PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

PROGRAM HANDBOOK

B.TECH (CIVIL ENGINEERING)

PART TIME

[REGULATION 2024]

[for candidates admitted to B.Tech (Civil Engineering) program from June 2024 onwards]

Program Educational Objectives

PEO1 To produce graduates who have developed the skills required to design Civil Engineering systems and facilities, including the graduate's abilities to formulate problems, to think creatively, to synthesize information, and to work collaboratively in teams.

PEO2 To produce graduates who are trained thoroughly in methods of analysis, including the mathematical and computational skills appropriate for Civil Engineers to use when problem solving.

PEO3 To produce graduates who are prepared for life-long learning and successful careers as Civil Engineers & also taught to use current, experimental and data analysis techniques for Civil Engineering applications.

PEO4 Contribute towards technological development through academic research andindustrial practices.

PEO5 Practice their profession with good communication, leadership, ethicsand social responsibility.

PROGRAMME OUTCOMES:

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **The engineer and society**: An ability to develop the professional status using the broad education to understand the potential impact of Engineering solutions in various geographical settings including societal and environmental contexts.

6. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

7. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities andnorms of the engineering practice.

8. **Individual and team work**: Function effectively as an individual, and as a member or leaderin diverse teams, and in multidisciplinary settings.

9. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give andreceive clear instructions.

10. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

11. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMMEOUTCOMES

Programme Educational Objectives	Programme Outcomes										
	A	B	C	D	E	F	G	H	I	J	K
PEO 1	3	3	2	3	2	1	1	2	1	1	3
PEO 2	3	3	3	3	3	1	1	1	1	1	1
PEO 3	3	3	3	3	3	2	2	3	1	2	2
PEO 4	3	3	2	3	3	2	3	2	1	2	2
PEO 5	3	3	3	3	3	3	3	2	2	2	2

1-Reasonable: 2- Significant: 3- Strong

B.TECH (CIVIL ENGINEERING)–PART TIME-R-2024*

SEMESTER I – VII CURRICULUM

SEMESTER – I

S. No	Sub. Code	Name of the Subject	Core	L	T	P	C
1	24148S11P	Transforms & Partial Differential Equations	S	2	1	0	4
2	24155C12P	Engineering Mechanics	C	3	1	0	4
3	24155C13P	Fluid Mechanics	C	3	1	0	4
4	24155C14P	Surveying & Levelling	C	3	0	0	3
5	24155C15P	Construction Materials and Technology	C	3	0	0	3
TOTAL							18

SEMESTER – II

S. No	Sub. Code	Name of the Subject	Core	L	T	P	C
1	24148S21P	Numerical Methods	S	3	1	0	4
2	24155C22P	Problem Solving and Python Programming	C	3	0	0	3
3	24155C23P	Applied Hydraulics Engineering	C	3	1	0	4
4	24155C24P	Strength of Materials	C	3	1	0	4
5	24155L25P	Problem Solving and Python Programming Laboratory	C	0	1	4	2
TOTAL							17

SEMESTER – III

S. No	Sub. Code	Name of the Subject	Core	L	T	P	C
1	24155C31P	Design of Reinforced Concrete Structural Elements	C	3	1	0	4
2	24155C32P	Structural Analysis I	C	3	1	0	4
3	24155C33P	Hydrology and Water Resource Engineering	C	3	1	0	4
4	24155C34P	Soil Mechanics	C	3	0	0	3
5	24155L35P	Soil Mechanics laboratory	-	0	0	3	2
TOTAL							17

SEMESTER – IV

S. No	Sub. Code	Name of the Subject	Core	L	T	P	C
1	24155C41P	Structural Design and Drawing	C	3	1	0	4
2	24155C42P	Structural Analysis II	C	3	1	0	4
3	24155C43P	Water Supply and Wastewater Engineering	C	3	0	0	3
4	24155E44-P	Hard Core Elective I	-	3	0	0	3
5	24155L45P	Water and Wastewater Analysis Laboratory	-	0	0	3	2
TOTAL							16

SEMESTER – V

S. No	Sub. Code	Name of the Subject	Core	L	T	P	C
1	24155C51P	Design of Steel Structures	C	3	1	0	4
2	24155C52P	Foundation Engineering	C	3	0	0	3
3	24155C53P	Concrete Technology	C	3	0	0	3
4	24155E54-P	Hard Core Elective II	-	3	0	0	3
5	24155L55P	Building Drawing and Detailing Laboratory	L	0	0	3	2
TOTAL							15

SEMESTER – VI

S. No	Sub. Code	Name of the Subject	Core	L	T	P	C
1	24155C61P	Estimation, Costing and Valuation Engineering	C	3	1	0	4
2	24155C62P	Construction Equipment and Machinery	C	3	1	0	4
3	24155C63P	Highway and Railway Engineering	C	3	1	0	4
4	24155E64-P	Hard Core Elective III	-	3	0	0	3
5	24155L65P	Materials Testing Laboratory	L	0	0	3	2
TOTAL							17

SEMESTER – VII

S. No	Sub. Code	Name of the Subject	Core	L	T	P	C
1	24155S71P	Total Quality Management	S	3	0	0	3
2	24155C72P	Housing, Planning & Management	C	3	1	0	4
3	24155C73P	Repair And Rehabilitation of Structures	C	3	1	0	4
4	24155E74-P	Hard Core Elective IV	-	3	0	0	3
5	24155P75P	Project Work	-	-	-	12	6
TOTAL							20

LIST OF ELECTIVES

HARD CORE ELECTIVE I

S.No	Sub. Code	Name of the Subject	L	T	P	C
1	24155E44AP	Total Station And GPS Surveying	3	1	0	4
2	24155E44BP	Water Resource Engineering	3	1	0	4
3	24155E44CP	Building Technology	3	1	0	4
4	24155E44DP	Pile Foundation	3	1	0	4

HARD CORE ELECTIVE II

S.No	Sub. Code	Name of the Subject	L	T	P	C
1	24155E54AP	Urban Planning And Developement	3	1	0	4
2	24155E54BP	Transportation Engineering	3	1	0	4
3	24155E54CP	Ground Water Engineering	3	1	0	4
4	24155E54DP	Highway Engineering	3	1	0	4

HARD CORE ELECTIVE III

S.No	Sub. Code	Name of the Subject	L	T	P	C
1	24155E64AP	Remote Sensing And GIS	3	1	0	4
2	24155E64BP	Concrete Structures	3	1	0	4
3	24155E64CP	Airport & Harbours	3	1	0	4
4	24155E64DP	Air Pollution And Control Engineering	3	1	0	4

HARD CORE ELECTIVE IV

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	24155E74AP	Pavement Engineering	3	1	0	4
2	24155E74BP	Pre Fabricated Structures	3	1	0	4
3	24155E74CP	Traffic Engineering Management	3	1	0	4
4	24155E74DP	Prestressed Concrete Structures	3	1	0	4

B.TECH (PART TIME) – CIVIL - R-2024*

COURSE STRUCTURE AND CREDITS DISTRIBUTION

Sem.	Core Courses				Elective Courses		Total Credits
	Theory Courses		Practical Courses				
	Nos.	Credits	Nos.	Credits	Nos.	Credits	
I	05	18	-	-	-	-	18
II	04	15	01	02	-	-	17
III	04	15	01	02	-	-	17
IV	03	11	01	02	01	03	16
V	03	10	01	02	01	03	15
VI	03	12	01	02	01	03	17
VII	03	11	01	06	01	03	20
Total Credits							120

SEMESTER – I

24148S11P TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
3 1 0 4

COURSE OBJECTIVES

- To introduce Fourier series analysis which is central to many applications in engineering a part from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used invarious situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques fordiscrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Formation of partial differential equations –Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types- Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 9 + 3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution oftwo dimensional equation of heat conduction (Cartesian coordinates only).

UNIT IV FOURIER TRANSFORMS 9 + 3

Statement of Fourier integral theorem– Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9 + 3

Z-transforms - Elementary properties – Convergence of Z-transforms - – Initial and final valuetheorems - Inverse Z-transform using partial fraction and convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms.

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

CO1 Understand how to solve the given standard partial differential equations.

CO2 Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.

CO3 Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.

CO4 Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

CO5 Use the effective mathematical tools for the solutions of partial differential equations by usingZ transform techniques for discrete time systems.

TEXT BOOKS:

1. Grewal B.S.,"Higher Engineering Mathematics" 44thEdition, Khanna Publishers,New Delhi,2018.

2. Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India,2016.

REFERENCES:

1. Andrews. L.C and Shivamoggi. B, "Integral Transforms for Engineers" SPIE Press, 1999.

2. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition,

LaxmiPublications Pvt. Ltd, 2015.
3. James. G., "Advanced Modern Engineering Mathematics", 4thEdition, Pearson Education, NewDelhi, 2016.
4. Narayanan. S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics forEngineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi,2018.
6. Wylie. R.C. and Barrett . L.C., “Advanced Engineering Mathematics “Tata McGraw HillEducation Pvt. Ltd, 6th Edition, New Delhi, 2012.

COs- PO’s& PSO’sMAPPING

	PO 01	**PO 02**	**PO 03**	**PO 04**	**PO 05**	**PO 06**	**PO 07**	**PO 08**	**PO 09**	**PO10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO2	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO3	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO4	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO5	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
Avg	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-

24155C12P **ENGINEERING MECHANICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To Learn the use scalar and vector analytical techniques for analyzing forces in Staticallydeterminate structures
- To introduce the equilibrium of rigid bodies
- To study and understand the distributed forces, surface, loading on beam and intensity.
- To learn the principles of friction, forces and to determine the apply the concepts of frictionalforces at the contact surfaces of various engineering systems.
- To develop basic dynamics concepts – force, momentum, work and energy

UNIT I STATICS OF PARTICLES **9**

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's First Law ofMotion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNIT II EQUILIBRIUM OF RIGID BODIES **9**

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Forceabout a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNIT III DISTRIBUTED FORCES **9**

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies , Determination of Centroids ofVolumes by Integration. Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem , Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Momentsof Inertia of Thin Plates , Determination of the Moment of Inertia of a Three-Dimensional Body byIntegration.

UNIT IV FRICTION **9**

The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, WheelFriction, Rolling Resistance, Ladder friction.

UNIT V DYNAMICS OF PARTICLES **9**

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulseand Momentum, Impact of bodies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 Illustrate the vectorial and scalar representation of forces and moments

CO2 Analyse the rigid body in equilibrium

CO3 Evaluate the properties of distributed forces

CO4 Determine the friction and the effects by the laws of friction**CO5** Calculate dynamic forces exerted in rigid body

TEXTBOOKS:

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, SanjeevSanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education.,

11thEdition,2017.
2. Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.

REFERENCES:

1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning,2008.
2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13thedition, Prentice Hall, 2013.
3. Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics,4thEdition, Pearson Education Asia Pvt. Ltd., 2005.
4. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics:Dynamics, 7th edition, Wiley student edition, 2013.
5. Timoshenko S, Young D H, Rao J V and SukumarPati, Engineering Mechanics, 5thEdition,McGraw Hill Higher Education, 2013.

COs- PO's& PSO'sMAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	1	2						2		3	1	1
2	3	2	2	1	2						2		3	1	1
3	3	2	3	1	2						2		3	1	2
4	3	2	3	1	2						2		3	1	2
5	3	2	3	1	2						2		3	1	2
Avg	**3**	**2**	**3**	**1**	**2**						**2**		**3**	**1**	**2**
Low(1);Medium(2);High(3)															

24155C13P **FLUID MECHANICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To introduce the students about properties and behaviour of the fluids under static conditionsand to impart basic knowledge of the dynamics of fluids through the control volume approach and to expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends with anexposure to the significance of boundary layer theory and its applications.

UNIT I FLUIDS PROPERTIES AND FLUID STATICS **10**

Scope of fluid mechanics – Definitions of a fluid – Methods of analysis – Continuum hypothesis – System and Control volume approach – Reynold's transportation theorem – Fluid properties – Fluidstatics – Manometry – Forces on plane and curved surfaces – Buoyancy and floatation – Stability offloating bodies.

UNIT II BASIC CONCEPTS OF FLUID FLOW **10**

Kinematics: Classification of flows – Streamline, streak-line and path-lines – Stream function and velocity potentials – Flow nets;

Dynamics : Application of control volume to continuity, energy and momentum – Euler's equationof motion along a stream line – Bernoulli's equation – Applications to velocity and discharge measurements – Linear momentum equation – Application to Pipe bends – Moment of momentumequation.

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES **7**

Fundamental dimensions – Dimensional homogeneity – Rayleigh's method and Buckingham Pi theorem – Dimensionless parameters – Similitude and model studies – Distorted and undistortedmodels.

UNIT IV INCOMPRESSIBLE VISCOUS FLOW **10**

Reynolds experiment – Laminar flow in pipes and between parallel plates – Development of laminarand turbulent flows in pipes – Darcy-Weisbach equation – Moody diagram – Major and minor lossesof flow in pipes – Total energy line – Hydraulic grade line – Siphon – Pipes in series and parallel – Equivalent pipes.

UNIT V BOUNDARY LAYERS **8**

Definition of boundary layers – Laminar and turbulent boundary layers – Displacement, momentumand energy thickness – Momentum integral equation – Applications – Separation of boundary layer-Drag and Lift forces.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to

CO1 Demonstrate the difference between solid and fluid, its properties and behaviour in staticconditions.

CO2 Apply the conservation laws applicable to fluids and its application through fluid kinematicsand dynamics.

CO3 Formulate the relationship among the parameters involved in the given fluid phenomenon andto predict the performance of prototypes by model studies.

CO4 Estimate the losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel.

CO5 Explain the concept of boundary layer and its application to find the drag force excreted by thefluid on the flat solid surface.

TEXTBOOKS:

1. Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines StandardBook House New Delhi. 2015.

2. Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics. (9th Ed.) Tata McGraw Hill, NewDelhi, 1998.

REFERENCES:

1. S K Som; Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and FluidMachines, Tata McGraw Hill Education Pvt. Ltd., 2012.
2. Pani B S, Fluid Mechanics: A Concise Introduction, Prentice Hall of India Private Ltd, 2016.
3. Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2014.
4. Narayana Pillai N. Principles of Fluid Mechanics and Fluid Machines, (3rd Ed.) University Press(India) Pvt. Ltd. 2009.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	2	2	2	3	3	2
PO3	Design/development of solutions	1	1	3	3	2	3
PO4	Investigation	1	1	2	2	2	2
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	2	2	2	3	3	2
PO7	Environment and Sustainability	2	2	2	2	2	2
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	1	1	1	1	1	1
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	3	3	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	3	3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	1	1	2	3	3	3

24155C14P SURVEYING AND LEVELLING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the rudiments of plane surveying and geodetic principles to Civil Engineers andto learn the various methods of plane and geodetic surveying to solve the real world problems. To introduce the concepts of Control Surveying. To introduce the basics of Astronomical Surveying

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING 9

Definition – Classifications – Basic principles – Equipment and accessories for ranging and chaining – Methods of ranging – Well conditioned triangles – Chain traversing – Compass – Basic principles – Types – Bearing – System and conversions – Sources of errors and Local attraction – Magnetic declination – Dip – compass traversing – Plane table and its accessories – Merits and demerits – Radiation – Intersection – Resection – Plane table traversing.

UNIT II LEVELLING 9

Level line – Horizontal line – Datum – Benchmarks – Levels and staves – Temporary and permanent adjustments – Methods of leveling – Fly leveling – Check leveling – Procedure in leveling – Booking – Reduction – Curvature and refraction – Reciprocal leveling – Precise leveling - Contouring.

UNIT III THEODOLITE SURVEYING 9

Horizontal and vertical angle measurements – Temporary and permanent adjustments – Heights and distances – Tacheometric surveying – Stadia Tacheometry – Tangential Tacheometry – Trigonometric leveling – Single Plane method – Double Plane method.

UNIT IV CONTROL SURVEYING AND ADJUSTMENT 9

Horizontal and vertical control – Methods – Triangulation – Traversing – Gale‘s table – Trilateration – Concepts of measurements and errors – Error propagation and Linearization – Adjustmentmethods - Least square methods – Angles, lengths and levelling network.

UNIT V MODERN SURVEYING 9

Total Station: Digital Theodolite, EDM, Electronic field book – Advantages – Parts and accessories – Working principle – Observables – Errors - COGO functions – Field procedure and applications. GPS: Advantages – System components – Signal structure – Selective availability and antispoofingreceiver components and antenna – Planning and data acquisition – Data processing – Errors in GPS Field procedure and applications.

TOTAL 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Introduce the rudiments of various surveying and its principles.

CO2 Imparts knowledge in computation of levels of terrain and ground features

CO3 Imparts concepts of Theodolite Surveying for complex surveying operations

CO4 Understand the procedure for establishing horizontal and vertical control

CO5 Imparts the knowledge on modern surveying instruments

TEXTBOOKS:

1. Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi PublicationsPvt Ltd, New Delhi, Sixteenth Edition, 2016.

2. T. P. Kanetkarand S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008.

REFERENCES:

1. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.

2. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition,Mc Graw Hill 2001.

3. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.

4. S. K. Roy, Fundamentals of Surveying, Second Edition, Prenticeˆ Hall of India2010.
5. K. R. Arora, Surveying Vol I & II, Standard Book house, Twelfth Edition 2013.
6. C. Venkatramaiah, Textbook of Surveying, Universities Press, Second Edition, 2011.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	3	3	3	3	3
PO2	Problem analysis	2	3	3	3	3	2
PO3	Design/development of solutions	3	2	3	3	3	3
PO4	Investigation	2	2	2	3	3	2
PO5	Modern Tool Usage	2	2	3	3	3	3
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability				2	2	2
PO8	Ethics	2	2	2	2	3	2
PO9	Individual and Team work	2	2	2	3	2	2
PO10	Communication						
PO11	Project Management and Finance	2	2	2	2	2	2
PO12	Life Long Learning				2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

24155C15P CONSTRUCTION MATERIALS AND TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce students to various construction materials and the techniques that are commonlyused in civil engineering construction.

UNIT I STONES - BRICKS - CONCRETE BLOCKS - LIME 9

Stone as building material – Criteria for selection – Tests on stones – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive strength – Water Absorption – Efflorescence – Lime – Preparation of lime mortar – Concrete hollow blocks – Lightweight concreteblocks.

UNIT II OTHER MATERIALS 9

Timber – Market forms – Plywood – Veneer – False ceiling materials – Steel – Mechanical treatment – Aluminum – Uses – Market forms – Glass – Ceramics – Refractories – Composite Materials – Types and applications – FRP – Fibre textiles – Geomembranes and Geotextiles for earthreinforcement.

UNIT III CONSTRUCTION PRACTICES & SERVICE REQUIREMENTS 9

Types of Foundations – Shallow and Deep Foundations – Stone Masonry – Brick Masonry – Plastering and Pointing – Cavity Walls – Diaphragm Walls – Formwork – Centering and Shuttering
– Shoring – Scaffolding – Underpinning – Roofing – Flooring – Joints in concrete – Contraction/Construction/Expansion joints – Fire Protection – Thermal Insulation – Ventilation andAir conditioning – Acoustics and Sound Insulation – Damp Proofing.

UNIT IV CONSTRUCTION EQUIPMENTS 9

Selection of equipment for earthwork excavation, concreting, material handling and erection ofstructures – Dewatering and pumping equipment.

UNIT V CONSTRUCTION PLANNING 9

Introduction to construction planning – Scheduling for activities – Critical path method (CPM) andPERT network modelling and time analysis – Case illustrations.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Students will be able to

CO1 Identify the good quality brick, stone and blocks for construction.

CO2 Recognize the market forms of timber, steel, aluminum and applications of various composite materials.

CO3 Identify the best construction and service practices such as thermal insulations and air conditioning of the building

CO4 Select various equipments for construction works conditioning of building

CO5 Understand the construction planning and scheduling techniques

TEXTBOOKS

1. Varghese.P.C, Building Materials, Second Edition PHI Learning Ltd., 2015.
2. Arora S.P and Bindra S.P Building construction, Dhanpat Rai and sons, 2013.

REFERENCES:

1. Varghese.P.C, Building Construction, Second Edition PHI Learning ltd., 2016.
2. Punmia ,B.C Building construction , Laxmi publication (p)ltd..,2008.
3. Peurifoy R.L., Schexnayder,C.J., Shapira A., Schmitt.R., Construction Planning Equipment andMethods, Tata McGraw-hill, 2011.
4. Srinath L.S.,PERT and CPM -Principles and applications, Affliated East West Press 2001

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	3	3	3	3	3
PO2	Problem analysis	2	3	3	3	3	2
PO3	Design/development of solutions	3	2	3	3	3	3
PO4	Investigation	2	2	2	3	3	2
PO5	Modern Tool Usage	2	2	3	3	3	3
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability				2	2	2
PO8	Ethics	2	2	2	2	3	2
PO9	Individual and Team work	2	2	2	3	2	2
PO10	Communication						
PO11	Project Management and Finance	2	2	2	2	2	2
PO12	Life Long Learning				2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

SEMESTER – II

24148S21P **NUMERICAL METHODS** **L T P C**
3 1 0 4

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

Linear interpolation methods (method of false position) – Newton's method – Statement of fixed point theorem – Fixed point iteration: x=g(x) method – Solution of linear system by Gaussian elimination and Gauss-Jordon methods - Iterative methods: Gauss Jacobi and Gauss-Seidel methods - Inverse of a matrix by Gauss Jordon method – Eigen value of a matrix by power method.

UNIT II INTERPOLATION AND APPROXIMATION 9

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulas.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Derivatives from difference tables – Divided differences and finite differences –Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpsons's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step methods: Taylor series method – Euler and modified Euler methods – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

TOTAL: 60 PERIODS

TEXT BOOKS

1. C.F. Gerald and P.O. Wheatley, 'Applied Numerical Analysis', Sixth Edition, Pearson Education Asia, New Delhi, 2002.
2. E. Balagurusamy, 'Numerical Methods', Tata McGraw Hill Pub.Co.Ltd, New Delhi, 1999.

REFERENCE BOOKS

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, 'Numerical Methods', S.Chand Co. Ltd., New Delhi, 2003.
2. R.L. Burden and T.D. Faires, 'Numerical Analysis', Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.

COs- PO's& PSO'sMAPPING

	PO 01	**PO 02**	**PO 03**	**PO 04**	**PO 05**	**PO 06**	**PO 07**	**PO 08**	**PO 09**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO2	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO3	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO4	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO5	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
Avg	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-

24155C22P PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

COURSE OBJECTIVES:

To understand the basics of algorithmic problem solving.

- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

TOTAL : 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and looping for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

1. Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.

3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data‘‘, Third Edition, MIT Press 2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/ 6. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill,2018.

COs- PO’s & PSO’s MAPPING

	PO 01	**PO 02**	**PO 03**	**PO 04**	**PO 05**	**PO 06**	**PO 07**	**PO 08**	**PO 09**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO2	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO3	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO4	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO5	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
Avg	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-

24155C23P **APPLIED HYDRAULICS ENGINEERING** **L T P C**
3 1 0 4

COURSE OBJECTIVES:

- To impart basic knowledge to the students about the open channel flows with analysis ofuniform flow, gradually varied flow and rapidly varied flow and to expose them to basicprinciples of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, Centrifugal and Reciprocating pumps.

UNIT I UNIFORM FLOW **9+3**

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties ofopen channel - Fundamental equations - Sub-critical, Super-critical and Critical flow - Velocity distribution in open channel - Steady uniform flow: Chezy's equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.

UNIT II VARIED FLOWS **9+3**

Dynamic equations of gradually varied - Water surface flow profile classifications: Hydraulic Slope,Hydraulic Curve - Profile determination by Numerical method: Direct step method and Standard step method – Change in Grades.

UNIT III RAPIDLY VARIED FLOWS **8+3**

Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation –Positive and Negative surges.

UNIT IV TURBINES **9+3**

Turbines - Classification - Impulse turbine – Pelton wheel - Reaction turbines - Francis turbine - Kaplan turbine - Draft tube - Cavitation - Performance of turbine - Specific speed - Runaway speed-Minimum Speed to start the pump.

UNIT V PUMPS **9+3**

Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitation's in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Indicator diagrams and itsvariations - Air vessels - Savings in work done.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Describe the basics of open channel flow, its classification and analysis of uniform flow insteady state conditions with specific energy concept and its application

CO2 Analyse steady gradually varied flow, water surface profiles and its length calculation usingdirect and standard step methods with change in water surface profiles due to change in grades.

CO3 Derive the relationship among the sequent depths of steady rapidly varied flow and estimating energy loss in hydraulic jump with exposure to positive and negative surges.

CO4 Design turbines and explain the working principle

CO5 Differentiate pumps and explain the working principle with characteristic curves and designcentrifugal and reciprocating pumps.

TEXT BOOKS:

1. Jain. A.K., Fluid Mechanics, Khanna Publishers, Delhi, 2010.
2. Chandramouli P N, Applied Hydraulic Engineering, Yes Dee Publisher, 2017

REFERENCES:

1. Ven Te Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi,19th edition, 2013.
3. Mays L. W., Water Resources Engineering, John Wiley and Sons (WSE), New York, 2019
4. Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2019.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design/development of solutions	2	2	2	3	3	2
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	2	1	1	1	1
PO6	Engineer and Society	2	2	2	2	2	2
PO7	Environment and Sustainability	2	2	2	2	2	2
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	2	2	2	2	2	2
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	2	2	3	3	3	3

24155C24P **STRENGTH OF MATERIALS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To learn the fundamental concepts of Stress in simple and complex states and to know the mechanism of load transfer in beams and the induced stresses due to simple bending and unsymmetrical bending and to determine the deformation in determinate beams and to knowthe basic concepts of analysis of indeterminate beams.

UNIT I SIMPLE AND COMPOUND STRESSES **9**

Stresses in simple and compound bars – Thermal stresses – Elastic constants - Thin cylindrical and spherical shells – Biaxial state of stress – Principal stresses and principal planes – Mohr's circle ofstresses - Torsion on circular shafts.

UNIT II BENDING OF BEAMS **9**

Types of beams and transverse loadings– Shear force and bending moment for simply supported, cantilever and over-hanging beams - Theory of simple bending – Bending stress distribution – Shear stress distribution.

UNIT III DEFLECTION OF BEAMS **9**

Double Integration method – Macaulay's method – Area moment method – Conjugate beam method - Strain energy method for determinate beams.

UNIT IV INDETERMINATE BEAMS **9**

Propped Cantilever and Fixed Beams – Fixed end moments reactions, slope and deflection for standard cases of loading — Continuous beams – support reactions and moments – Theorem of threemoments – Shear Force and Bending Moment Diagrams.

UNIT V ADVANCED TOPICS **9**

Unsymmetrical bending of beams - shear centerapplied - Thick cylinders - Theories of failure –Principal stress, principal strain, shear stress, strain energy and distortion energy theories – application problems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Understand the concepts of stress and strain, principal stresses and principal planes.

CO2 Determine Shear force and bending moment in beams and understand concept of theory ofsimple bending.

CO3 Calculate the deflection of beams by different methods and selection of method fordetermining slope or deflection.

CO4 Analyze propped cantilever, fixed beams and continuous beams for external loadings andsupport settlements.

CO5 Determine the stresses due to Unsymmetrical bending of beams, locate the shear center, andstudy the various theories of failure

TEXTBOOKS

1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi,2018.
2. Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017.
3. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain,"Theory of Structures" (SMTS) Vol - II,Laxmi Publishing Pvt Ltd, New Delhi 2017.
4. Basavarajiah and Mahadevapa, Strength of Materials, University press, Hyderabad, 2016
5. Vazirani.V.N, Ratwani.M.M, Duggal .S.K Analysis of Structures: Analysis, Design and Detailingof Structures-Vol.1, Khanna Publishers, New Delhi 2014.

REFERENCES:

1. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2017
2. William A .Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, TataMcGraw Hill Publishing company, 2017.
3. Singh. D.K., " Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2021

4. Egor P Popov, “Engineering Mechanics of Solids”, 2nd edition, PHI Learning Pvt. Ltd., NewDelhi, 2015
5. Irwing H.Shames, James M.Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India,New Delhi, 2002
6. Beer. F.P. &Johnston.E.R.“Mechanics of Materials”, Tata McGraw Hill, Sixth Edition, New Delhi2010.
7. James M.Gere., Mechanics of Materials, Thomas Canada Ltd., Canada, 2006.
8. Egor. P.Popov, Engineering Mechanics of Solids, Prentice Hall of India, Second Edition NewDelhi 2015.

COs-PO’s & PSO’s MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design/development of solutions	3	3	3	3	3	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	2	2	2	2	2	2
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	3	3	3	3	3	3
PO9	Individual and Team work	2	2	2	2	2	2
PO10	Communication	3	3	3	3	3	3
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

24155L25P PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY **L T P C 0 0 4 2**

COURSE OBJECTIVES:

.• To learn the basic programming constructs in Python.

- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries

.• To do input/output with files in Python.

EXPERIMENTS:

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points)
. 3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples) 5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Implement programs in Python using conditionals and loops for solving problems.
CO4: Deploy functions to decompose a Python program.
CO5: Process compound data using Python data structures.
CO6: Utilize Python packages in developing software applications.

TEXT BOOKS:

1. Allen B. Downey, "Think Python : How to Think like a Computer Scientist",
2. 2nd Edition, O'Reilly Publishers, 2016. 2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.

2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data‘‘, Third Edition, MIT Press, 2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/ 6. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.

COs- PO’s & PSO’s MAPPING

	PO 01	**PO 02**	**PO 03**	**PO 04**	**PO 05**	**PO 06**	**PO 07**	**PO 08**	**PO 09**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO2	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO3	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO4	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO5	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
Avg	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-

SEMESTER – III

24155C31P **DESIGN OF REINFORCED CONCRETE STRUCTURAL ELEMENTS** **L T P C 3 0 0 3**

COURSE OBJECTIVE:

- To introduce the different design philosophy for reinforced concrete and discuss the limit state method of design of RC rectangular beams and to learn the concept in the design of RCflanged beams and design for shear and torsion and design of RC slabs and staircase, short RC columns, RC footing for walls, pad, sloped and combined rectangular footings.

UNIT I METHODS OF DESIGN OF CONCRETE STRUCTURES **9**

Concept of Elastic method, ultimate load method and limit state method – Working stress method asdetailed in IS code - Design of Singly Reinforced beam by working stress method - Limit State philosophy as detailed in IS code - Advantages of Limit State Method over other methods - Analysisand design of singly and doubly reinforced rectangular beams by limit State Method.

UNIT II LIMIT STATE METHOD - FLANGED BEAM, SHEAR & TORSION **9**

Analysis and design of flanged beams – Use of design aids for Flexure - Behaviour of RC members in bond and Anchorage - Design requirements as per current code - Behaviour of RC beams in shearand torsion - Design of RC members for combined bending, shear and torsion - serviceability.

UNIT III LIMIT STATE DESIGN OF SLABS AND STAIRCASE **9**

Analysis and design of cantilever, one way, two way and continuous slabs subjected to uniformlydistributed load for various boundary conditions- Types of Staircases – Design of dog-legged Staircase –Introduction to Flat Slab.

UNIT IV LIMIT STATE DESIGN OF COLUMNS **9**

Types of columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending.

UNIT V LIMIT STATE DESIGN OF FOOTING **9**

Design of wall footing – Design of axially and eccentrically loaded rectangular pad and slopedfootings – Design of combined rectangular footing for two columns only.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Know the various design concepts and design RC rectangular beams by working stress and limit state methods

CO2 Understand the design of flanged beams, design for shear and torsion, and anchorage and development length.

CO3 Design a RC slabs and staircase and draw the reinforcement detailing.

CO4 Design short columns for axial, uni-axial and bi-axial eccentric loadings **CO5** Design wall footings, isolated footings and combined rectangular footing.**TEXT BOOKS:**

1. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India PrivateLimited, New Delhi, 2006.

2. Krishnaraju.N " Design of Reinforced Concrete Structurres ", CBS Publishers & Distributors Pvt.Ltd., New Delhi.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design/development of solutions	3	3	3	3	3	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	2	2	2	2	2	2
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

24155C32P **STRUCTURAL ANALYSIS I** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

- To introduce the students to the basic theory and concepts of classical methods of structuralanalysis

UNIT I ANALYSIS OF TRUSSES **9**

Determinate and indeterminate trusses - analysis of determinate trusses - method of joints - method of sections - Deflections of pin-jointed plane frames - lack of fit - change in temperature method oftension coefficient - Application to space trusses.

UNIT II SLOPE DEFLECTION METHOD **9**

Slope deflection equations – Equilibrium conditions - Analysis of continuous beams and rigidframes – Rigid frames with inclined members - Support settlements - symmetric frames with symmetric and skew-symmetric loadings.

UNIT III MOMENT DISTRIBUTION METHOD **9**

Stiffness - distribution and carry over factors –- Analysis of continuous Beams- Plane rigid frameswith and without sway – Support settlement - symmetric frames with symmetric and skew- symmetric loadings.

UNIT IV FLEXIBLITY METHOD **9**

Primary structures - Compatibility conditions – Formation flexibility matrices - Analysis of indeterminate pin- jointed plane frames, continuous beams and rigid jointed plane frames by directflexibility approach.

UNIT V STIFFNESS METHOD **9**

Restrained structure –Formation of stiffness matrices - equilibrium condition - Analysis ofContinuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Analyze the pin-jointed plane and space frames.

CO2 Analyse the continuous beams and rigid frames by slope defection method.

CO3 Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.

CO4 Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames usingmatrix flexibility method.

CO5 Understand the concept of matrix stiffness method and analysis of continuous beams, pinjointed trusses and rigid plane frames.

TEXTBOOKS:

1. Bhavikatti, S.S,Structural Analysis,Vol.1,& 2, Vikas Publishing House Pvt.Ltd.New Delhi-4,2014.

2. Punmia.B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications,New Delhi, 2004.

REFERENCES:

1.Sinha, S.N., “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., NewDelhi, 2017

2. Unnikrishna Pillai, S., Devdas Menon, “Reinforced Concrete Design”, Tata McGraw HillPublishing Company Ltd., 2021

3. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, “Limit State Design of ReinforcedConcrete”,Laxmi Publication Pvt. Ltd., New Delhi, 2016

4. Shah V L Karve S R., "Limit State Theory and Design of Reinforced Concrete", StructuresPublilcations, Pune, 2013

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design/development of solutions	3	3	3	3	3	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	2	2	2	2	2	2
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	1	1	1	1	1
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

24155C33P HYDROLOGY AND WATER RESOURCE ENGINEERING **L T P C**
3 0 0 3

OBJECTIVE:

To introduce the student to the concept of hydrological aspects of water availability andrequirements and should be able to quantify, control and regulate the water resources.

UNIT I PRECIPITATION AND ABSTRACTIONS **10**

Hydrological cycle- Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges-Spatial analysis of rainfall data using Thiessen and Isohyetal methods-Interception -Evaporation. Horton‟s equation, pan evaporation measurements and evaporation suppression - Infiltration-Horton‟s equation - double ring infiltrometer, infiltration indices.

UNIT II RUNOFF **8**

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - Strange‟s table and SCS methods – Stage discharge relationshipsflowmeasurements- Hydrograph – Unit Hydrograph – IUH

UNIT III FLOOD AND DROUGHT **9**

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts-Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysisDrought ProneArea Programme (DPAP)

UNIT IV RESERVOIRS **8**

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area -capacity - storage estimation, sedimentation - life of reservoirs – rule curve

UNIT V GROUNDWATER AND MANAGEMENT **10**

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteadyflow - artificial recharge - RWH in rural and urban areas

TOTAL : 45 PERIODS

OUTCOMES:

The students completing the course will have an understanding of the key drivers on water resources, hydrological processes and their integrated behaviour in catchments, ability to construct and apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial rechargeability to conduct Spatial analysis of rainfall data and design water storage reservoirs Understand the concept and methods of ground water management.

TEXTBOOKS:

1. Subramanya .K. "Engineering Hydrology"- Tata McGraw Hill, 2010
2. Jayarami Reddy .P."Hydrology", Tata McGraw Hill, 2008.

REFERENCES:

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007
2. Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
3. Raghunath. H.M., "Hydrology", Wiley Eastern Ltd., 1998. 4. Bhagu R. Chahar, Groundwater
4. Hydrology, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2017.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	2	2	2	2	2
PO2	Problem analysis	2	3	2	2	2	2
PO3	Design/development of solutions	-	2	2	1	2	1
PO4	Investigation	2	2	1	1	2	2
PO5	Modern Tool Usage	1	1	-	1	1	1
PO6	Engineer and Society	2	2	2	3	3	2
PO7	Environment and Sustainability	2	2	2	2	2	2
PO8	Ethics	-	-	-	2	2	1
PO9	Individual and Team work	2	3	2	2	3	2
PO10	Communication	2	2	2	2	2	2
PO11	Project Management and Finance	-	-	2	-	2	1
PO12	Life Long Learning	2	2	2	3	3	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	2	3	2	3	3	3

24155C34P **SOIL MECHANICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification. To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils. To impart knowledge of design of bothfinite and infinite slopes.

UNIT I SOIL CLASSIFICATION AND COMPACTION **9**

Formation of soil - Soil description – Particle – Size shape and colour – Composition of gravel, sand,silt, clay particles – Particle behaviour – Soil structure – Phase relationship – Index properties – Significance – BIS classification system – Unified classification system – Compaction of soils – Theory, Laboratory and field tests – Field Compaction methods – Factors influencing compaction of soils.

UNIT II EFFECTIVE STRESS AND PERMEABILITY **9**

Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena– Permeability interaction – Hydraulic conductivity – Darcy's law – Determination of Hydraulic Conductivity – Laboratory Determination (Constant head and falling head methods) and field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability ofsoils – Seepage - Two dimensional flow – Laplace's equation – Introduction to flow nets – Simple problems. (Sheet pile and weir).

UNIT III STRESS DISTRIBUTION AND SETTLEMENT **9**

Stress distribution in homogeneous and isotropic medium – Boussinesq theory – (Point land, Lineland and udl) Use of New marks influence chart –Components of settlement — Immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – Computation of rate ofsettlement. - $\sqrt{t}$ and log t methods– e-log p relationship.

UNIT IV SHEAR STRENGTH **9**

Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – Measurement ofshear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction.

UNIT V SLOPE STABILITY **9**

Stability Analysis - Infinite slopes and finite slopes – Total stress analysis for saturated clay – Friction circle method – Use of stability number – Method of slices – Fellenious and Bishop'smethod - Slope protection measures.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Demonstrate an ability to identify various types of soils and its properties, formulate and solve engineering Problems

CO2 Show the basic understanding of flow through soil medium and its impact of engineeringsolution

CO3 Understand the basic concept of stress distribution in loaded soil medium and soil settlementdue to consolidation

CO4 Show the understanding of shear strength of soils and its impact of engineering solutions to theloaded soil medium and also will be aware of contemporary issues on shear strength of soils.

CO5 Demonstrate an ability to design both finite and infinite slopes, component and process as perneeds and specifications.

TEXTBOOKS:

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd.,New Delhi. 2015

2. Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Ltd. InternationalPublisher New Delhi (India) 2006.

REFERENCES:

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2006.
2. Coduto, D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of IndiaPvt.Ltd. New Delhi, 2010.
3. Das, B.M., "Principles of Geotechnical Engineering". Brooks / Coles / Thompson LearningSingapore, 8th Edition, 2013.
4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 2005.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	3	3	2	3	3
PO2	Problem analysis	3	2	3	3	3	3
PO3	Design/development of solutions	2	3	2	3	2	2
PO4	Investigation	2	2	2	2	2	2
PO5	Modern Tool Usage	3	3	2	2	2	2
PO6	Engineer and Society	1	1	2	1	1	1
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	2	2	2	1	1	2
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	2	2	2	2	1	2
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	3	2	2	2	3	2
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	2	3	3	3	2	3

24155L35P **SOIL MECHANICS LABORATORY** **L T P C**
0 0 3 1.5

COURSE OBJECTIVES:

- To develop skills to test the soils for their index and engineering properties and tocharacterize the soil based on their properties.

EXERCISES:

1. DETERMINATION OF INDEX PROPERTIES

Specific gravity of soil solids
a. Grain size distribution – Sieve analysis
b. Grain size distribution - Hydrometer analysis
c. Liquid limit and Plastic limit tests
d. Shrinkage limit and Differential free swell tests

2. DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS

a. Field density Test (Sand replacement method)
b. Determination of moisture – density relationship using standard proctor compaction test.

3. DETERMINATION OF ENGINEERING PROPERTIES

a. Permeability determination (constant head and falling head methods)
b. One dimensional consolidation test (Determination of co-efficient of consolidation only)
c. Direct shear test in cohesion less soil
d. Unconfined compression test in cohesive soil
e. Laboratory vane shear test in cohesive soil
f. Tri-axial compression test in cohesion less soil (Demonstration only)
g. California Bearing Ratio Test

4. TEST ON GEOSYNTHETICS (Demonstration only) Determination of tensile strength andinterfacial friction angle.
a. Determination of apparent opening sizes and permeability.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to

CO1 Conduct tests to determine the index properties of soils
CO2 Determine the insitu density and compaction characteristics.
CO3 Conduct tests to determine the compressibility, permeability and shear strength of soils.
CO4 Understand the various tests on Geosynthetics.

REFERENCES:

1. Soil Engineering Laboratory Instruction Manual" published by Engineering College Co-operativeSociety, Anna University, Chennai, 2010.
2. "Saibaba Reddy, E. Ramasastri, K. "Measurement of Engineering Properties of Soils", New ageInternational (P) limited publishers, New Delhi, 2008.
3. Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1951. Digitized2008.
4. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of IndianStandards, New Delhi.
5. G.Venkatappa Rao and Goutham .K. Potable, "Geosynthetics Testing – A laboratory Manual", SaiMaster Geoenvironmental Services Pvt. Ltd., 1st Edition 2008.
6. Braja M.Das., "Soil Mechanics: Laboratory Manual", Oxford University Press, eighth edition,2012.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	1	3	1	1	2
PO2	Problem analysis	2	2	3	2	2	2
PO3	Design/development of solutions	3	3	3	2	3	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	2	1	1
PO6	Engineer and Society	1	1	1	1	1	1
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	1	2	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	2	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	2	3	3	3	3

SEMESTER – IV

24155C41P STRUCTURAL DESIGN AND DRAWING L T P C
3 2 0 4

OBJECTIVE:

- This course aims at providing students with a solid background on the principles of structural engineering design. Students will be acquire the knowledge of liquid retaining structures, bridges components, retaining wall and industrial structures.

UNIT I RETAINING WALLS 9+6

Reinforced concrete Cantilever and Counter fort Retaining Walls–Horizontal Backfill with Surcharge–Design of Shear Key-Design and Drawing.

UNIT II FLAT SLAB and BRIDGES 9+6

Design of Flat Slabs with and without drops by Direct Design Method of IS code- Design and Drawing - IRC Specifications and Loading – RC Solid Slab Bridge – Steel Foot-over Bridge-Design and Drawing.

UNIT II LIQUID STORAGE STRUCTURES 9+6

RCC Water Tanks - On ground, Elevated Circular, underground Rectangular Tanks– Hemispherical Bottomed Steel Water Tank –-Design and Drawing

UNIT IV INDUSTRIAL STRUCTURES 9+6

Structural steel Framing - Steel Roof Trusses – Roofing Elements – Beam columns – Codal provisions - Design and Drawing.

UNIT V GIRDERS AND CONNECTIONS 9+6

Plate Girders – Behaviour of Components-Deign of Welded Plate Girder-Design of Industrial Gantry Girders – Design of Eccentric Shear and Moment Resisting connections.

TOTAL: 75 PERIODS

OUTCOMES:

- At the end of the course the student will be able to
- Design and draw reinforced concrete Cantilever and Counterfort Retaining Walls
- Design and draw flat slab as per code provisions
- Design and draw reinforced concrete and steel bridges
- Design and draw reinforced concrete and steel water tanks
- Design and detail the various steel trusses and cantry girders

TEXTBOOKS:

1. Krishnaraju N, Structural Design and Drawing, Universities Press, 2009.
2. Punmia B.C,Ashok Kumar Jain and Arun KumarJain,Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., 2003.

REFERENCES:

1. Krishnamurthy D,Structural Design and Drawing VolI,IIandIII,CBS Publishers, 2010.
2. Shah V L and Veena Gore,Limit State Design of Steel Structures
3. IS800-2007,Structures Publications, 2009.
4. IS 456(2000) Indian Standard Plain and Reinforced Concrete-Code of Practice, Bureau of Indian Standards, New Delhi.
5. SP34 Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.
6. IS 800 (2007) Indian Standard General Construction In Steel—Code of Practice, Bureau of Indian Standards, New Delhi.
7. IS 875 Part 1 (2003) Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Code of Practice-Dead Load, Bureau of Indian Standards, New Delhi.
8. IS 875 Part 2 (2003) Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Code of Practice-Imposed Load, Bureau of Indian Standards, New Delhi.
9. IS 875 Part 3 (2003) Code of Practice for Design Loads (Other than Earthquake) for Buildings

and Structures, Code of Practice-Wind Load, Bureau of Indian Standards, New
10. IS 3370 Part 1 (2009) Indian Standard Concrete Structures for Storage of Liquids-Code of Practice–General Requirements, Code of Practice, Bureau of Indian Standards, New Delhi.
11. IS 3370 Part 2 (2009) Indian Standard Concrete Structures for Storage of Liquids-Code of Practice-Reinforced Concrete Structures, Code of Practice, Bureau of Indian Standards, New Delhi.
12. IS 3370–Part 4 (2008) Indian Standard Code of Practice for Concrete Structures for The Storage of Liquids-Design Tables, Code of Practice, Bureau of Indian Standards, New Delhi.
13. IS 804 (2008) Indian Standard Specification for Rectangular Pressed Steel Tanks, Code of Practice, Bureau of Indian Standards, New Delhi.
14. IS 805 (2006) Indian Standard Code of Practice for Use of Steel in Gravity Water Tanks, Code of Practice, Bureau of Indian Standards, New Delhi.
15. IRC 112-2011, Code of Practice for Concrete Road Bridges, The Indian Roads Congress, New Delhi.
16. IRC 6-2014, Standard Specifications and Code of Practice for Road Bridges Section: II-Loads and Stresses, The Indian Roads Congress, New Delhi.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	1	3	1	1	2
PO2	Problem analysis	2	2	3	2	2	2
PO3	Design/development of solutions	3	3	3	2	3	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	2	1	1
PO6	Engineer and Society	1	1	1	1	1	1
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	1	2	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	2	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	2	3	3	3	3

24155C42P **STRUCTURAL ANALYSIS II** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

- To learn the method of drawing influence lines and its uses in various applications likebeams, bridges and plane trusses and to analyse arches and suspension bridges

UNIT I INFLUENCE LINES FOR DETERMINATE STRUCTURES **9**

Introduction to moving loads, Concept of Influence Lines, Influence lines for reactions in staticallydeterminate structures –Influence lines for shear force and bending moment in beam section – Calculation of critical stress resultants due to concentrated and distributed moving loads - Influencelines for member forces in pin jointed plane frames.

UNIT II INFLUENCE LINES FOR INDETERMINATE BEAMS **9**

Muller Breslau's principle - Influence line for support reactions, shearing force and bending moments for indeterminate beams - propped cantilevers, fixed beams and continuous beams.

UNIT III ARCHES **9**

Arches - Eddy's theorem - Types of arches – Analysis of three-hinged, two-hinged and fixed arches - Parabolic and circular arches - influence lines, rib shortening– Settlement and temperature effects.

UNIT IV SUSPENSION BRIDGES AND SPACE TRUSSES **9**

Analysis of suspension bridges – Unstiffened cables and cables with three hinged stiffening girders –Influence lines for three hinged stiffening girders - Introduction to analysis of space trusses using method of tension coefficients.

UNIT V APPROXIMATE ANALYSIS OF FRAMES **9**

Approximate analysis for gravity loadings - substitute frame method for maximum moments in beams and columns - Approximate analysis for horizontal loads - portal method and cantilever method - assumptions - axial force, shearing force and bending moment diagrams.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to ;

CO1 Draw influence lines for statically determinate structures and calculate critical stress resultants.

CO2 Understand Muller Breslau principle and draw the influence lines for statically indeterminate beams.

CO3 Analyse three hinged, two hinged and fixed arches.

CO4 Analyse the suspension bridges with stiffening girders

CO5 AnalysHYDe rigid frames by approximate methods for gravity and horizontal loads.

TEXTBOOKS:

1. Bhavikatti,S.S, Structural Analysis,Vol.1 & 2, Vikas Publishing House Pvt.Ltd., NewDelhi-4,2014.

2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi,Publications,2004.

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1. Negi.L.S and Jangid R.S ., Structural Analysis , Tata McGraw-Hill Publishers, 2004.

2. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co. Ltd., Third Edition,2010.

3. Gambhir.M.L., Fundamentals of Structural Mechanics and Analysis, PHI Learning Pvt. Ltd.,2011.

4. Vazrani.V.N And Ratwani,M.M, Analysis of Structures, Vol.II, Khanna Publishers,2015.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design/development of solutions	3	3	3	3	3	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	2	2	2	2	2	2
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	1	1	1	1	1
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

24155C43P WATER SUPPLY AND WASTEWATER ENGINEERING L T P C
4 0 0 4

COURSE OBJECTIVES:

- To introduce students to various components and design of water supply scheme, water treatment methods, water storage distribution system, sewage treatment and disposal anddeign of intake structures and sewerage system.

UNIT I WATER SUPPLY **12**

Estimation of surface and subsurface water resources - Predicting demand for water- Impurities of water and their significance - Physical, chemical and bacteriological analysis - Waterborne diseases -Standards for potable water. Intake of water: Pumping and gravity schemes.

UNIT II WATER TREATMENT **12**

Objectives - Unit operations and processes - Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation – Clarifloccuator - Plate and tubesettlers - Pulsator clarifier - sand filters - Disinfection - softening, removal of iron and manganese -Defluoridation - Softening - Desalination process - Residue Management - Construction, Operationand Maintenance aspects

UNIT III WATER STORAGE AND DISTRIBUTION **12**

Storage and balancing reservoirs - types, location and capacity. Distribution system: layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters,analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations - House service connections.

UNIT IV PLANNING AND DESIGN OF SEWERAGE SYSTEM **12**

Characteristics and composition of sewage - Population equivalent - Sanitary sewage flow estimation - Sewer materials - Hydraulics of flow in sanitary sewers - Sewer design - Storm drainage-Storm runoff estimation - Sewer appurtenances - Corrosion in sewers - Prevention andcontrol – Sewage pumping-drainage in buildings - Plumbing systems for drainage

UNIT V SEWAGE TREATMENT AND DISPOSAL **12**

Objectives - Selection of Treatment Methods - Principles, Functions, - Activated Sludge Process andExtended aeration systems - Trickling filters - Sequencing Batch Reactor(SBR) - UASB - Waste Stabilization Ponds - Other treatment methods - Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment - Construction, Operation and Maintenance aspects. - Discharge standards-sludge treatment -Disposal of sludge

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Understand the various components of water supply scheme and design of intake structure and conveyance system for water transmission

CO2 Understand on the characteristics and composition of sewage, ability to estimate sewagegeneration and design sewer system including sewage pumping stations

CO3 Understand the process of conventional treatment and design of water and wastewater treatment system and gain knowledge of selection of treatment process and biological treatmentprocess

CO4 Ability to design and evaluate water distribution system and water supply in buildings and understand the self-purification of streams and sludge and septage disposal methods.

CO5 Able to understand and design the various advanced treatment system and knowledge about the recent advances in water and wastewater treatment process and reuse of sewage

TEXTBOOKS:

1. Garg, S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 2010.
2. Modi, P.N., Water Supply Engineering, Vol.I Standard Book House, New Delhi, 2016.
3. Garg, S.K., Environmental Engineering Vol.II, Khanna Publishers, New Delhi, 2015.
4. Duggal K.N., “Elements of Environmental Engineering” S. Chand and Co. Ltd., New Delhi, 2014.
5. Punmia, B.C., Jain, A.K., and Jain.A.K.., Environmental Engineering, Vol.II, Laxmi

Publications,2010.

REFERENCES:

1.Punmia B.C, Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd.,New Delhi 2010.

2. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Governmentof India, New Delhi, 1999.

3. Syed R. Qasimand Edward M. Motley Guang Zhu, Water Works Engineering Planning, Designand Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.

4. Of Urban Development, Government of India, New Delhi, 2013.

5. Metcalf and Eddy – Waste water Engineering – Treatment and Reuse, Tata Mc. Graw – HillCompany, New Delhi, 2010.

6. Syed R.Qasim "Waste water Treatment Plants", CRCPress,WashingtonD.C.,2010

7. Gray N.F, "Water Technology", Elsevier India Pvt.Ltd. New Delhi, 2006.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	2	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design/development of solutions			3	3	3	3
PO4	Investigation	2	2			2	2
PO5	Modern Tool Usage				2	2	2
PO6	Engineer and Society			3	3	3	3
PO7	Environment and Sustainability			2	3	3	3
PO8	Ethics	1	1	2	2	2	2
PO9	Individual and Team work	1	1	2	3	3	2
PO10	Communication					2	2
PO11	Project Management and Finance			2	2	2	2
PO12	Life Long Learning					3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation			2	2	2	2
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues			2	2	2	2

24155L45P WATER AND WASTEWATER ANALYSIS LABORATORY L T P C
0 0 3 1.5

COURSE OBJECTIVE:

- This subject includes the list of experiments to be conducted for characterization of water andmunicipal sewage. At the end of the course, the student is expected to be aware of the procedure for quantifying quality parameters for water and sewage.

LIST OF EXPERIMENTS: ANALYSIS OF WATER SAMPLE

1. Sampling and preservation methods for water and wastewater (Demonstration only)
2. Measurement of Electrical conductivity and turbidity
3. Determination of fluoride in water by spectrophotometric method /ISE
4. Determination of iron in water (Demo)
5. Determination of Sulphate in water
6. Determination of Optimum Coagulant Dosage by Jar test apparatus
7. Determination of available Chlorine in Bleaching powder and residual chlorine in water

ANALYSIS OF WASTEWATER SAMPLE

8. Estimation of suspended, volatile and fixed solids
9. Determination of Sludge Volume Index in waste water
10. Determination of Dissolved Oxygen
11. Estimation of B.O.D.
12. Estimation of C.O.D.
13. Determination of TKN and Ammonia Nitrogen in wastewater
14. Determination of total and faecal coliform (Demonstration only)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Calibrate and standardize the equipment
CO2 Collect proper sample for analysis
CO3 To know the sample preservation methods
CO4 To perform field oriented testing of water, wastewater
CO5 To perform coliform analysis

REFERENCES:

1. APHA, "Standard Methods for the Examination of Water and Waste water", 22nd Ed.Washington, 2012.
2. "Laboratory Manual for the Examination of water, wastewater soil Rump", H.H. and Krist,H. –Second Edition, VCH, Germany, 3rd Edition, 1999.
3. "Methods of air sampling & analysis",James P.Lodge Jr(Editor) 3rd Edition, Lewispublishers,Inc,USA,1989.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	2	1	3	2	2
PO2	Problem analysis	1	1	1	3	3	2
PO3	Design/development of solutions	1	1	1	3	3	2
PO4	Investigation	1	1	1	3	3	2
PO5	Modern Tool Usage	2	1	1	3	3	2
PO6	Engineer and Society	1	2	2	2	2	2
PO7	Environment and Sustainability	2	2	2	2	2	2
PO8	Ethics	2	2	2	3	3	3
PO9	Individual and Team work	1	1	2	3	2	2
PO10	Communication	1	1	2	2	2	2
PO11	Project Management and Finance	1	2	2	3	2	2
PO12	Life Long Learning	3	3	2	2	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	1	2	2	3	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	3	2	2
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	2	2	2	3	2	2

SEMESTER – V

24155C51P DESIGN OF STEEL STRUCTURAL ELEMENTS L T P C
3 0 0 3

COURSE OBJECTIVE

- To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections and to provide the students thetools necessary for designing structural systems such as roof trusses and gantry girders as perprovisions of current code (IS 800 - 2007) of practice.

UNIT I INTRODUCTION TO STRUCTURAL STEEL AND DESIGN OF CONNECTIONS 9

General -Types of Steel -Properties of structural steel - I.S. rolled sections - Concept of Limit StateDesign - Design of Simple and eccentric Bolted and welded connections - Types of failure and efficiency of joint – prying action - Introduction to HSFG bolts

UNIT II DESIGN OF TENSION AND COMPRESSION MEMBERS 9

Behaviour and Design of simple and built-up members subjected to tension - Shear lag effect-Design of lug angles - tension splice - Behaviour of short and long columns - Euler's column theory-Design of simple and built-up compression members with lacings and battens - Design of column bases - slab base and gusseted base

UNIT III DESIGN OF BEAMS 9

Design of laterally supported and unsupported beams - Design of built-up beams - Design of plategirders

UNIT IV INDUSTRIAL STRUCTURES 9

Design of roof trusses – loads on trusses – purlin design using angle and channel sections – truss design, Design of joints and end bearings–Design of gantry girder - Introduction to pre-engineeredbuildings

UNIT V PLASTIC ANALYSIS AND DESIGN 9

Introduction to plastic analysis - Theory of plastic Analysis - Design of continuous beams and portalframes using plastic design approach

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO1 Recognize the design philosophy of steel structures and identify the different failure modes ofbolted and welded connections, and determine their design strengths

CO2 Select the most suitable section shape and size for tension and compression members andbeams according to specific design criteria

CO3 Apply the principles, procedures and current code requirements to the analysis and design ofsteel tension members, columns, column bases and beams

CO4 Identify and compute the design loads on Industrial structures, and gantry girder

CO5 Find out ultimate load of steel beams and portal frames using plastic analysis

TEXT BOOKS

1. Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi,2010

2. Bhavikatti S.S, Design of Steel Structures, Ik International Publishing House, New Delhi, 2017.

REFERENCES

1.Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India PvtLimited, 2013

2.Jack C. McCormac and Stephen F Csernak, Structural Steel Design, Pearson Education Limited,2013.

3.Sarwar Alam Raz, Structural Design in Steel, New Age International Publishers, 2014

4.Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	2	2	3	2	2
PO2	Problem analysis	2	2	2	2	3	2
PO3	Design/development of solutions	3	3	3	3	3	3
PO4	Investigation					2	2
PO5	Modern Tool Usage		2	2	2		2
PO6	Engineer and Society				2		2
PO7	Environment and Sustainability	2			2		2
PO8	Ethics				2		2
PO9	Individual and Team work				2		2
PO10	Communication					1	1
PO11	Project Management and Finance		2	2	2		2
PO12	Life Long Learning	2	2	2	3	3	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues				3	3	3

24155C52P **FOUNDATION ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

- To impart knowledge to plan and execute a detail site investigation programme, to select geotechnical design parameters and type of foundations. Also to familiarize the students forthe geotechnical design of different type of foundations and retaining walls.

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION **9**

Scope and objectives – Methods of exploration – Auguring and boring – Wash boring and rotary drilling – Depth and spacing of bore holes – Soil samples – Representative and undisturbed – Sampling methods – Split spoon sampler, Thin wall sampler, Stationary piston sampler – Penetrationtests (SPT and SCPT) – Data interpretation - Strength parameters and Evaluation of Liquefaction potential - Selection of foundation based on soil condition- Bore log report.

UNIT II BEARING CAPACITY OF SHALLOW FOUNDATION **9**

Introduction – Location and depth of foundation – Codal provisions – Bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – Factors affecting bearing capacity – Bearing capacity from in-situ tests (SPT, SCPT and plate load) – Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codal provision – Methods of minimizing total and differential settlements.

UNIT III FOOTINGS AND RAFTS **9**

Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behaviour – Minimum depth forrigid behaviour – Applications – Floating foundation – Special foundations – Seismic force consideration – Codal provision

UNIT IV PILE FOUNDATION **9**

Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity ofsingle pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering news and Hileys) – Capacity from insitu tests (SPT, SCPT) – Negative skin friction – Uplift capacity- Group capacity by different methods (Field's rule, Converse – Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles – Capacity under compression and uplift – Codal provision.

UNIT V RETAINING WALLS **9**

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann Graphical method – Pressure on the wall due toline load – Stability analysis of retaining walls – Codal provision.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to be able to

CO1 Graduate will demonstrate an ability to plan and execute a detailed site investigation to select geotechnical design parameters and type of foundation

CO2 Graduate will demonstrate an ability to design shallow foundations, its component or processas per the needs and specifications.

CO3 Graduate will demonstrate an ability to design combined footings and raft foundations, its component or process as per the needs and specifications.

CO4 Graduate will demonstrate an ability to design deep foundations, its component or process asper the needs and specifications.

CO5 Graduate will demonstrate an ability to design retaining walls, its component or process as perthe needs and specifications.

TEXTBOOKS:

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and DistributersLtd., New Delhi, 2015.

2. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", New Age International (P)Ltd, New Delhi,2006.

REFERENCES:

1. Das, B.M. "Principles of Foundation Engineering" (Eigth edition), Thompson Asia Pvt. Ltd.,Singapore, 2017.

2. Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hillpublishing company Ltd., New Delhi, 2017.

3. Varghese, P.C.,"Foundation Engineering", Prentice Hall of India Private Limited, New Delhi,2012.

4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt.Ltd., New Delhi, 2017.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	2	2	3	3	2
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design/development of solutions	3	3	3	3	3	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	2	2	2	1	2	2
PO7	Environment and Sustainability	1	2	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	1	1	1	1	1	1
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	1	2	2	2	2
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	2	2	3	3	3

24155C53P **CONCRETE TECHNOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To study the properties of concrete making materials.
- To have better knowledge about the chemical and mineral admixtures in concrete.
- To familiarize with the IS method of mix design as per the latest code .
- To understand the fresh and hardened properties of concrete. To know the importance andapplications of special concretes

UNIT I CONSTITUENT ATERIALS **9**

Cement-Different types-Chemical composition and Properties -Tests on cement-IS Specifications- Aggregates-Classification-Mechanical properties and tests as per BIS Grading requirements-Water-Quality of water for use in concrete.

UNIT II CHEMICAL AND MINERAL ADMIXTURES **9**

Accelerators-Retarders- Plasticisers- Super plasticizers- Water proofers - Mineral Admixtures likeFly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline -Their effects on concrete properties

UNIT III PROPORTIONING OF CONCRETE MIX **9**

Principles of Mix Proportioning-Properties of concrete related to Mix Design-Physical properties of materials required for Mix Design - Design Mix and Nominal Mix-BIS Method of Mix Design - MixDesign Examples

UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE **9**

Workability-Tests for workability of concrete-Slump Test and Compacting factor Test-Segregationand Bleeding-Determination of Compressive and Flexural strength as per BIS - Properties of Hardened concrete- Stress-strain curve for concrete-Determination of Modulus of elasticity.

UNIT V SPECIAL CONCRETES **9**

Light weight concretes - High strength concrete - Fibre reinforced concrete – Ferrocement - Readymix concrete - SIFCON - Shotcrete – Polymer concrete - High performance concrete-self compacting concrete - Geopolymer Concrete.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1 Understand the requirements of cement, aggregates and water for concrete
CO2 Select suitable admixtures for enhancing the properties of concrete
CO3 Design concrete mixes as per IS method of mix design
CO4 Determine the properties of concrete at fresh and hardened state.
CO5 Know the importance of special concretes for specific requirements.

TEXTBOOKS:

1. Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003

REFERENCES:

1. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995
2. Gambhir.M.L.Concrete Technology,Fifth Edition, McGraw Hill Education,2017.
3. Job Thomas., Concrete Technology, Cencage learning India Private Ltd, New Delhi, 2015.
4. IS10262-2019 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards,New Delhii.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	1	1	2	1	1	1
PO3	Design/development of solutions	1	1	3	1	1	2
PO4	Investigation	2	1	3	1	1	2
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability	3	3	3	3	3	3
PO8	Ethics	2	1	1			
PO9	Individual and Team work	1	1	1	1	1	1
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	2	1
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

24155L55P BUILDING DRAWING AND DETAILING LABORATORY **L T P C**
0 0 4 2

COURSE OBJECTIVE:

- To impart knowledge and skill relevant to Building drawing and Detailing lab usingcomputer software

LIST OF EXPERIMENTS

1. Principles of planning and orientation
2. Buildings with load bearing walls and RCC roof (Plan , section , elevation)
3. Buildings with sloping roof
4. Buildings with Framed structures.
5. Building information modeling.
6. Reinforcement details of RCC structural elements (slab, beam and column)
7. Reinforcement details of footings (Isolated, stepped, combined footing)
8. Steel structures (Steel Connections detailing, beam to column connection, beam to beamconnection – bolt & Weld, Roof truss & purlin)

TOTAL : 60 PERIODS

REFERENCES:

1. V.B.Sikka, "A course in Civil Engineering Drawing" S.K.Kataria & Sons Publishers, SeventhEdition, 2015.
2. D.N.Ghose, "Civil Engineering Drawing and Design" CBS Publishers & Distributors Pvt.Ltd.,2nd Edition, 2010.
3. National Building Code of India 2016 (NBC 2016)
4. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design (Third Edition), Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2017.
5. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016

COURSE OUTCOME

- On completion of the course, the student is expected to be able to

CO1 Draft the plan, elevation and sectional view of the load bearing and framed buildings
CO2 Draw the structural detailing of RCC elements
CO3 Draw the structural detailing of RCC water tanks, footings and retaining walls
CO4 Draw the structural detailing of steel structures **CO5** Draft the structural detailing of Industrial structures

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	-	2	2	2	2	2
PO3	Design/development of solutions	-	-	-	-	-	-
PO4	Investigation	-	-		2	2	2
PO5	Modern Tool Usage	2	2	2	2	2	2
PO6	Engineer and Society	-	3	3	3	3	3
PO7	Environment and Sustainability	-	-	-	-	-	-
PO8	Ethics	1	2	2	1	2	2
PO9	Individual and Team work	-	3	3	3	3	3
PO10	Communication	-	2	2	2	2	2
PO11	Project Management and Finance	-	-	-	-	-	-
PO12	Life Long Learning	1	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	-	2	2	2	2	2

SEMESTER – VI

24155C61P ESTIMATION, COSTING AND VALUATION ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVE:

- The students will acquire knowledge in estimation, tender practices, contract procedures,and valuation and will be able to prepare estimates, call for tenders and execute works.

UNIT I QUANTITY ESTIMATION **9**

Philosophy – Purpose – Methods of estimation – Centre line method – Long and short wall method –Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, bituminous and cement concrete roads, septic tank, soak pit, retaining walls – Culverts (additional practice in class room using computer softwares- qE Pro)

UNIT II RATE ANALYSIS AND COSTING **9**

Standard Data – Observed Data – Schedule of rates – Market rates – Materials and Labour – Standard Data for Man Hours and Machineries for common civil works – Rate Analysis for all Building works, canals, and Roads – Cost Estimates (additional practice in class room using Computer softwares) – (Analysis of rates for the item of work asked, the data regarding labour, ratesof material and rates of labour to be given in the Examination Question Paper)

UNIT III SPECIFICATIONS, REPORTS AND TENDERS **9**

Specifications – Detailed and general specifications – Constructions – Sources – Types of specifications – Principles for report preparation – report on estimate of residential building – Culvert – Roads – TTT Act 2000 – Tender notices – types – tender procedures – Drafting modeltenders , E-tendering- e NOI – e NOT -Digital signature certificates – Encrypting - Decrypting –Reverse auctions.

UNIT IV CONTRACTS **9**

Contract – Types of contracts – BOT – Types - Formation of contract – Contract conditions – Contract for labour, material, design, construction – Drafting of contract documents based on IBRD /MORTH Standard bidding documents – Construction contracts – Contract problems – Arbitration ,litigation and legal requirements.

UNIT V VALUATION **9**

Definitions – Various types of valuations – Valuation methods - Necessity –Year's purchase-sinking fund- Capitalised value – Depreciation – Escalation – Valuation of land – Buildings – Calculation ofStandard rent – Mortgage – Lease - Types of lease

TOTAL : 45 PERIODS

COURSE OUTCOMES:

The student will be able to

CO1 Gain knowledge on types of contracts.
CO2 Understand types of specifications, principles for report preparation, tender notices types.
CO3 Rate Analysis for all Building works, canals, and Roads and Cost Estimate.
CO4 Estimate the quantities for buildings.
CO5 Evaluate valuation for building and land.

TEXTBOOKS:

1. B.N Dutta 'Estimating and Costing in Civil Engineering', CBS Publishers & Distributors (P) Ltd,Twenty eighth revised edition, 2020.
2. B.S.Patil, 'Civil Engineering Contracts and Estimates', 7th edition, University Press, 2015
3. D.N. Banerjee, 'Principles and Practices of Valuation', V Edition, Eastern Law House, 2015

REFERENCES:

1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD
2. Tamil Nadu Transparencies in Tenders Act, 1998 and rules 2000
3. Arbitration and Conciliation Act, 1996
4. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996
5. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2019

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	2	1	1	2	2
PO3	Design/development of solutions	3	3	2	1	2	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	3	3	1	1	3	3
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability	3	3	2	2	2	2
PO8	Ethics	2	2	2	2	2	2
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	2	2	2	2	2	2
PO11	Project Management and Finance	3	3	2	2	2	2
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

24155C62P CONSTRUCTION EQUIPMENT AND MACHINERY L T P C
3 0 0 3

COURSE OBJECTIVE

To expose the students in the field of construction equipment and machineries so as to gain• knowledge in carrying out engineering tasks.

UNIT I CONSTRUCTION EQUIPMENTS 9

Identification - Planning of equipment - Selection of equipment - Equipment management in projects - Maintenance management - Equipment cost - Operating cost - Cost control of equipment - Depreciation analysis - Replacement analysis - Safety management.

UNIT II EQUIPMENT FOR EARTHWORK 9

Fundamentals of earthwork operations - Earth moving operations - Types of earthwork equipment - Tractors, motor graders, scrapers, front end waders - Dozer, excavators, rippers, loaders, trucks and hauling equipment, compacting equipment, finishing equipment - Case studies on earthwork equipment.

UNIT III OTHER CONSTRUCTION EQUIPMENT 9

Equipment for dredging, trenching, drag line and clamshells, tunneling - Jacking equipment - Equipment for drilling and blasting - Pile driving equipment - Erection equipment - Crane, mobile crane - Types of pumps used in construction - Equipment for dewatering, grouting and demolition.

UNIT IV ASPHALT AND CONCRETE PLANTS 9

Aggregate production - Different crushers - Feeders - Screening equipment - Handling equipment - Batching and mixing equipment - Ready mix concrete equipment, concrete pumping equipment - Asphalt plant - Asphalt pavers - Asphalt compacting equipment.

UNIT V MATERIALS HANDLING EQUIPMENT 9

Forklifts and related equipment - Portable material bins - Material handling conveyors - Material handling cranes - Industrial trucks - Aerial transporting equipment.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of this course, the student is expected to be able to:

CO1 Develop knowledge on planning of equipment and selection of equipment

CO2 Explain the knowledge on fundamentals of earth work operations, earth moving operations and types of earth work equipment

CO3 Develop the knowledge on special construction equipment

CO4 Apply the knowledge on asphalt and concrete plants

CO5 Apply the knowledge and select the proper materials handling equipment

TEXTBOOKS:

1. Peurifoy, R.L., Schexnayder, C., Schmitt, R.L. and Aviad Shapira., Construction Planning, Equipment and Methods, 9th Edn. McGraw Hill, Singapore, 2018.

2. Granberg G.,Popescu M Construction Equipment and Management for Engineers Estimators and Owners, Taylor and Francis Publishers, New York, 2006.

REFERENCES:

1. Deodhar, S.V. Construction Equipment and Job Planning, 4th Edn. Khanna Publishers, New Delhi, 2020.

2. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, 2018.

3. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 2008. 4. Dr. Mahesh Varma., Construction Equipment and its Planning and Application, Metro-politan Book Company, New Delhi., 2003.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	3	3	2	2	2
PO2	Problem analysis		3	3	3	1	3
PO3	Design/development of solutions		3	3		2	3
PO4	Investigation		2	2		3	2
PO5	Modern Tool Usage			2			1
PO6	Engineer and Society	2					1
PO7	Environment and Sustainability	2	2				2
PO8	Ethics						
PO9	Individual and Team work	3	3	3	2	2	3
PO10	Communication						
PO11	Project Management and Finance	3	2	2	2	3	2
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation		3	3			2
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues		2	3			2

24155C63P HIGHWAY AND RAILWAY ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE:

- To give an overview about the highway and railway engineering with respect to, planning,design, construction and maintenance as per IRC standards, specifications and methods.

UNIT I HIGHWAY ENGINEERING 9

Classification of highways – Institutions for Highway planning, design and construction at differentlevels – factors influencing highway alignment –Typical cross sections of Urban and Rural roads – Engineering surveys for alignment- Conventional and Modern method

UNITII DESIGN OF HIGHWAY ELEMENTS 9

Cross sectional elements – Horizontal curves, super elevation, transition curves, widening of curves – Sight distances – Vertical curves, gradients– pavement components and their role - Design practicefor flexible and rigid pavements (IRC methods only).

UNIT III HIGHWAY CONSTRUCTION AND MAINTENANCE 9

Highway construction materials, properties, testing methods – Construction practice of flexible and concrete pavement- Highway drainage – Evaluation and Maintenance of pavements.

UNIT IV RAILWAY PLANNING AND CONSTRUCTION 9

Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges - Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods-Geometric design of railway, gradient, super elevation, wideningof gauge on curves (Problems)-Railway drainage- Level Crossings-Signalling.

UNIT V RAILWAY TRACK CONSTRUCTION MAINTENANCE AND OPERATION 9

Points and Crossings - Design of Turnouts, Working Principle-Track Circuiting - Construction & Maintenance – Conventional, Modern methods and Materials, Lay outs of Railway Stations and Yards, Rolling Stock, Tractive Power, Track Resistance - Role of Indian Railways in National Development – Railways for Urban Transportation – LRT & MRTS Feasibility study, Planning andconstruction.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to

CO1 Plan a highway according to the principles and standards adopted in various institutions inIndia.

CO2 Design the geometric features of road network and components of pavement.

CO3 Test the highway materials and construction practice methods and know its properties and ableto perform pavement evaluation and management.

CO4 Understand the methods of route alignment and design elements in railway planning and constructions.

CO5 Understand the construction techniques and maintenance of track laying and railway stations

TEXTBOOKS:

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nemchand Publishers,2014.

2. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications(India), Chennai,2010

3. Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications,6th edition Delhi, 2015.

4. C. Venkatramaiah., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours,Bridges and Tunnels., Universities Press (India) Private Limited, Hyderabad, 2015.

REFERENCES:

1. Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements, (Third Revision),IRC:37-2012

2. Indian Road Congress (IRC), Guidelines for the Design of Plain Jointed Rigid Pavements forHighways, (Third Revision), IRC:58-2012
3. ang H. Huang, "Pavement Analysis and Design", Pearson Education Inc, Nineth Impression,South Asia,2012
4. Ian D. Walsh, "ICE manual of highway design and management", ICE Publishers, Ist Edition,USA,2011
5. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of HighwayEngineering and Traffic Analysis", Wiley India Pvt. Ltd., New Delhi, 2011
6. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, NewDelhi,2010
7. O'Flaherty.C.A "Highways, Butterworth – Heinemann, Oxford,2006
8. IRC-37–2012,The Indian roads Congress, Guidelines for the Design of Flexible Pavements,NewDelhi
9. IRC 58-2012. The Indian Road Congress, Guideline for the Design of RigidPavements forHighways, NewDelhi

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	2	2	3		2
PO2	Problem analysis		3	3			3
PO3	Design/development of solutions		3	2		3	3
PO4	Investigation	2	2	2			2
PO5	Modern Tool Usage		2	2		2	2
PO6	Engineer and Society	3		3	3		3
PO7	Environment and Sustainability	1	2	3			2
PO8	Ethics	3	3	3	3		3
PO9	Individual and Team work		2			2	2
PO10	Communication	`			1		1
PO11	Project Management and Finance		2	3			3
PO12	Life Long Learning		3	3		2	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation		3	3			2
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues		2	3			2

24155L65P MATERIALS TESTING LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

- To develop skills to test various construction materials.

I. TESTS ON METALS

a. Tension test on steel rod
b. Torsion test on mild steel rod
c. Deflection test on metal beam
d. Double shear test on metal
e. Impact test on metal specimen (Izod and Charpy)
f. Hardness test on metals (Rockwell and Brinell Hardness Tests)
g. Compression test on helical spring
h. Deflection test on carriage spring

II. TESTS ON CEMENT

a. Determination of fineness of cement
b. Determination of consistency of cement
c. Determination of specific gravity of cement
d. Determination of initial and final setting time of cement

III. TESTS ON FINE AGGREGATE

a. Determination of specific gravity and water absorption of fine aggregate
b. Determination of grading of fine aggregate
c. Determination of water absorption for fine aggregate

IV. TESTS ON COARSE AGGREGATE

a. Determination of compacted and loose bulk density of coarse aggregate
b. Determination of impact value of coarse aggregate
c. Determination of elongation index of coarse aggregate
d. Determination of flakiness index of coarse aggregate
e. Determination of aggregate crushing value of coarse aggregate
f. Determination of specific gravity and water absorption of coarse aggregate

V. TESTS ON BRICKS

a. Determination of compressive strength of bricks
b. Determination of water absorption of bricks
c. Determination of efflorescence of bricks

VI. TESTS ON CONCRETE

a. Determination of slump of concrete
b. Determination of compressive strength of concrete
c. Determination of flowability of self-compacting concrete (Demo only)

VII. TEST ON WOOD

a. Determination of Compression test on wood

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Determine the mechanical properties of steel.
CO2 Determine the physical properties of cement
CO3 Determine the physical properties of fine and coarse aggregate.
CO4 Determine the workability and compressive strength of concrete.
CO5 Determine the strength of brick and wood.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	3	3	3	3	3
PO2	Problem analysis	2	2	3	3	3	3
PO3	Design/development of solutions	1	1	2	2	2	2
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	1	2	1
PO6	Engineer and Society	2	2	2	2	2	2
PO7	Environment and Sustainability	2	2	2	2	2	2
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	2	2	2	2	2	2

SEMESTER – VII

24155S71P **TOTAL QUALITY MANAGEMENT** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQMframework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking andFMEA.
- Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques likeQFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.

UNIT I INTRODUCTION **9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of productand service quality –Definition of TQM-- Basic concepts of TQM - Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES **9**

Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal-- Continuous process improvement –Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnershipPartnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I **9**

The seven traditional tools of quality - New management tools - Six-sigma Process Capability- Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: DesignFMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II **9**

Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM –Concepts, improvement needs – Performance measures- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM **9**

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards -AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation- Internal Audits-Registration-ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Ability to apply TQM concepts in a selected enterprise.
CO2: Ability to apply TQM principles in a selected enterprise.
CO3: Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking andFMEA.
CO4: Ability to understand Taguchi's Quality Loss Function, Performance Measures and applyQFD, TPM, COQ and BPR.
CO5: Ability to apply QMS and EMS in any organization.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and RashmiUrdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition,Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. Joel.E. Ross, "Total Quality Management – Text and Cases", Routledge.,2017.
2. Kiran.D.R, "Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 2016.
3. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition,2003.
4. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006

CO's-PO's&PSO'sMAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1		3										3	2		3
2						3						3		2	
3					3				3					2	3
4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
AVg.		2.5	3		3	2.6	3	2	3			3	2.5	2	3

24155C72P HOUSING, PLANNING AND MANAGEMENT L T P C
3 1 0 4

UNIT I INTRODUCTION TO HOUSING 9

Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

UNIT II HOUSING PROGRAMMES 9

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organisations.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS 9

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (DesignProblems)

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS 9

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL 9

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing o f Housing Units, Rents, Recovery Pattern (Problems).

TOTAL: 60 PERIODS

TEXT BOOKS

1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd.,NewDelhi,1999.
2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Bombay, 1997.

REFERENCES

1. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
2. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat),Nairobi,1994.
3. National Housing Policy, 1994, Government of India.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	2	3		3	3
PO2	Problem analysis					2	2
PO3	Design/development of solutions		3	3	2	1	2
PO4	Investigation		2		2	2	2
PO5	Modern Tool Usage				2		2
PO6	Engineer and Society	3	3	2		3	3
PO7	Environment and Sustainability	3	2	3	2	2	2
PO8	Ethics		2		2	2	2
PO9	Individual and Team work	3	2	2	3	2	2
PO10	Communication			2		2	2
PO11	Project Management and Finance	3	3	2	3	3	3
PO12	Life Long Learning		2	1	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	2	2	1	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	2	1	1	2
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	2	3	2	2	2

24155C73P REPAIR AND REHABILITATION OF STRUCTURES L T P C
3 1 0 4

UNIT I MAINTENANCE AND REPAIR STRATEGIES 9

Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration

UNIT II SERVICEABILITY AND DURABILITY OF CONCRETE 11

Quality assurance for concrete construction concrete properties- strength, permeability, thermal properties and cracking. - Effects due to climate, temperature, chemicals, corrosion – design and construction errors - Effects of cover thickness and cracking

UNIT III MATERIALS FOR REPAIR 9

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete.

UNIT IV TECHNIQUES FOR REPAIR AND DEMOLITION 8

Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and drypack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection. Engineered demolition techniques for dilapidated structures-case studies

UNIT V REPAIRS, REHABILITATION AND RETROFITTING OF STRUCTURES 8

Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Denison Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991.
2. R.T.Allen and S.C.Edwards, Repair of Concrete Structures, Blakie and Sons, UK, 1987

REFERENCES

1. M.S.Shetty, Concrete Technology - Theory and Practice, S.Chand and Company, New Delhi, 1992.
2. Santhakumar, A.R., Training Course notes on Damage Assessment and repair in Low Cost Housing , "RHDC-NBO" Anna University, July 1992.
3. Raikar, R.N., Learning from failures - Deficiencies in Design, Construction and Service - R&D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
4. N.Palaniappan, Estate Management, Anna Institute of Management, Chennai, 1992.
5. Lakshmipathy, M. etal. Lecture notes of Workshop on "Repairs and Rehabilitation of Structures", 29 - 30th October 1999.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	2	2	3
PO2	Problem analysis	2	2	2	2	2	2
PO3	Design/development of solutions	3	3	3	3	3	3
PO4	Investigation	-	-	-	-	-	-
PO5	Modern Tool Usage	-	-	-	-	-	-
PO6	Engineer and Society	-	-	-	-	-	-
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	2	1	1	1	1	1
PO10	Communication	-	-	-	-	-	-
PO11	Project Management and Finance	-	-	-	-	-	-
PO12	Life Long Learning	1	1	1	1	1	1
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	-	1	1	-	-	1
PSO2	Critical analysis of Civil Engineering problems and innovation	-	1	-	1	2	1
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	-	1	2	-	2	2

24155P75P **PROJECT WORK** **L T P C**
0 0 20 10

COURSE OBJECTIVE:

- To develop the ability to solve a specific problem right from its identification and literaturereview till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

STRATEGY:

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team ofexaminers including one external examiner.

TOTAL: 300 PERIODS

COURSE OUTCOMES:

- On Completion of the project works students will be in a position to take up any challengingpractical problems and find solution by formulating proper methodology.

CO1 Identify civil engineering problems reviewing available literature.
CO2 Identify appropriate techniques to analyze complex civil engineering problems.
CO3 Apply engineering and management principles through efficient handling of Project have a clear idea of his/her area of work and they are in a position to carry out the work in a systematic way.

COs- PO's& PSO'sMAPPING

PO/PSO		**Course Outcome**			**Overall Correlation of Cos to POs**
		CO1	**CO2**	**CO3**	
PO1	Knowledge of Engineering Sciences	3	3	2	3
PO2	Problem analysis	1	3	2	2
PO3	Design/development of	1	1	2	1
	solutions				
PO4	Investigation	3	3		3
PO5	Modern Tool Usage				
PO6	Individual and Team work	3	3	2	3
PO7	Communication	2		2	2
PO8	Engineer and Society	2		2	2
PO9	Ethics	2		2	2
PO10	Environment and Sustainability	1	1	1	1
PO11	Project Management And Finance	1	1	1	1
PO12	Life Long Learning	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	3	1	3
PSO2	Critical analysis of Civil Engineering problems And innovation	3	3	1	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	3	3	1	3

LIST OF ELECTIVES
SEMESTER IV
HARD CORE ELECTIVE I

24155E44AP TOTAL STATION AND GPS SURVEYING L T P C
3 0 0 3

OBJECTIVE :

- To understand the working of Total Station equipment and solve the surveying problems.

UNIT I FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES 9

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying. Classification - applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies- Refractive index (RI) - factors affecting RI-Computation of group for light and near infrared waves at standard and ambient conditions-Computation of RI for microwaves at ambient condition - Reference refractive index- Real time application of first velocity correction. Measurement of atmospheric parameters- Mean refractive index- Second velocity correction -Total atmospheric correction- Use of temperature - pressure transducers.

UNIT II ELECTRO-OPTICAL AND MICROWAVE SYSTEM 9

Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments — Traversing and Trilateration-COGO functions, offsets and stake out-land survey applications.

UNIT III SATELLITE SYSTEM 9

Basic concepts of GPS - Historical perspective and development - applications - Geoid and Ellipsoid- satellite orbital motion - Keplerian motion — Kepler‘s Law - Perturbing forces - Geodetic satellite - Doppler effect - Positioning concept –GNSS, IRNSS and GAGAN - Different segments - space, control and user segments - satellite configuration — GPS signal structure - Orbitdetermination and representation - Anti Spoofing and Selective Availability - Task of control segment - GPS receivers.

UNIT IV GPS DATA PROCESSING 9

GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation — downloading the data RINEX Format — Differential data processing – software modules -solutions of cycle slips, ambiguities, Concepts of rapid, static methods with GPS - semi Kinematic and pure Kinematic methods -satellite geometry& accuracy measures - applications- long baseline processing- use of different softwares availablein the market.

UNIT V HYDROGRAPHIC, MINE AND CADASTRAL SURVEYING 9

Reconnaissance – Route surveys for highways, railways and waterways – Hydrographic survey-Tides — MSL — Sounding methods — Three point problem — River surveys — Measurement ofcurrent and discharge – Mine surveying Equipment – Weisbach triangle – Tunnel alignment andsetting out – Transfer of azimuth – Gyro Theodolite – Shafts and audits - Cadastral survey- Legal – Real – Taxcadastre – Land record system – Settlement procedure – deformation studies.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 1996
2. Satheesh Gopi, rasathishkumar, N.madhu, —— Advanced Surveying , Total Station GPSand Remote Sensing — Pearson education , 2007 isbn: 978-81317 00679

REFERENCES :

1. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.

2. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1993.
3. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin, 2003.
4. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004.Seeber G, Satellite Geodesy, Walter De Gruyter, Berlin, 1998

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	2	2	2	2	3	2
PO3	Design/development of solutions	2	3	2	3	3	3
PO4	Investigation	2	2	2	3	3	2
PO5	Modern Tool Usage	3	3	3	3	3	3
PO6	Engineer and Society	2	3	2	3	3	3
PO7	Environment and Sustainability						
PO8	Ethics						
PO9	Individual and Team work	1	1	1	1	2	1
PO10	Communication						
PO11	Project Management and Finance						
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

24155E44BP WATER RESOURCES ENGINEERING L T P C
3 1 0 4

AIM & OBJECTIVE:

The student is exposed to the different phases in Water Resources viz planning, collection of relevant data on water resources and also on National Water Policy. Reservoir planning, management and economic analysis aspects are covered in detail.

UNIT I GENERAL 9

Water resources survey – Water resources of India and Tamilnadu – Description of water resources planning – Economics of water resources planning, physical and socio economic data – National Water Policy – Collection of meteorological and hydrological data for water resources development.

UNIT I I INETWORK DESIGN 9

Hydrologic measurements – Analysis of hydrologic data – Hydrologic station network – Station network design – Statistical techniques in network design.

UNIT III WATER RESOURCE NEEDS 9

Consumptive and non-consumptive water use - Estimation of water requirements for irrigation, for drinking and navigation - Water characteristics and quality – Scope and aims of master plan - Concept of basin as a unit for development - Water budget and development plan.

UNIT IV RESERVOIR PLANNING AND MANAGEMENT 9

Reservoir - Single and multipurpose – Multi objective - Fixation of Storage capacity -Strategies for reservoir operation - Sedimentation of reservoirs - Design flood-levees and flood walls - Channel improvement.

UNIT V ECONOMIC ANALYSIS 9

Estimation of cost and Evaluation of Benefits - Discount rate - Discounting factors - Discounting techniques – Computer Applications.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Linsley R.K. and Franzini J.B, “Water Resources Engineering”, McGraw-Hill Inc, 2000.
2. Douglas J.L. and Lee R.R., “Economics of Water Resources Planning”, Tata McGraw-Hill Inc. 2000.
3. Duggal, K.N. and Soni, J.P., “Elements of Water Resources Engineering”, New Age International Publishers

REFERENCES

1. Chaturvedi M.C., “Water Resources Systems Planning and Management”, Tata McGraw-Hill Inc., New Delhi, 1997.
2. Goodman Alvin S., “Principles of Water Resources Planning”, Prentice-Hall, 1984.
3. Maass et al. Design of Water Resources Systems, Macmillan, 1968.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	-	2	3	3	3	3
PO3	Design/development of solutions	-	-	2	3	3	3
PO4	Investigation	-	-	-	-	3	3
PO5	Modern Tool Usage	-	-	2	3	3	3
PO6	Engineer and Society	-	3	2	3	3	3
PO7	Environment and Sustainability	-	-	-	2	-	2
PO8	Ethics	-	-	-	-	2	2
PO9	Individual and Team work		3	2	3	3	3
PO10	Communication	2	-	-	-	-	2
PO11	Project Management and Finance	-	2	3	2	3	3
PO12	Life Long Learning	3	2	2	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	2	1	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	2	2	3	3	3	3

24155E44CP **BUILDING TECHNOLOGY** **L T P C**
3 1 0 4

AIM & OBJECTIVE:

At the end of this course the students can expand his knowledge on site selection of sub structure and super structure, types , components of flooring and roofing and details about stair case.

UNIT I PRELIMINARY INVESTIGATION 9

Principles of planning – Planning regulations and bye-laws-site works and setting out – Excavations and timbering – Sub soil drainage – Electricity lighting on building sites – Winter building – Preparation of layout – Site plan – Orientation of buildings.

UNIT II SITE SELECTION AND SUB STRUCTURES 9

Site selection – Types of building as per NBC – Types of foundations – Shallow – Deep foundations – Machine foundation

UNIT III SUPER STRUCTURE 9

Stone and brick masonry – Composite masonry – Load bearing walls – Cavity walls – Partition walls – Reinforced brick masonry

UNIT IV FLOORING AND ROOFING 9

Ground floors – Components – Types – Suspended flooring – Upper floors – Types – Methods of laying – Type of roofs – Types of pitched roof – Shell roofs – Folded plate roofs – Constructional practices – Roof covering details.

UNIT V STAIRCASE AND SERVICES 9

Requirement of a good staircase – Type of staircase calculation for geometry – Ramps – Escalators lifts – Types – Handling capacity.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Arora, S.P. and Bindra, S.P., "Building construction Planning Techniques and Methods of Construction", Dhanpat Rai and Sons, 1997.
2. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain, "Building Construction", Laxmi Publications Pvt., Ltd., 1997.

REFERENCES

1. Chudley, "Construction Technology" Vol.1, 2, 3 and 4 ELBS Publisher, 1997.
2. National Building Code of India, Parts III, IV, VII and IX 1983.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	2	3	3	3	3
PO3	Design/development of solutions	3	2	3	3	3	3
PO4	Investigation	2	2	3	2	3	2
PO5	Modern Tool Usage	1	1	1	2	2	2
PO6	Engineer and Society	1	1	3	2	3	2
PO7	Environment and Sustainability	1	1	2	3	3	2
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	1	1	1	1	1	1
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	3	3	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	2	3	3	3	3

24155E44DP **PILE FOUNDATION** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- The student will be exposed to the design of piles, pile groups and caissons with respect tovertical and lateral loads for various field conditions**.**

UNIT I PILE CLASSIFICATIONS AND LOAD TRANSFER PRINCIPLE **9**

Necessity of pile foundation – classification of piles – Factors governing choice of type of pile – Load transfer mechanism – piling equipments and methods – effect of pile installation on soil condition – pile raft system – basic interactive analysis - criteria for pile socketing.

UNIT II AXIAL LOAD CAPACITY OF PILES AND PILE GROUPS **9**

Allowable load of piles and pile groups – Static and dynamic methods – for cohesive and cohesionless soil – negative skin friction – group efficiency – pile driving formulae - limitation – Wave equation application – evaluation of axial load capacity from field test results - Settlement ofpiles and pile group.

UNIT III LATERAL AND UPLIFT LOAD CAPACITIES OF PILES **9**

Piles under Lateral loads – Broms method, elastic, p-y curve analyses – Batter piles – response tomoment – piles under uplift loads – under reamed piles – Drilled shaft – Lateral and pull out capacity from load test

UNIT IV STRUCTURAL DESIGN OF PILE AND PILE GROUPS **9**

Structural design of pile – structural capacity – pile and pile cap connection – pile cap design – shape, depth, assessment and amount of steel – truss and bending theory- Reinforcement details ofpile and pile caps — pile subjected to vibration.

UNIT V CAISSONS **9**

Necessity of caisson – type and shape - Stability of caissons – principles of analysis and design – tilting of caisson – construction - seismic influences.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Explain the importance of pile foundation and various functions and responsibilities of geotechnical engineer and contractor, in addition to the piling equipments.

CO2 Determine the vertical load carrying capacity of pile and pile group- keeping the settlement ofpile as an important criteria based on field practices and codal provisions.

CO3 Apart from vertically loaded piles, the structures are exposed to the peculiar pile subjected tolateral and uplift load with reference to codal provision and case studies.

CO4 Understand the design of pile and pile caps, considering the wind and seismic loads.

CO5 Explain the importance of caisson foundation and checking the stability of caissons based oncodal provisions.

REFERENCES:

1. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWSPublishing, 1999.
2. Poulos, H.G., Davis, E.H., Pile foundation analysis and design, John Wiley and Sons, New York,1980.
3. Tomlinson, M.J. Foundation engineering, ELBS, Longman Group, U.K. Ltd., England 1995.
4. Michael Tomlinson and John Woodward, Pile design and construction practice, Taylor & FrancisGroup, London & New York, 2008.
5. Cernica, J.N. Geotechnical Engineering Foundation Design, John Wiley and Sons, Inc. 1995.
6. Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1996.
7. Donald, P., Coduto, Foundation Design Principles and Practices, Prentice Hall, Inc. EnglewoodCliffs, New Jersey, 1996.
8. Varghese P.C.," Foundation Engineering", PHI Learning Private Limited, New Delhi, 2005.
9. Reese,L.C., Isenhower,W.M. and Wang,S.T. Analysis and Design of Shallow and DeepFoundations, John Wiley and Sons, New York, 2005.

10. Varghese P.C.," Design of Reinforced Concrete Foundations", PHI Learning Private Limited,New Delhi, 2009.
11. Reese, L. C. and Van Impe, W. F., Single Piles and Pile Groups Under Lateral Loading, Taylorand Francis, London, 2011.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	1	2	2	1	2	2
PO2	Problem analysis	1	3	3	3	3	3
PO3	Design/development of solutions	1	3	3	3	2	3
PO4	Investigation	3	1	2	2	2	2
PO5	Modern Tool Usage	2	1	2	2	2	2
PO6	Engineer and Society	1		1		1	1
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	2	1	1	1	1	2
PO10	Communication	2	1	1	1	1	2
PO11	Project Management and Finance	1	1		1	1	1
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	2	2	3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	2	2	3	3	3

SEMESTER IV

HARD CORE ELECTIVE II

24155E54AP URBAN PLANNING AND DEVELOPMENT L T P C
3 0 0 3

OBJECTIVE:

- To enable students to have the knowledge on planning process and to introduce to thestudents about the regulations and laws related to Urban Planning.

UNIT I BASIC ISSUES 8

Definition of Human settlement, Urban area, Town, City, Urbanisation, Suburbanisation, Urban sprawl, Peri - urban areas, Central Business District (CBD), Classification of urban areas — Trend of Urbanisation at International, National, Regional and State level.

UNIT II PLANNING PROCESS 8

Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Surveys and Questionnaire Design.

UNIT III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION 10

Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development Control Rules, Transfer of Development Rights , Special Economic Zones- Development of small town and smart cities-case studies

UNIT IV PLANNING AND DESIGN OF URBAN DEVELOPMENT PROJECTS 9

Site Analysis, Layout Design, Planning Standards, Project Formulation — Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects.

UNIT V LEGISLATION, DEVELOPMENTAND MANAGEMENT OF URBAN SYSTEM 10

Town and Country Planning Act, Land Acquisition and Resettlement Act etc., Urban Planning Standards and Regulations, Involvement of Public, Private, NGO, CBO and Beneficiaries.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi2002
2. George Chadwick, A Systems view of planning, Pergamon press, Oxford 1978
3. Singh V.B, Revitalised Urban Administration in India, Kalpaz publication, Delhi, 2001
4. Edwin S.Mills and Charles M.Becker, Studies in Urban development, A World Bank publication, 1986

REFERENCES:

1. Tamil Nadu Town and Country Planning Act 1971, Government of Tamil Nadu, Chennai
2. Goel S.L., Urban Development and Management, Deep and Deep Publications, New Delhi,2002
3. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A publications, Chennai, 2005
4. CMDA, Second Master Plan for Chennai, Chennai 2008

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	2	3		3	3
PO2	Problem analysis	2				2	2
PO3	Design/development of solutions		3	3	2	1	2
PO4	Investigation		2		2	2	2
PO5	Modern Tool Usage				2		2
PO6	Engineer and Society	3	3	2		3	3
PO7	Environment and Sustainability	3	2	3	2	2	2
PO8	Ethics		2		2	2	2
PO9	Individual and Team work	3	2	2	3	2	2
PO10	Communication			2		2	2
PO11	Project Management and Finance	3	3	2	3	3	3
PO12	Life Long Learning		2	1	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	2	2	1	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	2	1	1	2
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	2	3	2	2	2

24155E54BP TRANSPORTATION ENGINEERING L T P C
3 1 0 4

OBJECTIVE

This course imparts the students knowledge of planning, design, construction and maintenance of railway tracks. The students acquire proficiency in the application of modern techniques such as GIS, GPS and remote sensing in Railway Engineering. The student develops skills on airport planning and design with the prime focus on runway and taxiway geometrics. Students become conversant with the definition, purpose, location and materials of coastal structures such as piers, breakwaters, wharves, jetties, quays and spring fenders. The students acquire knowledge on site investigation for location and planning of harbours.

UNIT I HIGHWAY PLANNING AND ALIGNMENT 9

History of road construction – Highway development in India – Jayakar committee Recomendations and realisations – Twenty year road development plans – Concepts of on-going highways development programmes at national level – Institutions for highway development at national level – India road congress – Highway research board, national highway authority of India – Ministry of Road Transport and Highway (MORTH) Central road research institute – Requirements of ideal alignment – Factors controlling highway alignment engineering surveys for alignment – Conventional methods and modern methods (Remote sensing, GIS and GPS techniques) – Classification and cross section of urban and rural roads – Highway cross sectional elements – Right of way, carriage way, camber, kerbs, shoulders and footpaths (IRC Standards) – Cross sections of different class of roads – Principles of highway financing.

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 9

Design of horizontal alignment – Horizontal curves super elevation – Widening of pavements on horizontal curves and transition curves design of vertical alignments – Rolling, limiting, exceptional and minimum gradients, summit and valley curves – Sight distances – Factors affecting sight distances – PIEV theory, stopping sight distance (SSD) – Overtaking sight distance – Sight distance at intersections – Intermediate sight distance and illumination sight distance [Derivations and problems in SSD and OSD] – Geometric design of hill roads [IRC Standards Only].

UNIT III FLEXIBLE AND RIGID PAVEMENTS 9

Rigid and flexible pavements – Components and their functions – Design principles of flexible and rigid pavements – Factors affecting the design of pavements – ESWL, climate, sub-grade soil and traffic – Design practice for flexible pavements (CBR method, IRC Method and Recommendations – Problems) – Design practice for rigid pavements – IRC Recommendations (concept only).

UNIT IV RAILWAY PLANNING AND DESIGN 12

Role of Indian Railways in National Development – Railways for Urban Transportation – LRT & MRTS. - Engineering Surveys for Track Alignment – Obligatory points Conventional and Modern methods (Remote Sensing, GIS & GPS, EDM and other equipments) - Permanent Way, its Components and their Functions: Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps and kinks -Sleepers – Functions, Materials, Density – Functions, Materials, Ballastless Tracks - Geometric Design of Railway Tracks – Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal and Vertical Curves.

TEXT BOOKS

1.Saxena Subhash C and Satyapal Arora, A Course in Railway Engineering, Dhanpat Rai and Sons, Delhi, 1998.

2.Khanna, K. and Justo, C.E.G., “Highway Engineering”, Khanna Publishers, 2001.

REFERENCES

1.Rangwala, Railway Engineering, Charotar Publishing House, 1995.

2.Rangwala, Airport Engineering, Charotar Publishing House, 1996.

3.Oza.H.P. and Oza.G.H., “A course in Docks & Harbour Engineering”. Charotar Publishing Co.1976

4.J.S. Mundrey, “A course in Railway Track Engineering”. Tata McGraw Hill, 2000

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	2	3
PO2	Problem analysis	1	3	1	2	2	2
PO3	Design/development of solutions	2	3	3	2	3	3
PO4	Investigation	1	2	2	2	3	2
PO5	Modern Tool Usage	3	1	1	3	2	2
PO6	Engineer and Society	2	3	1	2	2	2
PO7	Environment and Sustainability	3	3	3	3	2	3
PO8	Ethics	1	2	3	2	2	2
PO9	Individual and Team work	1	3	2	3	3	2
PO10	Communication	2	1	2	1	3	2
PO11	Project Management and Finance	2	3	3	3	2	3
PO12	Life Long Learning	1	1	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	2	2	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	2	3	3	2	3	3

24155E54CP GROUNDWATER ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the student to the principles of Groundwater governing Equations and Characteristics of different aquifers,
- To understand the techniques of development and management of groundwater.

UNIT I HYDROGEOLOGICAL PARAMETERS 9

Introduction — Water bearing Properties of Rock — Type of aquifers - Aquifer properties — permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation – GECnorms - Steady state flow - Darcy's Law - Groundwater Velocity —- Dupuit Forchheimer assumption – Steady Radial Flow into a Well

UNIT II WELL HYDRAULICS 9

Unsteady state flow - Theis method - Jacob method – Chow's method – Law of Times – Theis Recovery – Bailer method – Slug method - tests - Image well theory – Partial penetrations of wells-Well losses – Specific Capacity and Safe yield - Collector well and Infiltration gallery

UNIT III GROUNDWATER MANAGEMENT 9

Need for Management Model – Database for Groundwater Management – Groundwater balancestudy – Introduction to Mathematical model – Model Conceptualization – Initial and Boundary Condition — Calibration — Validation — Future Prediction — Sensitivity Analysis — Uncertainty —Development of a model

UNIT IV GROUNDWATER QUALITY 9

Ground water chemistry - Origin, movement and quality - Water quality standards – Drinking water,Industrial water — Irrigation water - Ground water Pollution and legislation - Environmental Regulatory requirements

UNIT V GROUNDWATER CONSERVATION 9

Artificial recharge techniques – Reclaimed wastewater recharge – Soil aquifer treatment (SAT) –Aquifer Storage and Recovery (ASR)Seawater Intrusion and Remediation – Ground water Basinmanagement and Conjunctive use – Protection zone delineation, Contamination source inventory and remediation schemes

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Understand aquifer properties and its dynamics
- Get an exposure towards well design and practical problems
- Develop a model for groundwater management.
- Students will be able to understand the importance of artificial recharge and groundwaterquality concepts
- Gain knowledge on conservation of groundwater.

TEXTBOOKS:

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, NewDelhi, 2010.
2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.

REFERENCES:

1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2002.
2. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	1	2	2	1	2
PO2	Problem analysis	2	-	3	3	3	3
PO3	Design/development of solutions	1	-	3	3	3	3
PO4	Investigation	3	2	2	3	3	3
PO5	Modern Tool Usage	3	2	3	2	2	2
PO6	Engineer and Society	2	2	3	1	2	2
PO7	Environment and Sustainability	2	3	2	2	1	2
PO8	Ethics	-	-	1	1	1	1
PO9	Individual and Team work	1	1	2	1	2	1
PO10	Communication	1	1	2	1	2	1
PO11	Project Management and Finance	2	2	3	2	3	2
PO12	Life Long Learning	1	1	2	1	2	1
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	3	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	2	3	3	2	3

24155E54DP HIGHWAY ENGINEERING L T P C
3 1 0 4

UNIT I HIGHWAY PLANNING AND ALIGNMENT 9

Tresaguet and Macadam's method of Road Construction, Highway Development in India - Jayakar Committee Recommendations and Realisations, Twenty-year Road Development Plans, Concepts of On-going Highway Development Programmes at National Level, Institutions for Highway Development at National level - Indian Roads Congress, Highway Research Board, National Highway Authority of India, Ministry of Road Transport and Highways (MORTH) and Central Road Research Institute.

Requirements of Ideal Alignment, Factors Controlling Highway Alignment Engineering Surveys for Alignment - Conventional Methods and Modern Methods (Remote Sensing, GIS and GPS techniques)Classification and Cross Section of Urban and Rural Roads (IRC), Highway Cross Sectional Elements – Right of Way, Carriage Way, Camber, Kerbs, Shoulders and Footpaths [IRC Standards], Cross sections of different Class of Roads.

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 9

Design of Horizontal Alignments – Super elevation, Widening of Pavements on Horizontal Curves and Transition Curves [Derivation of Formulae and Problems] Design of Vertical Alignments – Rolling, Limiting, Exceptional and Minimum Gradients, Summit and Valley Curves Sight Distances - Factors affecting Sight Distances, PIEV theory, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections, Intermediate Sight Distance and Illumination Sight Distance

UNIT III DESIGN OF RIGID AND FLEXIBLE PAVEMENTS 9

Rigid and Flexible Pavements- Components and their Functions, Design Principles of Flexible and Rigid Pavements, Factors affecting the Design of Pavements - ESWL, Climate, Sub-grade Soil and Traffic. Design Practice for Flexible Pavements [CBR method, IRC Method and Recommendations- Problems]. Design Practice for Rigid Pavements – Joints

UNIT IV HIGHWAY MATERIALS AND CONSTRUCTION PRACTICE 9

Desirable Properties and Testing of Highway Materials: - (Tests have to be demonstrated in Highway Engineering Laboratory) Soil – California Bearing Ratio Test, Field Density Test. Aggregate - Crushing, Abrasion, Impact Tests, Water absorption, Flakiness and Elongation indices and Stone polishing value test. Bitumen - Penetration, Ductility, Viscosity, Binder content and Softening point Tests. Construction Practice - Water Bound Macadam Road, Bituminous Road and Cement Concrete Road [as per IRC and MORTH specifications] Highway Drainage [IRC Recommendations]

UNIT V HIGHWAY MAINTENANCE 9

Types of defects in Flexible pavements – Surface defects, Cracks, Deformation, Disintegration – Symptoms, Causes and Treatments.Types of Pavement, Failures in Rigid Pavements – Scaling, Shrinkage, Warping, Structural Cracks Spalling of Joints and Mud Pumping – and Special Repairs. Pavement Evaluation – Pavement Surface Conditions and Structural Evaluation, Evaluation of pavement Failure and strengthening - Overlay design by Benkelman Beam Method [Procedure only], Principles of Highway Financing

Total: 60 Periods

TEXT BOOKS

1.Khanna K and Justo C E G, Highway Engineering, Khanna Publishers, Roorkee, 2001.

2.Kadiyali L R, Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi, 2000.

REFERENCES

1. IRC Standards (IRC 37 - 2001 & IRC 58 -1998)
2. Bureau of Indian Standards (BIS) Publications on Highway Materials
3. Specifications for Road and Bridges, MORTH (India)

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	2	2	3
PO2	Problem analysis	2	3	2	3	2	2
PO3	Design/development of solutions	2	3	3	3	1	2
PO4	Investigation	2	3	2	3	1	2
PO5	Modern Tool Usage	1	3	1	3	1	2
PO6	Engineer and Society	1	2	1	2	2	2
PO7	Environment and Sustainability	1	1	1	2	3	1
PO8	Ethics	1	2	2	2	3	2
PO9	Individual and Team work	2	3	2	2	1	2
PO10	Communication	2		3	3	1	2
PO11	Project Management and Finance	3	3	2	3	2	3
PO12	Life Long Learning	1	1	1	1	1	1
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	3	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	3	2	3	3	2	3

SEMESTER VI

HARD CORE ELECTIVE III

24155E64AP REMOTE SENSING AND GIS L T P C

3 1 0 4

UNIT I EMR AND ITS INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL 9

Definition of remote sensing and its components – Electromagnetic spectrum – Wavelength regions important for remote sensing – Wave theory, particle theory, stefan – Boltzman and Wein's displacement law atmospheric scattering, absorption – Atmospheric windows – Spectral signature concepts – Typical spectral reflective characteristics of water, vegetation, soil.

UNIT II PLATFORMS AND SENSORS 9

Types of platforms – Orbit types, sun synchronous and geosynchronous – Passive and active sensors – Resolution concepts – Payload description of important earth resources and meteorological satellites – Airborne and space borne TIR and microwave sensors – Types of data products.

UNIT III IMAGE INTERPRETATION AND ANALYSIS 9

Types of image interpretation – Visual interpretation keys – Basic elements of image interpretation – Digital image processing – Pre-processing – Image enhancement techniques – Multispectral image classification – Supervised and unsupervised.

UNIT IV GEOGRAPHIC INFORMATION SYSTEM 9

Introduction – Maps – Definitions – Map projections – Types of projections – Map analysis – GIS definition – Basic components of GIS – Standard GIS soft wares – Data type – Spatial and non spatial (attribute data) – Measurement scales – Data Base Management Systems (DBMS).

UNIT V DATA-ENTRY, STORAGE AND ANALYSIS 9

Data models: vector and raster – Data compression – Data input by digitization and scanning – Attribute data analysis and integrated data analysis – Modeling in GIS – Highway alignment studies – Land information system.

Total: 60 Periods

TEXT BOOKS

1 Thomas, L.M. and Ralph, K.W., "Remote Sensing and Image Interpretation ",John Wiley and Sons, 2002.

2. Anji Reddy, M., "Text Book of Remote Sensing and Geographical information Systems", 3rd Edition, BS Publications, 2006.

REFERENCES

1. Lo, C.P. and Yeung, A.K.W., "Concepts and Techniques of GIS", Prentice Hall of India Pvt. Ltd., 2002.

2. Burrough, P.A. and Rachael A.Mc. Donnell "Principles of GIS", Oxford University Press, 2006.

3. Lan Heywood, "An Introduction to GIS", Pearson Education Asia, 2000

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	2	2	2	2
PO2	Problem analysis				3	3	3
PO3	Design/development of solutions				2	2	2
PO4	Investigation				3	3	3
PO5	Modern Tool Usage				3	3	3
PO6	Engineer and Society					3	3
PO7	Environment and Sustainability				3	3	3
PO8	Ethics				3		3
PO9	Individual and Team work			3		3	3
PO10	Communication			3		3	3
PO11	Project Management and Finance				1	1	1
PO12	Life Long Learning				2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation				3	3	3
PSO3	Conceptualization and evaluation engineering solutions to Civil Engineering Issues	2	2	3	3	3	3

24155E64BP **CONCRETE STRUCTURES** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

- To acquire hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice using Computer Software Staad Pro, E-Tabs and any Structural design and analysis Software.

UNIT I INTRODUCTION AND CODES **9**

Geometric Parameters, Grade of concrete and steel for different elements, Exposure and cover requirements, Fire rating, Load Combinations, Serviceability Requirements, Analysis tools. Indian & International Codes for Reinforced concrete Design, Design loads, National Building Code 2016, Practical building example, drawing sizes and scale.

UNIT II LOADS ACTING ON STRUCTURES **9**

Introduction, Dead, Live loads, Wind loading and Calculations of - force coefficients, Wind pressure, storey forces and base shears. Earthquake loading and Calculations of - accelerationcoefficient, Time period, Base shear.

Scheme Design, Concrete floor systems, Sizing and design of various slab systems, Beams, Reinforced Concrete Columns - Location and Shape, Design Axial Load, sizing, Lateral LoadSystems, IS 1893- Requirements.

UNIT III MODELLING OF BASIC STRUCTURAL ELEMENTS **9**

Introduction to Analysis & Modelling, Modelling of Cantilever, Portal Frame, three bay Portal Frame, 3D structural models - Geometry, gravity loads, defining earthquake loads, defining windloads, Modelling Shear walls, Practical Structural Model of building, Structural models of Floor System, Estimation of deflections

UNIT IV DESIGN OF STRUCTURAL ELEMENTS **9**

Design of Beams- flexural reinforcement, shear reinforcement, Design of flat slabs- FlexuralReinforcement, shear reinforcement, Design of 2-way continuous slabs.

Design of Reinforcements in Columns, Post processing, Design and arrangement of verticalreinforcement, horizontal reinforcement in the design of buildings.

Design of shear walls - Sizing of elements based on Constructability aspects like formwork, concrete placement and compaction, rebar arrangement to satisfy economy and optimum utilisation.

UNIT V DETAILING OF STRUCTURAL ELEMENTS **9**

Development of Reinforcement, Typical details of- flat slabs, two-way continuous slabs, beams,columns and shear wall, detailing and documentation.

Case Studies : Structural analysis and design of a multi-storey building with load calculation (dead,live, wind and seismic) as per Indian standard codes using any Structural design and analysis Software.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will able to

CO1 Plan a layout of a structure
CO2 Calculate loads using IS codes and various computational tools
CO3 Analyse the structure for various loads and load combination according to the relevant IS codes
CO4 Design and Analysis of structures using computer software/tools
CO5 Prepare the complete structural drawings using computer software

REFERENCES:

1. Unnikrishna Pillai, S., Devdas Menon, “Reinforced Concrete Design”, Tata McGraw HillPublishing Company Ltd., 2009.
2. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India PrivateLimited, New Delhi, 2006.
3. Krishnaraju.N “ Design of Reinforced Concrete Structurres “, CBS Publishers & Distributors Pvt.Ltd., New Delhi.

4. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002.
5. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete",Laxmi Publication Pvt. Ltd., New Delhi, 2007.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	2	2	2	2
PO2	Problem analysis				3	3	3
PO3	Design/development of solutions				2	2	2
PO4	Investigation				3	3	3
PO5	Modern Tool Usage				3	3	3
PO6	Engineer and Society					3	3
PO7	Environment and Sustainability				3	3	3
PO8	Ethics				3		3
PO9	Individual and Team work			3		3	3
PO10	Communication			3		3	3
PO11	Project Management and Finance				1	1	1
PO12	Life Long Learning				2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation				3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	2	2	3	3	3	3

24155E64CP **AIRPORTS AND HARBOURS** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

- To introduce the students about airport planning, design, construction and planning designprinciples of seaport

UNIT I AIRPORT PLANNING **7**

Air transport characteristics - airport classification – ICAO - airport planning: Site selection typical Airport Layouts, Case Studies, parking and Circulation Area

UNIT II AIRPORT COMPONENTS **9**

Airport Classification, Planning of Airfield Components – Runway, Taxiway, Apron, Hangar-Passenger Terminals- Geometric design of runway and taxiways-Runway pavement Design- Difference between Highway and airport pavements- Introduction to various design methods-Airport drainage.

UNIT III AIRPORT DESIGN **10**

Runway Design: Orientation, Wind Rose Diagram, Problems on basic and Actual Length, GeometricDesign – Elements of Runway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings- Air Traffic Control Tower- Instrumental Landing.

UNIT IV SEAPORTS COMPONENTS AND CONSTRUCTION **10**

Definition of Basic Terms: Harbor, Port, Satellite Port, Docks- Dry and Floating Dock, Waves and Tides – Planning and Design of Harbors: Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins Floating LandingStage – Navigational Aids-Inland Water Transport.

UNIT V SEAPORT REGULATIONS AND EIA **9**

Wave action on Coastal Structures and Shore Protection and Reclamation – Coastal RegulationZone, 2011-EIA – methods of impact analysis and its process

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Gain an insight on the planning and site selection of Airport Planning and design.
CO2 Knowledge on Design of various Airport components
CO3 Analyze and design the elements for orientation of runways and passenger facility systems.
CO4 Understand the various features in Harbours and Ports, their construction, coastal protectionworks
CO5 Knowledge on various Environmental Regulations and Acts

TEXTBOOKS:

1. Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand and Bros,Roorkee,1994
2. Robert Honjeff and Francis X.Mckelvey, "Planning and Design of Airports", McGraw Hill, NewYork,1996 2. Richard De Neufille and Amedeo Odoni, "Airport Systems Planning and Design", McGraw Hill, New York,2003
3. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering,Scitech Publications(India), Chennai, 2010

REFERENCES:

1.Venkatramaiah. C., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels.,Universities Press (India) Private Limited, Hyderabad, 2015.
2.Mundrey J S, Railway Track Engineering, McGraw Hill Education (India) Private Ltd, NewDelhi, 2013.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences		3		3	3	3
PO2	Problem analysis	3	3	3	3	2	3
PO3	Design/development of solutions	3		3		3	3
PO4	Investigation	2	2	2	2	3	2
PO5	Modern Tool Usage	3	2	3	2		2
PO6	Engineer and Society		3		3		3
PO7	Environment and Sustainability	2	2	2	2	2	2
PO8	Ethics	3	1	3	1		3
PO9	Individual and Team work		2		2		2
PO10	Communication						
PO11	Project Management and Finance	1		1		1	1
PO12	Life Long Learning	2	2	2	2		2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation				3	3	3
PSO3	Conceptualization and evaluation engineering solutions to Civil Engineering Issues	2	2	3	3	3	3

24155E64DP AIR AND NOISE POLLUTION CONTROL ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE:

- To impart knowledge on the sources, effects and control techniques of air pollutants andnoise pollution.

UNIT I GENERAL **9**

Atmosphere as a place of disposal of pollutants – Air Pollution – Definition - Air Pollution and Global Climate - Units of measurements of pollutants - Air quality criteria - emission standards - National ambient air quality standards - Air pollution indices - Air quality management in India.

UNIT II SOURCES, CLASSIFICATION AND EFFECTS **9**

Sources and classification of air pollutants - Man made - Natural sources - Type of air pollutants - Pollution due to automobiles - Analysis of air pollutants - Chemical, Instrumental and biological methods.Air pollution and its effects on human beings, plants and animals - Economic effects of airpollution - Effect of air pollution on meteorological conditions - Changes on the Meso scale, Microscale and Macro scale.

UNIT III SAMPLING, METEOROLOGY AND AIR QUALITY MODELLING **9**

Sampling and measurement of particulate and gaseous pollutants - Ambient air sampling - Stack sampling. Environmental factors - Meteorology - temperature lapse rate and stability – Adiabatic lapse rate - Wind Rose - Inversion – Wind velocity and turbulence - Plume behavior - Dispersion ofair pollutants- Air Quality Modeling.

UNIT IV AIR POLLUTION CONTROL MEASURES **9**

Control - Source correction methods - Control equipments - Particulate control methods – Bag house filter - Settling chamber - cyclone separators - inertial devices - Electrostatic precipitator - scrubbers - Control of gaseous emissions - Absorption - Absorption equipments - adsorption and combustiondevices (Theory and working of equipments only).

UNIT V NOISE POLLUTION AND ITS CONTROL **9**

Sources of noise – Units and Measurements of Noise - Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – General Control Measures – Effects of noise pollution – auditory effects, non-auditory effects. Noise Menace– Prevention andControl of Noise Pollution – Control of noise at source, control of transmission, protection of exposed person - Control of other types of Noise Sound Absorbent

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Understand various types and sources of air pollution and its effects
CO2 Know the dispersion of air pollutants and their modeling
CO3 Know about the principles and design of control of particulate pollutants
CO4 Understand the principles and design of control of gaseous pollutant
CO5 Know the sources, effects and control of vehicular, indoor air and noise pollution

TEXTBOOKS:

1. C. S. Rao, “Environmental Pollution Control Engineering”, Wiley Eastern Limited, 2006.
2. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 2017
3. Dr. Y. Anjaneyulu, “Air Pollution and Control Technologies”, Allied publishers Pvt. Ltd., 2019.

REFERENCES:

1. Noel De Nevers, "Air pollution control Engineering", McGraw Hill International Edition,McGraw Hill Inc, New Delhi, 2000.
2. Air Pollution act, India, 1987
3. Peterson and E.Gross Jr., “Hand Book of Noise Measurement”, 7th Edition, 1974
4. Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986
5. Antony Milne, “Noise Pollution: Impact and Counter Measures”, David & Charles PLC, 1979.
6. Kenneth wark, Cecil F.Warner, “Air Pollution its Origin and Control”, Harper and RowPublishers, New York, 1998.

COs- PO's & PSO's MAPPING

CO	PO									PSO					
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3				3			2	1	2			2		
2	2			3		2						2	1	2	2
3	2		3		3		1				2		2	2	2
4	2		3		3		1				2		2	2	2
5	3	3	2	3	2					2			2		
AVg.	2	3	3	3	3			2	1	2	2	2	2	2	2

SEMESTER VII

HARD CORE ELECTIVE IV

24155E74AP	**PAVEMENT ENGINEERING**	**L T P C**
		3 0 0 3

OBJECTIVE:

- Student gains knowledge on various IRC guidelines for designing rigid and flexible pavements. Further, the student will be in a position to assess quality and serviceability conditions of roads.

UNIT I TYPE OF PAVEMENT AND STRESS DISTRIBUTIONON LAYERED SYSTEM 8

Introduction — Pavement as layered structure — Pavement types rigid and flexible. Resilient modulus - Stress and deflections in pavements under repeated loading.

UNIT II DESIGN OF FLEXIBLE PAVEMENTS 10

Flexible pavement design Factors influencing design of flexible pavement, Empirical – Mechanistic empirical and theoretical methods – Design procedure as per IRC guidelines – Design and specification of rural roads.

UNIT III DESIGN OF RIGID PAVEMENTS 9

Cement concrete pavements Factors influencing CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines – Concrete roads and their scope in India.

UNIT IV PERFORMANCE EVALUATION AND MAINTENANCE 10

Pavement Evaluation - Causes of distress in rigid and flexible pavements — Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance. Structural Evaluation by Deflection Measurements - Pavement Serviceability index, - Pavement maintenance (IRC Recommendations only).

UNIT V STABILIZATION OF PAVEMENTS 8

Stabilisation with special reference to highway pavements – Choice of stabilizers – Testing andfield control - Stabilisation for rural roads in India – Use of Geosynthetics in roads.

TEXTBOOKS:

1. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, "Highway Engineering", New Chandand Brothers, Revised 10th Edition, 2014.
2. Kadiyali, L.R., "Principles and Practice of Highway Engineering", Khanna tech.Publications, New Delhi, 2005.

REFERENCES:

1. Yoder, R.J. and Witchak M.W. "Principles of Pavement Design", John Wiley 2000.
2. Guidelines for the Design of Flexible Pavements,IRC-37–2001,The Indian roads Congress,New Delhi.
3. Guideline for the Design of Rigid Pavements for Highways, IRC 58-1998, The Indian RoadCongress, New Delhi.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	2	2	2	2
PO2	Problem analysis				3	3	3
PO3	Design/development of solutions				2	2	2
PO4	Investigation				3	3	3
PO5	Modern Tool Usage				3	3	3
PO6	Engineer and Society					3	3
PO7	Environment and Sustainability				3	3	3
PO8	Ethics				3		3
PO9	Individual and Team work			3		3	3
PO10	Communication			3		3	3
PO11	Project Management and Finance				1	1	1
PO12	Life Long Learning				2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation				3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	2	2	3	3	3	3

24155E74BP PREFABRICATED STRUCTURES L T P C
3 1 0 4

AIM & OBJECTIVE:

At the end of this course the student shall be able to appreciate modular construction, industrialised construction and shall be able to design some of the prefabricated elements and also have the knowledge of the construction methods using these elements.

UNIT I INTRODUCTION 9

Need for prefabrication – Principles – Materials – Modular coordination – Standardization – Systems – Production – Transportation – Erection.

UNIT II PREFABRICATED COMPONENTS 9

Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls

UNIT III DESIGN PRINCIPLES 9

Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

UNIT IV JOINT IN STRUCTURAL MEMBERS 9

Joints for different structural connections – Dimensions and detailing – Design of expansion joints.

UNIT V DESIGN FOR ABNORMAL LOADS 9

Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

TOTAL: 45 PERIODS

TEXT BOOKS

1. CBRI, Building materials and components, India, 1990
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994

REFERENCES

1. Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH,1971.
2. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	2	2	3
PO2	Problem analysis	3	2	2	2	2	2
PO3	Design/development of solutions	3	3	3	3	3	3
PO4	Investigation	1	1	1	1	1	1
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	1	1	1	1	1	1
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	2	2	2	2	2	2
PO9	Individual and Team work	1	1	1	1	1	1
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	1	3	3	2	3	1
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	1	2	2	2	2	2

24155E74CP TRAFFIC ENGINEERING AND MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVE

- To give an overview of Traffic engineering, various surveys to be conducted, trafficRegulation, management and traffic safety

UNIT I TRAFFIC SURVEYS AND ANALYSES 8

Traffic characteristics: Human, vehicular, and Pavement Characteristics, Problems- presentation of traffic volume data, Annual Average Daily Traffic, Average Daily Traffic, Design hourly traffic volume; Speed- spot speed, presentation of spot speed data, speed and delay studies, methods of conducting spot-speed studies and Speed and Delay studies; Problems Origin and Destination – methods of conducting the survey and presentation of data; parking surveys, presentation of data andanalyses, determination of parking demand; Accident studies and analyses; Different problems.

UNIT II TRAFFIC FLOW AND ROADWAY CAPACITY 8

Traffic Flow Characteristics – Basic traffic manoeuvres, Traffic stream flow characteristics, Speed- Flow- Density Relations; Passenger Car Units – Mixed traffic flow and related issues – Concept of PCU value- Factors affecting PCU values- Recommended PCU values for different conditions; Capacity and Level of Service – Factors affecting practical capacity – Design Service Volumes **UNIT III COST – EFFECTIVE TRAFFIC MANAGEMENT TECHNIQUES 10**

Traffic System Management: Regulatory Techniques- one way street, Reversible Street, Reversiblelane, Turning moment restrictions, closing streets; Traffic Control Devices – Traffic Signs – Road Markings, Traffic Signals, Miscellaneous traffic control devices; Traffic Segregation – Vehicle segregation, Pedestrian segregation, Traffic signals design; Bus Priority Techniques – Priority manoeuvres – With-flow bus lane and contra-flow bus lane; Self-Enforcing Techniques- Demand Management Techniques (TDM) Road pricing, parking control, Tolls, Staggering of office/educational institution hours.

UNIT IV DESIGN OF ROAD INTERSECTIONS 10

Importance and Classification; Intersections at-grade – uncontrolled, channelised; Rotary intersections (problems)- Signalised intersections (problems)- Grade Separated Intersections – meritsand demerits, types, pattern of intersections with different types of interchanges- Capacity, Concept diagrams.

UNIT V DESIGN OF PARKING AND PEDESTRIAN FACILITIES AND CYCLE TRACKS 9

Parking: Need for parking studies and its ill effects- Parking Standards for different land uses, different types of parking - Conceptual plans for different types of parking; **Pedestrians:** Importance, Barriers, Behaviour, Pedestrian facilities – Principles of planning, Level of Service (LoS), Design standards.; **Cycle Tracks:** Principles of design, Design criteria, Design standards forRural Expressways.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Apply the knowledge of science and engineering fundamentals in conducting traffic surveys, analyze the problems and relating it with standards

CO2 Understand the principles of traffic flow characteristics and their relationships

CO3 Understand various traffic management measures in addressing the demand Pricing and ITS applications.

CO4 Designing various types of control and regulatory measures to meet an efficient trafficnetwork.

CO5 Understand various type of facilities and plan for Non Motorised Transport

TEXT BOOKS:

1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2019.
2. Khanna .K and Justo C.E.G. and Veeraragavan, A Highway Engineering, Nem Chand Bros.,Roorkee, Revised 10th Edition, 2014.
3. Srinivasa Kumar, “Introduction to Traffic Engineering”, Universities Press, 2018

4. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI LearningPvt. Ltd., 2011.
5. Papacosta.P.S and Prevedouros.P.D, " Transportation Engineering and Planning, third edition,2015

REFERENCES

1. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on TrafficPlanning and Management.
2. Khanna S. K, and others, Highway Engineering, Nam Chand & Bros, Roorkee, 2014, Pages 177 –308.
3. C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
4. Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions, HargreenPublishing Company , 1998.
5. Salter. R.I and Hounsell N.B, Highway Traffic Analysis and design, Macmillan Press Ltd.1996.
6. Roger P.Roess, William R.Mcshane and Elena S.Prassas, Traffic Engineering-Second Edition,Prentice Hall Publishers,, Upper Saddle River, New Jersey 1998

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	2	2	2	2
PO2	Problem analysis				3	3	3
PO3	Design/development of solutions				2	2	2
PO4	Investigation				3	3	3
PO5	Modern Tool Usage				3	3	3
PO6	Engineer and Society					3	3
PO7	Environment and Sustainability				3	3	3
PO8	Ethics				3		3
PO9	Individual and Team work			3		3	3
PO10	Communication			3		3	3
PO11	Project Management and Finance				1	1	1
PO12	Life Long Learning				2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation				3	3	3
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	2	2	3	3	3	3

24155E74DP PRESTRESSED CONCRETE STRUCTURES L T P C
3 0 0 3

COURSE OBJECTIVE

- To understand the methods and types of prestressing and to enable the students to designprestressed concrete structural elements and systems

UNIT I INTRODUCTION – THEORY AND BEHAVIOUR **9**

Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept – Losses of prestress in post -tensioned and pre-tensioned members.

UNIT II DESIGN FOR FLEXURE AND SHEAR **9**

Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343 Code – Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for flexural capacity based on I.S. 1343 Code – Influence of Layout ofcables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear basedon I.S. 1343 Code.

UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE **9**

Factors influencing deflections – Short-term deflections of uncracked members – Prediction of long- term deflections due to creep and shrinkage – Check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and I.S.1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pre- tensioned beams– design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS **9**

Analysis and design of composite beams – Shrinkage strain and its importance – Differential shrinkage - Methods of achieving continuity in continuous beams – Analysis for secondary moments Concordant cable and linear transformation – Calculation of stresses – Principles of design.

UNIT V MISCELANEOUS STRUCTURES **9**

Role of prestressing in members subjected to Tensile forces and compressive forces – Design of Tension members and Compression members - Design of Tanks, Pipes, Sleepers and Poles – Partialprestressing – methods of achieving partial prestressing, merits and demerits of partial prestressing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Design a prestressed concrete beam accounting for losses.
CO2 Design for flexure and shear.
CO3 Design the anchorage zone for post-tensioned members and estimate the deflection in beams.
CO4 Design composite members and continuous beams.
CO5 Design water tanks, pipes, poles and sleepers.

TEXTBOOKS:

1. Krishna Raju N., "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, New Delhi,2012
2. Pandit.G.S. and Gupta. S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd,2014

REFERENCES:

1. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013
2. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2017
3. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2017

COs-PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	2	2	3
PO2	Problem analysis	3	2	2	2	2	2
PO3	Design/development of solutions	3	3	3	3	3	3
PO4	Investigation	1	1	1	1	1	1
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	1	1	1	1	1	1
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	2	2	2	2	2	2
PO9	Individual and Team work	1	1	1	1	1	1
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	1	3	3	2	3	1
PSO3	Conceptualization and evaluation f engineering solutions to Civil Engineering Issues	1	2	2	2	2	2