B. E. SYLLABUS

CIVIL ENGINEERING

V & VI 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

V Semester **30 Hours/week**

Sl. No.	Code	Subject	Theory /Tuto./Prac./ Self Study	Total Hrs./Week	CIE	SEE	Credits
1.	15CV501	Structural Analysis-II	3+2+0+0	5	50	50	4
2.	15CV502	Design of RCC Structural Elements	3+2+0+0	5	50	50	4
3.	15CV503	Geotechnical Engg. I	4+0+0+0	4	50	50	4
4.	15CV504	Transportation Engg. I	3+0+0+S*	3	50	50	3
5.	15CV505	Environmental Engg. I	3+0+0+0	3	50	50	3
6.	15CV51X	Elective –I	3+0+0+0	3	50	50	3
7.	15CV506	Hydraulics & Hydraulic Machinery Lab	0+0+3+0	3	50	50	**2**
8.	15CV507	Computer Aided Design Lab	0+0+3+0	3	50	50	**2**
9.	15IL001	Employability Skill Development	1+0+0+0	1	50	-	**0**
		TOTAL	**30**	**30**	**400**	**400**	**25**

DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF TEACHING AND EXAMINATION

VI Semester **31 Hours/week**

Sl. No	Code	Subject	Theory /Tuto./Prac./ Self Study	Total Hrs./Week	CIE	SEE	Credits
1.	15CV601	Design & Drawing of RCC Structures	2+0+3+0	5	50	50	4
2.	15CV602	Geotechnical Engg. – II	3+0+0+0	3	50	50	3
3.	15CV603	Transportation Engg. –II	4+0+0+0	4	50	50	4
4.	15CV604	Environmental Engg. –II	3+0+0+S*	3	50	50	3
5.	15CV61X	Elective-II	3+0+0+0	3	50	50	3
6.	15CV62Y	Elective-III	3+0+0+0	3	50	50	3
7.	15CV605	Geotechnical Engg. Lab	0+0+3+0	3	50	50	2
8.	15CV606	Environmental Engg. Lab	0+0+3+0	3	50	50	2
9.	15CV607	Extensive Survey Project/Mini Project	2 weeks	3	50	-	1
10.	15CV608	IGW	1Week				
11.	15IL002	Employability Skill Development	1+0+0+0	1	50	-	0
		TOTAL	**31**	**31**	**450**	**400**	**25**

ELECTIVE – I

15CV512	Advanced Applied Engg Geology
15CV513	Design of Masonry Structures
15CV515	Alternative Building Materials & Technologies

ELECTIVE – II

15CV611	Matrix Method of Structural Analysis
15CV612	Traffic Engineering
15CV613	Rural Water Supply and Sanitation

ELECTIVE – III

15CV621	Groundwater Hydrology
15CV622	Ground Improvement Techniques
15CV623	Remote Sensing & GIS Applications in Civil Engineering

STRUCTURAL ANALYSIS – II

Sub Code	**: 15CV501**	**Credits**	**: 04**
Hrs/Week	**: 3+2+0+0**	**Total Hours**	**: 52**

Course Learning Objectives:

This Course will enable students to

1. Get the idea how strain energy concept can be used to analyze statically indeterminate trusses.
2. Recall and recognize the concept of slope deflection method of analysis of indeterminate beams and frames.
3. Tell, how concept of MD method can be used for analysis of indeterminate structures.
4. Demonstrate Kani's Rotation Contribution method to analyze the indeterminate beams and frames.
5. Make use of matrix method of analysis for analyze indeterminate beams.

UNIT – I

REDUNDANT TRUSSES

Introduction, Analysis of statistically indeterminate structures using strain energy method, Analysis of trusses (Redundant up to second degree), Lack of fit in member of indeterminate trusses. Temperature stress in redundant trusses. **8 Hours**

UNIT - II

SLOPE DEFLECTION METHOD

Introduction, Sign convention, Development of slope – deflection equations, Analysis of continuous beams, Analysis of frames (Kinematics indeterminacy <3)

10 Hours

UNIT - III

MOMENT DISTRIBUTION METHOD

Introduction, Definition of terms, Development of method, Analysis of continuous beams, Analysis of frames (Static indeterminacy <3)

10 Hours

UNIT - IV

KANI'S METHOD

Introduction, Basic concept, Analysis of continuous beams, Analysis of frames with no lateral translation of joints, Analysis of symmetrical frames.

10 Hours

UNIT – V

MATRIX METHOD OF ANALYSIS

Introduction ,Axes and coordinates, Flexibility matrix, Stiffness matrix, Relation between flexibility method and stiffness matrices, System approach of flexibility method for analysis

of propped cantilevers and continuous beams. System approach of stiffness method for analysis of propped cantilevers and continuous beams.

14 Hours

Course Outcomes:

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

1. Acquire knowledge of analysis of the indeterminate trusses by minimum strain energy method.
2. Develop slope deflection equation and apply this for analysis of continuous beams and frames.
3. Explain the concept of carry-over moment in indeterminate structures and able to compute the end moments by number of iterations.
4. Analyze the performance of continuous beams and frames by acquiring the knowledge of Kani's Rotation Contribution method.
5. Illustrate basic definition of Flexibility and Stiffness, able to develop relationship between flexibility and stiffness matrices and analyze the structures by matrix approach.

Mapping of POs & COs :

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

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

TEXT BOOKS:

1. Punmia B.C, Ashok Kumar Jain, Arun Kumar Jain, "Strength of materials and Theory of Structures", Volume I & Volume II, Laxmi Publications (P) Ltd.,2015
2. Shah H.J and Junnarkar S.B., "Mechanics of Structures", Volume I & II, Charotar Publications, New Delhi, 2014

REFERENCE BOOKS:

1. Reddy S.C, "Basic Structural Analysis", Tata McGraw Hill, New Delhi, March 2014
2. Pandith G.S., Gupta S.P., "Structural Analysis - A Matrix Approach", Tata McGraw Hill, New Delhi, 2012
3. Prakash Rao D.S., "Structural Analysis - A unified Approach", University Press, 2010
4. Ramamrutham S, "Theory of Structures", Dhanpal Rai & Sons, New Delhi, 2015
5. Vazirani V.N. and M.M.Ratwani, "Analysis of Structures", Khanna Publications, New Delhi, 2014

6. Wang C.K., "Indeterminate Structural Analysis", Tata McGraw Hill Publications, 2010

NPTEL ONLINE COURSE:

- http://nptel.ac.in/courses/105101086/
- http://nptel.ac.in/courses/105105109/

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DESIGN OF R.C.C. STRUCTURAL ELEMENTS

Sub Code	**: 15CV502**	**Credits**	**: 04**
Hrs/Week	**: 3+2+0+0**	**Total Hours**	**: 52**

Course Learning Objectives:

This Course will enable students to

1. To provide basic knowledge of mathematics, science and engineering in the areas of limit state of collapse and serviceability of R C elements.
2. Enable the students to identify, formulate and solve engineering problems of R C elements subjected to flexure, shear and torsion.
3. To give procedural knowledge to design R C elements such as beams, slabs, columns, footing and stairs subjected to various load combinations and boundary conditions as per specification and needs.
4. To develop the culture of professional and ethical responsibilities by following codal provisions in the analysis, design and detailing of R C elements for strength and durability.

UNIT – I

Chapter 1: Introduction

Materials for RCC, advantages of RCC, general features of RCC, codal requirements, design philosophy – Working stress and Limit State Methods of design

Chapter 2: Principles of Limit State Method of design and Ultimate Strength of RC sections

Introduction, characteristic and design loads, principles of LSM of design, characteristic and design strength, general aspects of ultimate strength, stress block parameters for limit state of collapse, ultimate flexural strength of singly reinforced and doubly reinforced rectangular sections, ultimate flexural strength of flanged sections, ultimate shear strength of RC sections, ultimate torsional strength of RC sections **10 Hours**

UNIT - II

Chapter 3: Analysis of RC sections

Concepts of development length and anchorage, problems on the analysis of singly reinforced, doubly reinforced and flanged sections, problems on computing shear strength, development length **10 Hours**

UNIT - III

Chapter 4: Serviceability Limit States

General aspects, deflection limits as per IS456:2000, calculation of deflection by theoretical method, cracking in structural concrete members, calculation of deflections and crack width

Chapter 5: Design of Beams

Practical requirements, size of beam, cover to reinforcement, spacing of bars, design procedures for critical sections for moments and shears, anchorages of bars, check for development length, reinforcement requirements, slenderness limits for beams to ensure lateral stability, design examples for simply supported and cantilever beams for rectangular and flanged sections. **12 Hours**

UNIT - IV

Chapter 6: Design of Slabs

General considerations, rectangular slabs spanning in one direction, rectangular slabs spanning in two directions for various boundary conditions, design of simply supported, cantilever and continuous slabs as per IS456:2000

Chapter 7: Design of Columns

General aspects, effective length of column, loads on columns, slenderness ratio for columns, minimum eccentricity, design of short axially loaded columns, design of columns subjected to combined axial load and uniaxial moment and biaxial moment using IS456:2000 and SP16

10 Hours

UNIT – V

Chapter 8: Design of Footings

Introduction, loads for footing, design basis for limit state method, design of isolated rectangular footing for axial load and uniaxial moment, design of pedestal

Chapter 9: Design of Staircases

General features, types of staircases, loads on staircases, effective span as per IS code provisions, distribution of loading on stairs, design of doglegged staircases. **10 Hours**

Course Outcomes:

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

1. Understand the behaviour of different components of RCC structures.
2. Identify the various types of failures in the different components of a RCC structure.
3. Assess the strength and stability of components of RCC structures and are able to Design the various types of beams for limit state of collapse & serviceability.
4. To successfully design the slabs and columns for various end conditions and loading combination.
5. Design the stairs and footing with necessary checks as per codal provisions.

Course Articulation Matrix :

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

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

TEXT BOOKS

1. N. Krishnaraju and R.N.Pranesh, Reinforced Concrete Design (IS456:2000)-Principles and Practice, New Age International Publishers, New Delhi, 1st edition 2003, reprinted 2015.
2. Dr.B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Limit State Design of Reinforced Concrete, Laxmi Publications (P) Limited, New Delhi, 1st edition – 2007, reprinted 2015.

REFERENCE BOOKS:

1. Dr. Ramchandra and Virendra Gehlot, Limit State Design of Concrete Structures (As per IS:456-2000), Scientific Publishers (India), Jodhpur, September 2012.
2. S. N. Sinha, Reinforced Concrete Design, Tata- McGraw Hill Publishing Company Limited, New Delhi.
3. Dr. P.C. Varghese, Limit State Design of Reinforced concrete, 2nd Edition-2004, Prentice Hall of India Private Limited, Reprinted-2015.
4. IS: 456-2000 (to be supplied in the examination), SP16.

NPTEL ONLINE COURSE:

- http://nptel.ac.in/courses/105105164/
- http://nptel.ac.in/courses/105105105/

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GEOTECHNICAL ENGINEERING – I

Sub Code	**: 15CV503**	**Credits**	**: 04**
Hrs/Week	**: 4+0+0+0**	**Total Hours**	**: 52**

Course Learning Objectives:

This course will enable students to

1. To acquire knowledge of Soil as a three system and explain various terminology.
2. To understand the need for soil classification based on various classification systems and to know the concept of 'Soil Structure' and 'Clay Mineralogy'.
3. To understand the concept of Permeability and Capillarity on soils and study the effect of Compaction Characteristics on soil sample.
4. Explain the Consolidation Characteristic of soil and its use in the field of engineering.
5. Assess the Shear Strength of soil and its determination using laboratory experiments.

UNIT – I

INTRODUCTION: Phase Diagram, Definitions- void ratio, porosity, degree of saturation, percentage air voids, air content, specific gravity, water content, soil densities, functional relationships, field identification of soils.

INDEX PROPERTIES OF SOILS AND THEIR DETERMINATION: Grain size distribution, Atterberg's Limits and Indices, Insitu density, density index Laboratory determination: specific gravity, grain size distribution-sieve analysis and sedimentation analysis (Hydrometer Method), Liquid Limit (Casagrande Method), plastic limit and shrinkage limit. **10 Hours**

UNIT - II

CLASSIFICATION OF SOILS: Need for classification, unified soil classification and IS classification - plasticity chart and its importance.

SOIL STRUCTURE AND CLAY MINERALOGY: Soil structure –Single grained, honey combed, flocculent and dispersed structures. Valence bonds, Soil-water system- diffuse double layer, adsorbed water, base-exchange capacity; Common clay minerals - Kaolinite, Illite and Montmorillonite. **10 Hours**

UNIT – III

PERMEABILITY AND CAPILLARITY OF SOILS: Darcy's law - assumptions and validity; coefficient of permeability and its determination (laboratory and field). Factors affecting permeability. Permeability of stratified soils. Seepage velocity, superficial velocity and coefficient of percolation. Effective stress principle - total pressure and effective stress, quick sand phenomenon. Capillary phenomenon.

COMPACTION OF SOILS: Moisture Content – Dry density relationship, Zero-air void line, Laboratory compaction tests. Factors affecting compaction; properties. Field compaction methods, Field compaction control - Proctor needle method **12 Hours**

UNIT – IV

COMPRESSIBILITY AND CONSOLIDATION OF SOILS: The consolidation process-spring analogy, compressibility of soil and volume change- coefficient of compressibility and compression index, normally consolidated and over consolidated soils , pre-consolidation pressure and its determination (Casagrande method), Modulus of volume change and consolidation settlement. Terzaghi's theory of one dimensional consolidation - assumptions. Coefficient of consolidation- Time fitting methods. **10 Hours**

UNIT – V

SHEAR STRENGTH OF SOIL: Stress – strain curve, Mohr - Coulomb failure criterion, peak and residual strength theory. Laboratory measurement of shear strength- drainage conditions, direct shear test, unconfined compression test, triaxial compression test and vane shear test. Failure envelops - conventional and modified. Total and effective shear strength parameters. Factors affecting shear strength of soils, sensitivity and thixotropy. Pore pressure coefficient – measurement and application. **10 Hours**

Course Outcomes:

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

1. Have a clear knowledge of Soil based on three Phase system and understand the use of various terminology.
2. Understand the need for soil classification based on various classification systems and the 'Soil Structure' and concept of 'Clay Mineralogy'.
3. To know the concept of Permeability and Capillarity of soils and understand the behavior of soil under Compaction and its applications.
4. To understand and implementation of Consolidation Characteristic on soil and its application.
5. Assess importance of the Shear Strength of soil in in the field of engineering.

Mapping of POs & COs :

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	H	L		M						L	L	L	M	L	
CO2	H	M	L	L			L			L	M		M	M	L
CO3	H	M	M	L	L								M	L	
CO4	M	H	H										M	L	
CO5	H	L	H	L									M	L	

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

TEXT BOOKS:

1. Punmia B.C.,(2014) "Soil Mechanics and Foundations" Laxmi Publishing Co
2. Purushothama Raj. P.,(2005) "Geotechnical Engineering", Tata McGraw Hill Publishing Company Ltd, New Delhi.
3. B. M. Das, Principles of Foundation Engineering, Thomson, Indian Edition, 2003.

REFERENCE BOOKS:

1. Murthy V.N.S.,(2007) "Principles of Soil Mechanics and Foundation Engineering", UBS Publishers Distributors Pvt.Ltd.
2. Gopal Ranjan and Rao A.S.R., "Basic and Applied Soil Mechanics", New Age International Pvt Ltd, Publishers(2007)
3. Venkatramaiah C., "Geotechnical Engineering", Universities Press (India) Ltd.
4. Terzaghi K. and Peck R.B.,(1996) "Soil Mechanics in Engineering Practice" John Wiley & Sons, Inc.
5. Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1995.
6. Muni budhu., Soil Mechanics and Foundations, Third Edition , John Wiley And Sons, Inc , 2010.

INTERNET SOURCES:

- http://nptel.ac.in/courses/105106142/
- http://nptel.ac.in/courses/105101001/
- http://nptel.ac.in/courses/105101001/5

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TRANSPORTATION ENGINEERING – I

Sub Code	**: 15CV504**	**Credits**	**: 03**
Hrs/Week	**: 3+0+0+S***	**Total Hours**	**: 39**

*** 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. Plan the road network for a given area.
2. Design road cross sections for the traffic and type of road.
3. Select a proper site for a bridge to road.
4. Critically review the highway materials.
5. Critically analyze the economics of a road.
6. Critically analyze the performance of a road.

UNIT - I

Introduction: Importance of transportation, Modes, characteristics – comparison of different modes. Jayakar committee recommendations and implementation, road development in India – Third 20 year plan and problems.

Highway Planning and alignment: Road patterns, planning surveys – Master plan – Saturation system of road plan – factor affecting alignment – Ideal alignment – surveys for new and realignment projects. **8 Hours**

UNIT - II

Design Principles: Introduction to highway geometric design, Importance, cross sectional elements, Width of carriage way, camber, Shoulder width, Design speed, Sight distance, design of horizontal and vertical alignment.

Pavement design: Types of pavements, design factors, ESWL concept in pavement design.

9 Hours

UNIT - III

Traffic Engineering: Importance, Objects of volume, speed and capacity studies, PCU concepts.

Pavement materials and Construction: Properties and requirements of Subgrade soils, CBR and Plate load test on soil, Properties and requirements of road aggregates, Bitumen, Tar, emulsion, Cutback – Specifications. **7 Hours**

UNIT - IV

Highway Economics and Financing: Highway users benefits, Highway costs, Economic analysis by annual cost method and Benefit cost ratio method, Highway Financing – BOT and BOOT concepts.

Subsurface drainage system for road pavement: Objects and Requirements, Types, Functions and basic design principles. **8 Hours**

UNIT - V

Introduction to bridges: Selection of sites, Types of bridges, Components and functions.

Pavement maintenance: Functional and structural deterioration of pavements, Principles of pavement evaluation, Types of pavement failures, Maintenance measures for road.

7 Hours

Course Outcomes:

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

1. Acquire knowledge on various stages of planning the alignment of a road network
2. Apply the design principles for cross sectional and geometrics of highway as per IRC guidelines.
3. Explain the pavement materials, design, construction and maintenance aspects of road way as per IRC guidelines.
4. Explain the basic drainage design and economics of highway.
5. Acquire the knowledge to locate a ideal site and component parts of a bridge.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PS O1	PSO2	PSO3
CO1	M	M				M	L			H		M		H	
CO2	M		M	M					M				H		L
CO3			M					M		H		M	L	M	
CO4			H		M				H		H			M	H
CO5	M	M		M	M			M		H		M		H	

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

TEXT BOOKS:

1. Khanna. S. K, Justo. C.E.G, Veeraragavan. A, "Highway Engineering", Revised 10th edition, Nem Chand and Bros, 2014.
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) .
5. Johnson Victor, "*Essentials of bridge Engineering"*, 6th revised edition, Oxford IBH publications, New Delhi (2007).

INTERNET SOURCES:

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

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ENVIRONMENTAL ENGINEERING – I

Sub Code : 15CV505 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives:

This Course will enable students to

1. Determine the objectives of water treatment
2. Discuss various methods of population forecasting

3. Explain the characteristics of water
4. Design the various water treatment units

UNIT – I

QUANTITY OF WATER

Introduction; Human activities and environmental pollution; requirement of water for various beneficial uses; need for protected water supply. Demand of water-Types of water demands – domestic demand in detail, institutional and commercial, public uses, fire demand, Per capita consumption – Factors affecting per capita demand.

Population forecasting – Different methods with merits & demerits – variations in demand of water.

Fire demand – estimation by Kuichling's formula, Freeman formula & National board of fire underwriters' formula; peak factors; design periods & factors governing the design period.

7 Hours

UNIT - II

QUALITY OF WATER

Objectives of water quality management, concept of safe water, wholesomeness & palatability & portability. Water borne diseases.

Examination of water – objectives – Physical, chemical and microbiological examinations (IS: 3025 and IS: 1622) using analytical and instrumental techniques. Drinking water standards BIS & WHO guidelines. Health significance of fluorides, nitrates and heavy metals like mercury and cadmium. Sampling of water for examination.

Sources, collection and conveyance of water -Surface and subsurface sources – suitability with regard to quality and quantity. Intake structures – different types of intakes; factor of selection and location of intakes. Pumps – Necessity; types – power of pumps; factors for the selection of a pump, design of the economical diameter for the rising main. **8 Hours**

UNIT - III

WATER TREATMENT

Objectives, flow-chart of treatment process. Aeration-principles; types of aerators, Sedimentation- Theory; settling tanks; types; design. Aided with coagulants, dosages; chemical feeding, flash mixing and flocculators.

Filtration- Mechanism – theory of filtration; types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning and their design – excluding under drainage system – back washing of filters. **8 Hours**

UNIT - IV

MISCELLANEOUS TREATMENT

Disinfection;Theory of disinfection; methods of disinfection, chlorination, chlorine demand, residual chlorine, use of bleaching powder. Softening- Definition, methods of removal of hardness by lime soda process and zeolite process

Miscellaneous Treatment- Removal of color, odor, taste with methods like aeration, activated carbon treatment; oxidizing organic matters; removal of iron and manganese; fluoridation and defluoridation. **8 Hours**

UNIT –V

WATER DISTRIBUTION SYSTEMS

Methods of distribution systems- System of supply, service reservoirs and their capacity determination, methods of layout distribution

Miscellaneous-Pipe appurtenances, various valves, type of fire hydrants, pipefitting, Location of water supply pipes in buildings. **8 Hours**

Course Outcomes:

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

1. Trace the objectives of water treatment
2. Solve the problems connected to population forecasting
3. Explain the characteristics of water
4. Solve the problems on various water treatment units
5. Design miscellaneous water treatment options.

Mapping of POs & COs :

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

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

TEXT BOOKS:

1. S.K. Garg, "*Water Supply Engineering*", Khanna Publishers, 2016
2. B.C. Punima and Ashok Jain, "*Environmental Engineering - I*", Lakshmi Publications, 2017

REFERENCE BOOKS:

1. Hammer and Hammer, "*Water Technology*", Tata McGraw Hill, 2016
2. Howard S. Peavey, Donald R. Rowe, George Tchobanoglous, "*Environmental Engineering*", McGraw Hill International Edition, 2013.
3. CPHEEO, "Manual *on Water supply and treatment*", Ministry of Urban Development, New Delhi,2015

NPTEL ONLINE SOURCE: http://nptel.ac.in/course.php?disciplineId=105

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HYDRAULICS AND HYDRAULIC MACHINERY LAB

Sub Code : 15CV506 **Credits : 02**
Hrs/Week : 0+0+3+0 **Total Hours : 39**

Course Learning Objectives:

This Course will enable students to

1. Understand the flow measuring devices in pipes and channels
2. Know the working principle of Turbines and Pumps
3. Compute the losses in pipe flow

Experiments to be conducted:

1. Determination of friction factor in pipes
2. Determination of minor loss constants in pipes – bend, sudden expansion, sudden contraction
3. Determination of hydraulic coefficients of a vertical circular orifice and mouthpiece
4. Calibration of Triangular notch
5. Calibration of Rectangular or Trapezoidal notch
6. Calibration of Venturimeter
7. Calibration of Venturiflume
8. Determination of coefficient of impact for a fixed flat vane
9. Performance Tests on Pelton Turbine
10. Performance Tests on Francis Turbine or Kaplan Turbine
11. Performance Tests on Single stage centrifugal pump
12. Performance Tests on Reciprocating Pump
13. Calibration of Siphon spillway

Course Outcomes:

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

1. Explain the working of flow measuring devices
2. Demonstrate the working of Turbines and draw the characteristic curves
3. Draw the characteristic curves for a pump
4. Describe the various losses in pipe flow and their computation

Mapping of POs & COs:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	M	M	H	L								L	M		
CO2	M	M	H	L								L	M		
CO3	M	M	H	L								L	M		
CO4	M	M	H	L								L	M		

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

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COMPUTER AIDED DESIGN LABORATORY

Sub Code : 15CV507 **Credits : 02**
Hrs / Week : 0+0+3+0 **Total Hours : 39**

Course Learning Objectives:

This Course will enable students to:

1. Understand and know various commands in autocad.
2. Understand and apply autocad in various structural component drawings.
3. Know the properties and apply staad -pro software in analysis of structures.
4. Know and apply different formulation techniques using excel to solve and design civil engineering problems.

1. Autocad: Basics of Autocad

DRAWING TOOLS: Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse, *Modify tools*: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, *Using Text*: Single line text, Multiline text, Spelling, Edit text, *Special Features*: View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, Working with multiple drawings. **3 Hours**

2. Use of AUTOCAD in Civil Engineering Drawings:

Following drawings are to be prepared for the data given using AUTOCAD.
i) Cross section of Foundation - masonry wall, RCC columns (isolated)
ii)Different types of staircases
iii) Lintel and chejjah
iv) RCC slabs and beams
v) Drawing of Plan, elevation and sectional elevation of single storied residential and public buildings given the single line diagram and preparing excavation plan.

18 Hours

3. Structural analysis software

Use of commercially available software for the analysis of
i) Plane Trusses
ii) Continuous beam
iii) 2D Portal frames-single storied and multistoried. **9 Hours**

4. Use of excel in civil engineering problems

Use of spread sheet for the following civil engineering problems
i) SFD and BMD for Cantilever and simply supported beam subjected to uniformly distributed and uniformly varying load acting throughout the span.
ii) Design of singly reinforced and doubly reinforced rectangular beams.
iii) Computation of earthwork.
iv) Design of horizontal curve by offset method.
v) Design of super elevation. **9 Hours**

Course Outcomes:

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

1. Apply the understanding of commands in civil drawings.
2. To draw structural component drawings in practice.
3. Apply staad -pro software in analysis and design of different structures in practice.
4. Use different formulation techniques using excel to solve and design civil engineering problems.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	L		M				L						L	L	
CO2		M	H	M			M						L	L	
CO3	L		M				L						M	M	
CO4			L	M			M						M	M	

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

REFERENCE BOOKS:

1. Computer Aided Design Laboratory- Dr M.N.Shesha Prakash, Dr.G.S.Suresh, Lakshmi Publications.
2. CAD Laboratory- M.A.Jayaram, D.S.Rajendra Prasad- Sapna Publications.
3. AUTOCAD 2002- Roberts JT, -BPB publications.
4. AUTOCAD 2004- Sham Tickoo, A beginner's Guide, Wiley Dreamtech India Pvt Ltd.
5. Learning Excel 2002- Ramesh Bangia, -Khanna Book Publishing Co (P) Ltd.
6. Microsoft Excel- Mathieson SA, Starfire publishers.

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ADVANCED APPLIED ENGINEERING GEOLOGY

Sub Code : 15CV512 **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. **Understand** and **Appraise** the significance of Earth Sciences in Civil Engineering practices.
2. **Identify and differentiate** the suitable Materials of construction **appreciating** its Engineering properties

3. **Appraise and Appreciate** the advanced applications of Earth Sciences in the field of resource exploration, natural calamities, health and environmental management, etc.,
4. **Identify, Appreciate, Analyse, Interpret, Evaluate and Solve** the geological problems coming under Civil Engineering practices

UNIT - I

Geology and Engineering: Earth Science and its disciplines in Engineering practices, Geological Engineering, significance of geology in the Civil Engineering projects, Maps and Map Reading **7 Hours**

UNIT - II

Earth Resources and Applied Geology: Geology of dams and reservoirs, tunnels, highways and bridge site engineering. Engineering Properties of Rocks: Crushing strength, Transverse strength, porosity, density, abrasive resistance, frost and fire resistance, Qualities of good Building stones, Road Metals, Railway Ballasts & Concrete aggregates. Rocks as M.O.C. – foundation, decorative stones, flooring & roofing with examples **7 Hours**

UNIT - III

Geohydrology and Watershed Management: Concept of watershed and its development, rainwater harvesting & artificial recharging, water quality and water pollution **8 Hours**

UNIT - IV

Environmental Geology & Medical Geology: Earth and Health, Impact of Geology on environmental health hazards, Environmental Geology of landslides, mining, developmental projects, etc., its applications in Engineering disciplines and civil engineering projects viz: tunneling, dams and reservoirs, etc., Impact of Weathering and Erosion in the Civil Engineering projects and structures **8 Hours**

UNIT - V

Exploration Geology and Geophysics: for foundation and groundwater; geological, geophysical and hydrological investigations, electrical resistivity and seismic methods, Remote Sensing, GIS, GPS and their application in the field of exploration and civil engineering **9 Hours**

Course Outcomes:

At the end of the course, upon successful completion, each student will be able to:

1. **Identify, Explain and Appraise** the significance of Earth Sciences in Civil Engineering practices.

2. **Identify and differentiate** the suitable Materials of construction **appreciating** its Engineering properties
3. **Appraise and Appreciate** the advanced applications of Earth Sciences in the field of resource exploration, natural calamities, health and environmental management, etc.,
4. **Identify, Appreciate, Analyse, Interpret, Evaluate and Solve** the geological problems coming under Civil Engineering practices.
5. **Understand** and **Appreciate** the advanced technology in Earth sciences for the **solution** of civil engineering problems

Mapping of POs & COs :

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

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

TEXT BOOKS:

1. Legget, Robert F & Hatheway, Allen W., (1988) ***Geology and Engineering*** 3rd ed., Mc. Graw Hill Book company, Singapore
2. Valdiya, K.S. (2005) ***Environmental Geology*** John Wiley & sons, New Delhi
3. Anji Reddy, M. (2012) ***Text Book of Remote Sensing and Geographical Information Systems***, Fourth Edition, BS Publication, Hyderabad

REFERENCE BOOKS:

1. Krynine, Dimitri. P & Judd, William. R (1998) ***Principles of Engineering Geology and Geotechnics***, Tata McGraw Hill Publ. Co., New Delhi
2. Keller, Edward A., (1985) ***Environmental Geology*** 4th Ed., CBS Publishers & Distributors, Delhi
3. R3. Johnson, Robert. B & De Graff V. Jerome (1989), ***"Principles of Engineering Geology and Geotechnics",*** Mc Graw Hill Book co.. London

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DESIGN OF MASONRY STRUCTURES

Sub Code : 15CV513		**Credits**	**: 03**
Hrs/Week : 3+0+0+0		**Total Hours**	**: 39**

Course Learning Objectives:

This Course will enable students to

1. Know about 'Masonry', its use, advantages and disadvantages
2. Have clear knowledge of different types of 'Masonry units', types and grades of 'Mortar' as per IS Code, properties of masonry units and mortar.
3. Know the strength of masonry unit and masonry prism, computation of permissible strength of masonry for different types of masonry structures considering factors like 'Effective height',' Effective length', 'Slenderness ratio' and 'Eccentricity ratio'.
4. Design different types of masonry structures selecting suitable masonry units and mortar using IS 1905 (revised in 2002) and SP 20.
5. Know about the use of (i) Reinforced Masonry, (ii) Composite Masonry (iii) Confined Masonry and (iv) 'In filled frames', their advantages and disadvantages.

UNIT – I

Brick, stone, and block masonry units – Strength, modulus of elasticity and water absorption of masonry materials- classification and properties of mortars, selection of mortars. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking and remedial methods.

Strength and stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of ageing, workmanship, strength formulae and mechanism of failure of masonry subjected to direct compression. **8 Hours**

UNIT – II

Permissible compressive stresses, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses.

Load considerations for masonry: walls carrying axial load, eccentric load with different eccentric ratios—walls with openings and free standing wall. **8 Hours**

UNIT - III

Design considerations: Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action and lintels. **8 Hours**

UNIT – IV

Design of load bearing masonry walls for building up to 3storeys using IS 1905 and SP20 procedure. **8 Hours**

UNIT –V

Reinforced masonry and its application, flexural and compression elements of reinforced masonry, shear walls.
Composite masonry walls, composite wall beam elements, infilled frames. **7 Hours**

Course Outcomes:

1. Students will know about the masonry units and mortar, properties of different masonry units and mortar. Defects and errors in masonry construction will be understood by them. Strength and stability of concentrically loaded masonry walls and factors affecting them will be understood by them. Strength formulae and mechanism of failure of masonry subjected to direct compression will be known to the students.
2. Students will understand the emerging permissible compressive, tensile and shear stress and factors influencing them for masonry elements. They come to know how to consider loads for masonry walls subjected to axial, eccentric and lateral loads as well as walls with opening and free standing wall.
3. Students will understand the concept of effective height of walls and columns, effective length, effective thickness of wall and factors affecting them. They also come to know about evaluation of slenderness ratio resultant eccentricity ratio and the concept of load dispersion, arching action and lintels.
4. Students will know how to design load bearing masonry walls for buildings up to three stories using IS:1905 and SP-20.
5. Students will understand the concept of reinforced masonry and its applications, and how to bring flexural and compression elements (beams and columns) of reinforced masonry shear walls. They also understand the concept of composite wall beam elements and in filled frames. They will know how to design these masonry structures.

Course Articulation Matrix :

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	M	M		L		H		H		M	M		H	H	
CO2	L	M					M				M				H
CO3			H			L		H	L			L		L	
CO4			L			L				L		L			L
CO5	M							M			H			L	M

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

L : Low M: Medium H : High

TEXT BOOKS:

1. Henry,A.W (1990), "Structural masonry", Macmillan Education Ltd.
2. Dayarathnam.P (1987), "Brick and reinforced brick structures", Oxford & IBH Publication.

REFERENCE BOOKS:

1. Sinha, B.P and Davies, S.R (1997), "Design of Masonry Structures", E & FN spon.
2. IS 1905-1987 (3rd revision), "Code of practice for structural use of unreinforced masonry", BIS, New Delhi.
3. SP 20 (S& T) 1991, "Hand book on Masonry Design and Construction (1st revision)", BIS, New Delhi

INTERNET SOURCE:

- http://nptel.ac.in/courses/105102088/28
- https://www.vssut.ac.in/lecture_notes/lecture1424715726.pdf

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ALTERNATIVE BUILDING MATERIALS & TECHNOLOGIES

Sub Code	**: 15CV515**	**Credits**	**: 03**
Hrs/Week	**: 3+0+0+0**	**Total Hours**	**: 39**

Course Learning Objectives:

This Course will enable students to

1. To learn the environmental issues due to building materials and the energy consumption in manufacturing building materials
2. To study the various masonry blocks, masonry mortar and structural behavior of masonry under compression.
3. To study the alternative building materials in the present context.
4. To understand the alternative building technologies which are followed in present construction field.
5. To design green building taking into consideration of local climatic condition and building materials.

UNIT – I

INTRODUCTION

Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry, Green concepts in buildings, Rating, Rainwater harvesting & solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions. **5 Hours**

UNIT – II

ELEMENTS OF STRUCTURAL MASONRY – Elements of Structural Masonry, Masonry materials, requirements of masonry units' characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal G blocks and Stabilized mud block. Manufacture of stabilized blocks.

STRUCTURAL MASONRY MORTARS - Mortars – cementations materials, sand - natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and requirements of mortar, selection of mortar.

Uses of masonry, masonry bonding, Compressive strength of masonry elements - Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry, Design of masonry compression elements subjected to axial load.

10 Hours

UNIT – III

ALTERNATIVE BUILDING MATERIALS - Lime –pozzolana cements - Raw materials, Manufacturing process, Properties and uses. Fiber reinforced concrete - Matrix materials, Fibers metal and synthetic, Properties and applications. Fiber reinforced plastics - Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes - Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. **8 Hours**

UNIT – IV

ALTERNATIVE BUILDING TECHNOLOGIES

Use of arches in foundation, alternatives for wall constructions – composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components - Materials and specifications, Properties, Construction methods, Applications. Top down construction, Mivan Construction Technique.

ALTERNATIVE ROOFING SYSTEMS

Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes

9 Hours

UNIT –V

Equipment for production of stabilised blocks, moulds and methods of production of precast elements. Green Building Design- Cost concept & Case studies. **7 Hours**

Course Outcomes:

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

1. Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;
2. Suggest appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
3. Analyse different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
4. Recommend various types of alternative building materials and technologies to be used for civil engineering constructions keeping in view the green concept.
5. One can able to design a energy efficient building by considering local climatic condition and building material.

Mapping of POs & COs:

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

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

TEXT BOOKS:

1. K.S Jagadish etal., "Alternative Building Materials and Technologies", New Age International Publishers – 1st edition -2007, Reprint : Aug – 2014
2. Arnold W Hendry, "Structural Masonry", Macmillan Publishers 3rd Edition December 2013.

REFERENCE BOOKS:

1. Relevant IS Codes.
2. James J Marks, "The Alternative Building Source Book", Chelsea Green Publishers, 1st Edition 1998.
3. Clarke Snell etal., "Building Green", Large Book Publishers, 1st edition in 2005, reprinted -2014.
4. Jon Nunan, "The Complete Guide to Alternative Home Building Materials and Methods", Atlantic Publishing Company 30th October – 2009, Re-Print 2010.

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DESIGN & DRAWING OF RCC STRUCTURES

Sub Code : 15CV601 **Credits : 04**
Hrs/Week : 2+3+0+0 **Total Hours : 52**

Course Learning Objectives:

This Course will enable students to

1. Outline the concepts of different RC Structural member's drawings and Bar-bending Schedules.
2. Analyse and design the various structural units.

UNIT – I

1. Layout Drawing: General layout of building showing, position of columns, footings, beams and slabs with notations and abbreviations.
2. Beam and Slab floor system, continuous beams.
3. Staircase: Dog legged and Open well.
4. Column footing: Column and footing (Square and Rectangle). **20 Hours**

UNIT – II

1. Simple Portal Frames (Single bay & Single storey).
2. Circular and Rectangular water tanks resting on ground (Flexible base and Rigid base), using IS: 3370 (Part IV) only.
3. Cantilever Retaining walls. (Without surcharge).
4. Combined footing (Rectangular), slab and beam type. **32 Hours**

Course Outcomes:

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

1. Aquire knowledge about RC, Structural Members, Analyze and draw general Layout out of building, reinforcement details for beam and slab floor system and continuous beam, stair case and footing along with the bar bending schedule for the given structural member.
2. Analyze, design and detailing of reinforcement for the following structural units- Portal frames, circular and rectangular water tank using IS 3370 (Part IV), Cantilever Retaining walls, Combined footing.

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	M	M	H	M			M			M				M	H

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

TEXT BOOKS:

1. B.C. Punmia, "Reinforced Concrete Structures Vol.1 and Vol.2", Laxmi Publication, 1992.
2. S.S. Bhavikatti, "Advanced R.C.C. Design Vol. II", New Age International Publishers, 2005, New Delhi.
3. T. Y. Lin and S. D. stotes Bury, "Structural concepts and systems for Architects & Engineers", 1992, John Willey and Sons Publication.
4. S.K. Mallick, A.P. Gupta, "Design of RC Structures", Oxford & IBH Publishers Co. Pvt., Ltd, 1992, New Delhi.
5. R. Park & T. Paulay, "Reinforced concrete structures", John Willey and Sons Publication, 2009.
6. SP 34 – Handbook on concrete reinforcement and detailing, Bureau of Indian Standard, New Delhi.
7. Krishnamurthy, "Structural Design and Drawing (Concrete Structures)", CBS Publishers, Volume 1, 1999, New Delhi.
8. N. Krishnaraju, "Design of RC structures", CBS publishers, 5th edition, 2013, New Delhi.

REFERENCE BOOKS:

1. B.C. Punmia, "Reinforced Concrete Structures Vol.1 and Vol.2", Laxmi Publication, 1992.
2. S.S. Bhavikatti, "Advanced R.C.C. Design Vol. II", New Age International Publishers, 2005, New Delhi.
3. T. Y. Lin and S. D. stotes Bury, "Structural concepts and systems for Architects & Engineers", 1992, John Willey and Sons Publication.
4. S.K. Mallick, A.P. Gupta, "Design of RC Structures", Oxford & IBH Publishers Co. Pvt., Ltd, 1992, New Delhi.
5. R. Park & T. Paulay, "Reinforced concrete structures", John Willey and Sons Publication, 2009.
6. SP 34 – Handbook on concrete reinforcement and detailing, Bureau of Indian Standard, New Delhi

Note: All designs except water tanks shall be with limit state method only using SP – 16.

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GEOTECHNICAL ENGINEERING – II

Sub Code : 15CV602		**Credits**	**: 03**
Hrs/Week : 3+0+0+0		**Total Hours**	**: 39**

Course Learning Objectives:

This course will enable students to

1. Understand the significance of Soil investigation technique.
2. Understand the stress distribution in soils based on various theories and types of loading and also to know the flow characteristics in soil and uses of flow net.
3. Understand and appraise the significance of Lateral earth pressure.
4. List the types of slopes and understand the causes of failure of finite slopes and to know the stability analysis of slopes based various methods.
5. Assess the bearing capacity of various types of shallow foundations and estimate the probable settlements.

UNIT – I

SOIL EXPLORATION

Objectives of soil exploration, Methods of Boring, Types of soil samples and Samplers, Sample disturbance, inside clearance, outside clearance, Area ratio, Recovery ratio, Spacing and depth of exploration, Ground water observation – Hvorselev's method , Indirect methods of exploration - Sounding Tests (Cone penetration Tests and Standard penetration tests), Geophysical methods - Electrical resistivity and Seismic refraction methods, Borehole logs, Site investigation reports. **8 Hours**

UNIT – II

STRESS DISTRIBUTION IN SOILS: Boussinesq's theory – point load, line load, strip load, uniformly loaded circular area, Vertical stress distribution diagrams, Newmark's influence chart, Westergard's equation, Comparison, Contact pressure.

SEEPAGE FLOW THROUGH SOILS: Laplace equation (no derivation), Flow nets, Characteristics and uses, flownet construction – graphical method.

Determination of quantity of seepage, seepage pressure, uplift pressure, exit gradient, determination of phreatic line in earthen dams with and without filter, piping mechanism and its control. **9 Hours**

UNIT – III

LATERAL EARTH PRESSURE: Effect of wall movement on earth pressure, Earth's pressure at rest, Earth pressure theories, Rankine's and Coulomb's theories. Graphical solutions to earth pressure theories (cohesion less soils only) - Culmann's method and Rebhan's construction. **7 Hours**

UNIT – IV

STABILITY OF SLOPES: Types of slopes, Causes and types of failure of finite slopes; Factor of safety; Stability of finite slopes – $\Phi = 0$ analysis, C - Φ analysis - Method of slices, Location of most critical circle, Friction Circle method, Taylor's stability number.

7 Hours

UNIT –V

BEARING CAPACITY OF SHALLOW FOUNDATIONS: Terms related to bearing capacity - ultimate, net and safe bearing capacity, Types of failure in soils, Terzaghi's and Brinch Hansen's bearing capacity equations, Effect of ground water table on bearing capacity, IS code recommendations for bearing capacity. Plate load test, Safe bearing pressure from SPT and CPT value.

FOUNDATION SETTLEMENT: Types of settlement - Immediate, Consolidation and Secondary settlements. Allowable limits of settlement - BIS specifications, Allowable bearing pressure. **8 Hours**

Course Outcomes:

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

1. Know the various method involved in soil exploration in laboratory and field condition.
2. Describe the various types and methods involved in the study of stresses under various types of loadings and determine the characteristics of flow of water in soil and studies related to seepage.
3. Students are capable to evaluate, Design the lateral stress due various types of movement from the earth.
4. Capable of designing and study the safety of slopes.
5. Students are exposed to foundation design for various types of footing and implement in field and understand the various types of settlement.

Mapping of POs & COs:

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

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

TEXT BOOKS:

1. Punmia B.C.,(2014) “Soil Mechanics and Foundations” Laxmi Publishing Co
2. Purushothama Raj. P. (2005) “Geotechnical Engineering”, Tata McGraw Hill Publishing Company Ltd, New Delhi.
3. B. M. Das, Principles of Foundation Engineering, Thomson, Indian Edition, 2003

REFERENCE BOOKS:

1. Murthy V.N.S.(2007) “Principles of Soil Mechanics and Foundation Engineering”, UBS Publishers Distributiors Pvt.Ltd.
2. Gopal Ranjan and Rao A.S.R., “Basic and Applied Soil Mechanics”, New Age International Pvt Ltd, Publishers(2007)

3. Venkatramaiah C., "Geotechnical Engineering", Universities Press (India) Ltd.
4. Alam Singh and Chowdhary, G.R., Soil Engineering in Theory & Practice, Volume-2, Geotechnical testing & instrumentation, CBS Publishers &Distributors, New Delhi, 2006.
5. Arora. K.R. (2003). *Soil Mechanics and Foundation Engineering*, 6th Edition, Standard Publishers Distributors, Delhi.
6. Terzaghi K. and Peck R.B. (1996) "Soil Mechanics in Engineering Practice" John Wiley & Sons, Inc.
7. Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1995.
8. Muni budhu., Soil Mechanics and Foundations, Third Edition , John Wiley And Sons, Inc , 2010.

INTERNET SOURCES:

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

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TRANSPORTATION ENGINEERING – II

Sub Code	**: 15CV603**	**Credits**	**: 04**
Hrs/ Week	**: 4+0+0+0**	**Total Hours**	**: 52**

Course Learning Objectives:

1. To study the components of a railway track and material quantity
2. To understand the geometric design elements of a railway track and the various tractive resistances due to the movement of the train
3. To understand the different types of Points and crossings, level crossing, Signals and Station Yards. Also to study the various methods of tunneling.
4. Understand the basic orientation and geometric design of Airport Runway and Taxiway as per ICAO and FAA specifications.
5. Study the design standards of taxiway and the importance of visual aids and Aircraft landing systems. Also to study the functions of different components of harbors.

UNIT - I

Railways: Role and selection of routes.
Permanent way: Gauges in railways, railway track, cross sections, coning of wheels, rails, rail sections, ballast, sleepers, creep of rails, rail fixtures, calculation of quantity of materials.

11 Hours

UNIT - II

Traction and tractive resistances, tractive power, hauling capacity.
Geometric design of track – grade, types of grade, speed of train, super elevation, cant deficiency, negative cant, speed calculations based on IR formula. **10 Hours**

UNIT - III

Points and crossing, turnout, station and yards, signals, level crossing.
Tunnels – tunnels for railways and roads, cross sections, tunneling in soft soils: Forepoling method, Needle beam method, principle of tunneling through hard and soft rocks: Drift method, Heading and bench method, Full face method, Objects tunnel lining.

10 Hours

UNIT - IV

Airport planning, aircraft characteristics, airport classifications, site selection and regional Planning.
Runway design, analysis of wind data, determination of best orientation of runway configuration, basic length, corrections to runway length by ICAO and FAA specifications, runway cross section. **10 Hours**

UNIT - V

Taxiway design, factors affecting the layout and geometrics of Taxiway, design of exit taxiway – ICAO specifications. Visual aids – ILS.
Harbours – types, components, typical layout, objects and function of different elements of harbor. **11 Hours**

Course Outcomes:

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

1. Calculate the quantity of materials required to lay a railway track and to explain the various elements of the railway track and to
2. Set-out the major geometric design elements of a railway track and to calculate the tractive resistances due to the movement of the train
3. Design the elements required to set out a turnout and to understand the different types of level crossing, Signals and Station Yards. Also to explain the basic concepts, different types and requirements of tunneling methods.
4. Design the runway orientation and to calculate the corrected basic runway length. Also, to explain different basic component parts and geometric design standards of an airport.
5. Design the elements of the taxiway and to explain the placements of visual aids, and aircraft landing system in an airport. Also, to narrate the importance of various components of a harbor.

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	-	L	L	-
CO2	L	L	-	-	-	-	-	-	-	L	L	-	L	L	-
CO3	-	-	-	-	-	-	L	-	-	-	L	-	-	-	-
CO4	-	-	-	-	-	-	L	-	-	-	L	-	-	-	-
CO5	M	L	L	L	-	-	-	-	L	L	L	-	L	L	-

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

TEXT BOOKS:

1. Saxena. S.S., Arora S.P., "A Text Book of Railway Engineering", DhanpathRai and Sons, New Delhi, Revised edition 2013.
2. Khanna S.K., Arora M.G., Jain S.S., "Airport Planning and design", Nem Chand and Bros, Roorkee, 6th Revised edition, 2009.
3. R. Srinivasan, "Harbour, Dock and Tunnel Engineering", Charotar Publishing House Pvt. Ltd., Anand (Gujarat), 27th Revised edition, 2015.

REFERENCE BOOKS:

1. Rangwala, "Airport Engineering" Charotar Publishing House Pvt. Ltd., Anand (Gujarat), 16th Revised edition, 2016.
2. Satish Chandra., Agarwal. M.M., "Railway Engineering", Oxford University Press, New Delhi, 2nd Revised edition 2013.

INTERNET SOURCES:

1. NPTEL Source for Transportation Engineering II :
   http://nptel.ac.in/courses/105107123/
2. Railway Engineering eBook:
   http://dl4a.org/uploads/pdf/Ebook%20-%20Railway%20Engineering%20.pdf

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ENVIRONMENTAL ENGINEERING – II

Sub Code	**: 15CV604**	**Credits**	**: 03**
Hrs/Week	**: 3+0+0+S***	**Total Hours**	**: 39**

*** 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. Determine the objectives of wastewater collection, treatment and disposal.
2. Discuss the merits and demerits of various sewer materials.
3. Explain the characteristics of wastewater.
4. Depict the information about various sewage treatment processes.
5. Design the various wastewater treatment units.

UNIT – I

QUANTITY OF SEWAGE & DESIGN OF SEWERS:

Introduction: Necessity for sanitation; methods of domestic waste water disposal; types of sewerage systems and their suitability.

Quantity of sewage: Dry weather flow; factors affecting dry weather flow, flow variations and their effects on design of sewerage system; computation of design flow, estimation of storm

flow, rational method and empirical formulae of design of storm water drain; Time of concentration

Design of sewers: Hydraulic formulae for velocity, effects of flow variations on velocity, self-cleansing and non-scouring velocities, Design of hydraulic elements for circular sewers flowing full and flowing partially full. **8 Hours**

UNIT – II

MATERIALS OF SEWERS &HOUSE DRAINAGE SYSTEMS

Materials of sewers: Sewer materials; shapes of sewers; laying of sewers; joints and testing of sewers; ventilation and cleaning of sewers.

Sewer appurtenances: Catch basins, manholes, flushing tanks, oil and grease traps, drainage traps.

Basic principles of house drainage; typical layout plan showing house drainage connections; maintenance of house drainage.

Sewage pumping: Need, Types of pumps and pumping stations. **8 Hours**

UNIT – III

ANALYSIS OF SEWAGE& DISPOSAL OF EFFLUENTS

Analysis of sewage: physical, chemical and biological characteristics; concepts of aerobic and anaerobic activity; CNS cycles; BOD and COD; sampling–significance, techniques and frequency.

Disposal of effluents: Disposal of Effluents by dilution, self-purification phenomenon; Oxygen sag curve, Zones of purification; Sewage farming, sewage sickness; effluent disposal standards for land, surface water & ocean. **8 Hours**

UNIT – IV

TREATMENT OF SEWAGE

Treatment of sewage: Flow diagram of municipal waste water treatment plant. Preliminary treatment – Screening, grit chambers, skimming tanks.

Primary treatment: sedimentation tanks – designs; Secondary treatment: Trickling filter – theory and operation, types and designs. **8 Hours**

UNIT – V

ACTIVATED SLUDGE PROCESS

Activated sludge process – Principle and flow diagram, methods of aeration; modifications; F/M ratio; design of ASP – methods of sludge disposal, Sludge drying beds, sludge digestion and filter beds.

Miscellaneous treatment methods: Septic tank and Oxidation Pond – design; Introduction to RBC, UASB and anaerobic filters. **7 Hours**

Course Outcomes:

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

1. Identify the waste water source and estimate quantity of wastewater generated.

2. Design sewers flowing full and partially full and have gained knowledge of materials used for construction of sewers.
3. Describe various sewer appurtenances and their uses in sewer line and how beneficial it can be utilized.
4. Analyze characteristics of wastewater and Find out various zones of pollution of a river and importance of oxygen in self-purification phenomenon.
5. Design of primary and secondary treatment units. and how effectively the wastewater can recycle and reused.

Mapping of POs & COs :

CO	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1		M						M							
CO2			H					H							
CO3	L					L								M	
CO4				M								M			
CO5						H						H			

L : Low M: Medium H : High

TEXT BOOKS :

1. S. K. Garg, "Wastewater treatment", Khanna Publishers.2016
2. B. C. Punmia & Ashok Jain, "Environmental Engineering II", Lakshmi Publications, 2017
3. K. N Duggal, "Elements of Public Health Engineeering", S Chand and company Limited, New Delhi
4. C.S Rao, "Environmemtal pollution control Engineering", Willey Eastern Limited, New Delhi

REFERENCE BOOKS:

1. Mark J. Hammer and Mark. J. Hammer, Jr., "Water and Wastewater Technology", Eastern Economy Editions, 2016
2. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, "Environmental Engineering", McGraw Hill International Edition.
3. Metcalf and Eddy, "Wastewater Treatment, Disposal and Reuse", Tata McGraw Hill Publications, 2013
4. Birdie, G.S. and Birdie, J.S., Water Supply and Sanitary Engineering, Dhanpat Rai and Sons, New Delhi, 2010.
5. Manual of Sewage and Sewage Treatment CPHEEO, 2013.

NPTEL ONLINE SOURCE: http://nptel.ac.in/course.php?disciplineId=105

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GEOTECHNICAL ENGINEERING LABORATORY

Sub Code : 15CV605	**Credits : 02**
Hrs/Week : 0+0+3+0	**Total Hours : 39**

Course Learning Objectives:

This course will enable the student to

1. To provide a basic understanding of the physical and mechanical characteristics of soils and how these relate to the engineering behavior of soil
2. To estimate index properties of soils (coarse and fine)
3. To estimate consistency limit of fine grained soils
4. To estimate the engineering properties of the soils by density test, CBR test permeability test and consolidation test.
5. To estimate shear strength of soils by direct shear test, triaxial shear test, vane shear test & unconfined compressive test

Details of Experiments

1. Tests for determination of specific gravity and moisture content.
2. Grain size analysis of soil sample (sieve analysis).
3. In situ density by core cutter and sand replacement methods.
4. Consistency Limits – Liquid Limit (Casagrande Method), plastic limit and shrinkage limit.
5. Standard Proctor Compaction Test (IS light compaction test).
6. Coefficient of permeability by constant head and variable head methods.
7. Strength Tests
    a. Unconfined Compression Test
    b. Direct Shear Test
    c. Tri-axial Compression Test (undrained)
8. Consolidation Test- Determination of coefficient of consolidation.
9. Laboratory vane shear test
10. Determination of California Bearing resistance.
11. Demonstration tests:
    a. Miscellaneous equipments such as Augers, Samplers, Rapid Moisture meter, Proctor's needle.
    b. Hydrometer Test.
    c. Free Swell Index and Swell Pressure Test
    d. Determination of relative density of sands.

Course Outcomes:

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

1. Determine the physcical and mechnical Behaviour of soils.
2. Build the knowledge of site specified field investigations of soil samples and its behaviour under loading.
3. Find and Classify the soil properties based on Indian soil Classification system.
4. To understand the various engineering behaviour of soil under loading.
5. Perform and analyse the determine permeability of soil.

6. Design and validiate the results for field condition
7. To operate the different soil testing equipment.

Mapping of POs & COs :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	H				L	L	L	L	M	L	H	H	H
CO2					M	L			L	L					M
CO3										L					L
CO4	H			H			L		L		M	M		H	M
CO5	H						L		L	L	L				M
CO6	H						L			L	M				M
CO7	H	H				L	L		L	L	L				M

Note : 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

REFERENCE BOOKS:

1. Lambe T. W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi.
2. Head K.H., (1986), "Manual of Soil Laboratory Testing", Vol. I, II, III, Princeton Press, London.
3. Bowles J.E. (1988), "Engineering Properties of Soil and Their Measurements", McGraw Hill Book Co. New York.
4. Relevant IS codes (latest edition)

INTERNET SOURCE:

- http://nptel.ac.in/courses/105101160/

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ENVIRONMENTAL ENGINEERING LAB

Sub Code : 15CV606 **Credits : 02**
Hrs/Week : 0+0+3+0 **Total Hours : 39**

Course Learning Objectives:

This Course will enable students to

1. To learn about water & Wastewater analysis techniques
2. To design and carry out water and waste water treatment units.

LIST OF EXPERIMENTS

1. Determination of solids in sewage: Total solids, suspended solids, dissolved solids, volatile Solids, fixed Solids and settable solids.
2. Determination of electrical conductivity, turbidity and Sulphates.

3. Determination of Chlorides.
4. Determination of Alkalinity, Acidity and pH.
5. Determination of Calcium, Magnesium and Total Hardness.
6. Determination of Dissolved Oxygen.
7. Determination of BOD.
8. Determination of COD.
9. Determination of Available Chlorine in bleaching powder.
10. Determination of Chlorine Demand and Residual Chlorine.
11. Determination of Optimum dosage of Alum by Jar test.
12. Determination of Iron.
13. Determination of Fluorides.
14. Determination of Nitrates.

Course Outcomes:

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

1. Conduct various quality tests on water and waste water
2. Assess the suitability of water for drinking and irrigation purpose
3. Assess the suitability of water for concreting works

Mapping of POs & COs :

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1				L						L					
CO2	L			M				M							
CO3				M				L							

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

REFERENCE BOOKS:

1. Manual of water and wastewater Analysis – NEERI Publication
2. Standard methods for examination of water and wastewater, (1995), American Public Health Association, Water Pollution Control Federation, American Water Works Association, Washington DC.
3. Relevant IS codes (latest edition)
4. Sawyer and McCarty, “Chemistry for Environmental Engineering.” McGraw Hill Publications

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EXTENSIVE SURVEY PROJECT /MINI PROJECT

Sub Code : 15CV607 **Credits : 01**

Course Learning Objectives:

1. To study the practical applications of Surveying.
2. To study the usage of Total station and other Electronic Distance Measurement Equipment.

Pre-requisites of the course: 15CV304, 15CV307, 15CV403, 15CV407.
(To be conducted between 5th& 6th Semester for a period of 1 weeks; Viva Voce conducted along with 6th Sem. Exams)

An extensive survey training involving investigation and design of the following projects is to be conducted for 1 weeks (7 days).The students shall submit a project report consisting of designs drawings.

1. General instruction, Reconnaissance of the sites and fly leveling to establish bench marks.
2. Highway Project
   Preliminary and detailed investigations to align a new road between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment .Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road & earth work calculation.
3. New Tank Project
   Preliminary and detailed investigations to align a new tank bund. Determination of capacity of the tank by capacity contour method using Total Station. Drawing shall include bund alignment, longitudinal section, typical cross sections of the bund at the deepest level & capacity contours.
4. Stake out using Total Station and marking centre line for column footing

Scheme of examinations: (CIE)

1. Evaluation of reports and drawings: 30marks
2. Viva voice : 20 marks

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ENTRY EDGE: IMMERSIVE GROUP WORKSHOP (IGW)

Sub Code : 15CV608 **Duration: 5 Days**

Syllabus

Module 1: Minds-on and hands-on simulation project

- Understanding Task environment – Goals, responsibilities, Task focus
- Working in Teams towards common goals
- Organizational performance expectations–technical and behavioural competencies.

7.5 Hours

Module 2: Re- enforcement of critical individual skills and behaviours

- Application of individual effectiveness skills in team and organizational context – improving self-awareness, goal setting, time management, communication and presentation skills. **3.5 Hours**

Module 3: Etiquettes and Ethics

- Professional etiquettes at workplace – dressing, telephone, e-mail, meeting and general behaviour
- Basic honesty & respect for law / rules
- Conflict of interest
- Use of organizational resources
- Misrepresentation and misappropriation
- Intellectual property
- Whistle blowing **7 Hours**

Module 4: Interpersonal Behaviour& relationship skills

- Establishing trust based relationships in team & organizational environment
- Trust equation – credibility, responsiveness, integrity, self-interest

3.5 Hours

Module 5: Dealing with Conflicts

Orientation towards conflicts in team and organizational environment

- Understanding sources of conflicts
- Conflict resolution styles and techniques **3.5 Hours**

Pedagogical tools & techniques used in the workshop

- Organizational templates for simulating an organizational context- structures, units, roles and activities
- Metaphoric scenarios for simulating real –life tasks and dynamics in a team/project context
- LEGO ^{TM} building blocks for simulating last-mile technical activity in teams
- Case studies, Role play scenarios group learning activities, observation and feedback.

Note: Evaluation is done and a grade of P (pass) or NP (not pass) is awarded

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MATRIX METHODS OF STRUCTURAL ANALYSIS

Sub Code	**: 15CV611**	**Credits**	**: 03**
Hrs/Week	**: 3+0+0+0**	**Total Hours**	**: 39**

Course Learning Objectives:

This Course will enable students to

1. Explain static and kinematic indeterminacy of a structure, develop flexibility matrix for determinate beams and analyse plane trusses and pin jointed frames by flexibility method
2. Recall the steps involved in the analysis of indeterminate beams and frames by flexibility method
3. Develop the stiffness matrix for determinate beams and frames, analyse plane trusses and pin jointed frames by displacement transformation method
4. Demonstrate the steps in the analysis of beams and frames by stiffness method using element approach
5. Explain direct stiffness method in solving indeterminate beams, plane trusses and pin jointed frames

UNIT – I

Introduction to flexibility method, Element flexibility matrix, Principle of contragradience, and Force Transformation Matrix, Member Flexibility matrix, Construction of structure flexibility matrix. Matrix determination of the displacement vector, Determination of member forces. Analysis of trusses by flexibility method using force transformation matrix. **8 Hours**

UNIT – II

Analysis of axially rigid continuous beams and rigid plane frames with axially rigid members by flexibility method using Force transformation Matrix. **8 Hours**

UNIT – III

Fundamentals of the stiffness method, equivalent joint loads, Displacement Transformation matrix. Member stiffness matrix, Total or System stiffness matrix, Truss analysis by stiffness method using Displacement Transformation Matrix.

UNIT – IV

Continuous Beam and rigid frame analysis with axially rigid members by stiffness method using displacement transformation matrix. **7 Hours**

UNIT –V

Introduction to direct stiffness method, local and global co-ordinate system, transformation of variables, transformation of the member displacement matrix, force matrix, stiffness matrix, transformation of the stiffness matrix of the member of a truss, transformation

of the stiffness matrix of the member of the rigid frame, overall stiffness matrix, boundary conditions, computation of internal forces.
Analysis of trusses, pin jointed frames and continuous beams by direct stiffness method.

8 Hours

NOTE:

1. Determination of member forces, displacement and reactions using matrices only
2. Number of indeterminacy shall be ≤ 3 (for paper setting)

Course Outcomes:

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

1. Outline the structural behavior under the action of forces and the reactions developed to restore the deformations
2. Apply matrix algebra for the determination of flexibility coefficients and hence to derive the flexibility matrix for a given determinate structure
3. Solve problems on finding the unknown forces and reactions in structural systems like beams, trusses, rigid jointed and pin jointed frames by adopting flexibility approach
4. Apply the fundamental concepts of stiffness coefficient and develop stiffness matrix for a given determinate structure
5. Arrive at the solution of analysis of problems on beams, frames, trusses by element approach of stiffness method & build knowledge on system approach of stiffness method and solve problems on beams and trusses

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	L				L								M		
CO2	L	M			M								M		
CO3	M	M			M								M		
CO4	L				L								M		
CO5	M	M			M								M		

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

TEXT BOOKS:

1. W. Weaver J.M. Gere, (1986), "Matrix Analysis of framed structures", CBS publishers and Distributors.
2. S Rajshekharan. G Sankara Subramanian, (2010), "Computational Structural Mechanics", PHI.

REFERENCE BOOKS:

1. L. S. Negi and R S Jangid, (1997), "Structural Analysis", Tata Mc Graw-Hill.

2. H C Martin, (1996), "Introduction to Matrix Methods of Structural Analysis", International Text Book Company.
3. R. Vaidyanathan, P.Perumal, (2007), "Comprehensive Structural Analysis– Volume I", Laxmi Publications (P) Limited.
4. S.S.Bhavikatti, (2013), "Matrix Methods of Structural Analysis", I.K. International Publishing House Pvt. Ltd.

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TRAFFIC ENGINEERING

Sub Code	**: 15CV612**	**Credits**	**: 03**
Hrs/Week	**: 3+0+0+0**	**Total Hours**	**: 39**

Course Learning Objectives:

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

1. To have clear knowledge of the subject, its uses in the actual field conditions.
2. Know to design the traffic signals by various methods.
3. Design the street lighting layout.
4. Know the need of traffic volume, speed, capacity, speed and delay, origin and destination studies.
5. Know the flow theories in connection with traffic engineering.

UNIT – I

Introduction: Definition; Objectives; Scope of traffic Engineering
Road User and Vehicle Characteristics: Static and Dynamic Characteristics- Power performance of vehicles-Resistances to the motion of vehicles-Reaction time of driver.

7 Hours

UNIT – II

Traffic parameter Studies and Analysis: Objectives and method of study- Definition of study area- Sample size-Data Collection and Analysis- Interpretation of following Traffic Studies- Volume, Spot Speed, Origin and Destination, Speed and Delay- Parking- on Street and Off Street Parking- Accidents- Causes, Analysis (right angle collision only with parked vehicle)- Measures to reduce Accident. **9 Hours**

UNIT – III

Traffic Flow Theories: Traffic flow theory Green shield theory-Goodness of fit-correlation and regression analysis (linear only) –Queuing theory –car following theory. Traffic forecast-simulation technique. **8 Hours**

UNIT – IV

Traffic Regulation and Control: Driver, Vehicle and Road controls- Traffic Regulations- One Way-Traffic Signs-Traffic Markings- Traffic signals-Vehicle actuated and synchronized

signals –Signal Coordination- Webster's method of signal Design, IRC Method.

8 Hours

UNIT – V

Traffic Rotary elements and traffic operation-Street lighting-road side Aboriculture. Intelligent Transport system-case studies. **7 Hours**

Course Outcomes:

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

1. To have clear knowledge on objective and Scope of traffic engineering
2. To understand the importance of Traffic volume, Speed & delay, Origin & Destination studies
3. To impart the Knowledge on Traffic-flow theories &Correlation and regression analysis in Traffic Engineering
4. To clearly identify various traffic regulations and control of Traffic
5. To understand Traffic rotary and Impart the basics of ITS

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	L	L	-	-	-	L	-	L	L	L	L	L	M	-
CO3	L	M	-	L	-	-	-	-	-	L	L	L	L	L	-
CO4	-	-	-	-	-	-	-	-	-	L	-	-	-	L	-
CO5	-	-	-	-	-	-	-	-	-	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., "Traffic Engineering and Transport Planning", Khanna Publishers (2001).

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. Highway Capacity Manual – 2000

INTERNET SOURCES:

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

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RURAL WATER SUPPLY AND SANITATION

Sub Code	**: 15CV613**	**Credits**	**: 03**
Hrs/Week	**: 3+0+0+0**	**Total Hours**	**: 39**

Course Learning Objectives:

This Course will enable students to

1. Provide fundamental knowledge on the design and management of water supply system and sanitation facilities
2. Play essential roles in rural places, government institutions and the private sector for sustained water supply or sanitation delivery

UNIT – I

Rural water supply- introduction; need for a protected water supply, well waters, water-borne diseases. Types of systems viz., BWS, MWS, PWS water treatment Deflouridation, hardness and iron removal, ground water contamination and control **8 Hours**

UNIT – II

Rural sanitation-conservancy, public latrine, concept of eco sanitation, trenching and composting methods, two pit latrines, aqua privy, Water Closets, septic tank, soak pit, Sullage disposal, rain water harvesting and uses **8 Hours**

UNIT – III

Communicable diseases- Terminology, classifications, methods of communication, general methods of control. Disease vectors: mosquito and house fly, control measures **8 Hours**

UNIT - IV

Refuse collection and disposal-garbage, ash, rubbish, collection methods, transportation, disposal- salvaging, dumping, controlled tipping, incineration, composting, dung disposal-digester, biogas plant **8 Hours**

UNIT – V

Milk sanitation- Essentials, test for milk quality, pasteurization, quality control, cattle borne diseases, planning for a cow shed**.** **7 Hours**

Course Outcomes:

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

1. Provide a protected water supply with various systems and remove impurities from water by suitable methods.
2. Identify suitable rural disposal methods.
3. Understand the various types of diseases and preventive measures for the same.
4. Collection and transporting methods of refuse and disposal.

5. Maintain hygiene in cowshed so that quality of milk is maintained and avoid diseases from cattle.

Mapping of POs & COs:

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

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

TEXT BOOKS:

1. Joseph A. Solveto , "Environmental Sanitation"
2. E.W Steel. "Water supply & sanitary Engineering"

REFERENCE BOOKS:

1. Park and Park, "Preventive & Social Medicine"
2. B.C Punmia & Ashok jain. "Environmental Engineering-II", Lakshmi publications, 2009
3. Cairncross, S. and Feachem, R. (2000): Environmental Health Engineering in the Tropics, John Wiley & Sons, 306 p.
4. Dangerfield, B. J. (1983): Water Supply and Sanitation in Developing Countries, The Institution of Water Engineers and Scienticts, London, England.
5. McGhee, T. J. (1991): Water Supply and Sewerage, McGraw-Hill, 602 p.
6. Morgan, P. (1990): Rural Water Supplies and Sanitation, MACMILLAN EDUCATION LTD, 358 p.
7. Qasim S. R., Motley E. M., Zhu G., (2000)Water Works Engineering – Planning, Design and Operation, Prentice-Hall PTR, Upper Saddle River, NJ 07458.

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GROUND WATER HYDROLOGY

Sub Code : 15CV621		**Credits**	**: 03**
Hrs/Week : 3+0+0+0		**Total Hours**	**: 39**

Course Learning Objectives:

To make the students to understand the fundamentals and importance of groundwater, its exploration, development and management techniques.

UNIT – I

INTRODUCTION: Importance. Vertical distribution of subsurface water.Occurrence in different types of rocks and soils. Definitions-aquifers, aquifuge, aquitard, aquiclude. Confined and Unconfined aquifers.

GROUND WATER EXPLORATION: Seismic method. Electrical resistivity method – principles, yield of a well. **8 Hours**

UNIT – II

FUNDAMENTALS OF GROUND WATER FLOW: Aquifer parameters-Specific yield and specific retention, porosity, storage coefficient: derivation of the expression. Darcy's law, hydraulic conductivity, coefficient of permeability and intrinsic permeability. transmissibility, permeability in isotropic - unisotropic layered soils, steady one dimensional flow - different cases with recharge. **8 Hours**

UNIT – III

WELL HYDRAULICS STEADY FLOW: Radial flow in Confined and Unconfined aquifers, pumping tests, well recuperation tests **8 Hours**

UNIT - IV

WELL HYDRAULICS-UNSTEADY FLOW: General equation derivation; Theiss method, Cooper and Jacob method, Chow's method. Solution of unsteady flow equations. Leaky aquifers (only introduction); Interference of wells - Image well theory.

8 Hours

UNIT - V

GROUND WATER DEVELOPMENT: Types of wells. Methods of construction, tube well design, dug wells, pumps for lifting water - working principles, power requirement. Conjunctive use - necessity, techniques and economics. **7 Hours**

TEXT BOOKS :

1. Todd, D.K. "Groundwater Hydrology", Wiley and Sons.
2. Raghunath, H.M, "Groundwater". Wiley Eastern publications.

REFERENCE BOOKS:

1. Bouwer H, Groundwater Hydrology, –McGraw Hill.
2. Karanth, K.R. "Groundwater Assessment, development and Management", Tata Mcgraw Hill.
3. Walton W.C. "Groundwater Resource Evaluation", Mc Graw Hill Pubication, New Delhi.

NPTEL ONLINE SOURCE:

- http://nptel.ac.in/courses/105105042/

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GROUND IMPROVEMENT TECHNIQUES

Sub Code : 15CV622	**Credits : 03**
Hrs/Week : 3+0+0+0	**Total Hours : 39**

Course Learning Objectives:

This Course will enable students to

1. Know about the objectives of soil improvement, classification of ground improvement techniques and how to select the best method or technique for the existing condition.
2. Have clear knowledge of types of mechanical modification, principle of compaction for various types of soils.
3. Know the effect of grain size distribution on compaction for various soil types like BC soil, lateritic soil, coarse-grained soil and effect of compaction on engineering behaviour of different soil.
4. Apply different field compaction methods such as - static, dynamic, impact and vibratory type. Draw specification of compaction and introduce tolerance of compaction.
5. Know 'Hydraulic modification', its aim, principle and techniques such as gravity drain, lowering of water table, multistage well point, vacuum dewatering etc.
6. Design dewatering system, use preloading method without or with vertical drains and design a vertical drain system for given soil condition.
7. Define chemical modification, its aim, special effects, different methods or techniques such as – use of sandwich technique, admixtures, and cement stabilization.
8. Know the effect of cement stabilization and other methods on engineering properties of soil.

9. Have a clear knowledge regarding "Grouting", effects of grouting, Chemicals and materials used, types of grouting. Grouting procedure and applications of grouting.
10. Know the concepts and use of recent methods like Soil reinforcement. Thermal methods, Ground improvement by confinement - Crib walls, Gabions & Mattresses, Anchors, Rock bolts and Soil nailing.

UNIT – I

GROUND IMPROVEMENT: Definition, Objectives of soil improvement. Classification of ground improvement techniques. Factors to be considered in the selection of the best soil improvement technique.

MECHANICAL MODIFICATION: Type of mechanical modification,compaction, Principle of modification for various types of soils. Effect of grain size distribution on compaction for various soil types like BC soil, latertic soil, coarse-grained soil, micaceous soil. Effect of compaction on engineering behaviour like Compressibility, Swelling and Shrinkage, Permeability, relative density, liquefaction potential. Field compaction - static, dynamic, impact and vibratory type.Specification of compaction. Tolerance of compaction.

9 Hours

UNIT – II

HYDRAULIC MODIFICATION: Definition, aim, principle, techniques, gravity drain, lowering of water table, multistage well point, vacuum dewatering, design of dewatering system including pipe line effects of dewatering. Drainage of slopes, preloading, vertical drains, sand drains, Electro osmotictic dewatering. **8 Hours**

UNIT - III

CHEMICAL MODIFICATION: Definition, aim, special effects, and methods, Techniques - sandwich technique, admixtures, cement stabilization. Hydration - effect of cement stabilization on permeability, Swelling and shrinkage. Criteria for Lime stabilization, cement stabilization. - Suitability, process, special effects, criteria. Other chemicals, chlorides, hydroxides, lignin, hydrofluoric acid. Fly ash in cement stabilization, Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization. **8 Hours**

UNIT – IV

GROUTING: Introduction, Effects of grouting, Chemicals and materials used, Types of grouting, Grouting procedure and Applications of grouting. **7 Hours**

UNIT – V

MISCELLANEOUS METHODS (only Concepts): Introduction, Soil reinforcement. Thermal methods, Ground improvement by confinement - Crib walls, Gabions &Mattresses, Anchors, Rock bolts and soil nailing. **7 Hours**

TEXT BOOKS:

1. Purushoptham Raj., P. "Ground Improvement Techniques" TataMcGrawHill, New

Delhi,2005.
2. Koerner., R.M. "Construction and Geotechnical Methods in Foundation Engineering"Prentice Hall, New Jersy, 3rd Edn. 2002

REFERENCE BOOKS:

1. Manfred Hausmann., "Engineering Principles of Ground modification".McGraw-Hill Ryerson, Limited, 1990
2. Colin., J.F.P.(1988) "Earth Reinforcement and Soil Structures".
3. Ingles., C.G. and Metcalf., J.B.(1956), Soil Stabilization- Principle and Practice.
4. Jewell, R.A., Soil Reinforcement with Geotextile, CIRIA, London, 1996.

INTERNET SOURCES:

- http://nptel.ac.in/courses/105104034/
- http://nptel.ac.in/courses/105108075/

Course Outcomes:

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

1. Understand the need of ground improvement, the types of ground modifications and to understand the various methods of mechanical modifications in the soil improving techniques.
2. Implementation of various methods involved in ground modification by hydraulic methods.
3. Understand about chemical modifications applied in field conditions.
4. Consider the implementation of various ground improvement methods using grouting.
5. Know about various new methods involved in soil improvement.

Mapping of POs & COs :

CO	PO 1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	M	M		H	H	L				H	H		H		H
CO2					H			M		H	M				M
CO3	L					L		M		M			H		
CO4				L		M		H		M			H		M
CO5	H		M	L	H		M		L		M		M		L

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

REMOTE SENSING & GIS APPLICATIONS IN CIVIL ENGINEERING

Sub Code	**: 15CV 623**	**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. **Define and Describe** the basics of Photogrammetry, physics of RS, GPS & GIS and Image interpretation techniques
2. **Describe** the visual and digital image processing and interpretation techniques.
3. **Explain and Appraise** Maps and Overlays, data structures, process and operation of GIS and GPS.
4. **Identify and Explain** the significance of GEOMATICS in various Civil Engineering practices

UNIT – I

Remote sensing and its Principles: Physical basis of Remote sensing, Remote sensing model, EM spectrum, Blackbody concept, atmospheric windows, ranges of sensing systems, spectral response of common earth features., Platforms and Sensors: Ground, Aircraft, Spacecraft platforms, hyper spectral remote sensing, Photographic sensors, scanners, radiometers, radar, thermal infrared imagery, mission planning, Mission planning, Indian satellites and sensors, capabilities, data products data products. **8 Hours**

UNIT - II

Image Interpretation and Analysis techniques: Photogrammetry -basic principles and photo interpretation, Interpretation and Analysis techniques: Multispectral, Multitemporal, Multisensoral, Multistage concepts, Photo-interpretation techniques for aerial photos and satellite imagery, Visual & Digital Image interpretation, Interpretation elements, False Colour Composites (FCC). **8 Hours**

UNIT – III

Digital Image Processing and Analysis: pre-processing and processing (DIP), image restoration/enhancement procedures, information extraction, pattern recognition concepts, post processing procedures. **7 Hours**

UNIT – IV

Geographic Information System -concept and spatial models: Fundamentals of GIS, spatial and non-spatial data, Vector and Raster GIS, GPS, GIS Hardware and software, georeferencing, digitization, Thematic Maps, Overlay Analysis, Operation of GIS, Co-ordinate systems and map projections, Map scale, data display and cartography.

8 Hours

UNIT - V

RS & GIS Applications in Civil Engineering: Watershed characteristics, Soil moisture analysis, Water quality assessment and monitoring, Transportation, Village resource mapping, Smart City Development, Groundwater inventory, coastal environmental studies

8 Hours

Course Outcomes:

At the end of the course, upon successful completion, each student will be able to:

1. ***Define, Describe, Distinguish and Explain*** the principles and Physical basis of remote sensing, Photogrammetry, RS & GIS techniques, various types of platforms, sensors & resolutions in RS with a special reference on Indian satellites and data products.
2. ***Define, Describe, Distinguish, Explain and Analyse*** Photogrammetry, its basic principles, photo interpretation, ***Compare and Contrast*** the Visual & Digital Image interpretation and ***Appraise*** its application in related disciplines.
3. ***Define, Describe, Explain and*** **Analyze** digital image formats, different stages involved in Digital Image Processing, and **Apply and Classify** the information extracted for various purposes.
4. ***Define Describe, Explain, Distinguish, Illustrate*** *and* ***Appraise Maps and Overlays****- its components, preparation and projections, Geographic Information System- its components, data structures, process and operation, and GPS.*
5. ***Identify, Describe, Explain, Assess, Analyze, Appraise and Evaluate*** *the applications and significance of geospatial technology or GEOMATICS (Photogrammetry, RS, GIS & GPS) in various fields of Civil Engineering practices.*

Mapping of POs & COs:

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

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

TEXT BOOKS:

1. Anji Reddy, M. (2012) ***Text Book of Remote Sensing and Geographical Information Systems***, Fourth Edition, BS Publication, Hyderabad
2. Lillesand, T.M., Kiefer, R.W and Chipman, J.W. (2015) ***Remote sensing and Image Interpretations,*** 7th edition, John Wiley and sons, New Delhi

REFERENCE BOOKS:

1. Anji Reddy, M. & Hari Shankar, Y. (2006) ***Digital Image Processing***, BS Pub., Hyd.
2. Bernhardsen, Tor (2002) ***Geographic Information Systems-3rd*** Ed., Wiley India, Delhi
3. Canada Centre for Remote Sensing **(2011)** ***Fundamentals of Remote sensing-Tutorial***

4. Chang, Kang-tsung (2008) ***Introduction to Geographic Information Systems*** 4th Ed., Tata McGraw Hill Publishing Company Limited, New Delhi
5. Korte, George B. (2001), ***The GIS Book***, Onword Press, Thomson Learning Inc., USA
6. Kumar, S. (2008) ***Basics of Remote sensing and GIS*** Laxmi Publications (P) Ltd., Delhi
7. Longler, Paul A., Goodchild, Michael F., Maguire, David J., Rhind. David W.,(2004) ***Geographic Information Systems and Science*** John Wiley & Sons Ltd., ESRI Press
8. Sabins, F.L.(1997) ***Remote Sensing: Principles and Interpretation*** 3rd edn. WH Freeman and Company, New York, 494p.

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EMPLOYABILITY SKILL DEVELOPMENT

Sub Code : 15IL002 **Credits : Nil (MLC)**
Hrs/Week : 1+0+0+0 **Total Hours : 12**

Course Learning Objectives

This Course will enable students to

1. Know the aptitude problems on Permutations & Combinations, Cause & Effect statements.
2. Know the aptitude problems on Profit & loss, Simple and compound interest and Scenario based questions and to correct the sentence.
3. Know the aptitude problems on Profit & loss, Simple and compound interest, and mathematical puzzles.
4. Know the aptitude problems on Logarithms, Stocks & Shares, tables and bar chart, and to understand the comprehension.
5. Know the aptitude problems on Discounts, Clocks & Calendars, Line graphs & Pie charts, and to know the data insufficiency.

Course Content

UNIT - I

Quantitative- Permutations & Combinations
Analytical/logical- Cause & Effect statements
Verbal- Sentence corrections (Pronoun errors & misplaced modifiers) **2 Hours**

UNIT – II

Quantitative- Area, volume & surface areas
Analytical/logical- Scenario based questions
Verbal- Sentence correction (Parallel construction & Parallel Comparison) **2 Hours**

UNIT – III

Quantitative- Profit & loss, Simple and compound interest
Analytical/logical- Figure series& mathematical puzzles, Statement & assumption

Verbal- Sentence correction (Tense usage, Subject-verb agreement) **3 Hours**

UNIT – IV

Quantitative- Logarithms, Stocks & Shares.
Analytical /logical- Reasoning analogies, Tables and bar charts.
Verbal- Verbal analogies, Reading comprehension (simple passage, Difficult passage)
3 Hours

UNIT – V

Quantitative- Discounts (True discounts, bankers' discount), Clocks & Calendars
Analytical/logical- Line graphs & Pie charts, Data sufficiency
Verbal- Inferences from passages **2 Hours**

Course Outcomes:

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

1. Understand and solve the aptitude problems on Permutations & Combinations, Cause & Effect statements.
2. Understand and solve aptitude problems on Profit & loss, Simple and compound interest and Scenario based questions and to correct the sentence.
3. Understand and solve aptitude problems on Profit & loss, Simple and compound interest, and mathematical puzzles.
4. Understand and solve aptitude problems on Logarithms, Stocks & Shares, tables and bar chart, and to understand the comprehension.
5. Understand and solve aptitude problems on Discounts, Clocks & Calendars, Line graphs & Pie charts, and to know the data insufficiency.

Course Articulation Matrix :

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

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

L : Low M: Medium H : High

TEXT BOOKS:

1. Aggarwal R.S "Modern Approach to Logical Reasaning" S. Chanda Publication, 2008.

2. Aggarwal R.S "Quantitative Aptitude" S. Chand Publication, 2014.
3. Aggarwal R.S "Modern Approach to verbal and nonverbal reasoning" S. Chanda Publication, 2013.

REFERENCE BOOKS:

1. Arun Sharma "Verbal ability and reading comprehension CAT" TMH Publications, 2014.
2. Ethnus Consultancy Pvt. Ltd " APTIMTRA: Your friend for cracking aptitude test", MGH Publications, 2014.
3. Aggarwal R.S "Advanced objective general knowledge" S. Chanda Publication, 2014.

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