 2. Understand the importance of watershed in terms of drinking water, irrigation water, increases in ground water. 3. Plan and design of Watershed protection, conservation elements. 4. Envisage the management plan of Watershed.
Mapped Program Outcomes: a, e, h, k & l	

UNIT – 1 :
Soil and Water– Issues related to plant life like composition of soil, water requirement of crops, necessary conditions for plant growth etc. Soils, their origin and classification.Land classification for WM, Land capability rating, determination of land capability class, land capability and suitability surveys, (Desalination of water logging and its remedial measures).

[07 Hrs.]

UNIT – 2 :
Watershed Behavior– Physical elements of a watershed, effects of land use changes on hydrological cycle component Concept of vegetative management of water yield and quality. Watershed Experiments, extrapolation of results from representative and experimental basins, Regional studies. (Water auditing and Bench marking).Soil erosion – problem, types, conservation, and control measures in agricultural and non-agricultural land.

[06 Hrs.]

UNIT – 3 :
Water conservation and Harvesting– Agronomical measures in soil and water conservation. examples and critical reviews. Inventory techniques for precipitation runoff, soil, timber, range-land and wild life Water harvesting techniques – Elements, Development of modern harvesting Techniques Estimation of peak runoff rate Land capability classification.

[06 Hrs.]

UNIT – 4 :
Erosion process – Factors affecting erosion, Types of erosion, Assessment of erosion, Control measures for erosion Conservative practices-Objective and general practices, land and soil classification, identification of critical areas, (Catchment area treatment).

[07 Hrs.]

UNIT – 5 :
Watershed Management- Objectives of Planning, Watershed Projects, Guidelines for Project Preparation. Approach in Government programmes, people's participation, conservation farming, watershed-management planning and identification of problems, objectives and priorities, socioeconomic survey, use of tools like GIS.

[07 Hrs.]

UNIT – 6 :
Watershed Modelling: Runoff components –Simple parametric models – Curve Number Method, variable source area models; quasi- physically based models; a simple physically based model. Rainfall-Runoff modelling, USLE model for soil erosion.

[06 Hrs.]

Text Books:
1. J. V. S Murthy, Watershed Management, New Age International Publishers, 1998.
2. Suresh Rao, Soil and Water Conservation Practices, Standard Publishers, 2003.
3. V.V. N. Murthy, Land and Water Management, Kalyani Publishers, 1994.

Reference Books:
1. Ghanshyam Das, Hydrology &soil Conservation Engineering, PHI Publication.

VIII SEMESTER

CV1451	PE III: Urban Transportation Planning			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	**15**	**10**	**60**	**100**		**4 hours**

COURSE OBJECTIVES	COURSE OUTCOMES
idents Understood about: 1. Importance of Planning, analysis and implementation. 2. Traffic forecasting and Environmental impacts. 3. O &D Studies based on trip distribution and generation. 4. Various Modes and Model split analysis 5. Traffic Regulation, ITS in urban traffic and illumination system.	1. Students understood about traffic forecasting and its effects on environment. 2. Students understood the necessity and importance of Traffic regulations. 3. Students understood the necessity and arrangement of street lighting. 4. Students understood about planning process and traffic problems.
Mapped Program Outcomes: a, b, c, e, h, i, k	

UNIT – 1 :
Importance of urban transport planning
Transport Planning Process: Scope, Independence of the land use and traffic, system approach to transport planning, stages, survey and analysis, forecast analysis and future condition of plan synthesis, evolution, programme adoption and implementation, continuing study, citizen participation, difficulties in transport planning process.
[07 Hrs.]

UNIT – 2 :
Traffic forecasting: Necessity, Limitations, Types of traffic, Methods of forecasting, Period of forecasting.
Traffic and environment: Introduction, Detrimental effects on environment, Noise, Air pollution, vibration, Visual intrusion and degrading aesthetics, Severance and land consumption, evaluation procedure, environmental areas, situation in India.
[06 Hrs.]

UNIT – 3 :
Trip Generation: introduc6tion and definition, trip purpose, factors governing trip generation and attraction rates.
Trip Distribution: Introduction, Methods: Uniform factor method, Average factor method. Farther method, Furness Method, Criticism of Growth factor method, Tranner's Model, Gravity Model, Opportunity Model. Delay studies.
[06 Hrs.]

UNIT – 4 :
Model Split: General consideration, factors affecting, Model split in transport planning process, recent development. Mode choice analysis. Introduction to Various modes of urban transportation: Local trains, Metro, Monorails, BRTS and MRTS.
[07 Hrs.]

UNIT – 5 :
Regulation of traffic: Basic principles of regulation, scope of traffic regulation, traffic laws, regulation of speed, vehicles, driver & traffic, parking & enforcement regulations, motor vehicle act.
[06 Hrs.]

UNIT – 6 :
Nature of traffic problems in cities: Growth of town & traffic, present difficulties in urban traffic condition, measures, Application of ITS in urban traffic management, VMS, Signal coordination, parking management.
Urban Street Light systems: Need, laws of illumination, decrement by artificial lightening, appearance of lighted pavement, types of surface, distribution of light, mounting height, spacing, lantern arrangement, types of lamps, quantity of illumination, lamp installation of T-junction and cross roads, illumination of traffic rotaries, lighting at bends, dual carriageway, roads, bridges, tunnels, maintenance of lightening installation.
[07 Hrs.]

Text books:
1. Traffic Engineering and Transport Planning, Kadiyali, L.R, Khanna Publishers
2. Principles & Practice of Highway Engineering, Chakroborty P Das, Khanna Publisher, 2000
3. Highway Engineering, Rangawala B.S, Charotar Publishing House, 2011
Reference books:
1. IRC Handbook and MOST Specifications, Indian Road Congress
2. Fundamentals of Transportation and traffic Operations. Pergamon, Elsevier science Inc
3. Institute of Transportation Engineers, 'Manual of Transportation Engineering Studies', Prentice Hall

VIII SEMESTER

CV1427	PE IV: Waste Water Treatment			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. To study necessity and objectives of wastewater treatment and layout of a wastewater treatment plant. 2. To study disposal methods for wastewater. 3. To study principles of working and design of various waste water treatment units and processes. 4. To understand need & processes of Advanced wastewater treatment. 5. To study treatment of wastewater from various industries.	1. An ability to understand the necessity of water quality management 2. An ability to design various treatment units for waste water 3. An ability to understand advanced treatment processes for waste water 4. An ability to understand treatment of waste water from various industires.
Mapped Program Outcomes: a, c, e	

UNIT – 1 :
Holistic approach to Wastewater management, Effluent & Stream standards, wastewater characteristics and their significance, disposal methods for wastewater on land and in water and its impact, self-purification of streams

[06 Hrs.]

UNIT – 2 :
Preliminary and primary treatment processes and units: Screens, grit chamber and primary settling tank- Principles, types & designs.

[07 Hrs.]

UNIT – 3 :
Secondary treatment processes & units: Concepts in biological treatment, bacterial growth and biological oxidation, Activated sludge process, Trickling filter- Principles, types. Simple design problems.

[07 Hrs.]

UNIT – 4 :
Other biological treatment units: Aerated lagoons, Stabilization Ponds, Up flow Sludge Blanket Reactors, fixed film reactors, Sludge De watering methods, Sludge Digester.

[06 Hrs.]

UNIT – 5 :
Need of advanced treatment, removal of trace organics, micro screening and control of nutrients, nitrification and de-nitrification, removal of phosphorus.

[07 Hrs.]

UNIT – 6 :
Treatment alternatives for Industrial waste, volume reduction, strength reduction, equalization tank, neutralization tank, Specific industrial wastewater treatment for paper and pulp industry, sugar industry, distillery industry, dairy industry, textile industry.

[06 Hrs.]

Text Books:
1. B.C. Punmia, 2010, Wastewater engineering, Laxmi Publications (P) Ltd., New Delhi.
2. P. N. Modi, 2008, Sewage Treatment & Disposal and Waste Water Engineering, Standard Book House.
3. S. K. Garg, 2010, Environmental Engineering (Volume-2), Khanna Publication.
4. M. N. Rao, 2007, Waste water treatment, oxford and IBH publishing.
5. Patwardhan, 2008, Industrial wastewater Treatment, PHI learning Pvt. Ltd.
6. G.L. Karia and R. A. Christian, 2006, Wastewater Treatment, PHI learning Pvt. Ltd.

Reference Books:
1. Metcalf and Eddy, 2006, Wastewater Treatment Disposal and reuse, Tata McGraw Hill publishing company Ltd.

VIII SEMESTER

CV1428	PE IV : Earthquake Engineering			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study geology of earth and interior. 2. To expose student to understand the detailed study of earthquake. 3. To expose students to understand various provisions related to earthquake design. 4. To understand various aspects of tall structures. 5. To understand detailing of RCC members for ductile behavior as IS code provisions. 6. To understand various effects of earthquakes on structures	After completion of course the student will be able 1. An ability to understand the necessity and Importance of Earthquake Engineering 2. An ability to understand the provision of IS Code used for Earthquake Resistance Design of Structure 3. An ability to design the structure by considering various loads. 4. An ability to understand various special aspects in Multi-story buildings, ductile detailing and its design. 5. An ability to prepare mathematical model to design tall structures. 6. An ability to study of Damages caused due to past Earthquake in & outside India and remedial measures
Mapped Program Outcomes: a, c, e, l, m	

UNIT – 1 :
Origin of earthquakes, engineering geology, seismicity of the world, faults, earthquake waves, quantification of earthquake (magnitude, energy, intensity of earthquake), measurements of earthquake, analysis of earthquake records and its interpretation.

[07 Hrs.]

UNIT – 2 :
Determination of magnitude, epicenter, epicenter distances, focal depth, seismic zoning, ground motion and their characteristics, factors affecting ground motions, causes or sources of earthquake damages, evaluation of seismic hazards, concept of response spectra, generation of response spectrum from available earthquake.

[06 Hrs.]

UNIT – 3 :
Study of IS: 1893, IS: 13920 for analysis and ductile detailing of RCC structures and other related codes, concept of earthquake resistant design, design philosophy, virtues of earthquake resistant design.

[06 Hrs.]

UNIT – 4 :
Design and detailing of RCC members, beam, column, shear wall and beam-column joints for ductile behaviors, calculation of base shear distribution to various floors.

[07 Hrs.]

UNIT – 5 :
Special aspects in multi-storey buildings, effect of torsion, flexible first storey, P-delta effect, and soil-structure interaction on building response, drift limitation, soil liquefaction during earthquakes.

[07 Hrs.]

UNIT – 6 :
Load bearing structures, masonry structures, strengthening and rehabilitation of non-engineered building for earthquake, earthquake disaster management, mitigation and social aspects, lessons from past earthquakes.

[06 Hrs.]

Text Books :
1. Agrawal & Shrikhande, Design of Earthquake Resistant Structures, 3rd 2006, Prentice – Hall of India Pvt. Ltd.
2. Roberto Villaverde, Fundamental Concepts of Earthquake Engineering, 2009, CRC Press
3. Asadour H. Hadjian, Basic Elements of Earthquake Engineering, 2015, Wiley

VIII SEMESTER

CV1428	**PE IV : Earthquake Engineering**			**L=3**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

References Books:

1. C.V.R. Murty, Earthquake Tips, 2005, NICEE, IITK
2. www.nicee.org / iaee / E_FrontCover.pdf, NICEE Guidelines for Earthquake Resistant Non-Engineered Construction, 2004, National information center of Earthquake engineering Indian Institute of Technology Kanpur Kanpur 208016, India.
3. Robin K. McGuire, Seismic Hazard and Risk Analysis, 2004, Earthquake Engineering Research Institute; First edition
4. Farzad Naeim, Handbook on Seismic Analysis and Design of Structures, 2001, Kluwer Academic Publisher
5. Paulay, T. & Prestiley M.J.N., Seismic design of R C & Masonry Buildings, 2nd 1999, John Willey & Sons

VIII SEMESTER

CV1429	PE IV: Matrix Analysis of Structures			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
At the end of the course the student will be able to understand 1. Basic concepts of direct stiffness method. 2. Analysis of various structural elements by stiffness method	1. An ability to understand the stiffness method for analyzing statically indeterminate structures. 2. An ability to model the behaviour of various structural elements and systems. 3. An ability to understand the effect of various loading and support conditions on structural elements and systems. 4. An ability to implement the computer program to analyse the structures.
Mapped Program Outcomes: a, e,g,h,j,k l, m	

UNIT – 1 :
Basic terminology, degree of freedom, basic concept of direct stiffness method, derivation of all stiffness coefficients, formulation of compatibility equations, rotation transformation matrix.

[06 Hrs.]

UNIT – 2 :
Analysis of Beam (without axial deformation): Formulation of elemental stiffness matrix for Beam, transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated load, uniformly distributed load and moment, assembly of global load matrix, solution to problem without sinking of support with maximum three degree of freedom.

[07 Hrs.]

UNIT – 3 :
Analysis of Plane Truss: Formulation of elemental stiffness matrix and global stiffness matrix, assembly of global stiffness matrix, member load matrix due to concentrated load, assembly of global load matrix, solution to problem of plane truss with maximum three degree of freedom.

[06 Hrs.]

UNIT – 4 :
Analysis of Plane Frame (Without axial deformation): Formulation of elemental stiffness matrix and, transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated loads, uniformly distributed loads and moments, assembly of global load matrix, solution to plane frame problems with maximum three degree of freedom, inclined member problem.

[06 Hrs.]

UNIT – 5 :
Analysis of Plane frame (With axial deformation): Formulation of elemental stiffness matrix and transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated loads, uniformly distributed loads and moments, assembly of global load matrix, solution to plane frame problems with maximum three degree of freedom, inclined member problem.

[07 Hrs.]

UNIT – 6 :
Analysis of Beam with sinking of support, analysis of member for temperature loading, lack of fit in trusses with maximum three degree of freedom, storing of global stiffness matrix, full storage, banded storage and band minimization.

[07 Hrs.]

VIII SEMESTER

CV1429	PE IV: Matrix Analysis of Structures			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

Text Books:

1. Gere and Weaver, Matrix Method of Structural Analysis, McGraw Hill. 2004
2. Kanchi M.B., Matrix Method of structural Analysis, New age International,1993
3. Martin H.C. Introduction to Matrix Method of Structural Analysis, 1966
4. Pandit Gupta, Structural Analysis: A Matrix Approach,Tata McGraw-Hill, 2001

Reference Books:

1. Meghre A.S. &Deshmukh S.K., Matrix Method of Structural Analysis,Charotar Publishing House Pvt. Limited, 2003
2. Flemming Computer Analysis of Structures, McGraw-Hill Education , 1996
3. Wang C K,, Intermediate Structural Analysis, McGraw-Hill Education, 2010
4. S. Rajasekaran, G. Sankarasubramanian Computational Structural Mechanics, PHI Learning Private Limited, 2004

VIII SEMESTER

CV1452	PE IV: Advanced Surveying			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**4 hours**

COURSE OBJECTIVE	COURSE OUTCOMES
1. To understand the importance of Higher surveying in the field of civil engineering 2. To understand fundamental knowledge of working principles of Advanced Electronic Devices and Total Station. 3. To understand fundamental knowledge of principles of GPS, GIS and Remote Sensing.	1. The students will be able to understand the advantages of electronic surveying over conventional surveying methods. 2. The student will be able to handle and to understand the working principle of Advanced Electronic Devices and total Station. 3. The student will be able to understand and to apply knowledge of GPS, GIS and Remote Sensing technique /data for required purpose.
Mapped Program Outcomes: a, b, d, e, f, g, k, l,	

UNIT – 1 :
ELECTRONIC SURVEYING
Basic principles, classifications, applications, comparison with conventional surveying, electromagnetic wave theory - electromagnetic distance measuring system - principle of working and EDM instruments, application of Lasers in distance measurement.

[07 Hrs.]

UNIT – 2 :
TOTAL STATION SURVEYING
Basic Principle - Classifications -Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system.Care and maintenance of Total Station instruments. Modern positioning systems - Traversing and Trilateration.

[06 Hrs.]

UNIT – 3 :
GPS SURVEYING
Introduction: Introduction to GPS, History, Satellite Navigations constellations today – GPS system, GLONASS system, Galileo System, GPS Errors Future of GPS. Reference Systems and Coordinate systems: Geodetic coordinate systems, Datum transformations, Height systems, Time systems. Modernization plans of navigational satellites, Hardware and software improvements.

[07 Hrs.]

UNIT – 4 :
GIS SURVEYING
Map – mapping concepts, analysis with paper based maps, limitations, GIS- Definition, advantages of digital maps. Fundamentals of GIS – Information Systems, Modeling Real World Features Data , Data Formats – Spatial and Non-spatial, Components, Data Collection and Input, Hardware – Computing, printing and scanning systems; Introduction to Software – Standard Packages like Arcview, ArcGIS, Autocad Map, Map Info etc.

[06 Hrs.]

UNIT – 5 :
PHYSICS OF REMOTE SENSING
Physics of Remote Sensing: Sources of Energy, Active and Passive Radiation, Electromagnetic Radiation - Reflectance, Transmission, Absorption, Thermal Emissions, Interaction with Atmosphere, Atmospheric windows, Spectral reflectance of Earth's surface features, Multi concept of Remote Sensing.

[06 Hrs.]

UNIT – 6 :
MICROWAVE REMOTE SENSING
Microwave Remote Sensing: Active and Passive Systems, Advantages, Platforms and Sensors, Microwave Radiation and Simulation, Principles of Radar – Resolution, Range, Angular Measurements, Microwave Scattering, Imagery – characteristics and Interpretation.
Applications: Geosciences, Water Resources, Land use – Land cover, Transportation

[07 Hrs.]

VIII SEMESTER

CV1452	**PE IV: Advanced Surveying**			**L=3**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**4 hours**

Text Books:

4. James B. Campbell & Randolph H. Wynne., Introduction to Remote Sensing, The Guilford Press, 2011.
5. Charles Elach & Jakob van Zyl., Introduction to the physics and techniques of Remote Sensing, John Wiley & Sons publications, 2006.
6. Thanappan Subash., Geographical Information System, Lambert Academic Publishing, 2011
7. Lillesand T.M and Kiefer R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, 2008.
8. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993

References Books:

1. Guocheng Xu, "GPS Theory, Algorithms and Applications", Springer - Berlin, 2003.
2. Satheesh Gopi, rasathishkumar, N. madhu, “Advanced Surveying, Total Station GPS and Remote Sensing" Pearson education, 2007

VIII SEMESTER

CV1453	PE IV-Foundation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study basic features and theory of shallow foundations. 2. To familiarize the students with different types of shallow foundations. Analysis and geotechnical design of shallow foundations. 3. Student will develop ability to predict and estimate settlement of foundations. 4. To study basic features and theory of deep foundations. 5. To acquaint students with foundations provided in various soil conditions for offshore structures.	1. Students will be able to understand basic features and theory of shallow foundations. 2. Students will be able to estimate settlement of foundations. 3. Students will understand basic features and theory of deep foundations. 4. Students will understand basics of offshore foundations.
Mapped Program Outcomes: a, b, c, d	

UNIT – 1 :
Ultimate bearing capacity of shallow foundation:
Features & criteria for various types of shear failure in foundation soil, types of footings and rafts, location and depth of footings. Overview of theories of bearing capacity under centric vertical, inclined & vertical loads; Terzaghi's theory, theories of Meyerhof's, Balla, Vesic, Reddy-Srinivasan etc. Effect of interference of footings, Ultimate load computation for rectangular footing/raft; for limited depth of soil below the foundation. Theoretical approaches for footings on slope. Ultimate & allowable bearing capacity determination and settlement estimation from the data of penetration tests (SPT & SCPT), plate load test and pressure meter test.

[07 Hrs.]

UNIT – 2 :
Settlement analysis
Boussineq's theory, pressure distribution for strip load, square and circular areas, pressure bulbs, contact pressure distribution. Methods of computation f elastic settlement, Janbu's equation, use of strain influence factor, Schmentmann's approach, settlement from elasticity theory, computation of primary and secondary consolidation of foundation on Normally Consolidated Clay& Over Consolidated Clay; Differential settlement & its permissible values. Control of excessive settlement. Special considerations for rafts on sand and clay, concept and design principle of floating raft foundation, proportioning the footings of public building for equal settlement. Overview of shallow foundation on reinforced earth under centric vertical load**.**

[06 Hrs.]

UNIT – 3 :
Axially loaded Piles
Load transfer mechanism, piles in sand and clay, computation of end bearing and skin resistance; α, βand λ methods, drained and undrained capacity, effect of pile installation methods on load capacity and pile behaviors, critical length of piles in sands, dynamic formulae: limitations. Effects of pile driving on ground, & adjacent structures. Constructional features of bored piles in different soil conditions, large diameter bored piles and pier foundations, Load Capacity of single and multi-undereamed piles, various methods to determine base resistance of piles (Meyerhof, Vesic, Janbu, Coyle-Castello etc.).

[06 Hrs.]

UNIT – 4 :
Laterally loaded piles:
Applications, lateral resistance of single pile, long and short piles, failure mechanisms, Approaches of analysis with Winkler model for soil, Reese-Matlock's analysis, Equivalent cantilever approach, IS code provisions, p-y concept, construction of p-y curves for piles in soft clays and sands, effect of cyclic loading, salient features & design charts of Brom's analysis for different pile-soil systems.

[07 Hrs.]

UNIT – 5 :
Foundation for offshore structures:
Nature and magnitude of loads, features and construction methods of template type piled platforms, Gravity platforms and Tension leg platforms, Pile behaviours under environmental loading conditions.

[06 Hrs.]

VIII SEMESTER

CV1453	PE IV-Foundation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

UNIT – 6 :

Anchor foundations:

Behaviour and failure mechanism of shallow anchors & deep anchors, Ultimate anchor capacity;

Well foundations:

Introduction to methods based on elastic theory and ultimate resistance, function and design of component parts of well foundations.

[07 Hrs.]

Assignment work shall comprise:
3 to 4 assignment based on the above syllabus.

Text Books:

1. Principles of Foundation Engineering, 1999, B.M. Das, PWS publishing co.
2. Advanced Foundation Engineering**,** 2007, Murthy V.N.S, CBS Publishing.
3. Foundation Engineering Handbook, 2004, H.Y. Fang.

Reference Books:

Theory & practice of foundation Design, 2002, Som N.N. & Das S.C., Sarita Prakashan, Meerut.

VIII SEMESTER

CV1454	PE IV: Water Power Engineering			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVE	COURSE OUTCOMES
rious objectives of the course will be: 1. To understand the significance of water power engineering 2. To correlate between hydrology and water power engineering 3. To understand the concepts of turbines and pumped storage tanks. 4. To design units of hydroelectric power station & its components.	1. An ability to understand Analysis and design of different components of hydro power plant 2. An ability to understand Analysis and design of surge tanks
d Program Outcomes: a, e, h, k & l	

UNIT – 1 :

Introduction: Sources of energy, types of power station, choice of type of generation, components of water power project, types and general layouts of various hydropower schemes, General arrangements of a power station, power house, sub-structure and super structure, underground power station–necessity, principal, types, development and economics.

[06 Hrs.]

UNIT – 2 :

Estimation of hydro power potential, basic water power equation, gross head, net head, nature of supply, storage and pondage, Method of computing hydrographs, mass curves, flow duration curves.

Nature of demand: Load curve, load duration curves, load factor, plant factor, plant use factor, firm power secondary power.

[07 Hrs.]

UNIT – 3 :

Intake structures: Types, level of intake, hydraulics of intake structures, trash rack, transition, intake gates. Conduits: Types, economic section, power canals, pen-stock types hydraulic design and economic diameter pipe supports, anchor blocks, tunnels – classification, location and hydraulic design, tunnel linings.

[06 Hrs.]

UNIT – 4 :

Surge Tank: Functions and behaviour of the surge tanks, location, types of surge tanks, basic design criteria of simple surge tank, fore-bay.

[07 Hrs.]

UNIT – 5 :

Turbines: Classification of turbines, characteristics of different types, choice of type of turbine, turbine setting and cavitations Tail race: Functions, types, channel and tunnel draft tubes, function and principal types

[07 Hrs.]

UNIT-6:

Pumped storage plants, purpose and general layout of pumped storage schemes, main types, typical arrangements of the upper reservoirs, economics of pumped storage plants. Introduction to Tidal power stations.

[06 Hrs.]

Text Books:

1. Dandekar M. M. & Sharma K. N, Water Power Engineering, Vikas Publishing House Pvt. Ltd., New Delhi.
2. Sharma R.K. & Sharma T.K., Water Power Engineering, S. Chand Publication.
3. Streeter V. L. & Wylie E. B, Hydraulic Transient, McGraw Hill Book Company, New York.

Reference Books:

1. Chaudhary Hanif, Applied Hydraulic Transients, Van Nostrand Rein Hold Company, New York. Varshney, Water power engineering, Nemchand Publication.

VIII SEMESTER

CV1432	PE V: Water Transmission & Distribution Systems			L= 3	T= 0	P= 0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVE	COURSE OUTCOMES
The students will learn the:- 1. Reservoir, pump, various valves in distribution system. 2. Analysis of flow in looped networks using various methods. 3. Analysis of flow in serial networks using node flow analysis. 4. Optimal and Economical diameter of pumping main 5. Design of water distribution networks 6. Optimization of water distribution network.	1. An ability to understand the Reservoir, pump, various valves in distribution system 2. An ability to understand Analysis of flow in looped networks using various methods 3. An ability to understand Analysis of flow in serial networks using node flow analysis 4. An ability to understand Optimal and Economical diameter of pumping main 5. An ability to understand Design of water distribution networks 6. An ability to understand Optimization of water distribution network
d Program Outcomes:a, c, e & k	

UNIT-1:
General Hydraulic Principles, Head loss formulae- Darcy-Weisbach formula, Hazen – Williams formula, Modified Hazen - Williams formula, minor losses, continuity equation,, Equivalent length of Pipes, Three Reservoirs, Pumps and Valves in Water distribution systems.

[06 Hrs.]

UNIT-2:
Types of network, Formulation of Equations for looped Water Distribution Networks, Analysis of flow in looped networks using Hardy-Cross method and Newton-Raphson method.

[07 Hrs.]

UNIT-3
Node flow analysis of water distribution networks (NFA): Necessity of node flow analysis, classification of node according to HGL, classification of node according to flow, compatibility, node head-discharge relationship, Application of NFA technique to serial networks.

[07Hrs.]

UNIT-4:
Optimal and Economical diameter of pumping main. Design of pumping main considering rising main diameter as continuous as well as discrete variable.

[06Hrs.]

UNIT-5:
Design of water distribution networks: Design of single source branching network using Critical path method, Determining number of branching configuration for a looped network by graph theory, Use of path concept and minimum spanning tree concept.

[07 Hrs.]

UNIT-6
Formulation of optimization model, Application of critical path method for design of looped networks. Application of Cost-head loss ratio method for optimal design of branched networks.

[06 Hrs.]

Text Books:
1. Bhave P.R., Optimal design of water distribution networks, 2003-12-04, Alpha science International Ltd
2. Bhave P.R., & Gupta R., Analysis of Water Distribution Networks, 2006-09-18, Alpha science International Ltd

Reference Books:
1. Jeppson, R.W., Analysis of flow in pipe networks, June 1976, Butterworth-Heinemann,
2. Walski, T. M., Analysis of water distribution systems, November 1992, Krieger Publishing Company CPHEEO, Ministry of Urban Development, New Delhi, 2005
3. Manual on Water Supply and Treatment, CPHEEO, GOI

VIII SEMESTER

CV1433	PE V: Advanced Steel Design			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study the fundamental design philosophies of steel structures 2. To study the codal provision for design of steel structure 2. To study the relationship between structural analysis and design provisions.	1. An ability to understand different types of loading with respect to structural parameters. 2. An ability to identify the type of structure and its design methodology. 3. An ability to utilize the application of Indian Standard code for design purpose.
Mapped Program Outcomes: **a, c, e, i, k, l, m**	

UNIT – 1 :
Eccentric Connection: Bracket Connection, Seat Connection, Frame Connection, Moment Resistant Connection. Drawing in sketchbook about eccentric connections.

[10 Hrs.]

UNIT – 2 :
Plate Girder: Element of Plate Girder, Types of Section, Design Aspect, Stability of Webs, Design of Welded Plate Girder. Drawing in sketchbook about plate girder.

[10 Hrs.]

UNIT – 3 :
Gantry Girder: Loads Acting onGantry Girder, Fatigue Effect, Selection of Gantry Girder, Design of Gantry Girder. Drawing in sketchbook about Gantry girder

[09 Hrs.]

UNIT – 4 :
Bridges: Types of Bridges, Foot Bridge, Road Bridge, Railway Bridge, Rolled Beam Bridges, Plate Girder Bridges, Truss Bridge, Through And Deck Type Bridges, Weight of Bridge Truss By Empirical Formulae, Loading on Footways, IRC Loading, Loading on Railway Bridges, Design Of Footbridge.
Introduction to Bearings-Types of Bearings, Bearing Pads, Rocker, Roller and elastomeric Bearings.
Drawing in sketchbook about bearings and bridges.

[10 Hrs.]

Text Books:
1. Design of steel structures, By S. Arya and J. L. Ajmani, New Chand & Bros. Roorkee, 1992
2. Fundamentals of Structural Steel Design, By M. L. Gambhir, Mc Graw Hill Education, 2013
3. Design of Steel Structures, By N. Subramanian, OXFORD University Press, First Edition, 2008

Reference Books:
1. Limit State Design of Steel Structures, By S. K. Duggal, Mc Graw Hill Education Private Limited, 2011
2. Design of Steel Structures, By P. Dayaratnam, S. Chand Publication, 2008

VIII SEMESTER

CV1434	PE V: Maintenance & Rehabilitation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOME
1. Understand various civil engineering materials. 2. Understand various methods of testing of materials. 3. Understanding and use of various codes related to the civil engineering materials.	1. Students will know about different high quality materials for civil engineering applications. 2. Ability to use materials for better and durable Civil Engineering Structures. 3. Student will know about various smart materials.
Mapped Program Outcomes: h, j, k	

UNIT – 1:

Introduction:

Deterioration of structures, definition of maintenance, need for maintenance of different civil engineering structures, maintenance characteristics, negligence and poor maintenance of structures, quantification of maintenance.

Classification of Maintenance Work:

Servicing, rectification, replacement, planned, unplanned, preventive, corrective, predictable and avoidable maintenance works, renovation and rehabilitation, routine maintenance of buildings, specifications for maintenance works.

Common Maintenance Problems:

Related to various civil engineering structures and systems, techniques of maintenance, areas prone to frequent maintenance, causes that aggravate maintenance work like high-rise buildings, special construction methods, new materials, accessibility, Environment etc., construction details for prevention.

[07 Hrs.]

UNIT – 2 :

Factors Affecting Frequency and Magnitude of Maintenance Work:

Over loading, movement of grounds, temperature variations, moisture, leakages and dampness, chemical actions and corrosion, growth of trees, earthquake, flood and fire, riots and vandalism, design defects, defects in construction and use of materials, choice of materials for durability and maintainability, design, exposure and other factors affecting durability, precautions to increase durability, effect of pollution on buildings.

Inspection, Identification and diagnosis of common defects and failures with possible causes in buildings, Roads, bridges, railway tracks, canals and C.D. Works, tunnels and special structures like service reservoirs, water supply, sewerage, storm water drains.

[06 Hrs.]

UNIT – 3 :

Preventive Maintenance: General, site selection, choice of structural systems and materials, specifications & detailing, special attention to foundations, walls, roofs, terraces, floors, doors, windows, plinth, compound walls, expansion joints and staircases to improve maintainability, water supply and sanitary works, termite control, external finishes.

Road stabilization techniques, compaction & drainage, shoulders, slope protection, joints in Cement Concrete Pavements, routine and service maintenance, recycling, bridges and Cross Drainage works repairs, strengthening and rehabilitation, reliability rating of existing structures and systems, service life & expected load carrying capacity, service & stability requirements, future service requirements, loads, fatigue and creep.

[07 Hrs.]

UNIT – 4 :

Materials and Techniques for Maintenance:

Materials for repairs like cement, cement grouts, epoxy grouts, mortars and coatings, polymer concrete composites, sealants, membrane overlays, fiber reinforced concrete, resin based compounds, emulsions, paints and geotextiles, techniques like stiffening, linings, guniting protection systems, prestressing, post-tensioning and base isolation technology, corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection, stitching, repair and strengthening of concrete buildings, foundation repair and strengthening, underpinning, leakage of roofs and methods of repair.

Failure of Buildings:

Definition of building failure, functional, structural and aesthetical failures, case studies, methodology of failure investigation, diagnostic testing methods and equipments, effect of fire on buildings.

[06 Hrs.]

VIII SEMESTER

CV1434	PE V: Maintenance & Rehabilitation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

UNIT – 5 :

Maintenance Planning:

In-depth significance of maintenance as opposed to cosmetic treatments, broad action plan, planning, budgeting and controlling the cost of maintenance work, policy formulation, standards of maintenance & controlling cost, planned maintenance, inspection cycles and condition surveys, investigation for assessing condition of structures including non-destructive evolution techniques like proof load test, photogrammetric analysis, assets and optical electric motion analysis, Bovescopesfiber optic probes, chain-dragging, acoustic emission and ultrasonic techniques, infrared thermography, high-speed non-contact sensor, sonar and sound penetrating radar techniques, reliability rating, maintenance cost records, maintenance manuals, their functions, contents and types, difficulties in planned maintenance.

Conservation and Recycling –

Historical buildings, conservation movement (needs), documentation, materials and methods for conservation work, recycling of old building and its advantages, case study.

[07 Hrs.]

UNIT – 6 :

Maintenance Oriented Designs: Design and its relation to maintenance, relationship between initial maintenance and running costs, cost appraisal techniques, consideration of maintenance at design stage, design needs, importance of feedback and feedback systems, information gathering, design data communication, interaction between designers and contractors, maintainability, role of design professionals

Maintenance Management: Need for data, relationship of the data base system to management process, cost of data base and management, uses of data base, problems in data collection, setting criteria from data collected, operational assessment.

Research in Maintenance: Importance of research, areas of research including materials, techniques, field equipment and tools for investigation, repairs and monitoring non-destructive evaluation techniques.

[06 Hrs.]

Text Books:

1. Concrete Technology, 2009, Shetty M.S., S.ChandPublication,New Delhi.
2. Concrete for Construction - Facts and Practice, 1999, Raina V.K, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. SP: 25 -1984 - Hand Book on Causes and Prevention of Cracks in Buildings, 1999, Bureau of Indian Standards, New Delhi.

Reference Books:

1. Concrete - Building Pathology, 2003, Macdonald S., Blackwell Science Limited, Oxford.
2. The Maintenance and Adaptation of Buildings, 1981, Chudley, R., Longman Group Ltd, New York.
3. Corrosion Damaged Concrete - Assessment and Repair, 1987, Strecker, P.P, Butterworths, London.

VIII SEMESTER

CV1455	PE V: Finite Element Method			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide the student with knowledge and analysis skills in applying basic laws and steps used in solving the problem by finite element method. 2. To provide the student the knowledge of various interpolation functions and elements to solve simple problems by finite element method. 3. To provide the student with some knowledge in is oparametric formulation. 4. To provide students the knowledge of mathematical modelling techniques.	1. Students will demonstrate an ability to apply the steps required for FEM solution to variety of physical systems. 2. Students will demonstrate an ability to create models for simple structures. 3. Students will be able to extend the knowledge of the application of FE to solve engineering problems.
Mapped Program Outcomes: a, d, e, k,	

UNIT – I :
Introduction: Development, Historical background, Applications, Advantages and Disadvantages of FEM, General steps of FEM, direct equilibrium approach, Variational approach , weighted residual approach, local and global FEM, application to simple problems.

[07 Hrs.]

UNIT – II :
Shape functions: Introduction, requirement of Ideal displacement functions, Derivation of shape functions using Cartesian Coordinates, Lagrange and Serendipity elements.

[06 Hrs.]

UNIT – III :
Application of FEM to 1D problems: Derivation of element property matrix and influence vector, application, Application to bar, truss, steady state heat conduction, steady state flow through porous medium problems.

[06 Hrs.]

UNIT – IV :
Application of FEM to 2D problems: Equilibrium equations, Triangular and Rectangular element formulation using Cartesian Coordinates, Application to two-dimensional stress analysis.

[07 Hrs.]

UNIT – V :
Natural coordinates, Isoparametric elements, Application to 1D and 2D Problems.

[07 Hrs.]

UNIT – VI :
Numerical integration, Modeling, storage and solution techniques.

[06 Hrs.]

Text Books :
1. Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991
2. Godbole P. N. , . Introduction to Finite Element Method, I. K. International Publishing House Pvt. Ltd., New Delhi, 2013
3. Desai Y. M., Eldho T. I. and Shah A. H., Finite Element Method s and Application to Engineerimg, Pearson , 2011.

Reference Books :
1. Krishnamoorthy C S, “Finite Element Analysis – Theory and Programming”, Tata McGraw Hill Publishing Co., New Delhi, 1994.
2. Cook R D, Malkus D S, Plesha M E and Witt R J, “Concepts and Applications of Finite Element Analysis”, John Weily & sons inc, New York, Fourth Edition, 2003.
3. Rajasekaran S, “Finite Element Analysis in Engineering Design”. S Chand & Co., 2003.

VIII SEMESTER

CV1456	PE V - Advanced Geotechnical Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To know the importance of engineering properties of soil in foundation design. 2. To create an ability to apply knowledge of geotechnical engineering.	1. Students will understand about clay mineralogy. 2. Students will understand the analysis and interpretation of data related to the field of Geotechnical engineering. 3. Students will understand about machine foundations and well foundations.
d Program Outcomes: a, b, e, h, l	

UNIT-1

Clay mineralogy:

Soil as three-phase system. Various soil weight & volume inter–relationship. Soil structure and clay mineralogy: atomic and molecular bonds, inter particle forces in a soil mass, clay minerals, mode of occurrence of water in soil, Effective, neutral and total stresses in soil mass.

[06 Hrs.]

UNIT-2

Shear strength parameters and their applications:

Shear strength parameters of cohesion less and saturated cohesive soils, Principle of effective stress, Stress- Strain relationship, Skempton's Pore pressure coefficients,

Bearing capacity of soils (IS: 6403), types of shear failure in foundation soil, Terzaghi's theory, its validity and limitations, bearing capacity factors, effect of water table on bearing capacity.

[07 Hrs.]

UNIT-3

Stability analysis of slope

Effective and total stress analyses, shape of slip surface, method of slices, graphic methods, location of critical slip circle, wedge analysis.

[07 Hrs.]

UNIT-4

Flow through soils:

Permeability, seepage, mathematical analysis, Finite difference formulae for steady state flow nets –computation of seepage, uplift pressure, and critical hydraulic gradient.

[06 Hrs.]

UNIT-5

Machine Foundation: Introduction, Types of machine foundation, Basic definitions, Degree of freedom of block foundation, General criteria for design of Machine foundation, free & forced vibrations, Vibration analysis of a machine foundation, Determination of natural frequency, foundations for impact loads and vibration isolation.

[07 Hrs.]

UNIT – 6 :

Well foundation : Different shapes of wells, forces acting on the well foundation, Analysis of well foundation, Individual components of well foundation, Uses, constructional features, sinking of wells, tilt and shift, their rectification, depth of well and grip length.

[06 Hrs.]

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books:

1. Design Aids in Soil Mechanics and Foundation Engineering, 1988, Kaniraj R., McGraw Hill New Delhi.
2. Analysis and Design of Foundations and Retaining Structures, 1979, Shamsher Prakash, Gopoal Ranjan and Swami Sharan, Sarita Prakashan.
3. Theory and Practice of Foundation Design, 2004, Som N.N. & Das S.C., Prentice Hall and co New Delhi.
4. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.

VIII SEMESTER

CV1457	PE V: Design of Bridge Structures			L=3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. Understand various types of bridges and loadings. 2. Understand seismic behavior of bridges. 3. Understand design philosophy for bridges.	1. Students will understand fundamentals of bridge design. 2. Students will understand analysis and design of various types of bridge decks. 3. Students will understand the Sub-Structure Design and design of various components.
Mapped Program Outcomes: a, b, c, e,h,l	

UNIT – 1 :
Introduction to IRC codes, Loads on bridges and load combinations.
Introduction to elevated rail transit system, grade separation structures, pedestrian crossing and sub- ways.
[06 Hrs.]

UNIT – 2 :
Design of Bridge Slabs: Longitudinally reinforced deck slabs, transversely reinforced bridge slabs.
[07 Hrs.]

UNIT – 3 :
Design of Reinforced Concrete Bridges: Design of T- beam, box girder bridges.
[06 Hrs.]

UNIT – 4 :
Design of Prestressed Concrete Bridges: Design considerations and design examples.
[07 Hrs.]

UNIT – 5 :
Design of bridge bearings, types of bridge bearings, design examples.
[05 Hrs.]

UNIT – 6 :
Sub-Structure Design: Foundation investigation, bridge pier design, abutment design, open foundation, pile foundation.
[08 Hrs.]

Text Books:
1. T.R. Jagadeesh, M.A. Jayaram, Design of Bridge Structure, PHI publication.
2. Krishnaraju „ Bridge Engineering, UPD Publishers, New Delhi,2000.
3. Baider Bakht and Leslie, G. Jaeger,‘ Bridge Analysis Simplied, Mcgraw Hill Book Co,1998.

Reference Books:
1. IRC 005, Standard Specifications and Code of Practice for Road Bridges, Section I (General Features of Design) (Seventh Revision), 1998.
2. IRC 006, Standard Specifications and Code of Practice for Road Bridges, Section II – Loads and Stresses (Fourth Revision), 2014.
3. IRC 078, Standard Specifications and Code of Practice for Road Bridges, Section VII – Foundations and Substructure (Revised Revision), 2014.
4. IRC 083-1, Standard Specifications and Code of Practice for Road Bridges, Section IX (Bearings), Part I (Metallic Bearings) (First Revision), 1999.
5. IRC 112, Code of Practice for Concrete Road Bridges, 2011.
6. Johnson Victor, ‘Bridge Engineering’, Oxford IBH, New Delhi, 2000.
7. Raina, R.K, ‘Principles of Design of RCC Bridges, Tata McGraw Hill,1999.
8. Conrad P. Heins and Richard A. Lawrie, ‘Design of Modern Concrete Highway Bridges, John Wiley and Sons, 1999.

VIII SEMESTER

CV1458	PE V – Advanced Foundation Engineering			L= 3	T=0	P=0	CREDITS = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	15	**15**	**10**	**60**		**100**	**3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study various theories and design of regarding shallow foundations. 2. To familiarize students with geotechnical design of Deep foundations. 3. To acquaint students with criteria for design of Machine foundation.	1. An ability to understand various approaches of determining bearing capacity shallow foundation. 2. An ability to predict and calculate settlement of foundation. 3. An ability to design deep and machine foundations
Program Outcomes: a,c,e,f,g,h,i,j,k,l	

UNIT-1

Bearing Capacity of Foundations: Terzaghi's, Meyerhoff, Hansens bearing capacity theories, Bearing capacity based on SPT, SPT Correlations, Design N Values, Bearing Capacity of Foundations with Uplift or Tension Forces, layered soils, eccentric and inclined loads, Bearing capacity on slopes, Safety Factors in Foundation Design,

[07 Hrs.]

UNIT-2

Foundation Settlements:

The Settlement Problem, Stresses in Soil Mass Due to Footing Pressure, Immediate Settlement Computations, Alternative Methods of Computing Elastic Settlements, Stresses and Methods of Computing.

[06 Hrs.]

UNIT-3

Combined and Mat Footing:

Safe bearing pressures for mat foundations on Sand and clay, Eccentric Loading, The Coefficient of Subgrade, Proportioning of Cantilever Footing, Design of Combined Footings by Rigid Method (Conventional) Method, Design of Mat Foundation by Rigid Method, Design of Combined Footings by Elastic Line Method, Design of Mat Foundations by Elastic Plate Method, Floating Foundation.

[07 Hrs.]

UNIT-4

Vertically Loaded Pile: Design of pile foundation: Ultimate Bearing Capacity in Cohesionless Soils, Critical Depth, Static Bearing Capacity of Piles in Clay Soil, Bearing Capacity of Piles in Granular Soils Based on SPT Value, Bearing Capacity of Piles Based on Static Cone Penetration Test (CPT),

Pile group : Settlement of pile groups in sand, settlement of pile groups in cohesive soils, allowable loads on groups of piles, uplift capacity of a pile group, behavior of laterally loaded, Winkler's hypothesis, *p-y* curves for the solution of laterally loaded piles

[06 Hrs.]

UNIT-5

Machine Foundation: Introduction, Types of machine foundation, Basic definitions, Degree of freedom of block foundation, General criteria for design of Machine foundation, free & forced vibrations, Vibration analysis of a machine foundation, Determination of natural frequency, foundations for impact loads and vibration isolation.

[07 Hrs.]

UNIT – 6:

Well foundation: Different shapes of wells, forces acting on the well foundation, Analysis of well foundation, Individual components of well foundation, Uses, constructional features, sinking of wells, tilt and shift, their rectification, depth of well and grip length.

[06 Hrs.]

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books:

1. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.
2. Principles of Foundation Engineering: Das B.M., PWS publishing co., (1999)
3. Foundation Analysis & Design: Bowles J.E., McGraw Hill, (1996)
4. Shallow Foundation: Das B.M., CRC Press, (2009)

VIII SEMESTER

CV1424	**Comprehensive Viva-Voce**			**L=0**	**T=0**	**P=0**	**CREDITS = 3**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	---	**----**	**----**	**100**		**100**	**---**

COURSE OBJECTIVES	COURSE OUTCOME
1. To understand necessity to study a topic comprehensively. 2. To know various ways and means to collect data and technical information related to a topic. 3. To understand ways to present literature collected.	1. An ability to collect information regarding only topic related in civil engineering 2. An ability to present the information collected in the expected format 3. An ability to express and communicate about the information collected.
Mapped Program Outcomes: b, c, e, i	

Every student will be allotted a specific topic related to civil engineering with the consent of the student. The student will be expected to prepare a detailed note on the topic and submit it to the guide. Evaluation will be based on the extent of information provided by the student and viva voce conducted by a panel of experts constituted by the department.

Operative Procedure for Comprehensive Viva Voce.

1] At the beginning of VIII Semester every faculty member in the Department (Regular and MR) will contribute at least *FIVE* sub-topics falling within the purview of UG Syllabus for preparing presentation during Comprehensive Viva-Voce. It should be seen that not more than 5 minute presentation shall be required to deal with the sub-topic.

2] A committee consisting of HoD and Five Senior Faculty Members shall go through the compiled list of sub-topics and finalise the list for onward processing.

3] The topic shall be allotted to each student from within the finalized list randomly and shall asked to prepare a presentation of FIVE minutes (5- 10 slides) for comprehensive viva voce with the help of their project guide.

4] The evaluation of the comprehensive viva voce shall be carried out not on the basis of the presentation of the topic, but on the basis of how the student have answered the questions arising out of the presentation and it's relevance to the General Civil Engineering.

5] The evaluation of the comprehensive viva voce shall be done by a panel of experts and be more in the context of overall understanding of Civil Engineering Syllabus rather than the topic of the presentation.

VIII SEMESTER

CV1425	**Project – Phase--II**			**L=0**	**T=0**	**P= 8**	**CREDITS = 8**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	---	**----**	**40**	**60**		**100**	**---**

COURSE OBJECTIVES	**COURSE OUTCOME**
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning.	1. An ability to apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning.
2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data.	2. An ability to designed a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interprete the data.
3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively.	3. An ability to work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively.
4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.	4. An ability to apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.
5. To analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	5. An ability to analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.
Mapped Program Outcomes: a,b,c,d, e,f, g,h, I,,j, k,l,m,n	

The group of students will continue to work for the project allotted previously and will submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

VIII SEMESTER

CV1426	**Extra / Co-Curricular / Competitive Examination**			**L=0**	**T=0**	**P=0**	**CREDITS = 2**
Evaluation Scheme	MSE-I	MSE-II	TA	ESE		Total	ESE Duration
	---	**----**	**100**	**----**		**100**	**---**

COURSE OBJECTIVES	**COURSE OUTCOME**
1. To expose to culture and tradition. 2. To provide opportunity for student to perform and present their hidden talent, still and art. 3. To nurture hobbies. 4. To organize co-curricular activities to make competitive spirit, cooperation, leadership, diligence, punctuality, team spirits. 5. To develope creative talent, self-confidence, sense of achievement. 6. To be able to design process on environmental, social, political, ethical, health and safety. 7. To develop broad education to understand the impact of engineering solution in a global economic, environmental, society.	1. An ability to develop team work, leadership qualities, competitive spirit. 2. An ability to develop thinking and analysis process for environmental, ethical society. 3. An ability to develop solution to engineering problems related with social, environmental and ethical issues. 4. An ability to develop and nurture soft and communications skills.
Mapped Program Outcomes:a, b, h, j, k	

Due credits will be given to the students based on their performance and involvement in different extra and co-curricular activities conducted within the college or by other organizations/ institutions. Due credit will also be given to the student if they are successful in different competitive examinations conducted by different organizations. The guidelines as given in academic regulations will be followed for evaluation.