SGGS Institute of Engineering &Technology, Nanded
Department of Civil Engineering
(An Autonomous Institute of Government of Maharashtra)

TY (Civil Engineering) SYLLABUS

CHOICE BASED CREDIT SYSTEM

EFFECTIVE FROM : 2017-2018

Program Education Objectives (PEOs)

The Graduates will be able to:

PEO1	Pursue a successful career in the diversified sectors of the engineering industry and/or higher studies by acquiring knowledge in mathematical, scientific and engineering fundamentals.
PEO2	Analyze and design Civil engineering systems with social awareness and responsibility.
PEO3	Exhibit professionalism and ethical approach through leadership, team work, good communication skills, and adapt to modern trends by engaging in lifelong learning.

Program Outcomes (POs)

On successful completion, graduates will be able to:

PO1	Apply knowledge of mathematics, science and engineering to civil engineering problems.
PO2	Identify, formulate and solve civil engineering problems.
PO3	Design various structures or particular system that meets desired specifications and requirements.
PO4	Design and conduct experiments, interpret and analyze data, synthesize the information to derive conclusions.
PO5	Select and use appropriate engineering techniques and software tools to analyze civil engineering problems with understanding of their applicability and limitations.
PO6	Assess local and global impact of societal issues on civil engineering profession.
PO7	Able to understand the impact of engineering solutions on society and demonstrate the knowledge for sustainable development.
PO8	Demonstrate their professional and ethical responsibilities.
PO9	Able to function as a member or a leader on engineering and science teams in various areas of civil engineering.
PO10	Communicate effectively in both verbal and written forms.
PO11	Understand and practice engineering and management principles.
PO12	Adapt transformations in industry through independent and lifelong learning.

Program Specific Outcomes

PSO1: Establish a Civil Engineering career in industry, government or academic field and achieve professional expertise as appropriate.
PSO2: Execute innovation and excellence in Civil engineering problem solving and design in global and societal contexts.
PSO3: Commit to lifelong learning and professional development in the Civil Engineering field to stay updated in technology, research topics and contemporary issues.
PSO4: Understand the fundamentals of Civil Engineering in commercial contexts and in expediting construction projects.

Mapping of Programme Educational Objectives with programme outcomes

PO/PSO ⬇ PEO ➡	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
I	✓	✓	✓	✓	✓	--	--	--	✓	✓	--	--	✓	✓	--	✓
II	✓	✓	✓	✓	✓	✓	✓	--	✓	--	✓	✓	--	✓	✓	✓
III	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

SGGS Institute of Engineering &Technology, Nanded
Department of Civil Engineering

(An Autonomous Institute of Government of Maharashtra)

T.Y. B.Tech. (Civil Engineering)

Curriculum Structure: CBCS - I Academic year 2017-18 onwards

SEMESTER - V

Course Code	Course Title	Contact Hours			Credits		Category Code
		Lectures	Tutorials	Practical	Th.	Pr.	
CE301	Geotechnical Engineering-I	04	--	02	04	01	PCC
CE302	Design of Structures-I(Steel)	04	--	02	04	01	PCC
CE303	Engineering Geology	03	--	02	03	01	PCC
CE304	Water Resources Engineering-I	04	--	02	04	01	PCC
CE305	Transportation Engineering-I	04	--	02	04	01	HSC
	Sub Total:	19	--	10	19	05	
	Total	**29 hrs**			**24**		

Semester - VI

Course Code	Course Title	Contact Hours			Credits		Category Code
		Lectures	Tutorials	Practical	Th.	Pr.	
CE306	Design of Structures-II (RCC)	04	--	02	04	01	PCC
CE307	Theory of Structures-II	04	--	--	04	--	PCC
CE308	Water Resources Engineering-II	04	--	02	04	01	PCC
CE309	Transportation Engineering-II	04	--	02	04		PCC
CE310	Environmental Engineering	04	--	02	04	01	PCC
CE311	Field Training	--	--	02	--	01	MDC
	Sub Total:	20	--	10	20	04	
	Total	**30 hrs**			**24**		

TY (Civil)	Contact Hours	Credits
TOTAL	**59**	**48**

Additional Optional subjects:

Course Code	Course Title	Contact Hours			Credits	
		Lecture (L)	Tutorial (T)	Practical (P)	Th.	Pr.
CE312	Construction Project Planning	04	--	--	04	--
CE313	Infrastructure System Planning	04	--	--	04	--

- The evaluation of 'Theory Course' Shall be continuous and consist of In-semester Evaluation I (ISE-I) of 10 Marks, Mid Term Examination (30 Marks), In semester Evaluation II (ISE-II) of 10 Marks and End Term Examination (50 marks) as per the academic Calendar of the institute.
- The evaluation of term work (practical examination)shall be continuous as per the academic Calendar of the institute
- Student can register for more courses other than prescribed (May be from other department or open electives) as per his/her interest and those credits will be treated as over and above

SEMESTER - V

CE301	GEOTECHNICAL ENGINEERING	L:04, T:0, P:02	Credits: 05

Course Outcomes: At the end of the course the student will be able to

CO1	Understanding and determination of Index properties of soil.
CO2	To study the permeability, compaction, shear strength and consolidation of soil and its evaluation.
CO3	Analysis of slopes and calculation of earth pressure for different soil under various conditions. Determination of effective stress.
CO4	Classifying the soil. Study of different methods of soil exploration and preparation of soil profile.
CO5	Experimental determination of different properties of soil.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	1	2	1	1	1	3	1
CO2	3	3	2	3	2	1	2	1	1	1	2	1
CO3	3	3	3	2	2	1	2	1	1	1	1	1
CO4	2	2	3	3	2	1	1	1	2	1	1	1
CO5	1	2	2	3	3	2	1	1	1	1	2	1

1: Slightly 2: Moderately 3: Substantially

1. Introduction: Definition, scope, Historical survey, nature of problems, soil formation (02 hrs)

2. Index properties of Soils: soil as phase system, Definitions: specific gravity, different densities, voids ratio, porosity, degree of saturation, moisture content, density Index, volume weight relationship, Determination of specific gravity, Determination of field density, grain size analysis; mechanical and sedimentation analysis, Partical size distribution curve, use of partical size distribution curve, consistency limits, determination of consistency limit, Use of consistency limit, Soil texture and structure (05 hrs)

3. Classification of Soil: Particle size classification, Unified soil classification and ISI classification, soil identification (02 hrs)

4. Permeability of Soil: Introduction, Darcy's law, Validity of Darcy's Law, Discharge and seepage velocity, factors affecting permeability, Laboratory methods for determination of coefficient of permeability, Determination of average permeability of stratified soil mass, critical hydraulic gradient (05 hrs)

5. Compaction: Introduction, standard and modified Proctor Test, factors affecting compaction, Air void line, zero air void line, field compaction (03 hrs)

6. Effective stress Principle: Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuation of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition (05 hrs)

7. Consolidation: Introduction, consolidation indices, relation between pressure and void ratio, Laboratory consolidation test. Terzaghi's one-dimensional consolidation theory, square root of time fitting method and logarithm of time fitting method, secondary consolidation, final settlement of soil deposit. (05 hrs)

8. Shear Strength: Concept of shear strength, Different theories, Mohr's envelopes for cohesive, non cohesive and composite soils. Type of shear test: Direct shear test, Unconfined compression test, Traiaxial shear test (UU, CU and CD), relation between major and minor principle stresses, and vane shear tests, (06 hrs)

9. Earth Pressure: Earth pressure at rest. Active and passive conditions. Rankines earth pressure theory, determination of earth pressure for cohesionless and cohesive soil, Coulombs earth pressure theories. Graphical methods for active pressure (06 hrs)

10. Stability of Slopes: Factors contributing to slope failures, classification of slope failures, Infinite and finite slopes, The Swedish method and its application to dry cohesive soils and composite soils, Friction circle method, Stability number and chart (05 hrs)

11. Soil Exploration: Importance of sub surface investigations Auger and wash borings sampling tool for exploration undisturbed and disturbed sample, Sub surface soundings, Drilling, spacing and depth of exploratory borings, Preparation of soil profiles (03 hrs)

TERM WORK

The term work shall consist of a record of laboratory experiments as mentioned below

1. Determination of specific gravity
2. Field density test (Core cutter method and sand replacement method)
3. Determination of particle size distribution: a) Sieve analysis; b) Sedimentation analysis
4. Determination of Consistency Limits.
5. Permeability test variable and constant head
6. Standard proctor compaction test
7. Direct shear test
8. Unconfined compression test
9. Triaxial compression test
10. Consolidation test

(Note: - Experiment No.9-10 only demonstration)

REFERENCE BOOKS:

1. Soil Mechanics and foundation Engineering by B.C. Punamia.
2. Modern Geotechnical Engineering by Alam Singh.
3. Geotechnical Engineering by P. Purshothamaraj
4. Soil mechanical and foundation Engg. by Arora.
5. Relevant Indian Standard Specification & Codes.
6. Soil Mechanics by Craig R. F. Chapman and Hall
7. Theoretical Soil Mechanics by Terzaghi.
8. Soil Mechanics by Lambe T.W. & Whitman R.V.
9. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
10. An Introduction to Geotechnical Engineering, by Holtz R.D., Prentice Hall, NJ
11. Soil Mechanics by Craig R.F., Chapman & Hall

CE302	DESIGN OF STRUCTURES – I (STEEL)	L:04, T:0, P:02	Credits: 05

Course Outcomes: At the end of the course the student will be able to

CO1	Study of rolled steel sections. Apply the IS code practice for the design of steel structural elements.
CO2	Analysis and design of compression and tension members including built-up sections
CO3	Analysis and design of column and beam. Design of column bases for column.
CO4	Analysis and design of the various members of the truss.
CO5	Design of plate girder and its components.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	2	1	2	1	1	1	1	1
CO2	1	2	2	2	3	1	2	1	1	1	2	1
CO3	1	2	3	2	2	1	2	1	1	1	2	1
CO4	2	2	3	3	3	2	2	1	2	1	1	1
CO5	2	3	3	3	2	2	2	1	1	1	2	1

1: Slightly 2: Moderately 3: Substantially

1. General Considerations: Advantages and disadvantages of steel structures, rolled steel sections, types of loads, design methods (04 hrs)
2. Connections: Riveted, Welded connections, design of concentric and eccentrically loaded riveted and welded connection Design of bolted connections. (08 hrs)
3. Tension Members: Introduction, types, permissible stresses, net sectional area, design of tension members (04 hrs)
4. Beams: Introduction, Types of sections, design of simple and built-up beams (06 hrs)
5. Compression Members: Introduction, slenderness ratio, types of sections, design of angle continuous and discontinuous struts, design of axially and eccentrically loaded compression members, built up column, lacing, battening. (10 hrs)
6. Column Bases: Introduction, types of column bases, design of bases: Slab base and Gusseted base, Moment resistant bases. (04 hrs)
7. Roof Trusses: Types of trusses, loading on trusses, design of tubular and angular roof truss with connection, design of purlin. Roofing System- Imposed loads on flat and sloping roofs and floors, wind loads on sloping roofs and vertical cladding including effect of degree permeability and wind drag, analysis of pin- jointed trusses under various loading cases, computation of design forces in members, design and detailing of connections and supports, wind bracing for roof system, supported on columns. (06 hrs)
8. Plate Girder: Introduction of plate girder, Proportioning and design of section and connections, curtailment of flange plates, design of web splices, design of stiffeners (06 hrs)

TERM WORK:

It shall consist of design and drawing of various elements as detailed below.

1. Design and drawing of industrial building: It shall consist of design and drawing for various structural elements as detailed below.
   a) Design and drawing of simple beam, Built up beam, Beam to beam connection, Beam to column connection.
   b) Design and drawing of compound columns, lacing, battening with bases
2. Design and drawing of roof truss.
3. Design and drawing of plate Girder.

REFERENCES BOOKS:

1. Design of steel structures by A.S. Arya and J.L. Ajmani, Nemichand and Bros., Roorkee.
2. Design of Steel Structures by S.K. Duggal, Tata-McGraw Hill Co.
3. Design of Steel Structures by I.S. Negi, Tata-McGraw Hill Co.
4. Design of Steel Structures by Vol. I & II, Ramchandran, Standard Book House.
5. IS 800 and IS 875 Part I, Part II &Part III
6. Limit State Design of Steel Structures, IS:800-2007 by V.L.Shah and Veena Gore, Structures Publications, 2010.
7. Design of Steel Structures by S.S. Bhavikatti , I.K. International Publishing House Limited,
8. Design of Steel Structures by N. Subramanian, Oxford University Press, 2010
9. Structural Design and Drawing R.C. and Steel by N. Krishna Raju, University Press, Hyderabad
10. Structural Design and Drawing, Vol. II & III by D. Krishna Murthy, CBS Publishing Co., New Delhi.

CE303	**ENGINEERING GEOLOGY**	**L:04, T:0, P:02**	**Credits: 05**

Course Outcomes: At the end of the course the student will be able to

CO1	Understand weathering process and mass movement
CO2	Distinguish geological formations
CO3	Identify geological structures and processes for rock mass quality
CO4	Identify subsurface information and groundwater potential sites through geophysical investigations
CO5	Apply geological principles for mitigation of natural hazards and select sites for dams and tunnels

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	3	2	2	2	1	1	1	1	1
CO2	1	1	2	2	2	1	2	1	2	1	1	1
CO3	1	2	3	3	2	2	2	1	1	1	2	1
CO4	2	2	2	3	3	2	2	1	1	1	2	1
CO5	3	3	3	3	2	2	2	1	1	1	2	1

1: Slightly 2: Moderately 3: Substantially

1. General Geology: Scope of geological studies in various civil engineering projects. Department dealing with this subject in India and their scope of work- GSI, Granite Dimension Stone Cell, NIRM. Age and interior of earth, Volcanism, Mountains, Origin of continents and oceans, Continental drift and plate tectonics. (04 hrs)

2. Physical Geology: Weathering. Erosion and Denudation. Factors affecting weathering and product of weathering. Engineering consideration. Superficial deposits and its geotechnical importance: Water fall and Gorges, River meandering, Alluvium, Glacial deposits, Laterite (engineering aspects), Desert Landform, Loess, Residual deposits of Clay with flints, Solifluction deposits, mudflows, Coastal deposits. River, River valley development, Geological work, Rejuvenation, Erosional and depositional landforms, Glaciers, Erosional and depositional landforms, Wind, Sand dunes and bars. (03 hrs)

3. Mineralogy: Mineral, Origin and composition. Physical properties of minerals, susceptibility of minerals toalteration, basic of optical mineralogy, SEM, XRD., Rock forming minerals, megascopicidentification of common primary & secondary minerals. Mineral, Types, Physical properties and Occurrence of minerals. (03 hrs)

4. Petrology: Igneous rocks: forms and structures classification (based on mode of occurrence, mineral and Sio2% (Tabular classification) and Common rocks. Secondary Rocks: Weathering, Transportation and deposition of sediments, Classification - textures and structures of secondary rocks, Characteristics of shallow water deposits and Common rocks. Metamorphic Rock: Metamorphism, Agents and engineering properties of igneous, sedimentary and kinds of metamorphism, Minerals and structures, Common rocks. Engineering properties of igneous, sedimentary and metamorphic rocks (with reference to exploration, targets and problems, hazards in natural and artificial slopes, escalation at surface, foundation, under ground work and groundwater) (06 hrs)

5. Structural Geology: Strike and dip, Fold and its various types, Faults and its various types, Identification of folds and faults in the field, Unconformity and its various types. Inliers and Outliers, Overlaps and Joints. Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding, Earthquake and Subsidence. Strength of Igneous rock structures. (05 hrs)

6. Topography and Landforms: Surface features of earth, Landforms (Hill, Basin, Plateau valley etc.) to understand construction material, rock types, soil conditions etc. (02 hrs)

7. Stratigraphy: Geological Time Scale, Physiographic divisions of India and their characteristics, Engineering significance of structural characteristics of Dharwar, Cuddapah, Vindhyan, Gondwana and Deccan formations, Deccan and Traps and Engineering projects (Dams, Tunnels, Roads). (03 hrs)

8. Engineering Geology: Preliminary geological investigations, Use of geological map, Aerial photo interpretation and remote sensing. Sources of information (NRSA, GSI, GSDA, CGWB), Types of geological maps, Agricultural soil maps, Drainage and Erosional patterns in aerial photos, Core borings, Drill holes and Test pits, Core and logging of drill core, Limitations of drilling, Engineering significance of geological structures such as stratification, Dip and strike, Faults, Folds, Joints, Dykes, Crush zones etc. Engineering properties of rocks, Porosity, Permeability, Compressive strength, Tensile strength Mechanics of shear in rocks and Modulus of elasticity for rock. (06 hrs)

9. Engineering Projects: Geology of dam and reservoir site, Required geological consideration for site selecting for dam and reservoir. Failure of reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures. Geological investigations of dam sites and their influence on type and design of dams. Case histories. Tunnels-Geological investigations

for tunneling Influence of geological conditions for tunneling, Roads and Bridges- Geological investigations for road and bridge constructions. (04 hrs)

10. Groundwater: Source and types, Water table types and its fluctuations, Types of Aquifers, Springs and its types, artesian well and artesian conditions. Engineering problems and groundwater. Scope of groundwater investigations in Civil engineering: Groundwater survey, Direction of groundwater flow, Pumping test, Groundwater recharge and conservation. Ground water: Factors controlling water bearing capacity of rock. Pervious & impervious rocks and ground water. Lowering of water table and Subsidence. (03 hrs)

11. Natural Hazards: Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence in Himalayan region in India. Seismic Zone in India. Earthquakes- Seismic waves and its recordings, Earthquake prone belts/areas, Engineering significance of earthquakes, Landslides- Causes and types, Influence of dip and strike, Safe and unsafe slopes, Soil creep, Precautions to be taken while making cuts in hill sides, Rock fall, Floods, Food control and disaster management. Geological Hazards- Rock Instability and Slope movement: Concept of sliding blocks. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. . Types of landslide. Prevention by surface drainage, slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Case study on black clay. (04 hrs)

12. Rock as Construction Material: Strength Behavior of Rocks- Stress and Strain in rocks. Concept of RockDeformation & TectonicsImportant variables influencing rock properties and behavior such as Fresh rock Influence from some minerals. Effect of alteration and weathering. Measurement of velocity of sound in rock. Classification of Rock material strength. Core logging. Rock Quality Designation. Rock mass description. Requirements as good construction material, Suitability of rocks as construction material. (02 hrs)

TERM WORK:

1. Identification of Minerals: Quartz and its varieties, Orthoclase, Plagioclase, Microcline, Zeolites, Muscovite, Biotite, Horhblende, Garnet, Asbestos, Actinolite, Chlorite, Olivine, Serpentine, Tourmaline, Kaoline, Calcite, Corundum, Apatite, Magnetite, Limonite, Chromite, Pyrite, Malachite, Chalcopynite, Pyralusite, Graphite, Native copper Galena and Baryte.

2. Identification of Rocks: Granites, Syenites, Diorites, Gabbro, Rhyolite, Trachite, Pumice, Pegmatite, Dolerite, Basalt and its varieties, Volcanic breccia. Shales, Sandstones, Conglomerate, Breccia, Grit, Arkose, Organic and chenicallimestones, Laterite, Ballxite and Kankar, Slate, phyllite, schists, Gneisses, Marbles and Quartzites.

3. Geological Maps and Problems: Contour map, Geological map and its reading, Identification of land form in contour maps, Construction of sections of simple geological maps, Selection of engineering sites from geological maps, Merits and demerits of sites, Core logging types and its significance.

REFERENCE BOOKS:

1. Principles of Engineering Geology - by R.B. Gupte
2. Engineering Geology - by Richard E. Godman
3. A Text Book of Geology - by P.K. Mukherjee
4. Geology of India - by D.N. Wadia
5. Principles of Physical Geology - by A. Holmes
6. Groundwater by H.M. Raghunath
7. Engineering and General Geology, by Parbin Singh, 8th Edition, S K Kataria & Sons.
8. Text Book of Engineering Geology, by Kesavvalu, MacMillan India.

9. Geology for Geotechnical Engineers, by J.C. Harvey, Cambridge University Press.

CE304	WATER RESOURCES ENGINEERING - I	L:04, T:0, P:02	Credits: 05

Course Outcomes: At the end of the course the student will be able to

CO1	Understand hydrological process and estimate the hydrological parameters
CO2	Understand agriculture soil water relationships and estimate the crop water requirements
CO3	Understand canal distribution system and design of irrigation canals
CO4	Understand need and design of canal structures and cross drainage works
CO5	Study of seepage theories for diversion head works

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	2	1	2	1	2	1
CO2	2	3	3	2	2	2	2	1	1	1	2	1
CO3	3	3	3	3	3	2	2	1	2	1	2	1
CO4	2	3	2	3	2	2	2	1	1	1	2	1
CO5	2	2	3	3	3	1	2	1	3	1	2	1

1: Slightly 2: Moderately 3: Substantially

1. Introduction: irrigation, water resources in India, need of irrigation in India, development of irrigation in India, impact of irrigation on human environment, irrigation systems: minor and major, command area development. (04 hrs)

2. Precipitation: Definition, conditions for occurrence of precipitation, forms of precipitation, Characteristics of monsoon over India, Measurement of precipitation, missing precipitation data, consistency of data, Presentation of data, Mean depth of rainfall over an area, Rainfall characteristics and their relations. Depth Area Duration Curves Maximum intensity-duration analysis (06 hrs)

3. Infiltration: Definition, factors affecting, infiltration indices, measurement of average infiltration rate, Horton's infiltration equation (03 hrs)

4. Evaporation and Transpiration: Definition, factors affecting evaporation rate, measurement of evaporation rate, Transpiration, evapotranspiration, PET, AET. Methods of estimation of evaporation and evapotranspiration rate, Reservoir evaporation and its reduction. (04 hrs)

5. Water Requirement of Crops: Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships- soil characteristics significant from irrigation considerations, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation. (06 hrs)

6: Distribution System: Canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels carrying clear and sediment laden

water, alluvial channels carrying clear and sediment laden water, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi-modular and modular outlets. Water logging: causes, effects and remedial measures. Lining of canals, economics of lining, and types of lining. Drainage of irrigated lands: necessity, methods. (08 hrs)

7. Canal Structures: Surface/sub-surface flow considerations for design of canal structures: hydraulic jump, seepage forces, uplift forces. Canal falls, cross regulator, distributory head regulator, canal escapes: types, components and design considerations (06 hrs)

8. Cross Drainage Works: need, types, design considerations. (03 hrs)

9. Canal Head Works: Weir and barrage, different units of head works, types of weirs, sediment control in canals, river training for canal head works. Theories of seepage for design of weirs: Bligh's creep theory, Lane's weighted creep theory, Khosla's method of independent variables. (06 hrs)

TERM WORK:

Term work shall consist of following:

1. Computer Programs for Canal design, Regulators C.D. Works, Canal flow
2. Neat sketches of various C,D, Works Canal falls at least-5

REFERENCE BOOKS:

1. Irrigation Engineering by G.L. Asawa, Wiley Eastern
2. Irrigation Engineering & Hydraulic Structures by S.K. Garg, Khanna Publishers
3. Irrigation Water Resources and Water Power Engg. by P.N. Modi, Standard Book House, New Delhi
4. Irrigation Engineering and Water Power Engg. by B.C. Punmia , Pande, B B Lal, Laxmi Publications

CE 305	**TRANSPORTATION ENGINEERING - I**	**L:04, T:0, P:02**	**Credits: 05**

Course Outcomes: At the end of the course the student will be able to

CO1	Study of road development, road alignment and preparation of highway project.
CO2	Design cross section elements, sight distance, horizontal and vertical alignment. Study, analysis and design of curves and grades.
CO3	Implement traffic studies, traffic regulations and control, and intersection design
CO4	Knowledge of pavement materials and characteristics.
CO5	Design flexible and rigid pavements as per IRC.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	3	2	2	2	1	3	1	2	1
CO2	2	2	2	3	3	2	3	1	2	1	2	1
CO3	2	2	2	3	3	2	2	1	2	1	2	1
CO4	1	2	2	3	3	2	3	1	3	1	2	1
CO5	1	2	2	2	3	3	3	1	2	1	1	1

1: Slightly 2: Moderately 3: Substantially

1. Introduction: Introduction- Role of transportation in society, Objectives of transportation system, different types of modes, planning & co-ordination of different modes for Indian conditions, Highway planning, Surveys, Historical Development, Components of Transportation systems, Road development and alignment Highway planning-Classification of roads, brief history of road development in India, present status of roads in India, road patterns, saturation systems, highway alignment: basic requirements for an ideal alignment, factors governing highway alignment, highway location surveys and studies, highway alignment in hilly areas, drawings and reports, highway project preparation. (06 hrs)

2. Highway Geometrics: Cross sectional elements, Design steps, Sight distance, Passing and Non passing distance, horizontal alignment, super – elevation, set back transition curves and vertical Alignment, Geometrics of hill road Design of horizontal alignment: horizontal curves, design of super elevation and its provision, radius at horizontal curves, widening of pavements at horizontal curves, analysis of transition curves. Design of vertical alignment: different types of gradients, grade compensation on curves, analysis of vertical curves, summit curves, valley curves. Intersection: at grade and grade separated intersections, speed change lanes, Canalization, Design of rotary intersection and mini roundabout (10 hrs)

3. Traffic Engineering: Traffic characteristics, Traffic survey's origin and destination studies, spot speed studies conflicts, 3–5 of traffic engineering. Intersection at grade, grade separations. Traffic control devices, parking and lighting. control-Traffic engineering definitions: functions, organization and importance, necessity of understanding the behaviour of road user and vehicle characteristics, human factors governing the road user behaviour- power performance and other vehicular characteristics. Traffic studies and surveys: Speed studies: presentation of data, journey time and delay studies, uses and various methods, relative merits and demerits Vehicular volume counts: types, various available methods, relative merits and demerits, planning of traffic counts, vehicle occupancy surveys. Origin: destination surveys need and uses, various available methods, checks for accuracy, presentation of data. Parking surveys: needs and types. Study of various photographic techniques available for traffic studies. Traffic signs and marking: types, location, height etc., miscellaneous traffic control aids like roadway delinators, hazard markers, object marker, speed breakers, rumble strips etc., Street lighting: needs, definitions, laws of illumination, methods of discernment, glare problem, light lantern arrangement, types of lamps, planning and designing.

(12 hrs)

4. Highway Materials Characterization: Soil classifications for road materials. Tests on bitumen, Bituminous mix design, Soil stabilization, geo textiles (02 hrs)

5. Highway Pavement and Construction: Introduction of G.I. and C.B.R. method of design for flexible pavements and construction basics of rigid pavement design and construction, highway maintenance and drainage Design of pavements-Types of pavements, comparison of different types of pavements, functions of pavement components, pavement design factors, design wheel load, equivalent single wheel load, repetition of loads, equivalent wheel load factors, strength characteristics of pavement materials, climatic variation; design of flexible highway pavement as per IRC approach, design of flexible airport pavements, Stresses in rigid highway pavements, critical load positions, stresses due to loads, stresses due to temperature change, combined loading and temperature stresses, Joints in rigid pavements: transverse joints, longitudinal joints, fillers and sealers. (10 hrs)

TERM WORK:

Term work shall consist of following Sketches

1. C/S of pavement.
2. C/S of Railway track.
3. Three sketches on Railway fixtures.
4. Detailed sketch of Turnout.
5. Two sketches on Track junctions.
6. Two sketches on Stations and yards

TESTS ON:

1. **Road Materials:** Specific gravity, Crushing, Impact, Abrasion and Shape.
2. **Bitumen:** Specific gravity, Viscosity, Flash point, Softening point and ductility.

REFERENCE BOOKS:

1. Highway Engineering	by Khanna, S.K and Justo, C.E.G. Nem Chand and Bros.
2. Traffic Engineering and Transport Planning	by Kadiyali, L.R, Khanna Publishers, New Delhi
3. Principles of Highway Engineering,	by Kadiyali, Khanna Publishers.
4. Principles of Transportation engineering	by B.V.Rao

SEMESTER-VI

CE306	DESIGN OF STRUCTURES – II (RCC)	L:04, T:0, P:02	Credits: 05

Course Outcomes: At the end of the course the student will be able to

CO1	Study of different design philosophies. Study of Limit state method in detail.
CO2	Analysis and design of beams.
CO3	Analysis and design of slab and staircase.
CO4	Analysis and design of column and footing.
CO5	Application of IS code provisions for design of structural elements. Drawing reinforcement detailing for designed structural elements.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	3	1	2	1	2	1	1	2
CO2	1	2	3	3	2	2	2	2	2	1	2	1
CO3	1	1	2	3	3	1	2	1	1	1	2	1
CO4	1	2	2	3	3	2	2	1	2	1	1	1
CO5	2	2	2	2	3	1	2	1	2	1	1	2

1: Slightly 2: Moderately 3: Substantially

1. Design Philosophies: Introduction to working stress method, ultimate load method, and detailed philosophy of limit state method. Types & classification of Limits states, Stress – strain relationship for concrete and steel. Characteristic strength, characteristic load, partial factor of safety (08 hrs)

2. Beams: Introduction, Assumptions, modes of failure, moment of resistance; Flexural shear; Diagonal tension, Design for shear reinforcement in beams, Concept of development length & bond, Design of beams :singly, doubly reinforced Rectangular beams and flanged beams for flexure, shear, bond and torsion: Simply supported, continuous, cantilever. (20 hrs)

3. Slabs: Introduction, Design of one way, two way, cantilever and continuous slabs (10 hrs)

4. Columns: Axial compression, design of short columns under axial load, uniaxial and biaxial bending (10 hrs)

5. Footings: Design of Isolated footings, design of eccentric footing. (04 hrs)

6. Staircases: Design of staircase: Dog legged and Open well stair case. (02 hrs)

(Note: All designs are by limit state method)

TERM WORK:

Design and drawing of RC building up to 12m height above ground level for gravity loads only, covering all types of structural elements of building. Detailed structural drawings for designed building with reinforcement detailing and bar bending schedule.

It shall consist of design and drawing for various structural elements as detailed below.

1. Design and drawing of beams.
2. Design and drawing of slabs
3. Design and drawing of column and footings

4. Design and drawing of staircase

CE307	THEORY OF STRUCTURES – II	L:04, T:0, P:00	Credits: 04

Course Outcomes: At the end of the course the student will be able to

CO1	Study of basic theorems of structural mechanics
CO2	Study and analysis of structures by slope deflection method and moment distribution method
CO3	Study and analysis of structures by Kani's method
CO4	Understand the behaviour of arches and analyze it
CO5	Study and apply the basic concepts of matrix methods in structural analysis

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	1	1	1	1	1
CO2	2	2	2	2	3	1	1	1	2	1	2	1
CO3	2	2	3	3	3	2	1	1	3	1	1	2
CO4	3	2	2	3	1	1	1	2	1	2	2	2
CO5	3	3	2	3	3	3	1	1	1	2	1	2

1: Slightly 2: Moderately 3: Substantially

1. Basic Theorems of Structural Mechanics: Maxwell's reciprocal theorems, Muller Breslau's principle, Application of these theorems (06 hrs)

2. Two Hinged Arches: Reaction, Horizontal thrust, effect of support yielding rib shortening and Temperature changes, influence line for Horizontal thrust, bending moment, radial shear and normal thrust (06 hrs)

3. Slope Deflection Method: Introduction, development of slope deflection equations, application to Beams (06 hrs)

4. Moment Distribution Methods: Introduction, concept of moment distribution, Application to beams, frames and frames with and without side sway. (08 hrs)

5. Kani's Methods: Introduction, Basic concepts, application to beams and frames, with and without side sway (10 hrs)

6. Matrix Methods: Fundamental concepts of flexibility and stiffness method of analysis, Formulation of flexibility matrix and stiffness matrix, Application to simple structures. (12 hrs)

REFERENCE BOOKS:

1. Basic Structural Analysis SI Units by C.S. Reddy, TMH Publishing Co. New Delhi
2. Theory of Structures by Gupta and Pandit, Tata Mcgraw hill Pub.
3. Structural Mechanics Vol. II, by Junnarkar S.B; Charotar Publishers.
4. Analysis of Structures, Vol. II by Vazrani and Ratwani, Khanna Publishers
5. Theory of Structures by Timosheko and Young.
6. Statically Indeterminate Structures by C.K. Wang.
7. Basic Structural Analysis by Wilbur and Norris

CE307	WATER RESOURCES ENGINEERING-II	L:04, T:0, P:02	Credits: 05

Course Outcomes: At the end of the course the student will be able to

CO1	Understand the runoff process and use the concepts of hydrograph, S-hydrograph, Unit hydrograph and IUH
CO2	Understand groundwater flow and properties of aquifer. Able to do water availability studies and determine storage capacity of storage reservoirs.
CO3	Study of various types of dams. Analyze gravity and earth dams
CO4	Study of spillways and energy dissipation works
CO5	Estimate hydropower potential and study various plant layouts

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3	1	2	2	1	2	1	2	2
CO2	1	3	3	2	2	1	2	1	2	1	2	1
CO3	2	2	2	2	3	2	2	1	2	1	2	2
CO4	1	1	2	2	2	2	2	1	2	1	2	2
CO5	1	2	2	2	2	3	3	2	2	1	2	2

1: Slightly 2: Moderately 3: Substantially

1. Runoff: Definition, types of runoff, annual yield and its estimation, dependability of annual yield, factors affecting runoff, flow duration curve and flow mass curve and their application (03 hrs)

2. Hydrographs: Stream flow hydrograph, factors affecting shape of hydrograph, methods of base flow separation, Unit hydrograph theory, applications of UH, S-Curve, Instantaneous Unit hydrograph, Frequency analysis of rainfall and runoff, Measurement of runoff. (04 hrs)

3. Groundwater Hydrology: Definition, importance of groundwater, Advantage of groundwater, types of aquifer, properties of aquifer general flow equation for groundwater and its applications, safe yield for aquifer, steady, unsteady, radial flow to wells, Thiem's equation for well flow, saltwater intrusion. (04 hrs)

4. Reservoir: Site selection, classification, water availability studies, demand analysis, estimation of storage capacity from mass curve, area–elevation curve, reservoir sedimentation, causes, problems and remedial measures, life of reservoir, reservoir losses, operation of multipurpose reservoir, and reservoir economics (04 hrs)

5. Dams: (10 hrs)

a) Arch Dams: Suitability, types, design methods, cylinder theory, and elastic theory.

b) Buttress Dams: Types and selection, design principles, miscellaneous types of dams steel dams, timber dams etc.

c) Gravity Dams: Suitability, forces acting on it, modes of failure and factors of safety, elementary and practical profile, Principle and shear stress, stability analysis by gravity method, galleries and joints in dams, treatment of dam foundation, grouting, control of crack

d) Earth Dams: Types, suitability, construction methods, criteria for safe design, phreatic line, types of filters, slope protection works, seepage control, stability of slope, rock fill dams.

6. Spillways: Necessity, types, factors affecting design, ogee spillway-profile and its computation, chute spillway, side channel, shaft, siphon spillways etc. spillway gates, operation and control (06 hrs)

7. Energy Dissipators: Types and selection, IS and USBR basins, bucket type stilling basins (02 hrs)

8. Hydropower Engineering: Definition, basic principles, estimation of hydropower potential, load curve, flow duration curve. Types of plants- typical layouts. (04 hrs)

TERM WORK:

Term work shall consist of following exercises on

1. Reservoir capacity estimation from mass curve
2. Calculation of life of reservoir
3. Types and design principles of buttress dam
4. Stability analysis of gravity dam with and without earthquake force
5. Plotting of phreatic line in an earth dam
6. Swedish slip circle method of stability analysis.
7. Design of ogee spillway

REFERENCE BOOKS:

1. Irrigation Engineering by B.C. Punmia and Pande
2. Irrigation Engineering and Hydraulic structures by S.K. Garg
   Irrigation Water Resources and Water Power Engineering by Dr. P.N. Modi
3. Irrigation Engineering by Bharat Sing.
4. Irrigation Practice and Design (Vol. I, II, and III) by Khushalani G. B.
5. Theory and Design of Irrigation Structures by R.S. Varabeny and Gupta
6. Engineering for Large Dam; (Vol. I, II) by Thomas
7. Concrete Dams by H.D. Sharma

CE309	**TRANSPORTATION ENGINEERING-II**	**L:04, T:0, P:00**	**Credits: 04**

Course Outcomes: At the end of the course the student will be able to

CO1	Study and understand the requirements of railways, airports and harbours
CO2	To design various components of railway engineering
CO3	To plan the airport terminal area
CO4	Perform geometric design for the three modes
CO5	Study of the fundamentals of urban transportation systems

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	3	2	2	2	1	2	1	1	1
CO2	1	2	2	2	3	2	2	1	2	1	2	2
CO3	1	1	2	2	3	2	2	2	2	1	2	1
CO4	2	2	2	3	2	2	2	2	1	1	1	2
CO5	1	2	3	3	3	2	1	1	2	1	2	2

1: Slightly 2: Moderately 3: Substantially

1. Introduction: Role of Railway in Transportation, Historical development and modernization of railway in India, classification of Indian railways, metro and suburban railways (02 hrs)

2. Railway Track: Permanent way, requirement of ideal permanent way, capacity of railway track, Types and selection of gauges, Coning of wheels, Function of rails, Selection and Types of rails, Rail failures, wear on rails; Creep of rails. Theories of creep, Measurement and Prevention of Creep Functions of sleepers, Types, Requirement of Sleepers: Functions of ballast, Different fixtures and their purposes, Railway track cross sections (08 hrs)

3. Railway Geometrics: Track alignment, Gradient and grade compensation, Speed of train, Cant and negative cant, Curves, Points and crossing Track junctions, Stations and yards, track drainage and maintenance Signaling and interlocking: classification of signals, interlocking of signals and points, control of train movements. Construction and maintenance of railway track, methods of construction, material requirements, special measures for high speed track, maintenance of tracks and traffic operations (10 hrs)

4. Airport Engineering-Aircraft characteristics - Airport obstructions and zoning - Runway - taxiways and aprons- Terminal area planning (10 hrs)

5. Docks and Harbors - Types - Layout and planning principles- breakwaters - docks- wharves and quays - Transit sheds- warehouses- navigation aids. (08 hrs)

6. Urban Transportation Systems - Bus transit - Mass Rapid Transit System - Light Rail Transit. Transport economics and Financing, Intelligent Transportation Systems (ITS)(06 hrs)

REFERENCE BOOKS:

1. Principles of railway engineering by S.C. Rangawala
2. A Textbook of Railway Engineering by S.C. Saxena and S.P. Arora, Dhanpat Rai& Sons Pub., New Delhi
3. A Course in Highway Engineering by S.P. Bindra, DhanpatRai& Pub., New Delhi
4. Railway Engineering by Satish Chandra and M.M. Agrawal
5. Airport Planning and Design, by Khanna, S.K. and Arora, M.G., Nemchand and Bros. 1999.
6. Elements of Dock and Harbor Engineering by Oza and Oza, Charotar Publishing House, 1996

CE310	**ENVIRONMENTAL ENGINEERING**	**L:04, T:0, P:02**	**Credits: 05**

Course Outcomes: At the end of the course the student will be able to

CO1	Identify the source of water and water demand
CO2	Apply the water treatment concept and methods
CO3	Apply water distribution processes and operation and maintenance of water supply
CO4	Determine the sewage characteristics and design various sewage treatment plants
CO5	Prepare basic process designs of water and wastewater treatment plants collect, reduce, analyze, and evaluate basic water quality data

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	3	1	2	2	2	2	1	1	2
CO2	1	2	2	2	3	3	3	2	2	1	2	1
CO3	2	2	2	1	2	2	2	1	2	1	1	2
CO4	1	1	2	2	3	3	2	2	2	1	2	2
CO5	2	2	3	3	2	2	2	1	2	1	2	1

1: Slightly 2: Moderately 3: Substantially

1.Introduction to Water Supply: Various components of environment, Necessity and importance of water works, components of water supply scheme (02 hrs)

2.Quantity of Water: Daily rate of water consumption for various purposes, factors affecting consumption, fire allowance, Variation in the demand of water and its effect on the design of water supply units, population forecast, Design capacity of scheme. (02 hrs)

3. Sources of Water: Comparative study of various sources with respect to quality and quantity, Selection of source from view point of service provider, Economics of scheme (02 hrs)

4.Raw water conveyance: Intake structures, various conveyance systems, Pressure pipes, Different types of valves, pressure regulating valves, Fire hydrants, services, Testing of pipes and pipe fittings. (03 hrs)

5. Treatment of water: Quality standards, physical, chemical and bacteriological aspects of water, typical layout of water purification plant for domestic and industrial supply, details and design of various treatment units: (06 hrs)

a) Screens
b) Plain sedimentation – Principle and types
c) Mechanical sedimentation – Principle, coagulant, dosing and mixing, coagulation,
d) flocculation, clarification, sludge removal.
e) Filtration – Theory, working, trouble shooting and design of rapid sand gravity filters,
f) pressure filters, portable filters.
g) Disinfection – Different methods, pre, post and super chlorination, break point
h) chlorination, chlorine demand, residual chlorine, Dechlorination.
i) Miscellaneous methods – Aeration, activated carbon, hardness removal, fluoride
j) removal, reverse osmosis.

6. Distribution of water: Objectives of distribution, Zoning of areas, service reservoirs –their purpose and capacity determination, systems of distribution, pressure in distribution system, determination of diameter of mains. (05 hrs)

7. Quantity of sewage: Definitions of terms, sources of sewage, domestic and industrial water, D.W.F., storm water runoff, ground water infiltration. Systems of sewerage, design discharge. (04 hrs)

8. Sewer Design: Common materials and shapes, Hydraulic design of sanitary sewers, storm sewers, Laying and jointing of sewers, testing of sewer pipes. (05 hrs)

9. Plumbing and sanitation system: Pipe line and fixtures for bathroom and W.C., House drainage, rain water collection system, Manholes, street inlets, flushing devices, domestic sewers – one pipe and two pipe systems, traps, I.C. and other special structures. (04 hrs)

10. Sewage Pumping: Types of pumps pump selection, sludge pumping. (03 hrs)

11. Wastewater Characteristics: Sampling procedure, Wastewater analysis, Determination and application of physical, chemical and biological characteristics. (02 hrs)

12. Effluent disposal: Various methods and their suitability, Treatment in receiving environment, Effects on biology. (03 hrs)

13**. Sewage Treatment:** Flow chart, various units incorporated, conventional and nonconventional methods: (04 hrs)

a) Primary Treatment – Principles and design of facilities
b) Secondary Treatment – Importance of micro organisms, aerobic and anaerobic process
   i. Trickling filters, Activated sludge process, Lagoons, Oxidation ponds and
   ii. Ditches, Constructed wetlands, RBC, Membrane bioreactors.
   iii. Sludge digestion – Sludge digestion, acid and methane fermentation in anaerobic treatment, factors affecting high rate digesters, sludge concentration mixing, input output balance, digester capacity, gas production.
c) Tertiary treatment-Filtration, Nutrient removal

14. Approach to treatment: End of pipe approach, Innovative approach. Reuse of wastewater (02 hrs)

15. Industrial Waste: Elementary knowledge about types and nature. (02 hrs)

TERM WORK:

List of practical: (Any four from group (A), any two from group (B) and two activities in group C)

Group 'A'

1. Conductivity 2. Chlorine demand and Residual chlorine.
3. Study of Chlorinator. 4. Study of Backwashing of filter
5. Study of flame photometer 6. Turbidity

Group 'B'

1. Sampling- Representative sample 2. Solids: Total, Dissolved, and volatile 2. B.O.D.
4. Bacteriological test - Study of slides showing pathogens and micro organisms in water

Group 'C'

1. Visit to water treatment plant (Report to be submitted)
2. Study of software of water distribution system/ water treatment plant
3. Visit to river pollution abatement program
4. Design problem on wastewater treatment.
5. Alkalinity
6. Hardness
7. pH
8. Turbidity
9. Jar test
10. Chlorides
11. Dissolved oxygen
12. Chemical oxygen demand (COD)
13. Sludge volume index (SVI)
14. Most probable number (MPN)

REFERENCE BOOKS:

1. Water Supply and Sanitary Engineering by Birdie
2. Water and wastewater technology by Hammer, John Wiley and Sons
3. IWWA Technical Data book
4. Wastewater Engineering: Treatment, Disposal and Reuse by MetCalf and Eddy 3rd Ed., TMH New Delhi.

CE311	FIELD TRAINING	L:00, T:0, P:02	Credits: 01

Course Outcomes: At the end of the course the student will be able to

CO1	Understand field practices in civil engineering
CO2	Correlate theoretical concepts with practical implementation
CO3	Execute various laboratory practices in civil engineering.
CO4	Acquire report preparation skills

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	2	2	2	2	2	1	1	2
CO2	1	2	2	3	2	1	1	1	1	2	2	2
CO3	1	2	2	3	3	2	2	2	2	2	2	1
CO4	1	1	2	2	2	1	1	2	2	3	2	2

1: Slightly 2: Moderately 3: Substantially

(Three Weeks duration in the winter vacations term work contains training, Report writing and delivery of seminar)

The practical training program between T.Y. first and second semester is aimed at imparting practical knowledge to support theoretical concepts and principles of Engineering. It is expected that the student should work at construction sites/projects/ design organizations, to acquire the knowledge of practical aspects of various engineering works (i.e. road works, Construction of pavements, culverts, bridges, irrigation works, building works, dams tunnels water supply, watershed management schemes etc.) for THREE WEEKS duration in the winter vacations. A detailed report of the training, comprising of the outline of the work, technical details, construction techniques, machinery used, its make, capacity, operations, consumption of fuel etc, Construction materials used, its rates, source, suppliers, technical specifications etc, Quality and quantity of labour force, its task work, source, wages, working hours residential arrangements, work sequence etc. should be submitted to the faculty in charge in the department. Assessment for term work and viva voce at the end of T.Y. second semester shall be based on training report submitted and seminar delivered, by the student. The size of the group working together on the project / site shall be depending on the size of the project, however it should not be greater than five. In one institute the repetition of the similar site should be avoided. The faculty in charge shall personally visit the site at least once during the training period. Faculty in charge should have a load of two hrs/week, during the entire second semester, who will guide the students in report writing. The faculty in charge will conduct the seminar of the students on the training received.

CE312	CONSTRUCTUION PROJECT PLANNING	L:04, T:0, P:00	Credits: 04

Course Outcomes: At the end of the course the student will be able to

CO1	Define the fundamental principles of management theories
CO2	Understand the feasibility analysis in construction management and network analysis tools for cost and time estimation
CO3	Apply theoretical and practical aspects of construction management techniques to achieve project goals
CO4	Analyze contemporary construction management tools and methodologies in Indian context.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	1	1	2	1	2	1	2	2
CO2	1	2	3	3	2	1	2	1	2	1	1	1
CO3	1	1	3	2	1	2	2	2	2	1	2	1
CO4	1	2	2	2	2	3	3	3	3	1	2	1

1: Slightly 2: Moderately 3: Substantially

1. Construction- Unique features of construction, construction project, types and features, phases of a project, agencies involved and their methods of execution. (02 hrs)

2. Construction project planning- Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, estimating durations, sequence of activities, activity utility data (06 hrs)

3.Techniques of planning- Bar charts, Networks: basic terminology, types of precedence relationships: finish to start, start to start, finish to finish, start to finish, preparation of CPM networks: activity on link and activity on node representation, analysis of single relationship (finish to start) networks, computation of float values, critical and semi-critical paths, calendering networks. (04 hrs)

4. Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts, resource aggregation, allocation, smoothening and leveling. (04 hrs)

5. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion. (06 hrs)

6. Planning and organizing construction site and resources- Site: site layout, developing site organization, record keeping at site, Manpower: planning, organizing, staffing, motivation, Materials: concepts of planning, procurement and inventory control, Equipment: basic concepts of planning and organizing, Funds: cash flow, sources of funds. (08 hrs)

7. Construction costs- Classification of costs, time cost trade-off in construction projects, compression and decompression (02 hrs)

8. Monitoring & control-Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of

inspection, basics of statistical quality control. Safety and health on project sites: accidents; their causes and effects, costs of accidents, occupational health problems in construction, organizing for safety and health. (10 hrs)

REFERENCE BOOKS:

1.Professional Construction Management by Barrie D.S. and Paulson B.C. McGraw Hill

2. Construction Project Management by Chitkara K K, Tata McGraw Hill

3. Handbook of Construction Management by P K Joy

4.Construction Hazard and Safety Handbook by King and Hudson, Butterworths

5.Critical Path Methods in Construction Practice by Antill J M & Woodhead R W, Wiley

CE313	**INFRASTRUCTURE SYSTEMS PLANNING**	**L:04, T:0, P:00**	**Credits: 04**

Course Outcomes: At the end of the course the student will be able to

CO1	Recall fundamentals of Building Planning and Computer Aided Drawing
CO2	Understand various systems of infrastructure planning
CO3	Analyze any given real-life problem with various infrastructure system planning
CO4	Apply the fundamentals of infrastructure system planning to solve problems of IT infrastructure and IT organizations.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	2	3	2	2	2	1	1	2	1
CO2	1	2	2	3	2	1	2	1	2	2	1	1
CO3	2	3	3	2	2	1	2	1	1	1	2	3
CO4	1	2	2	2	3	2	3	1	2	1	2	1

1: Slightly 2: Moderately 3: Substantially

1. Infrastructure Systems Planning- An Overview Definitions, Infrastructure management activities, Evolutions of Systems since 1960s (Mainframes-to-Midrange-to-PCsto- Client-server computing-to-New age systems) and their management, growth of internet, current business demands and IT systems issues, complexity of today's computing environment, Total cost of complexity issues, Value of Systems management for business. (08 hrs)

2. Preparing for Infrastructure Systems Planning & Management- Factors to consider in designing IT organizations and IT infrastructure, Determining customer's Requirements, Identifying System Components to manage, Exist Processes, Data, applications, Tools and their integration, Patterns for IT systems management, Introduction to the design process for information systems, Models, Information Technology Infrastructure Library (ITIL). (08 hrs)

3. Service Delivery Processes- Service-Level Management, Financial Management & Costing, IT Services Continuity Management, Capacity Management, Availability Management. Service Support Processes, Configuration Management, Service desk. Incident Management, Problem Management, Change Management, Release Management. (08 hrs)

4. Storage and Security Management Introduction Security, Identity management, Single sign-on, Access Management, Basics of network security, LDAP fundamentals, Intrusion detection, Firewall; security information management Introduction to Storage, Backup & Restore, Archive & Retrieve, Space Management, SAN & NAS, Disaster Recovery, Hierarchical space management, Database & Application protection, Bare machine recovery, Data retention. (08hrs)

5. System thinking method for model-building of infrastructural planning Model observation, Construction of model structure, Simulation analysis, Multi-agent system. (08 hrs)

REFERENCE BOOKS:

1. Foundations of IT Service Management: based on ITIL — by Jan Van Bon, Van Haren Publishing, 2005.
2. High Availability: Design, Techniques & Processes — by Floyd Piedad, Michael Hawkins, Prentice Hall, 2000.
3. IT Organization: Building a World class Infrastructure — by Harris Kem, Stuart Gaiup, Guy Nemiro, Prentice Hall, 2000.
4. IT Systems Management: Designing, Implementing, and Managing World-Class Infrastructures — by Rich Schiesser, Prentice Hall; 2001.