B. E. SYLLABUS

CIVIL ENGINEERING

VII & VIII SEMESTER

With

Scheme of Teaching

& Examination

DEPARTMENT: CIVIL ENGINEERING

Sl. No.	Name		Designation
1.	Dr. I. Ramesh Mithanthaya	Ph.D	Prof./ Vice Principal /Dean(Aca)
2.	Dr. A.N. Parameswaran	Ph.D	Professor/ Director (Industry Institute Interaction)
3.	Dr. Udayakmar G.	Ph.D	Professor/HoD
4.	Dr. Srinath Shetty K.	Ph.D	Professor
5.	Dr. Radhakrishnan K.	Ph.D	Professor
6.	Dr. Mahadeve Gowda	Ph.D	Professor
7.	Dr. Arunkumar Bhat	Ph.D	Professor
8.	Mr. Y.R. Suresh	M.E.,M.Tech (Ph.D.)	Asso. Prof
9.	Mr. J.K. Lokesh	M.Tech	Asst. Prof.Gd III
10.	Mr.Y. Umashankar Shetty	M.Tech	Asst. Prof. Gd III
11.	Mr. Pushparaj	M.Tech (Ph.D.)	Asst. Prof. Gd III
12.	Dr. Bhojaraja B E	Ph.D.	Asst. Prof. Gd III
13.	Mr.Sundip Shenoy R.	M.Tech	Asst. Prof. Gd II
14.	Mrs.Thangamani R.	M.Tech (Ph.D.)	Asst. Prof. Gd II
15.	Mr.Anil Kumar	M.Tech (Ph.D.)	Asst. Prof. Gd II
16.	Mr.Akshay N.K.	M.Tech	Asst. Prof. Gd I
17.	Mr.Prashantha Kumar K.	M.Tech (Ph.D.)	Asst. Prof. Gd I
18.	Mr.Manjunath M.	M.Tech (Ph.D)	Asst. Prof. Gd I
19.	Mr.Roshan Rai	M.Tech	Asst. Prof. Gd I
20.	Mr.Shriram P Marathe	M.Tech (Ph.D.)	Asst. Prof. Gd I
21.	Mr.Prithviraj H.K.	M.Tech	Asst. Prof. Gd I
22.	Mr. Shaik Kabeer Ahmed	M.Tech	Asst. Prof. Gd I
23.	Mr.Gururaj Acharya	M.Tech	Asst. Prof. Gd I
24.	Mr.Rakshith Kumar Shetty	M.Tech	Asst. Prof. Gd I
25.	Mr.Janakaraj	M.Tech	Asst. Prof. Gd I
26.	Mr.Mithun B.M.	M.Tech (Ph.D.)	Asst. Prof. Gd I
27.	Mr.Thushar S. Shetty	M.Tech	Asst. Prof. Gd I

28.	Mr.Pradeep Karanth	M.Tech	Asst. Prof. Gd I
29.	Mr.Shanmukha Shetty	M.Tech	Asst. Prof. Gd I
30.	Mr. Sabyath Shetty	M.Tech	Asst. Prof. Gd I
31.	Ms.Thanushree Hegde	M.Tech	Asst. Prof. Gd I

DEPARTMENT OF CIVIL ENGINEERING

Vision

To uphold the Department as a leader in community development through innovation and excellence in diverse areas of Civil Engineering to meet the global challenges and market demands.

Mission

1. To provide the students a strong theoretical knowledge and practical skills to understand the basic concept and fundamentals of various Civil Engineering subjects.
2. To be competent and skilled enough to take the challenges in Research, Consultancy and Entrepreneurship.
3. To encourage the students in developing professional ethics through discipline and principles.

Programme Educational Objectives (PEOs):

The graduates of the program will be :

1. Equipped with fundamentals of Civil Engineering along with interdisciplinary science, engineering and management concepts.
2. Equipped with advanced and emerging field of Civil Engineering practices to compete and match with the industrial requirements.
3. Competent enough to conceive the ideas, prepare plan, design, execute, monitor and manage the project with the effective utilization of resources such as men, material, machine and money along with time effectively.
4. Continue to learn and adapt to suit the needs and challenges of real world problems and come up with optimal solutions.

Programme Outcomes (POs):

After successful completion of the Civil Engineering Program, Graduates will be able to:

PO1	Apply the knowledge of mathematics, basic science and Civil Engineering and solve practical problems in the field of Civil Engineering.
PO2	Identify, formulate, review research literature, and analyze complex Civil Engineering problems using first principles of mathematics, basic sciences, and Civil Engineering
PO3	Design and conduct tests/experiments in the various domains related to Civil Engineering and develop methodology/ technology to implement the solution successfully to meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO4	Conduct investigations of complex problems in Civil Engineering using research based knowledge and research methods.
PO5	Exhibit skills to use modern engineering tools, software and equipment to analyze various problems in the Civil Engineering domain with an understanding of the limitations
PO6	Apply method of reasoning understood by the knowledge of social sciences to assess various issues of society and understand consequent responsibilities of a professional civil engineer.
PO7	Understand the impact of Civil Engineering solutions on existing ecology of a region and demonstrate the knowledge of and need for sustainable development.
PO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the Civil Engineering practice.
PO9	Function effectively as an individual member or leader in diverse teams and multidisciplinary settings.
PO10	Communicate effectively on complex Civil Engineering activities with the engineering community and general public, and write effective reports and design documents, make effective

	presentation, and give and receive clear instructions.
PO11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to implement/manage Civil Engineering projects and in multidisciplinary environments.
PO12	Recognize the need for and develop ability to engage in independent and lifelong learning of technological developments and changes

Program Specific Outcomes (PSOs):

PSO1	Apply knowledge of various domains of Civil Engineering, conduct experiments, analyze, interpret data, and design the system components.
PSO2	Enrich the knowledge in various specializations of Civil Engineering such as Structural, Geotechnical, Transportation, Environmental, Engineering, by means of research and innovative practices
PSO3	Plan, produce detailed drawings, write specification, and prepare cost estimates, select material, schedule work plans.

DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF TEACHING AND EXAMINATION

VII SEMESTER B.E. **30 Hours / Week**

Sl. No.	Code	Subject	Theory/Tuto./Prac./Self Study	Total Hrs./Week	C.I.E	S.E.E	Credits
1	14CV701	Hydrology & Irrigation Engg.	4+0+0+0	4	50	50	04
2	14CV702	Quantity Surveying and Estimation	4+0+0+0	4	50	50	04
3	14CV703	Design of Steel Structures	4+0+0+0	4	50	50	04
4	14CV704	Design of Pre stressed Concrete Structures	3+0+0+0	3	50	50	03
5	14CV71X	Elective – IV	3+0+0+0	3	50	50	03
6	14CV72Y	Elective – V	3+0+0+0	3	50	50	03
7	14CV705	Concrete & Highway Materials Lab	0+0+3+0	3	50	50	02
8	14CV706	Project Work- Phase1	0+0+3+0	3	50	-	01
9	14CV 707	Seminar on Current Topic	0+0+3+0	3	50	-	01
TOTAL			**30**	**30**	**450**	**350**	**25**

ELECTIVE – IV

14CV71X	14CV711	Solid Waste Management
	14CV712	Highway Geometric Design
	14CV713	Advanced Concrete Technology
	14CV714	Theory of Elasticity
	14CV715	Deep Foundations

ELECTIVE – V

14CV72Y	14CV721	Design of Bridges
	14CV722	Pavement Materials and Construction
	14CV723	Numerical methods in Civil Engineering
	14CV725	Earth Retaining Structures
	14CV726	Environmental Geotechnics

DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF TEACHING AND EXAMINATION

VIII SEMESTER B.E. **33 Hours / Week**

Sl. No.	Code	Subject	Theory/Tuto./Prac./Self Study	Total Hrs./Week	C.I.E	S.E.E	Credits
1	14CV801	Engineering Management	4+0+0+S	4	50	50	04
2	14CV802	Design and Drawing of Steel Structures	2+0+3+0	5	50	50	03
3	14CV81X	Elective-VI	3+0+0+0	3	50	50	03
4	14CV82Y	Elective-VII	3+0+0+0	3	50	50	03
5	14CV8X00	Open Elective	3+0+0+0	3	50	50	03
6	14CV803	Project Work	0+0+15+0	15	50	50	09
TOTAL			**33**	**33**	**300**	**300**	**25**

ELECTIVE – VI

14CV81X	14CV811	Reinforced Earth Structures
	14CV812	Ground Water Recharge & Water Conservation
	14CV813	Air Pollution & Control
	14CV814	Pavement Design
	14CV815	Applied Hydrology
	14CV816	Earthquake Resistant Structures

ELECTIVE – VII

14CV82Y	14CV821	Valuation of Real Properties
	14CV822	Finite Element Methods of Structural Analysis
	14CV823	Design of Hydraulic Structures
	14CV824	Road Safety and Management

OPEN ELECTIVE

14CV8X00	14CV8X07	Environmental Impact Assessment
	14CV8X30	Introduction to Geoinformatics

HYDROLOGY AND IRRIGATION ENGINEERING

Sub Code : 14CV701		**Credits**	**: 04**
Hrs/Week : 4+0+0+0		**Total Hours**	**: 52**

*** Self Study to be exercised under the supervision of course instructor and to be restricted to not more than 10% of the total teaching hours.**

Course Learning Objectives:

At the end of the course, student will be able to:

1. Make the students to understand the concepts of hydrological cycle, catchment area, rain fall distribution and its measurements.
2. Enable the students to analyse water losses like infiltration, evaporation and components of runoff.
3. Understand the benefits and ill effects of irrigation, methods of irrigation, reference crop evapotranspiration, and irrigation efficiencies.
4. Design the canal system for irrigation and cross drainage works.
5. Understand the stability analysis of gravity dams and types and failure of earthen dams.

UNIT – I

INTRODUCTION: Definition of hydrology, importance of hydrology, global water availability, practical applications of hydrology, hydrologic cycle, concept of catchment and water budget equation.

PRECIPITATION: Definition, forms and types of precipitation, measurement of rain fall recording and non-recording type of rain gauges, consistency of rainfall data (double mass curve method), computation of mean rainfall (arithmetic average, Thiessen's polygon), mass curve, rainfall hyetographs, intensity – duration - frequency curves. **10 Hours**

UNIT – II

WATER LOSSES: Introduction, infiltration, factors affecting infiltration capacity, measurement (double ring infiltrometer), Horton's infiltration equation, infiltration indices. Evaporation- process, factors affecting evaporation, evapotranspiration, PET, AET, factors affecting ET, estimation of ET.

RUNOFF: Components of runoff, factors affecting runoff, stream flow measurements, area velocity method and slope area method, rainfall - runoff relationship, peak runoff estimation using rational method**.** **12 Hours**

UNIT – III

IRRIGATION: Benefits and ill effects of irrigation, Water logging, need for drainage, sources of water for irrigation, Systems and Methods of irrigation, Reference crop evapotranspiration, crop coefficients, crop water requirements, irrigation water requirements, leaching requirements, irrigation efficiency, frequency of irrigation. **8 Hours**

UNIT – IV

CANALS: Types of canal, alignment of canals, and design of rigid and mobile boundary canals- Lacey's and Kennedy's methods, description of canal drops, canal regulators, cross drainage works. **10 Hours**

UNIT – V

RESERVOIRS: Types, investigation for reservoir sites, storage zones, determination of storage capacity and yield of a reservoir using mass inflow curve.
GRAVITY DAMS: Forces acting on gravity dam, modes of failure, elementary and practical profile, low and high gravity dams, simple design by single step method.
EARTHEN DAMS: Types of earthen dams, modes of failure of earthen dams.

12 Hours

Course Outcomes:

At the end of the course students will be able to

1. Explain the stages of hydrological cycle, Analyze and estimate the pattern of the rainfall, runoff intensity- duration- frequency curves.
2. Quantify the various water losses, stream flow and rainfall -runoff relationship.
3. Explicate the benefits and ill-effects of irrigation systems and crop and irrigation water requirements.
4. Designing of economically feasible canal systems for the given discharge.
5. Compute the storage capacity of reservoirs, to carry out the stability analysis of gravity dams and identify different types of earthen dams and their failure.

Mapping POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L			H					M		H		
CO2	H	H	M	M		H					H			M	
CO3	M	H	H	L							M		H		
CO4	H	L	L								M				L
CO5	M	M	H								L		M		

Note: L: Slight (Low) M: Moderate (Medium) H: Substantial (High)

TEXT BOOKS:

1. Subramanya K, "*Engineering Hydrology*", 3rd edition, Tata McGraw Hill, New Delhi, 3rd Edition, 2008.
2. B.C. Punmia and Pande Lal, "*Irrigation and Water Power Engineering*", Laxmi Publications, New Delhi, 16th edition, 2013

REFERENCE BOOKS:

1. S.K. Garg, "*Irrigation Engineering and Hydraulic Structures"*, Khanna Publications, New Delhi, 10th edition 1993
2. P.N. Modi, "Irrigation, *Water Resources, and Water Power Engineering"*, Standard Book House, New Delhi, 1990.
3. Michael A.M., *"Irrigation Theory and Practices"*,Vikas Publishing House Pvt Ltd, New Delhi, 2008
4. Jayarami Reddy, *"A Text Book of Hydrology"*, Lakshmi Publications, New Delhi, 2005
5. H.M. Raghunath, "*Hydrology*", Wiley Eastern Publication, New Delhi, 1990
6. Ghish S.N. "Flood Control and Drainage Engineering", Oxford & IBH Publishing Co.Pvt. Ltd., 3rd edition 2006.

NPTEL ONLINE SOURCE:

- http://nptel.ac.in/courses/105108081/
- http://nptel.ac.in/courses/105104103/

****

QUANTITY SURVEYING AND ESTIMATION

Sub Code : 14CV702		**Credits : 04**	
Hrs/Week : 4+0+0+S*		**Total Hours : 52**	

*** Self Study to be exercised under the supervision of course instructor and to be restricted to not more than 10% of the total teaching hours.**

Course Learning Objectives:

This Course will enable students to

1. Estimate the quantities of different items of work by using Centre line method and Long wall and Short wall method to know the approximate construction cost of buildings.
2. Able to read and understand the specifications. To carry out barbending schedule and calculate the quantity of steel for RCC structures. Estimate the quantities of items of work and cost of manhole, septic tank, and RCC culvert.
3. Should know the rates of materials and able to analyze the rates of different items of work of buildings.
4. To determine the approximate quantity and cost of earth embankment in cutting and filling for roads by using cross sections, mid-section formula, trapezoidal formula, average end area or mean sectional area method, prismoidal formula.
5. To know the contract systems from the point of contractor's interest to avoid conflicts between client and contractors.

UNIT – I

ESTIMATES: Different type of estimates, study of various drawing attached with estimates, important terms, units of measurements, abstract, approximate methods of estimating buildings, cost from materials and labour, equations recommended by CBRI-examples**.**

Building estimate: Methods of taking out quantities and cost, center line method, long and short wall method or crossing method, preparation of detailed and abstract estimates for the following - masonry structures and framed structures with flat sloped RCC roofs, beams, columns and column footings, RCC roof slabs**.** **20 Hours**

UNIT - II

ESTIMATES OF CIVIL ENGINEERING WORKS: Steel truss (Fink and Howe truss), RCC slab culverts manhole and septic tanks. Specification: Objective of writing specifications essentials in specifications, general and detail specifications of item of works in buildings, specifications of aluminum and wooden partitions, false ceiling, aluminum and fiber doors and windows, various types of claddings. **8 Hours**

UNIT – III

RATE ANALYSIS: Working out quantities and rates for following standard items of works-earth work in different types of soils, cement concrete of different mixes, bricks and stone masonry, flooring, plastering, RCC works, centering and form work for different RCC items, wood and steel works for doors, windows and ventilators. **8 Hours**

UNIT – IV

COMPUTATION OF EARTH WORK FOR ROADS: Methods for computation of earthwork, cross sections, mid-section formula, trapezoidal formula, average end area or mean sectional area method, prismoidal formula, for different terrains. **8 Hours**

UNIT – V

CONTRACTS: Types of contract-essentials of contract agreement-legal aspects, penal provisions on breach of contract, definition of the terms: tender, earnest money deposit, security deposit, tender forms, documents and types, comparative statements, acceptance of contract documents and issue of work orders, duties and liabilities, termination of contract, completion certificate, quality control, right of contractor, refund of deposit, administrative approval, technical sanction, nominal muster roll, measurements-preparation of bills**.**

8 Hours

Course Outcomes:

At the end of the course the student will be able to

1. Arrive approximate quantities of different items of work and cost of buildings.
2. Write the different specifications of items of work of buildings. Able to prepare the schedule of bar and arrive quantity of steel.

3. calculate the quantities of dry materials and analyze the rates of different items of work by using rates of dry materials.
4. Determine the quantity of earthen embankment in cutting and filling for road work.
5. Prepare the contractual documents for projects to avoid conflicts between client and contractors.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**L**									**H**					
CO2			**M**				**M**								
CO3	**L**					**M**				**L**					
CO4			**M**				**H**			**M**					
CO5							**M**	**L**			**H**				

Note: Enter correlation Levels L, M or H as defined below:

L: Low M: Medium H: High

TEXT BOOKS:

1. N.Chakraborti, (2014) "Estimating, Costing, specification and valuation in Civil Engineering." Published by author, Calcutta.
2. Dutta.B.N. (2014) "Estimating & specification", UBS publishers and distributors, New Delhi.

REFERENCE BOOKS:

1. Rangwala.S.C, (2014) "Estimating & specification", Charotar Publishing House Anand.
2. Birde.G.S, (2014) "Text book of Estimating & Costing", Dhanpath Rai and Sons, New Delhi.
3. Kohli D.D. and Kohli R.C, (2004) "A text book of Estimating, Costing and Accounts", S. Chand Co., New Delhi.
4. Martin Brook, (2008), "Estimating and Tendering for construction work", Butter worth- Heinemann Ltd, Oxford.
5. Ivor.H.Seeley, (1997), "Quantity Surveying Practice", Palgrave Macmillan.

NPTEL ONLINE SOURCE:

- http://nptel.ac.in/courses/105103093/14

****

DESIGN OF STEEL STRUCTURES

Sub Code	**: 14CV703**	**Credits**	**: 04**
Hrs/ Week	**: 4+0+0+0**	**Total Hours**	**: 52**

Course Learning Objectives:

This Course will enable students to

1. **Understand** the behavior of different types of steel structures
2. **Identify** different types of sections used in steel construction
3. **Assess** the strength and stability of components of steel structures
4. **Analyse** the strength of various types of members as per the codal provisions
5. **Design** the structural components, viz., tension members, compression members, flexural members, column bases, bolted and welded connections using IS800:2007, steel tables and they are to **Understand** the importance of steel structures and their connections.

UNIT – I

INTRODUCTION: Advantages and disadvantages of steel structures, loads and load combinations, Design considerations, Limit State Method (LSM) of design, failure criteria for steel, IS code provisions, section classification, fire resistance and ductility of steel.

BOLTED CONNECTIONS: Advantages and disadvantages, Design strength of HSFG bolts, design of simple bolted connections (lap and butt), bracket connections.

WELDED CONNECTIONS: Advantages and disadvantages, Types of welds, defects in welds, strength of welds, design of simple welded connections, bracket connections.

12 Hours

UNIT - II

DESIGN OF TENSION MEMBERS: Modes of failure, design of axially loaded tension members and their connections, concept of lug angles.

DESIGN OF COMPRESSION MEMBERS: Modes of failure, Design of single angle struts, compression members. **10 Hours**

UNIT - III

DESIGN OF COMPRESSION MEMBERS: Design of built up compression members, Laced and battened systems,splicing.

COLUMN BASES: Design of simple slab base, gusseted base. **10 Hours**

UNIT – IV

PLASTIC BEHAVIOUR OF STRUCTURAL STEEL: Introduction, Plastic theory, Plastic hinge concept, Plastic Modulus, Shape factor, Plastic Moment.

DESIGN OF FLEXURAL MEMBERS: Types of beams, Modes of failure, Design strength of laterally supported and unsupported beams in bending and shear, Maximum deflection, Design of laterally supported and unsupported beams. **10 Hours**

UNIT –V

TYPES OF CONNECTIONS: Beam to beam, beam to column – bolted and welded, framed and seated, stiffened and unstiffened connections (moment resistant connections not included). **10 Hours**

Course Outcomes:

At the end of the course the student will be able to

1. Tell the importance of steel structures, general guidelines as per IS 800:2007 and they are also able to analyze & design the connections, mainly bolted and welded ones.
2. Design tension members and simple compression members as per the code with proper connections by understanding the mechanism of failure of such members.
3. They are able to design built-up compression members along with lacings, battens and splices with proper connections and also they are able to design simple footings like slab base and gusset base for the columns.
4. Design laterally restrained and unrestrained beams with proper checks and understand the modes of failure of flexural members.
5. Design some of the simple types of beam-beam and beam-column connections, viz., framed, unstiffened seat, stiffened connections using bolts and welds.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L			M						M		M	L	
CO2	M	L	H		M						M		M	L	L
CO3	M	L	H		M						M		M	H	L
CO4	M	L	H		M						M		M	H	L
CO5	M	L	H		M						M		M	H	L

Note : L: Slight (Low) M: Moderate (Medium) H: Substantial (High)

TEXT BOOKS:

1. N.Subramanian, “Design of Steel Structures”, Oxford University Press, 2014.
2. Duggal, “Limit State Design of steel structures”, Tata McGraw Hill, 2013.

REFERENCE BOOKS:

1. S.S.Bhavikatti, “Design of Steel Structures by Limit State Method as per IS 800: 2007”, I.K. International Publishing House Pvt. Ltd., 2013.
2. IS – 800: 2007, Steel tables (to be supplied in examination).
3. Dr.V.L. Shah and Prof. Veena Gore, “Limit State Design of Steel Structures (IS 800: 2007)”, Structures Publications, Pune, 2010.
4. Dr. Ram Chandra and VirendraGehlot, “Limit State Design of Steel Structures”, Scientific Publishers (India), 2013.

NPTEL ONLINE SOURCE: http://nptel.ac.in/courses/105103094/
http://nptel.ac.in/courses/105106112/

****

DESIGN OF PRESTRESSED CONCRETE STRUCTURES

Sub Code : 14CV704	**Credits : 03**
Hrs/Week : 3+0+0+0	**Total Hours : 39**

Course Learning Objectives:

During the Course student should learn

1. The concept, materials and types of pre-stressing.
2. To analyse the member due to stress and losses in concrete under various loading condition.
3. To Interpret deflections in a pre-stressed concrete member.
4. To analyse the section for flexure, shear under limit state of serviceability.
5. To design a pre-tensioned and post-tensioned beam components as per the IS codal provision.

UNIT – I

MATERIALS: High strength concrete and steel, stress-Strain characteristics and properties. BASIC PRINCIPLES OF PRESTRESSING: Fundamentals, load balancing concept, Stress concept, centre of thrust. Pre-tensioning and post-tensioning systems, tensioning methods and end anchorages. **7 Hours**

UNIT - II

ANALYSIS OF SECTIONS FOR FLEXURE: Stresses in concrete due to pre-stress and loads, cable profiles.

LOSSES OF PRE-STRESS: Various losses encountered in pre-tensioning and post tensioning methods, determination of jacking force**.** **8 Hours**

UNIT - III

DEFLECTIONS : Deflection of a pre-stressed member – Short term and long term deflections, elastic deflections under transfer loads and due to different cable profiles, Deflection limits as per IS 1343, effect of creep on deflection, load verses deflection curve, methods of reducing deflection. **8 Hours**

UNIT - IV

LIMIT STATE OF COLLAPSE: Flexural strength of sections, Shear-IS Code recommendations, shear resistance of sections, shear reinforcement, limit state of serviceability – control of deflections and cracking. **8 Hours**

UNIT – V

DESIGN OF BEAMS: Design of pre-tensioned and post-tensioned symmetrical and asymmetrical sections. Permissible stress, design of prestressing force and eccentricity,

8 Hours

Course Outcomes:

At the end of the course the student will be able to

1. Acquire basic knowledge about material properties and Basic fundamentals of load balancing concept and pre-tensioned and post tensioned members.
2. Calculate the stresses in concrete member and to encounter the various losses in the tensioned members.
3. Determine Short term and long term deflections and creep effects under different loads.
4. Design for flexure, shear and limit state of serviceability for pre-tensioned and post tensioned structural members.
5. Design pre-tensioned and post tensioned beam components of structural member.

Mapping of POs & COs :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L					M			L			H		
CO2		L	H	M			M						L	M	
CO3		M	M	M			H							M	
CO4		M	H	M			L							M	
CO5		H	H	H			L							M	

L: Slight (Low) M: Moderate (Medium) H: Substantial (High)

TEXT BOOKS:

1. N. Krishna Raju, *"Pre-stressed Concrete"*, Tata McGraw Publishers, 2016.
2. P. Dayarathnam, *"Pre-stressed Concrete"*, Oxford and IBH Publishing Co, 2015.

REFERENCE BOOKS:

1. T.Y. Lin and Nd H. Burns, *"Design of pre-stressed concrete structures"*, John Wiley & Sons, New York, 2015.
2. N.C. Sinha & S.K. Roy, *"Fundamental of pre-stressed concrete", 2011*, S. Chand Limited.
3. IS: 1343: 2012 Code of practice for pre stressed concrete. (to be supplied in the examination)
4. N. Rajgopalan, *"Pre-stressed Concrete"*, Alpha Science International, 2005.

NPTEL ONLINE SOURCE: http://www.nptel.ac.in/courses/105106117/

****

CONCRETE AND HIGHWAY MATERIALS LABORATORY

Sub Code : 14CV705	**Credits : 02**
Hrs/Week : 0+0+3+0	**Total Hours : 39**

Course Learning Objectives:

This Course will enable students to

1. To know the property of cement and aggregates
2. To get an idea about testing of concrete and highway materials
3. To impart knowledge on mix design procedures

1. Normal Consistency Test for cement paste.
2. Setting time test for cement
3. Compressive strength test for cement
4. Specific gravity test for cement
5. Slump test
6. Compaction factor test
7. Vee Bee test
8. Compressive strength on concrete cubes
9. Split tensile test on concrete cylinders
10. Flexural strength test on concrete beams
11. Aggregate Crushing value test
12. Los Angeles Abrasion test
13. Aggregate Impact value test
14. Shape tests (Flaky and Elongation)
15. Specific Gravity test of aggregate
16. Water absorption test
17. Specific gravity test on bitumen
18. Penetration test on bitumen
19. Ductility test on bitumen
20. Softening point test on bitumen
21. Flash and Fire point test on bitumen
22. Viscosity test on bitumen

Demonstration of

1. Soundness test for cement by autoclave method
2. Air permeability test for cement

Course Outcomes:

At the end of the course the student will be able to

1. Test all the concrete construction materials as per IS code

2. Design the concrete mix using IS code methods
3. Determine the properties of fresh and hardened of concrete Measure the physical properties of the bitumen

Mapping of POs & COs :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		H				L					L	L		
CO2	M		H				M					M		M	
CO3	M		H				L					L		M	

Note L: Slight (Low) M: Moderate (Medium) H: Substantial (High)

REFERENCE BOOKS:

1. Highway material testing laboratory manual
2. Gambhir.M.L., "Concrete manual", Dhanpat Rai & Sons, New Delhi
3. Relevant IS Codes and IRC Codes

****

SOLID WASTE MANAGEMENT

Sub Code : 14CV711 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives:

1. Impart the knowledge of present methods of solid waste management system and to analyze the drawbacks.
2. Understand various waste management statutory rules for the present system.
3. Analyze different elements of solid waste management and design and develop recycling options for biodegradable waste by composting.
4. Identify incineration technologies and waste to energy incineration methods
5. Identify hazardous waste, e-waste, plastic waste and bio medical waste and their management systems.

UNIT – I

Introduction: Land Pollution. Present solid waste disposal methods. Merits and demerits of open dumping, feeding to hogs, incineration, pyrolysis, composting, sanitary landfill. Scope and importance of solid waste management. Definition and functional elements of solid waste management.

Sources: Sources of Solid waste, types of solid waste, composition of municipal solid waste, generation rate, Problems.

Collection and transportation of municipal solid waste: Collection of solid

waste- services and systems, Municipal Solid waste (Management and Handling) 2000 rules with amendments. **8 Hours**

UNIT – II

Composting Aerobic and anaerobic composting - process description, process microbiology, Vermicomposting.

Sanitary land filling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement

8 Hours

UNIT – III

Incineration and Energy Recovery , Air emission and control

Incineration Technologies, types of waste to energy incineration, gaseous pollutants and gas cleaning equipment's, environmental concern

7 Hours

UNIT – IV

Hazardous waste management: Definitions, Identification of hazardous waste, Classification of hazardous waste, onsite storage, collection, transfer and transport, processing, disposal, hazardous waste (Management and handling) rules 2008 with amendments.

E-waste management: Definition, Components, Materials used in manufacturing electronic goods**,** Recycling and recovery integrated approach

8 Hours

UNIT – V

Bio medical waste management: Classification of bio medical waste, collection, transportation, disposal of bio medical waste, Bio medical waste (Management and Handling) rules 1998 with amendments.

.

Plastic waste management: Manufacturing of plastic with norms. Plastic waste management. Plastic manufacture, sale & usage rules 2009 with amendments. **8 Hours**

Course Outcomes:

After going through this course the student will be able to:

1. Understand the current solid waste management system.
2. Analyze drawbacks in the present system and provide recycling and disposal options for each type of waste.
3. Discuss the environmental impacts of incineration on land, water and aesthetics.
4. Distinguish Hazardous waste, Biomedical waste, E waste and to provide scientific management system.
5. Evaluate and monitor the Biomedical waste, Hazardous waste, Ewaste, Plastic and Municipal waste management as per the rules laid by Ministry of Environment & Forest

Mapping of POs & COs :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L					L								
CO2			L						M						
CO3	M									M					
CO4	M				L					M					
CO5		H				L									

Note : L: Slight (Low) M: Moderate (Medium) H: Substantial (High)

TEXT BOOKS:

1. George.C. Tchobanoglous, "Integrated Solid Waste Management" – McGraw hill publication. International edition 1993, ISBN 978-0070632370
2. Bhide A D and Sunderashan B B, "Solid Waste Management in developing countries", Indian National Scientific Documentation Centre, 1983

REFERENCE BOOKS:

1. R.E. Hester, Roy M Harrison, "Electronic waste management", Cambridge, UK, RSC Publication, 2009, ISBN 9780854041121
2. Municipal Solid waste (Management & Handling Rules) , Ministry of Environment &Forest Notification, New Delhi, 25th Sept 2000 and amendments on 2013.
3. The Plastic Manufacture, Sale and usage Rules2009. Ministry of Environment and Forest Notification, New Delhi, amendment on February 4, 2011
4. Biomedical waste management (Management & Handling Rules) 20th July 1998. Ministry of Environment & Forest Notification, New Delhi, amendment on February 26, 2013.

NPTEL ONLINE SOURCE:

- http://nptel.ac.in/courses/120108005/

****

HIGHWAY GEOMETRIC DESIGN

Sub Code : 14CV712 **Credits : 03**
Hrs/ Week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives:

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

1. Study the different road geometrics and designing it as per IRC Standard.
2. Have clear knowledge of design control factors in designing the highways.
3. Know the different cross-section elements of highways.
4. Design the sight distances, horizontal alignments, and intersections.
5. Know the importance and design of highway drainage systems.

UNIT – I

INTRODUCTION: Elements of geometric design control factors like topography-design speed, design vehicle, traffic capacity, volume, environment and other factors-IRC and AAHO standards and specification, PCU concept for design. **7 Hours**

UNIT - II

CROSS SECTION ELEMENTS: Pavement surface characteristics –friction, skid and skid resistance, pavement unevenness, light reflecting characteristics, camber and its shapes, providing camber in the field, pavement width computation, kerbs and its types, medians, shoulders, foot paths, parking lanes, service roads, cycle- tracks, driveways, guard rails, width of formation, right of way, design of road humps as per IRC Specification. **9 Hours**

UNIT - III

SIGHT DISTANCES: Stopping and over taking sight distances, sight distances at Intersections, set back distances at curves (single lane and multiple lane). **7 Hours**

UNIT - IV

HORIZONTAL ALIGNMENT: Design elements, super elevation, extra widening of pavements at curves transition curves types and ideal curve; vertical alignment: gradient, vertical curve design criteria, types of summit and valley curves, design of vertical curves, design standards for hill roads. **8 Hours**

UNIT – V

INTERSECTION DESIGN: Elements of an intersection, maneuver area, speed lanes-various types of intersection, flyovers, grade separators, subways, under pass, suitability of each types and their design principles, grade separations, intersections at grade-islands, rotary and its design only.

HIGHWAY DRAINAGE: Importance, surface and subsurface drainage, design of cross sections. **8 Hours**

Course Outcomes:

At the end of the course the student will be able to

1. Impart the Knowledge on Road geometrics as per IRC & AASTHO guidelines.
2. Know the different cross-sectional elements of highway as per IRC guidelines
3. Study the design aspects of sight distance for Indian highways
4. Impart the Knowledge on designing various components in highway horizontal and vertical alignments
5. Study the various types of intersection and significance of highway drainage

Mapping of POs & COs :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	-	-	-	-	-	-	L	L	L	-	L	-	-
CO2	L	L	-	-	-	-	L	-	-	-	L	-	-	-	-

CO3	M	M	L	-	-	-	L	-	L	L	L	-	M	L	-
CO4	M	L	L	-	-	-	L	-	L	M	M	-	M	L	-
CO5	L	L	-	-	-	-	L	-	-	L	-	-	L	L	-

Note : L: Slight (Low) M: Moderate (Medium) H: Substantial (High)

TEXT BOOKS:

1. Khanna S.K, C.E.G Justo &Veeraraghavan A. "Highway Engineering", Nemchand& Bros , Roorkee.(2014) (10th Revised Edition)
2. Kadiyali L. R., Lal. N.B, "Principles and Practices in Highway Engineering", Khanna Publishers, New Delhi. 7th Revised Edition. (2013).

REFERENCE BOOKS:

1. Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 3rd Revised Edition. (2015).
2. Kadiyali, L. R., "Traffic Engineering and Transportation Planning", 7th Ed., Khanna publishers, India (2011).
3. Relevant IRC codes published by Bureau of Indian Standards, New Delhi.
4. Handbook for Roads and bridges – MORTH, New Delhi.(2001)

NPTEL ONLINE SOURCES:

- http://nptel.ac.in/downloads/105101087/
- http://nptel.ac.in/courses/105105107/

****

ADVANCED CONCRETE TECHNOLOGY

Sub Code : 14CV713 **Credit : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Prerequisites: This subject requires the student to know about fundamentals of Concrete technology.

Course Learning Objectives:

This Course will enable students to:

1. Understand the importance of hydrated cement paste, types of admixtures and its properties in fresh and hardened state of concrete.
2. Know the concept and to design cement concrete by different methods.
3. Know the durability of hardened concrete when subjected to atmospheric and chemical Attacks and also the importance of RMC, HVFAC.
4. Understand different properties, casting mechanisms and tests on self-compacting concrete, fiber reinforcing concrete.
5. Know and understand different properties of LWC, HDC and HPC and types of Non Destructive Testing on hardened concrete.

UNIT – I

INTRODUCTION: Importance of Bogue's compounds, Structure of a Hydrated Cement Paste, Volume of hydrated product, porosity of paste and concrete.

CHEMICAL ADMIXTURES- Mechanism of chemical admixture, Plasticizers and super plasticizers and their effect on concrete property in fresh and hardened state, Marsh cone test for optimum dosage of super plasticizer, retarder, accelerator, Air-entraining admixtures, new generation superplasticiser

MINERAL ADMIXTURE-Fly ash, Silica fume, GCBS, and their effect on concrete property in fresh state and hardened state. **8 Hours**

UNIT – II

MIX DESIGN - Factors affecting mix design, design of concrete mix by BIS method using IS10262 and current American (ACI)/ British (BS) methods. Provisions in revised IS: 10262-2009. **8 Hours**

UNIT – III

DURABILITY OF CONCRETE - Introduction, Permeability of concrete, chemical attack, acid attack, efflorescence, Corrosion in concrete. Thermal conductivity, thermal diffusivity, specific heat. Alkali Aggregate Reaction, IS456-2000 requirement for durability.

RMC concrete - manufacture, transporting, placing, precautions, Methods of concreting-Pumping, under water concreting, shotcrete, High volume fly ash concrete concept, properties, typical mix. **7 Hours**

UNIT – IV

SELF COMPACTING CONCRETE: Concept, materials, tests, properties, application and typical mix.

FIBER REINFORCED CONCRETE - Fibers types and properties, Behavior of FRC in compression, tension including pre-cracking stage and post-cracking stages, behavior in flexure and shear, Ferro cement - materials, techniques of manufacture, properties and application. **8 Hours**

UNIT – V

LIGHT WEIGHT CONCRETE: Materials, properties and types, typical light weight concrete mix.

HIGH DENSITY CONCRETE AND HIGH PERFORMANCE CONCRETE: Materials, properties and applications, typical mix.

TEST ON HARDENED CONCRETE: Effect of end condition of specimen, capping, H/D ratio, rate of loading, moisture condition. Compression, tension and flexure tests. Tests on

composition of hardened concrete-cement content, original w/c ratio. NDT tests concepts-Rebound hammer, pulse velocity methods. **8 Hours**

Course Outcomes:

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

1. Understand and apply the importance of hydrated cement paste, types of admixtures and its properties in fresh and hardened state of concrete.
2. Design cement concrete proportions for different grades by different methods.
3. Know the durability of hardened concrete when subjected to atmospheric and chemical Attacks and also the importance of RMC, HVFAC.
4. Apply different properties, casting mechanisms and tests on self-compacting concrete, fiber reinforcing concrete in practice.
5. Understand and apply different properties of LWC, HDC and HPC in practice and to perform different types of Non Destructive Testing on hardened concrete.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L		M				L						L	L	
CO2		M	H	M			M						M	M	
CO3	L		M				L						L	M	
CO4			L	M			M						M	M	
CO5	M	M	M										M	M	

L: Slight (Low) 40% M: Moderate (Medium) 60% H: Substantial (High)100

TEXT BOOKS:

1. Neville, A.M., "**Properties of Concrete",** ELBS Edition, Longman Ltd., London
2. M.S. Shetty, (2014) "**Concrete Technology Theory and Practice" S. chand and company New Delhi.**
3. P.K. Mehta, P J M Monteiro, "**Concrete microstructure and properties",** Prentice Hall, New Jersey (Special Student Edition by Indian Concrete Institute, Chennai).

REFERENCE BOOKS:

1. ACI Code for Mix Design
2. IS 10262-2009 " Concrete mix proportioning guidelines".
3. N. Krishna Raju, "**Concrete Mix Design",** Sehgal Publishers
4. Gambhir M.L, "**Concrete Manual**", Dhanpat Rai & Sons, New Delhi.

NPTEL:

- http://nptel.ac.in/courses/105104030/
- http://nptel.ac.in/courses/105102012/

****

THEORY OF ELASTICITY

Sub Code	**: 14CV714**	**Credits**	**: 03**
Hrs/Week	**: 3+0+0+0**	**Total Hours**	**: 39**

Course Learning Objectives:

This Course will enable students to

1. To understand the concept of plane stress and plane strain problems.
2. Use of polynomial function in solving civil engineering problems.
3. To drive the expressions for stress and deformation using polynomial function and to understand the compatibility relation for plane stress and plane strain problems.
4. Understand the concept how stresses and strains related in polar co-ordinates and to study axi-symmetric problems.
5. Understand the effect of circular hole on the stress distribution.

UNIT – I

Introduction to mathematical theory of elasticity, definition of continuum, stress and strain at a point, constitutive laws, Generalized Hooke's law, Strain-displacement relations, Stress tensor, Stress transformation, Stress invariants, Strain tensor, Strain invariants, Plane stress and plane strain, Principal stresses and strains. **8 Hours**

UNIT - II

Measurement of surface strains, Strain rosettes, Mohr's circle, Analytical method, Differential equations of equilibrium, Boundary conditions, Compatibility equations, Airy's stress function, Stress polynomials, Saint Venant's principle, Problems. **8 Hours**

UNIT – III

Two dimensional problems in Cartesian coordinates, Relationship between plane stress and plane strain, Stress function, Bending of a cantilever beam subjected to end load, Pure bending of beam, Effect of sheardeformation in beams, Simply supported beam subjected to udl, Numerical problems. **7 Hours**

UNIT – IV

Two dimensional problems in polar coordinates, Strain-displacement relations, Equilibrium equations, Compatibility equations, Airy's stress function, Axi-symmetric problems, Rotating discs of uniform thickness, Lame's problem- thick cylinder. **8 Hours**

UNIT – V

Effect of circular holes on stress distribution in plates subjected to tension, compression and shear, stress concentration factor.

Torsion: General solution, Boundary conditions, torsion of circular and elliptical sections, Membrane analogy of rectangular sections and continuous beams. System approach of

stiffness method for analysis of propped cantilevers and continuous beams. **8 Hours**

Course Outcomes:

At the end of the course the student will be able to

1. To determine the plane stress and plane strain.
2. Use of polynomial function in solving Civil Engineering problems.
3. Drive the expressions for stress and deformation using polynomial function and to understand the compatibility relation for plane stress and plane strain problems.
4. Understand the concept how stresses and strains related in polar co-ordinates and to study Axi-symmetric problems.
5. Understand the effect of circular hole on the stress distribution.

Mapping of POs & COs :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**H**			**H**			**M**								
CO2	**M**	**L**		**H**			**H**								
CO3	**H**		**H**	**M**			**M**								
CO4	**H**		**M**	**H**			**H**								
CO5	**M**		**M**												

Note : L: Slight (Low) M: Moderate (Medium) H: Substantial (High)

TEXT BOOKS:

1. Timoshenko S.P. and Goodier J.N. "Theory of Elasticity", International Student's Edition, Mc Graw Hill Book Co., Inc., New Delhi,2005.
2. Wang P.C., "Applied Elasticity",2005.

REFERENCE BOOKS:

1. Valliappan C., (1981), "Continuum Mechanics – Fundamentals", Oxford & IBH Publishing Co. Ltd, New Delhi.
2. Srinath L.S., (2009), "Advanced Mechanics of Solids", Tata Mc Graw Hill Publications Co. Ltd., New Delhi.
3. Venkataraman& Patel, "Structural Mechanics with introduction to Elasticity and Plasticity", Mc Graw Hill Book Inc., New York,2009.
4. Dr. Sadhu Singh, 'Theory of Elasticity", Khanna Publishers, Delhi,2009.
5. T.G.Seetharam&L.Govindaraju, "Applied Elasticity", Interline publishing.

DEEP FOUNDATIONS

Sub Code : 14CV715	**Credits : 03**
Hrs/Week : 3+0+0+0	**Total Hours : 39**

Course Learning Objectives:

At the end of the course the regular student will be able to:

1. To learn more about the introductory aspects of piles, selection of deep foundation systems and associated equipment.
2. Design of axial and lateral geotechnical capacity of driven piles in both individually and as group and Learn the usage of wave equation analysis applied to the design and installation of driven piles including driving problem.
3. To understand the structural mechanic aspects of the design in a laterally loaded pile and to estimate the ultimate resistance of a laterally loaded pile. Use Pile Load Tests and Pile Driving Formulas to determine in-situ pile capacities.
4. To carry out the design of pile and to estimate the efficiency of a Pile Group.
5. Study the different types of well foundations and carry out the analysis and design.

UNIT - I

PILE CLASSIFICATIONS

Function – classification of piles – Factors governing choice of pile foundation – Load transfer principles – piling equipment and methods – changes in soil condition during installation of piles – requirement of code of practice – responsibility of engineer and contractor. **8 Hours**

UNIT – II

AXIALLY LOADED PILES AND PILE GROUPS

Allowable load evaluation of piles and pile groups – Static method – cohesive –cohesionless soil – time effects – Dynamic method – pile driving formulae – Wave equation application – modeling – theoretical analysis – Interpretation of field test results and pile load test results – Settlement of Piles and Pile groups. **8 Hours**

UNIT – III

LATERAL AND UPLIFT LOAD EVALUATION

Piles subjected to Lateral loads – Broms method, elastic –p-y curve analyses –Batter piles – response to moment – pile subjected to uplift loads – load –deformation behaviour – Lateral and uplift load test data interpretation. Foundation on week compressible – collapsible soil – case studies **8 Hours**

UNIT – IV

STRUCTURAL DESIGN OF PILE AND PILE GROUPS

Pile foundation – structural design – pile cap analysis, pile – raft system basic interactive analysis – pile and pile groups subjected to vibrations – fundamental solutions. **8 Hours**

UNIT – V

WELL FOUNDATIONS

Types – Stability, principles of analysis and design, well sinking, pneumatic caissons

7 Hours

Course Outcome:

1. Capable to understand more about the introductory aspects of piles, Selection of deep foundation systems and associated equipment.
2. Able to carry out design of axial and lateral geotechnical capacity of driven piles in both individually and as group.
3. Able to understand the structural mechanics aspects of the design of a laterally loaded pile and Estimate the ultimate resistance of a laterally loaded pile. Use Pile Load Tests and Pile Driving Formulas to determine in-situ pile capacities.
4. Carry out the design of pile and estimate the efficiency of a Pile Group.
5. Able to understand the different types of well foundations and carry out the analysis and design.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	H	H	H	L	M			L	M	L	H	H	H
CO2	H	H	H	H			L				L	L	H	M	M
CO3	H	H	H	H			L			L	L	L	H	M	M
CO4	H	H	H	H			L		L	L	L	L	H	M	L
CO5	H	H	H	H			L				L	L	H	M	M

TEXT BOOKS:

1. Poulos, H.G., Davis, E.H., Pile foundation analysis and design, John Wiley and Sons, New York, 1980.
2. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
3. Tomlinson, M.J. Foundation engineering, ELBS, Longman Group, U.K. Ltd., England 1995.

REFERENCE BOOKS:

1. Cernica, J.N. Geotechnical Engineering Foundation Design, John Wiley and Sons, Inc. 1995.
2. Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1996.
3. Donald, P., Coduto, Foundation Design Principles and Practices, Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1996.

4. Winterkorn, H.F. and Fang, H.Y, Foundation Engineering Handbook, Von Nostrand Reinhold, 1994.
5. Grigorian, Pile Foundation for Buildings and Structures in collapsible Soil, Oxford & IBH Publishing Co, Pvt. Ltd., New Delhi, 1999.
6. Varghese P.C.," Foundation Engineering", PHI Learning Private Limited, New Delhi, 2005.
7. Varghese P.C.," Design of Reinforced Concrete Foundations", PHI Learning Private Limited, New Delhi, 2009

NPTEL ONLINE SOURCES:

- http://nptel.ac.in/courses/105106142/
- http://nptel.ac.in/courses/105101001/

****

DESIGN OF BRIDGES

Sub Code : 13CV721	**Credits : 03**
Hrs/Week : 3+0+0+0	**Total Hours : 39**

Course Learning Objectives:

At the end of the course the students will be able to:
1) Apply various IRC code provisions for bridge design.
2) Design a slab culvert & Pipe culvert.
3) Design a T-beam bridge.
4) Design a welded plate girder.
5) Design a P.S.C bridge.

UNIT – I

BRIDGES: Types of Bridges, Components of Bridges, Selection of site for bridge, linear waterway.
LOADS AND STRESSES: Various loads to be considered while designing bridges, IRC loading standards, impact factor. **7 Hours**

UNIT – II

SLAB CULVERT: Design of slab culvert for IRC class AA and class-A loading, design of pipe culvert, empirical design of bank connections. **8 Hours**

UNIT – III

DESIGN OF T-BEAM BRIDGE: Design of T-beam bridge for class AA tracked vehicle, design of interior deck slab panel by Piegaude's theory.
Design of longitudinal girder by Courbon's theory, approximate design of cross girder.
8 Hours

UNIT – IV

DESIGN OF WELDED PLATE GIRDER BRIDGE: Design of main section, intermediate stiffener, bearing stiffener, cross bracings.

8 Hours

UNIT - V

DESIGN OF PRESTRESSED BRIDGES: Design of girders only

8 Hours

Course Outcomes:

At the end of the course the student will be able to

1. Apply various IRC code provisions for bridge design.
2. Design a slab culvert and pipe culvert.
3. Design a T-beam bridge.
4. Design a welded plate girder.
5. Design a P.S.C. girder.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L										L			M
CO2	H	M	H				L			M		L	H	M	H
CO3	M	H	H	L			M			M	L	M	H	M	H
CO4	M	M	H	L			M			M	L	M	H	M	H
CO5	L	M	H				M			L	L	M	H	M	H

Note : L: Slight (Low) M: Moderate (Medium) H: Substantial (High)

TEXT BOOKS:

1. Johnson Victor, *"Essentials of bridge Engineering"*, Sixth edition, Oxford and IBH publications, 2007
2. Krishna Raju, *"Design of Bridges"*, Fourth edition, Oxford and IBH publications, 2009

REFERENCE BOOKS:

1. Jagadish T.R. & Jayaram M.A., "Design Of Bridge Structures", Second Edition, Prentice Hall Of India Private Limited, 2004
2. Ponnuswamy. S.' 'Bridge Engineering', Tata Mcgraw-Hill Publishing Co.' New Delhi, 2008.

****

PAVEMENT MATERIALS AND CONSTRUCTION

Sub Code : 14CV722	**Credits : 03**
Hrs/Week : 3+0+0+0	**Total Hours : 39**

Course Learning Objectives:

This Course will enable students to

1. Know the properties, requirements and uses of aggregates, Bitumen and Tar in the construction of pavement, and to understand the preparation, requirements and uses of bituminous emulsions and cutbacks.
2. Select suitable aggregate mix and design bituminous mix as per specification.
3. Study the various equipment used in the construction of pavement and their working principle. Also, to understand the different steps involved in preparing sub-grade and tests used to check its quality.
4. Know the specifications, construction methods and quality control checks used for different layers of flexible pavement.
5. Know the specifications, construction methods and quality control checks used for cement concrete pavement and its joints.

UNIT – I

AGGREGATES: Origin, classification, requirements, properties and tests on road aggregates. Concepts of size and gradation, design gradation. Maximum aggregate size, aggregate blending to meet the specification using Rothfutch's method.
BITUMEN AND TAR: Origin, preparation, properties and chemical constituents of Bitumen and Tar, Requirements for pavement construction. **8 Hours**

UNIT – II

BITUMINOUS EMULSIONS AND CUTBACKS: Types, preparation, characteristics, tests and uses in road construction. Adhesion of bituminous binders to road aggregates: Adhesion failure, mechanism of stripping, tests and methods of improving adhesion.
BITUMINOUS MIXES: Mechanical properties, dense and open textured mixes, flexibility and brittleness (excluding Hveemstabilometer&Hubbar – field tests). Bituminous mix design by Marshall method and specification using different criteria- voids in mineral aggregate, voids in total mix, density, flow, stability and voids filled with bitumen. **10 Hours**

UNIT – III

EQUIPMENT IN HIGHWAY CONSTRUCTION: Different types of equipment for excavation, grading and compaction, their working principle, advantages and limitations. Equipment for the construction of bituminous and cement concrete pavement and stabilized soil road.
SUB GRADE: Earthwork grading, construction of embankments and cuts for roads. Preparation of sub grade, quality control tests. **7 Hours**

UNIT – IV

FLEXIBLE PAVEMENTS: Introduction, Brief discussions on following: Interface treatment-Prime coat and tack coat, Penetration macadam, Built-up spray Grout, Bituminous Macadam and Dense Bituminous Macadam.

Specifications of materials, construction methods and quality control checks during construction for typical Wet mix Macadam base and Bituminous Concrete surface course as per BIS only.

Field quality control tests after the construction of flexible pavement. (Specifications of materials, construction method and field control checks for different types of flexible pavement layers.) **7 Hours**

UNIT – V

CEMENT CONCRETE PAVEMENTS: Specifications of materials and method of construction of cement concrete pavements, Quality control tests.
Different types of joints used and their construction method. **7 Hours**

Course Outcomes:

At the end of the course the student will be able to

1. Understand the various types of pavements, component layers, their functions, their importance, and the various materials used for the construction and to know the properties, requirements, preparation and uses of aggregates, Bitumen and Tar, bituminous emulsions and cutbacks in the construction of pavement.
2. Select suitable aggregate mix and to design bituminous mix as per Marshall Method.
3. Select the suitable equipment for the construction of pavement based on necessity and their working principle and to describe the different steps involved in preparing sub-grade and tests used to check its quality.
4. Narrate the specifications, construction methods and quality control checks used for different layers of flexible pavement.
5. Narrate the specifications, construction methods and quality control checks used for cement concrete pavement and to construct the different types of joints in cement concrete pavements.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			L		M				M			H	M	
CO2		M		H				L			M				H
CO3	M				M		L			L	L			H	
CO4		L				H		M		L	M				H
CO5		M					L					M			H

Note : **L : Low M: Medium H : High**

TEXT BOOKS:

1. Kadiyali L. R., Lal. N.B, "Principles and Practices in Highway Engineering", Khanna Publishers, New Delhi. Revised Edition. (2012).
2. Khanna. S. K, Justo. C.E.G, Veeraragavan. A, "Highway Engineering", Revised 10th edition, Nem Chand and Bros, 2014.

REFERENCE BOOKS:

1. Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 2006.
2. Peurifoy R. L., (2003), "Construction Planning, Equipment and Methods", TMH, New-Delhi.
3. F.L.Roberts. Prithvi S. Kandhal., E. Ray Brown, Dah-Yinn Lee, Thomas W. Kennedy, "Hot mix asphalt materials, mixture design, and construction", Second edition, National Asphalt Pavement Association Research and Education Foundation, Lanhman, Maryland, 1996.
4. RRL, DSIR, "Bituminous Materials in Road Construction", HMSO Publication, London.
5. Sharma, S. C., (2005), "Construction Equipment and its Management", Khanna Publishers, New Delhi, 110006.
6. Relevant publications of Bureau of Indian Standards, New Delhi.

NPTEL ONLINE SOURCES:

- http://nptel.ac.in/downloads/105101087/
- http://nptel.ac.in/courses/105105107/

****

NUMERICAL METHODS IN CIVIL ENGINEERING

Sub Code : 14CV723		**Credits**	**: 03**
Hrs/Week : 3+0+0+0		**Total Hours**	**: 39**

Course Learning Objectives:

This Course will enable students to:

1. Understand different numerical techniques to solve civil engineering problems
2. Solve ordinary differential equations related to civil engineering problems
3. Explain finite difference techniques

UNIT – I

INTRODUCTION, SCOPE AND IMPORTANCE OF THE SUBJECT:
Solution of linear simultaneous equations by the following methods:
(i) Gaussian elimination, (ii) Gauss-Jordan matrix inversion, (iii) Gauss-Siedel, (iv) Factorization. Application of the above methods in solving problems by slope-deflection method applied to beams and frames, problems in construction planning. **8 Hours**

UNIT – II

Finding the roots of nonlinear algebraic and transcendental equations by (i) Bisection method, (ii) Newton-Raphson method. Application of the above methods to solve problems in structural engineering, hydraulics, geotechnical engineering and environmental engineering.
8 Hours

UNIT – III

NUMERICAL INTEGRATION TECHNIQUES: (i) Trapezoidal rule, (ii) Simpson's one third rule. Application of the above methods for computing the area of BMD for statically determinate beams. Computation of slope and deflection in statically determinate beams by New Marks method. **8 Hours**

UNIT – IV

Solution of ordinary differential equations by (i) Euler's method, (ii) 4^{th} order Runge-Kutta method. Application of the above methods to solve civil engineering problems. **7 Hours**

UNIT – V

Finite difference techniques to solve problems in structural mechanics. Analysis of statically determinate and indeterminate beams, buckling of columns. **8 Hours**

Course Outcomes:

1. The students should understand the formation of linear equations in solving problems related to civil engineering and solve them by different techniques
2. They must know to solve problems in various fields of civil engineering by developing nonlinear equations from the given data.

3. They should be able to find the area of bending moment diagram for different problems on statically determinate structures by adopting numerical integration techniques.
4. They must calculate the slope and deflection of statically determinate structures by numerical technique.
5. They should be able to develop ordinary differential equations for solving problems in civil engineering.
6. They must have the knowledge of finite difference technique and its applications in solving problems in structural mechanics.
7. They must possess the basic knowledge about the different numerical techniques that can be adopted in developing equations and solving problems related to civil engineering

Mapping of POs & COs :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L		L										L	
CO2	M	M		L										L	
CO3	L	M		L										L	
CO4	L	M		L										L	
CO5	M	L		L										L	
CO6	M	L		L										L	
CO7	L	M		L										L	

TEXT BOOKS:

1. Chapra S.C. &R.P.Canale, “Numerical Methods for Engineers”, McGraw Hill, 2014.
2. N.Krishna Raju &K.U.Muthu, “Numerical Methods in Engineering Problems”, MacMillan India Limited, 2005.

REFERENCE BOOKS:

1. Iqbal H.Khan&Q.Hassan, “Numerical Methods for Engineers and Scientists”, Galgotia, New Delhi, 2010.
2. Pallab Ghosh, “Numerical Methods using Computer Programs in C”, Prentice Hall of India Private Limited, New Delhi, 2006.
3. Schilling, “Numerical methods for Engineers using MATLAB and C”, I Edition, Thomson Publications, 2009.
4. S. Rajasekaran, “Numerical Methods in Science and Engineering- A Practical Approach”, S. Chand and Company Limited, New Delhi, 2013.

****

EARTH RETAINING STRUCTURES

Sub Code : 14CV725		**Credits**	**: 03**
Hrs/Week : 3+0+0+0		**Total Hours**	**: 39**

Course Learning Objectives:

This Course will enable students to

1. Know about types of retaining wall, forces acting on them and possible modes of failure of each type.
2. Understand how to analyze stability of different types of retaining wall, and to study different types of sheet pile walls and how to design them under different soil conditions.
3. Differentiate between cantilever sheet pile wall and anchored sheet pile wall with reference to the design and construction for given field conditions.
4. Study and understand lateral earth pressure distribution on sheeting of braced system in different soil types.
5. Study different components of braced systems, their selection and design them for given soil and depth of excavation. Also, to study the different types of coffer dams and the usefulness under the different situations.

UNIT – I

RETAINING WALLS: Types of retaining wall and forces on each type of wall. Modes of failure of retaining walls - sliding, overturning and bearing. Stability analysis and principles of the design of retaining walls – Gravity retaining walls, Cantilever retaining walls, counter fort retaining walls (no structural design). Drainage from the backfill. **8 Hours**

UNIT – II

BULK HEADS: Cantilever sheet pile walls Types of sheet pile walls. Cantilever sheet pile wall in cohesion-less soils. Cantilever sheet pile wall in clay. Design problem in each case. **8 Hours**

UNIT –III

BULK HEADS: Anchored Sheet Pile Walls: Anchored sheet pile with free earth support in cohesion-less and cohesive soil. Anchored sheet pile with fixed earth support method. Design problems using free earth and fixed earth support method. Types, locations and design of anchors. Description of Relieving platform, its use and advantages. **8 Hours**

UNIT – IV

BRACED CUTS: Introduction. Lateral earth pressure on sheeting, Different types of sheeting and bracing systems. Design of various components of bracings. **7 Hours**

UNIT – V

COFFER DAMS & CELLULAR COFFER DAMS : Introduction. Coffer dams- Single and double wall coffer dams- Cellular Coffer dams, description of TVA methods of designing

cellular coffer dam on rock and soils- No working of problems (Types of coffer dams. Design of cellular coffer dams on rock using Tennessee Valley Authority (TVA) method. Safety against sliding, slipping, overturning,
Vertical shear and stability against bursting. Design of cellular coffer dam on soil -safety against sliding, slipping, overturning, vertical shear and stability against bursting).

8 Hours

Course Outcomes:

1. Students come to know about types of retaining wall, the force acting on earth type wall and possible mode of failure of each type. They will know how to analyze the stability of gravity type, cantilever type and counter fort type retaining walls against sliding, overturning and bearing capacity failure.
2. Different types of sheet pile walls will be understood by the students. They will know about the situation under which, cantilever sheet pile walls are used and how to determine the embedment of sheet pile walls under different soils i.e., cohesion less soil and cohesive soil.
3. Students will acquire the knowledge about anchored sheet pile walls, its advantage over cantilever sheet pile wall and how to design an anchored sheet pile for the given soil and water level conditions.
4. Students come to know about lateral earth pressure distribution on sheeting of braced system for earth trench in different soil types. Different components of the braced system will be known to them. Students will be in a position to select a suitable bracing system for the given soil condition and depth of trench. They also will be knowing how to design the selected bracing system.
5. Students will come to know about different types of coffer dams and situations in which each type is useful. Advantages of cellular coffer dam over other types will be known to the students. They will know different modes of failure and designing the cellular coffer dam to have required factor of safety against the modes of failure.

Mapping of POs & COs :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M		M				M					H		M
CO2			H							M	M				H
CO3		H								M				H	
CO4		H		L			M		L		M			H	
CO5	H			L					M		M				M

L : Low M: Medium H : High

TEXT BOOKS:

1. **Soil Mechanics and Foundation Engineering** : Dr. K.R. Arora, (Sixth edition) (2003), Pub : Standard Publishers & Distributors.
2. **Soil Mechanics and Foundation Engineering,** : S.K. Garg, (Fifth edition)(2004), Pub :Khanna Publishers.

REFERENCE BOOKS:

1. **Soil Mechanics and Foundation Engineering,**: Dr. B.C. Punmia (2005),Pub : Laxmi Publications Ltd.,
2. **Numericals in Geotechnical Engineering** : A.V. Narasimha Rao & Dr. C. Venkataramaiah :Pub : University Press.
3. **Soil Mechanics and Foundation Engineering,** : Dr. V.N.S. Murthy (2011), Pub : C B S Publishers and Distributers, Bengaluru.
4. **Geotechnical Engineering,** : Dr. C. Venkataramaiah (2006) : Pub : New Age publications.
5. **Foundation Analysis and Design:** Bowles.J.E, 4th edition, MeGraw Hill (MGH) Book Company (1988).

NPTEL ONLINE SOURCES:

- http://nptel.ac.in/courses/105106052/9
- http://nptel.ac.in/downloads/105101083/

****

ENVIRONMENTAL GEOTECHNICS

Sub Code : 14CV726	**Credits : 03**
Hrs/Week : 3+0+0+0	**Total Hours : 39**

Course Learning Objectives:

At the end of the course the regular student will be able to:

1. To acquire knowledge about various branches of environmental geotechniques
2. To familiarise with design of landfill impoundments
3. To study different waste disposal systems suiting for hazardous and non-hazardous wastes
4. To familiarise with non-destructive techniques of site characterization.
5. To study the remediation methods for contaminated soil

UNIT – I

Introduction to environmental geotechnology –Regulatory requirements Basic soil mineralogy: structural units of soil - Clay mineral structures - Identification and determination of clay minerals - Particle bonds, bond energies and linkages, Ion exchange reaction and capacity- Hydrophilic and hydrophobic soils. Soil water interaction: Introduction – Electrochemical characteristics of soil water system - Soil water interaction in the thermal energy field – Geomorphic process in soil – effect of bacteria on behaviour of soil water system – Sensitivity of soil to environment. Introduction to Hydrogeology – Hydraulic conductivity – Infiltration, percolation, retention and recharge – Flow in unsaturated soils – Flow in saturated soils Geo chemistry – Geochemical attenuation Ground water monitoring techniques. **9 Hours**

UNIT – II

Sources and types wastes - Waste characteristics - Objectives of waste disposal facilities Contaminant transport – Transport process: diffusion, dispersion, advection – Dispersion: analytical solutions Landfills and surface impoundments: – Types, components and requirements of landfills - siting of land fills – Various end uses of closed landfills - Landfill microbiology – Microbiology of refuse composition- Leachate and gas generation - Primary and Secondary leachate - Leachate collection and removal systems -Gas collection and removal systems – Impact of hazardous waste on leachate and gas characteristics **9 Hours**

UNIT - III

Liners – Natural clay liners – compacted clay liners – requirements of clay liners – Geo synthetic clay liners – Geomembrane liners - Specifications of liners in hazardous wastes land fills – Quality control of liners- Design of liners. Design of Cover systems – Recovery well design **7 Hours**

UNIT – IV

WASTE STABILIZATION AND DISPOSAL

Hazardous waste control and storage system stabilization/solidification of wastes – micro and macroencapsulation – absorption, adsorption, precipitation-detoxification – mechanism of stabilization – organic and inorganic stabilization – utilization of solid waste for soil improvement. **7 Hours**

UNIT – V

REMEDIATION OF CONTAMINATED SOILS

Rational approach to evaluate and remediate contaminated sites – monitored natural attenuation – exsitu and insitu remediation – solidification, bio – remediation, incineration, soil washing, electro kinetics, soil heating, verification, bio venting – Ground water remediation – pump and treat, air sparging, reactive well. **7 Hours**

Course Outcomes:

1. Student will be familiarise with contaminant transport mechanisms
2. Student will be able to do designs of waste disposal units
3. Student will be learning techniques to monitor, to maintain waste disposal units
4. To familiarise with various soil remediation techniques
5. Can be able to evaluate and can suggest remedial measures for contaminated soil.

Mapping of POs & COs :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				M	M	L	L	L				L	H	M	L
CO2	L				M	L		L							
CO3	L			L				L				L		M	
CO4				M							L		H		L
CO5		L		L	M			L		L			H	M	L

TEXT BOOKS:

1. Koerner, R.M. (2005). Designing with Geosynthetics. Fifth Edition. Prentice Hall, New Jersey, 2005.
2. Daniel, D.E. (1993). Geotechnical Practice for Waste Disposal.Chapman and Hall, London

REFERENCE BOOKS:

1. David. E. Daniel, Geotechnical practice for waste disposal – Chapman and Hall – London, 1993.
2. Masashi Kamon, editor – Balkema, Environmental Geotechnics, - Rotterdan 1996 3. Hsai- Yang Fang, 3. 3. Introduction to Environmental Geotechnology,- CRC Press, New York, 2009.
3. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989.
4. Daniel, B.E., Geotechnical Practice for waste disposal, Chapman and Hall, London, 1993.
5. ASTM Special Technical Publication 874, Hydraulic Barrier in Soil and Rock, 1985.

****

ENGINEERING MANAGEMENT

Sub Code : 14CV801 **Credits : 04**
Hrs/Week : 4+0+0+S* **Total Hours : 52**

* Self Study to be exercised under the supervision of course instructor and to be restricted to not more than 10% of the total teaching hours.

Course Learning Objectives:

At the end of the course the students will be able to:

1. Understand various concepts related to management and economics, project feasibility conditions
2. Know the principles and concepts involved in management.
3. Understand the needs of planning and updating project schedule through project management tools such as CPM, PERT.
4. Identify various equipment's used in construction industry and analyze their suitability and implement-ability in various projects.
5. Analyze the various optimization techniques and their uses in solving engineering problems.

UNIT - I

INTRODUCTION TO ENGINEERING ECONOMICS- Basic Concepts of economic analysis, Micro and Macro analysis, project feasibility, economic and financial feasibility, benefit cost ratio, interest formula, present worth, future worth, Annual equivalent, Basis for comparison of alternatives, rate of return method, break even analysis, planning methods.

12 Hours

UNIT – II

CONSTRUCTION INDUSTRY AND MANAGEMENT: Introduction, Value engineering, time management, labor and Material management, Contract and contractor, organization and administration, industrial financial management. **8 Hours**

UNIT – III

CONSTRUCTION PLANNING - Introduction, time estimates, planning methods of projects, Bar and Milestone charts, PERT and CPM network analysis, cost model, direct cost, indirect cost, total cost, optimum cost optimum duration of project problems, CPMnetwork analysis, Line of Balance Technique, Resource Allocation and Updating. **11 Hours**

UNIT - IV

CONSTRUCTION EQUIPMENT- Introduction, various earth moving equipments, hoisting equipments, concrete mixer and plants, conveyors and rollers, trenching machines, equipment for Highway construction, factor for selecting equipment, special equipment, economic analysis. Work study in construction, safety measures, bidding. **11 Hours**

UNIT -V

OPTIMIZATION TECHNIQUES: Linear Programming: graphical method, standard form of linear programming, formulation, Simplex method,
Transportation Problem: Introduction, mathematical formulation, methods for initial basic feasible solution, North West corner method. **10 Hours**

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L									L	L				L
CO2											H				L
CO3	M				M										
CO4										L	H				
CO5	L	M												L	

L: Slight (Low) M: Moderate (Medium) H: Substantial (High)

TEXT BOOKS:

1. K. Subramanyam, “Construction Management”, Anuradha Publishers Madras, (2009).
2. L.S. Srinath, “Pert and CPM”. Affiliated East-WestPress Pvt. Ltd. New Delhi. (1989).
3. B.C Punmia, “Pert and CPM”, Lakshmi publication (2002).
4. Peurifoy , R.L , “Construction Planning equipments and methods”, 8th edition, Mc Graw Hill Publication (2010).

REFERENCE BOOKS:

1. Mahesh Varma , "Construction planning and management", Metropolitan Book Co ., Delhi
2. S.D. Sharma, "Operation research". 4th edition, Pub: Kedarnath Ramnath, Meerut, Delhi (2009).

DESIGN AND DRAWING OF STEEL STRUCTURES

Sub Code : 14CV802	**Credits : 03**
Hrs/ Week : 2+0+3+0	**Total Hours : 52**

Course Learning Objectives:

This Course will enable students to

1. **Sketch** the different types of connections used in steel structures and to **draw** the column splices, lacings and battens, slab base and gusseted base.
2. **Understand** the behaviour of roof trusses, plate girders and gantry girders. Also **design and draw** the various components of a Truss, plate girder and gantry girder.

PART – A

(Drawings to be prepared for given structural details)

UNIT – I

Connections: Bolted and welded, beam-beam, Beam-column, seated, stiffened and un-stiffened.

UNIT – II

Columns: Splices, Column-column of same and different sections. Lacings and battens.

UNIT – III

Column Bases: Slab base and gusseted base (bolted and welded) **22 Hours**

PART – B

UNIT – IV

Design and drawing of

i. Welded plate girder (with and without stiffeners)
ii. Roof Truss (Forces in the members to be given)
iii. Gantry girder **30 Hours**

Course Outcomes:

At the end of the course the student will be able to

1. Aquire knowledge about Steel structural members, Analyze and draw different type

of connections used in steel structure, detailing for Column splices, Column lacings Column battens, slab base and gusseted base for the given structural member.

2. Analyze, design and detailing for the following structural units- Truss, Plate girder and Gantry girder.

Mapping of POs & COs :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	L												H
CO7		M	H	H									M		H

Note : L: Slight (Low) M: Moderate (Medium) H: Substantial (High

TEXT BOOKS:

1. N.Subramanian, "Design of Steel Structures", Oxford University Press, 2014
2. Duggal, "Limit State Design of steel structures", Tata McGraw Hill, 2013.

REFERENCE BOOKS:

1. S.S.Bhavikatti, "Design of Steel Structures by Limit State Method as per IS 800: 2007", I.K. International Publishing House Pvt. Ltd., 2013.
2. IS – 800: 2007, Steel tables (to be supplied in examination).
3. Dr.V.L. Shah and Prof. Veena Gore, "Limit State Design of Steel Structures (IS 800: 2007)", Structures Publications, Pune, 2010.
4. Dr. Ram Chandra and VirendraGehlot, "Limit State Design of Steel Structures", Scientific Publishers (India), 2013.

NPTEL ONLINE SOURCE:

- http://nptel.ac.in/courses/105106113/

****

REINFORCED EARTH STRUCTURES

Sub Code : 14CV811		**Credits**	**: 03**
Hrs/Week : 3+0+0+0		**Total Hours**	**: 39**

Course Learning Objectives:

This Course will enable students to

1. Know the concepts of reinforced earth structures.
2. Know the types, engineering properties and functions of "Geosynthetics"
3. Understand the concepts of reinforced earth in the design and construction of Retaining walls
4. Understand the principles and design of earth embankments and reinforced earth Foundations.
5. Know the concepts of "Soil nailing" and design "Soil nailing system" required to prevent the failure of soil slope in earth cutting.

UNIT – I

Historical background, principles of reinforced earth, mechanism of reinforced earth. Effect of reinforcement on soil. Application of reinforced earth, anchors, tiebacks, and soil nailing technique. Structural and economic advantages of reinforced earth structure over similar structures. **7 Hours**

UNIT – II

GEOSYNTHETICS: Introduction and an overview. Historical development. Classification based on material and method of manufacturing process. Types of Geosynthetics, their properties and determination. **6 Hours**

UNIT – III

FUNCTIONS OF GEOSYNTHETICS: Separation, reinforcement, filtration, drainage and containment. Two examples of application in the field (case histories) for each function are to be explained. **7 Hours**

UNIT – IV

REINFORCED EARTH RETAINING WALL:

Component materials: Soil, important properties governing the selection.

Reinforcement: requirements for the use, types of reinforcements, metallic and Geosynthetic in the form of bars, strips, mats and grids.

Facing elements: materials, types and important properties.

External and internal stability applied to Reinforced earth structures, Coherent gravity and Tieback wedge methods, design of typical reinforced earth retaining wall using Tieback wedge method. **10 Hours**

UNIT –V

REINFORCED EARTH EMBANKMENT AND SLOPES: Improving the stability of a typical earth embankment slope using Geo-fabric reinforcement, numerical examples.

REINFORCED EARTH FOUNDATION: Modes of failure, improvement of bearing capacity with the introduction of Geo-textile or Geo-grid reinforcements, typical example of a spread footing on reinforced earth.

SOIL NAILING SYSTEM: concept and principles, driven and grouted nail system, advantages and limitations. **9 Hours**

Course Outcomes:

1. Basic principles and mechanism of reinforced earth will be known to students. They understand effects of reinforcement on behavior of soil. They come to know the application of reinforced earth in the form of anchors, tie bars and soil nailing techniques. Structural and economic advantages of reinforced earth over other similar structures will be clearly understood by the students.
2. Students will know about classification of geo-synthetic based on raw materials and manufacturing process involved. Types of geo-synthetics, their properties and methods of evaluating each properties will be understood properly.
3. Students will acquire the knowledge on five functions of geo-synthetics namely separation, reinforcement, filtration, drainage and containment, when two examples of field applications (case studies) are explained.
4. Students come to know what are the components of reinforced earth retaining wall i.e., soil reinforcement and facing elements, properties governing the selection of soil type and requirements of reinforcement, material, type and required properties of facing elements are clearly understood by the students. They will know about the internal and external stability of reinforced earth retaining wall and will be able to design a reinforced earth wall using Tiebackwedge method.
5. Students will be able to improve the stability of earth embankment slope using suitable reinforcement. They understand the modes of failure of reinforced earth foundation and able to design a foundation to have required bearing capacity and specified settlement using suitable reinforcements. The concepts and principles of soil nailing will be understood by the students. They will come to know about grouted and driven soil nail system, and the situation in which each is used.

Mapping of POs & COs :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L		M		L	H		L		M	L			M
CO2		L					M		M			M		H	M
CO3	M	L		M		L					H		H		
CO4						M			M						
CO5	H	H		H		M			H	M		M			H

L : Low M: Medium H : High

TEXT BOOKS:

1. Jones C.J.E.P, (1996), “Earth Reinforcement and Soil Structure”, Butterworths, London.

2. Korner, R.M, (1999), "Design With Geo-synthetics", Prentice -Hall of India, Pvt. Ltd. New Delhi.

REFERENCE BOOKS:

1. Ingold,T.S., (1989), "Reinforced Earth", Thomas, Telford, London.
2. Purushothama Raj, P. (2004), "Ground Improvement Techniques", Laxmi Publication (P) Ltd., Bangalore
3. VenkatappaRao,G. and SuryanarayanaRaju, G.V,S., (1990), "Engineering With Geosynthetics", Tata McGraw Hill Publishing Company Limited, New Delhi.

NPTEL ONLINE SOURCES:

- http://nptel.ac.in/courses/105106052/9
- http://nptel.ac.in/downloads/105101083/

****

GROUNDWATER RECHARGE AND WATER CONSERVATION

Sub Code : 14CV812 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Outcomes :

1. Equip the students to understand the proper water management and water conservation
2. To understand the techniques through rainwater harvesting, conservation and artificial recharging of groundwater.
3. Understand the methods of reuse and recycle of water
4. Application of RS and GIS for water conservation
5. Study of ground water Pollution

UNIT - I

INTRODUCTION: Water for life, rainwater harvesting and groundwater recharge: concepts, basics of groundwater geology and water conservation techniques, importance. **7 Hours**

UNIT – II

WELLS AND WELL INVENTORIES: Definition, types, aquifer parameters, well inventories, ground water quality, groundwater pollution, significance of geology in recharging. **8 Hours**

UNIT - III

GROUNDWATER RECHARGING: Objectives, recharge, water balance, traditional, artificial, induced methods, hydro fracturing, roof top harvesting, site selection for groundwater recharging, quality of recharging water, coastal aquifers and recharging, benefits and problems. **9 Hours**

UNIT – IV

WATER CONSERVATION AND MANAGEMENT: Water conservation for commercial and industrial facilities, water quality management, management of freshwater and wastewater, recycling and reuse of water, water conservation, need of ensuring quality and cost-effectiveness of water harvesting. **8 Hours**

UNIT – V

RS & GIS application in groundwater conservation, harvesting, artificial recharging and management of water resources. **7 Hours**

TEXT BOOKS:

1. Patel, A.S., and Shah, D.L., (2008), "Water Management" New Age International Publishers, New Delhi
2. Karanth, K.R., (1987), "Groundwater Assessment Development and Management", Tata McGraw Hill Publishing co. Ltd., New Delhi

REFERENCE BOOKS:

1. Todd, D.K., (1980), "Groundwater Hydrology", 2nd ed. John Wiley and Sons,New York
2. Karnataka State Pollution Control Board, (2007). "Proceedings of International Workshop of Integrated Water Resources management"
3. Sharma, P.B.S. (2008) Groundwater Development and Management
4. Mohan, Seneviratne (2008). "A practical Approach to water conservation for commercial and Industrial facilities", Elsevier Publications.
5. LillesandThomas N., and Kiefer, R.W: (2003). "Remote sensing and image interpretations", 6th edition, John Wiley and Sons, New Delhi

****

AIR POLLUTION AND CONTROL

Sub Code	**: 14CV813**	**Credits**	**: 03**
Hrs/Week	**: 3+0+0+0**	**Total Hours**	**: 39**

Course Outcomes :

At the end of the course the students will be able to:

1. Characterization of air pollution with suitable case studies.
2. Understand general characteristics and meteorological models of air pollution.
3. Study the Sampling, analysis and control of air pollution.
4. Study the various elements of air pollution and their control measures.
5. Learn the Air quality and emission standards, legislation and regulation, air pollution index.

UNIT – I

INTRODUCTION: Classification and characterization of air pollutants. Emission sources, behavior and fate of air pollutants, chemical reaction in atmosphere, photo chemical Smog, coal induced smog, examples: London smog, Los Angeles smog & Bhopal gas tragedy. **8 Hours**

UNIT – II

METEOROLOGY: Meteorological variables, primary and secondary lapse rate, inversions, stability conditions, wind rose diagrams, stack plumes - general characteristics and meteorological models. **8 Hours**

UNIT - III

SAMPLING, ANALYSIS AND CONTROL: Sampling and measurement of gaseous and particulate matter stack sampling, analysis of air pollutants, smoke and smoke measurement. **8 Hours**

UNIT - IV

CONTROL METHODS: Particulate, emission control, gravitational settling chambers, cyclone separators, fabric filters, electrostatic precipitators, wet scrubbers. selection of a particulate collecting Equipment, control of gaseous emission, adsorption by liquids, adsorption by solids, combustion odors and their control. **8 Hours**

UNIT - V

AIR POLLUTION DUE TO AUTOMOBILES: Effects, direct and indirect method of control, environmental issues: acid rain, global warming, ozone depletion in stratosphere, indoor air pollution,

STANDARDS AND LEGISLATIONS: Air quality and emission standards, legislation and regulation, air pollution index. **7 Hours**

TEXT BOOKS:

1. Henry. C. Perkins, "Air Pollution", McGraw Hill Book company, 1974.
2. J.R. Mudakav.,"Principles And Practices Of Air Pollution Control And Analysis", I K International Pvt. Ltd ,2012
3. M Rao, H.V.N. Rao., "Air Pollution",McGraw Hill Education (India) Private Limited, 6 September 2001
4. Kenneth Wark , Cecil F. Warner, Wayne T. Davis "Air Pollution- its origin and control", Prentice Hall,3 edition,13 November 1997

REFERENCE BOOKS:

1. Howard.SPeavy, Donald R Rowe & George Tchobanoglous, "Environmental engineering", McGraw Hill Intnl. Edition, 1986
2. S.K. Garg, "Environmental Engineering", Khanna Publishers, 2013
3. Biomedical waste handling rules - 2011
4. George Tchobanoglous, Frank Kreith,"Hand book on solid waste disposal", McGraw-Hill Professional; 2 edition 1 September 2002

****

PAVEMENT DESIGN

Sub Code	**: 14CV814**	**Credits**	**: 03**
Hrs/Week	**: 3+0+0+0**	**Total Hours**	**: 39**

Course Learning Objectives

This Course will enable students to

1. Get the preliminary knowledge on flexible and rigid pavement design for highways and airport pavements.
2. Analyze the stresses and deflections in flexible and rigid pavements.
3. Know the various methods in designing the various layers of flexible pavement.
4. Know the various methods in designing the thickness of cement concrete pavement.
5. Know the functions of various types of joints in CC pavement.
6. Know to design the spacing and components of expansion and contraction joints in CC pavement by IRC method.

UNIT – I

PAVEMENT DESIGN: Desirable characteristics and requirements of a well-designed Pavement, Difference between highway and air field pavements, Functions of various components and comparison of flexible and rigid pavements, objects of pavement design, Factors affecting design and performance of pavements. **7 Hours**

UNIT – II

STRESSES AND DEFLECTIONS IN FLEXIBLE PAVEMENTS: Stresses and deflections, Principle-Assumptions-limitations, applications of Boussinesq's single layered theory and Burmister's two layered theories in pavement design and problems. Various factors in traffic design wheel load-Contact pressure-ESWL concept for dual and tandem wheel load assembly (Boyd and Foster method), repeated loads and EWL concept-Problems. **9 Hours**

UNIT - III

FLEXIBLE PAVEMENT DESIGN:

Methods for highways and airport pavement design – Introduction to CBR method-Advantages and limitations, Flexible pavement design only as per ***IRC: 37-2001***- design factors and recommendations- design steps and Problems.

McLeod method, Burmister's method and Kansas (triaxial) method- principle, design steps and problems. **7 Hours**

UNIT - IV

STRESSES IN RIGID PAVEMENTS: Factors to be considered in traffic wheel load during the design life of a CC pavement. Basic principle and concepts in analysis of stresses in rigid pavements. Westergaard's analysis- Assumptions, Modified Westergaard's (IRC) equations-Concept of Wheel load stresses-Warping stresses-Frictional stresses-Combined stresses (Using charts/equations)-Problems. **7 Hours**

UNIT – V

RIGID PAVEMENT DESIGN: Design of CC pavements for roads and runways, types of joints in cement concrete pavements and their functions, joints details for longitudinal joints, contraction joints and expansion joints.

Design of Dowel bars at load transfer joints, Design of Tie bars at longitudinal joints-design steps and problems as per ***IRC: 58-2002***. Guidelines for thickness design of CC slab as per ***IRC: 58-2002*** . **9 Hours**

Course Outcomes:

At the end of the course the student will be able to

1. Understand the design aspects and analysis of various types of stresses in flexible and rigid pavements.
2. Analyze the stresses and deflections in flexible pavement.
3. Design the thickness of the highway and airport pavements by different methods.
4. Analyze the stresses and deflections in cement concrete pavements.
5. Design various components of the rigid pavement as per IRC-58-2002.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M	L								M	H		
CO2		H				M		M		L				H	M
CO3				H		H				H		H	H		
CO4	H		H			M		M		L					M
CO5	H			H	L		M			H			H		

Note : **L : Low M: Medium H : High**

TEXT BOOKS:

1. Khanna, Justo. C.E.G, "Highway Engineering", 8th edition, Nem Chand and Bros, 2001.
2. Kadiyali L. R., Lal. N.B, "Principles and Practices in Highway Engineering", Khanna Publishers, New Delhi, 2014.
3. Khanna. S. K, Justo. C.E.G, Veeraragavan. A, "Highway Engineering", Revised 10th edition, Nem Chand and Bros, 2014.

REFERENCE BOOKS:

1. Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 2006.
2. Yoder E.J. and Witczak, "Principle of pavement design", 2nd edition, John Wiley and Sons, 1975.
3. Yang H. Huang, "Pavement Analysis and Design", Pearson Prentice Hall, 2004
4. Relevant IRC codes for the design.

NPTEL ONLINE SOURCES:

- http://nptel.ac.in/downloads/105101087/
- http://nptel.ac.in/courses/105105107/

****

APPLIED HYDROLOGY

Sub Code : 14CV815 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Outcomes :

1. The students should understand the processes of a hydrological cycle and the concept of hydrological modeling.
2. They should be able to solve problems related to precipitation using statistical analysis
3. They must be in a position to understand the stream networks and compute the abstractions from precipitation
4. They must draw unit hydrographs for a given catchment by different methods
5. They should learn to apply various probability distributions to hydrological problems
6. They must carry out frequency analysis and estimate the errors in the hydrological analysis

UNIT – I

Introduction - Hydrologic cycle, Systems concept, Hydrologic model classification, Hydrological processes. **3 Hours**

Design storm – Design precipitation depths, Intensity-Duration-Frequency relationships, Design Hyetographs, Probable Maximum Precipitation – Related Problems. **4 Hours**

UNIT – II

Surface water – Sources, Stream flow hydrograph, Base flow separation, Excess Rainfall and Direct runoff, SCS (Soil Conservation Service) method for abstractions, Flow depth and velocity, Travel time, Stream networks – Related Problems. **8 Hours**

UNIT – III

Unit Hydrograph – Assumptions, Derivation, Applications, Synthetic Unit Hydrographs, Unit Hydrographs for different rainfall durations –Related Problems. **7 Hours**

UNIT – IV

Hydrologic Statistics – Frequency and Probability functions, Statistical Parameters, Fitting a probability distribution, Probability distributions for hydrologic variables – Normal, Lognormal, Gamma, and Exponential Distributions – Related Problems. **9 Hours**

UNIT – V

Frequency Analysis – Return Period, Extreme Value Distribution, Frequency Factors, Probability Plotting, Reliability of Analysis, Confidence Limits, Standard Error of Estimate – Related Problems. **8 Hours**

TEXT BOOKS:

1. Subramanya K., Engineering Hydrology, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2014.
2. Yadupathi Putty M.R., Principles of Hydrology, I.K. International Publishing House Pvt. Ltd., 2011.

REFERENCE BOOKS:

1. Chow V.T., Maidment D.R., Mays L.W., Applied Hydrology, McGraw Hill Book Co., 1988.
2. Linsley R.K., Kohler M.A., Paulhus J.L.H., Applied hydrology, McGraw Pub., New York, 1982.
3. Raghunath H.M., Hydrology-Principles, Analysis, Design, New Age International Publishers, 2006.
4. Mutreja K.N., Applied Hydrology, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 1990.

****

EARTHQUAKE RESISTANT STRUCTURES

Sub Code : 14CV816		**Credits**	**: 03**
Hrs/Week : 3+0+0+0		**Total Hours**	**: 39**

Course Learning Objectives:

This Course will enable students to

1. To provide the basic knowledge of Earthquake and seismic zoning of India.
2. To study the performance of buildings due to irregularity during Earthquake
3. Ability to apply the knowledge of mathematics, science and engineering to analyse linear structural systems subjected to earthquake forces.
4. To study the detailing of Earthquake resistant RCC buildings and to gain basic knowledge on geotechnical earthquake engineering.
5. To study the code provisions for Earthquake resistant masonry and earthen buildings. And also to apply the knowledge of mathematics, science and engineering to analyse linear structural systems of masonry buildings.

UNIT – I

SEISMIC HAZARD ASSESSMENT

Engineering Seismology – Definitions, Classification of Earthquakes, Causes of Earthquakes, Internal structure of earth,Seismic waves, Theory of plate tectonics and seismic zoning of India, Intensity of earthquake and Magnitude of earth quake, Seismographs. **7 Hours**

UNIT - II

LESSONS LEARNT FROM PAST EARTHQUAKES ON THE PERFORMANCE OF THE BUILDINGS

Effect of Structural Irregularities on seismic performance of RCbuildings. Vertical irregularity and plan configuration problems, Seismo resistant building architecture – lateral load resistant systems, building configuration, Continuous load path, Building characteristics, and other cause of damages. Local site effects on behavior of building during earthquake, Response to ground acceleration – response analysis by mode superposition. **8 Hours**

UNIT - III

EARTHQUAKE RESISTANT DESIGN CONCEPTS:

Philosophy and principle of Earthquakes Resistant Design, Guidelines for Earthquakes Resistant Design, Structural system, types of buildings for seismic resistance, Failure mechanisms of infilled frame, analysis of infilled frames, Evaluation of Earthquake forces by Equivalent static method as per IS:1893-2002. Earth quake monitoring and seismic instrumentation torsional response of buildings, Response Spectra / Average response Spectra. **7 Hours**

UNIT - IV

GEOTECHNICAL EARTHQUAKE ENGINEERING:

Dynamic behaviour of soil, Dynamic design parameters of soil, Soil structure interaction. Liquefaction, factors affecting liquefaction, effects and Remedial measures- Soil Dynamics – Geotechnical failure of foundations during earthquake –Earthquake Resistant design of Shallow foundation.

EARTHQUAKE RESISTANT DESIGN OF RCC BUILDINGS – Ductility Considerations, requirement for ductility, Ductility ratio, structural ductility and factors affecting ductility, Confinement of concrete, Special confining reinforcement, Ductile detailing of RC structures as per IS:13920-1993. **9 Hours**

UNIT – V

EARTHQUAKE RESISTANT MASONRY AND EARTHEN BUILDINGS (IS: 13827–1993).

Study of Earthquake Resistant low strength earthen buildings as per IS:13827 – 1993, lessons learnt from past earthquakes on the performance of masonry and earthen buildings, Strength and Structural properties of masonry – Steps for improving seismic performance of masonry buildings- Design considerations, provisions of IS:4326-1993 for design of masonry buildings. **7 Hours**

Course Outcomes:

At the end of the course the student will be able to

1. Explain basic concepts earthquake engineering and how India is mapped into different seismic zones.

2. Suggest the building plan and building configuration for an Earthquake prone area ;
3. Calculate Earthquake forces in a building as per codal provisions and analyse the failure of R C buildings.
4. Suggest Earthquake resistant detailing for RCC buildings and they are able to analyses the effect of earthquake on different kinds of soil.
5. Identify, formulate, and solve engineering problems with respect to the design of Masonry and Earthen structures subjected to earthquake forces.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L											L	M	
CO2			M										L	M	L
CO3	M	M	L										H	M	
CO4	H							L						M	M
CO5	M	M	L										H		L

Note : L: Slight (Low) M: Moderate (Medium) H: Substantial (High)

TEXT BOOKS:

1. Jaikrishna et al., Elements of Earthquake Engineering, South Asia Publishers, New Delhi. 1st edition December 2000, reprinted 2014.
2. Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, PHI, India.2nd edition 2015.
3. Chopra, A.K., Dynamics of Structures, Prentice-Hall of India Pvt. Ltd. New Delhi. 1st edition 2011.
4. S K Duggal, Earthquake Resistant Design of Structures, Oxford University press, 2007.

REFERENCE BOOKS:

1. Clough, R.W. and Penzien J, Dynamics of Structures, McGraw Hill Book Co. New York 3rd edition 2003.
2. S. R. Damodarasamy and S. Kavitha, , Basics of Structural Dynamics and Aseismic Design, PHI Learning Private Limited,New Delhi, latest print 2015.
3. Biggs, M., An Introduction to Structural Dynamics, McGraw Hill Book Co. New York, January 1964.
4. PAZ M., Structural Dynamics, CBS Publishers, New Delhi. July 1997.

****

VALUATION OF REAL PROPERTIES

Sub Code	**: 14CV821**	**Credits**	**: 03**
Hrs/Week	**: 3+0+0+0**	**Total Hours**	**: 39**

Course Learning Objectives:

This Course will enable students to:

1. Classify properties and understand various forms of value.
2. Determine depreciation using different methods
3. Apply various techniques of valuation of lands
4. Understand different forms of rent and determine standard rent
5. Adopt various techniques of valuation of lands with buildings

Pre-requisites of the course: CV 403, CV405, CV702

UNIT - I

COST, PRICE AND VALUE: Nature and essential characteristics of value, forms of value, valuation and its purpose, classification of property- Freehold and leasehold.

7 Hours

UNIT – II

Sinking fund, amortization, depreciation and obsolescence, methods of depreciation-straight line method, constant percentage method, sum of years' digit method, sinking fund method and declining balance method. **8 Hours**

UNIT – III

VALUATION OF LAND: Comparative method, abstractive method, belting method, development method, flat rate technique and hypothetical building scheme or land residual method. Valuation for Land Acquisition. **8 Hours**

UNIT - IV

RENT AND FORMS OF RENT: Outgoings, gross income and net income, year's purchase, rate of interest, standard rent and its computation, estimating the future life of buildings.

8 Hours

UNIT - V

VALUATION OF LAND WITH BUILDINGS: Direct comparison, land and building method, rental method, profit method, Valuation for Capital Gains. The Real estate (Regulation and Development) Act 2016. **8 Hours**

Course Outcomes:

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

1. Understand various forms of value and property classifications.
2. Arrive at depreciation rates using different methods
3. Apply various techniques of valuation of lands
4. Understand different forms of rent and determine standard rent
5. Adopt various techniques of valuation of lands with buildings

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L					L		L					L		
CO2	M										M	M			
CO3	M				L		L	M		M					
CO4	M				L					M			L		
CO5	M				L		L	M		M			L		

L: Slight (Low) 40% M: Moderate (Medium) 60% H: Substantial (High)100%

TEXT BOOKS:

1. Namavati, R., (1991), "Theory and Practice of Valuation", Lakhani Book Depot, Mumbai
2. S.C. Rangwala, "Valuation of Real Properties" Charotar Publishing House Pvt ltd , Anand. Ninth edition (2013).
3. Syamales Dutta , "Valuation of Real Property" Eastern Law House, Kolkata Second edition (2004)

REFERENCE BOOKS:

1. S.C. Rangwala , "Elements of Estimating and Costing", Charotar Publishing House, Anand. (1984),
2. Sabapathy, B.K., (1996), "Practical Valuation", Ezhilarasi Prestige Flats, Tiruchirapalli.

****

FINITE ELEMENT METHODS OF STRUCTURAL ANALYSIS

Sub Code : 14CV822 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Outcomes :

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

1. Understand the basics of finite element method of structural analysis
2. Select the type of finite element to be used in structural analysis
3. Develop shape functions for different elements
4. Analyze plane truss and continuous beams by FEM
5. Develop the algorithm of computer program for Finite Element Analysis.

UNIT - I

INTRODUCTION: Basic concepts, Background Review: Theory of Elasticity, Matrix displacement formulation. Energy concepts, Equilibrium and Energy methods for analyzing structures. Raleigh-Ritz method, Simple applications in structural analysis. **8 Hours**

UNIT - II

FINITE ELEMENT METHOD: Fundamentals, Displacement function, Natural coordinates, Boundary conditions, Construction of displacement functions for 2 D truss and beam elements. Application of FEM for the analysis of plane truss and continuous beams.

8 Hours

UNIT - III

ANALYSIS OF 2 D CONTINUUM PROBLEMS: elements and shape functions, Triangular, rectangular and quadrilateral elements, other types of elements, their characteristics and suitability for application. **8 Hours**

UNIT – IV

Polynomial shape functions, Lagrange's and Hermitian polynomials, compatibility and convergence requirements of shape functions.

7 Hours

UNIT - IV

Isopararametric, sub-parametric and super-parametric elements, characteristics of isoparametric quadrilateral elements.Algorithm of computer program for Finite Element Analysis. **8 Hours**

TEXT BOOKS:

1. C.S. Krishnamoorthy, "Finite Element Analysis - Theory and Programming", Tata-McGraw Hill co. Ltd, New Delhi.
2. J.F.Abel and Desai, "Introduction to the Finite Element Method", Affiliated East West Press Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1. Rajasekaran S., "Finite Element Analysis in Engineering Design", Wheeler Publishers
2. Bathe K.J., "Finite Element Procedures", PHI Pvt. Ltd., New Delhi
3. Zienkeiwicz O.C., "The Finite Element Method", Tata Mc Graw Hill Co. Ltd., New Delhi
4. S.S. Bhavikatti, "Finite element Analysis", New Age International Publishers, New Delhi

DESIGN OF HYDRAULIC STRUCTURES

Sub Code	**: 14CV823**	**Credits**	**: 03**
Hrs/Week	**: 3+0+0+0**	**Total Hours**	**: 39**

Course Outcomes :

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

1. Study the various Hydraulic structures.
2. Learn how to design different cross drainage works
3. Understand the Analysis of stability of gravity dams
4. Study of types of failures of Dam
5. Management of floods using Spillways

UNIT - I

CROSS DRAINAGE WORKS

Introduction, Types of cross drainage works. Design of an aqueduct – Design of waterway for the stream. Fluming of canal: Mitra's hyperbolic transition formula. Design of protection works (hydraulic design only) **8 Hours**

UNIT - II

GRAVITY DAM

Introduction. Modes of failure. Design of Gravity dam by multistep method. Stress analysis using gravity method.

Joints in Gravity Dams. Keys and Water Stops. Temperature Control in Gravity Dams. Galleries in Gravity dams. Construction of a Gravity dam. Foundation grouting, Instrumentation for gravity dams. **8 Hours**

UNIT - III

EARTHEN DAM

Introduction. Causes of failure of Earth dam. Preliminary section of zoned earthen dam. Determination of phreatic line by Casagrande's method and analytical method. Stability of slope using ordinary method of slices. Design of filters – graded filters –geofabric filters.

8 Hours

UNIT - IV

SPILLWAYS

Introduction, components of a spillway, types of spillway. Design of ogee spillway. Down stream and up stream profile of the crest of an Ogee spillway. **8 Hours**

UNIT – V

CANAL REGULATORY WORKS

Introduction. Types of falls. Design of trapezoidal notch type fall.

Functions of a regulator. Design of a cross regulator and a head regulator. Devices for sediment control: silt-ejector and silt-excluder. **7 Hours**

TEXT BOOKS:

1. K.R. Arora, **"Irrigation, Water Power & Water Resources Engineering"**, Standard Publication, New Delhi, 4th Revised edition 2014
2. R.K. Sharma, "**Text Book of Irrigation Engineering and Hydraulic Structures",** Oxford & IBH Publishing Co. New Delhi, 1984

REFERENCE BOOKS:

1. Santosh Kumar Garg, **"Irrigation Engineering & Hydraulic Structures",** Khanna Publishers, New Delhi, 1992
2. P.N. Modi, **"Irrigation, Water Resources & Water Power",** Standard Book House, New Delhi. 2008.

****

ROAD SAFETY AND MANAGEMENT

Sub Code	**: 14CV824**	**Credits**	**: 03**
Hrs/Week	**: 3+0+0+0**	**Total Hours**	**: 39**

Course Learning Objectives:

This Course will enable students to

1. Get awareness about the global, national and regional road crash scenario and their impacts
2. Identify the risk factors associated with crash involvement and its severity
3. Demonstrate the traffic management measures to minimize road crash
4. Understand the methods of collection and analysis of crash data
5. Gain the knowledge of the procedure for performing road safety audit.

UNIT – I

INTRODUCTION TO ROAD SAFETY ENGINEERING -

Over view of road safety - Global road safety scenario and pattern - global trends and projections - national and state road safety level - problems in road safety in developing countries magnitude, socioeconomic and health effects. **8 Hours**

UNIT - II

TRAFFIC ELEMENTS -

Characteristics of Road user, Motor vehicle, Roadway- relationship between elements- human factors governing road user behavior- risk factors for traffic accidents- exposure to risk- crash involvement- crash severity- post crash injury outcomes **9 Hours**

UNIT - III

ANALYSIS AND PREVENTION OF ACCIDENTS

Collection of accident data- Statistical methods for analysis of accident data- Speed in relation of safety- Weather and its effects on accidents- Vulnerable road users safety- parking influence on accidents **8 Hours**

UNIT - IV

TRAFFIC MANAGEMENT MEASURES FOR ACCIDENT PREVENTION

Legislation, Enforcement, Education and Propaganda, Formulating and implementing road safety policy **6 Hours**

UNIT – V

ROAD SAFETY IMPROVEMENT PROGRAM

Road safety audit (RSA) - Procedure in road safety audit- design standards- audit tasks- stages of road safety audit- key legal aspects. Road design issues in RSA's – structuring and preparation of audit report. **8 Hours**

Course Outcomes:

At the end of the course the student will be able to

1. Identify the factors contributing to accidents
2. Collect the necessary data pertaining to road crashes and prepare comprehensive accident crash database.
3. Do the statistical analysis of accident crash data.
4. Implement traffic management measures for accident prevention
5. Perform road safety audit and prepare an detailed audit report.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H			M		L				H			H	
CO2	H			L			L		H						H
CO3	H			M	L						H				H
CO4			H		L				H			L	H		L
CO5	H	M				L		M			M			M	H

TEXT BOOKS:

1. David L. Geotsc. Occupational Safety and Health for Technologists, Engineers and Managers. 5th Edition, 2004.
2. Kadiyali, L.R. Traffic Engineering and Transportation Planning, Khanna Publishers, New Delhi, 2009.

REFERENCE BOOKS:

1. World Health Organization, Road Traffic Injury Prevention Training Manual, 2006.
2. Fuller, R., Santos, J.A. Human Factors for Highway Engineers, Pergamon, 2002.
3. IRC: 103-1988, Guidelines for Pedestrian Facilities, Indian Roads Congress, New Delhi.
4. IRC: SP: 32-1988, Road Safety for Children (5-12 Years old), Indian Roads Congress, New Delhi.
5. IRC: SP: 44-1996, Highway Safety Code, Indian Roads Congress, New Delhi.
6. IRC: SP: 88-2010, Road Safety Audit Manual, Indian Roads Congress, New Delhi.

****