GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)

Coimbatore - 641 013

Curriculum For

B. E. Civil Engineering

(Part Time)

2023

Regulations

OFFICE OF THE CONTROLLER OF EXAMINATIONS
GOVERNMENT COLLEGE OF TECHNOLOGY
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GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE – 641 013

B.E. CIVIL ENGINEERING - PART TIME

2023 REGULATIONS - CURRICULUM

(Part Time Candidates admitted during 2023-2024 and onwards)

FIRST SEMESTER

Sl. No.	Subject Code	Course Title	CA Marks	End Sem. Marks	Total Marks	Hours/week			
						L	T	P	C
THEORY									
1	23PTC1Z1	Applied Mathematics – I (Common to CIVIL,MECH,EEE,ECE)	40	60	100	3	0	0	3
2	23PTC1Z2	Environmental Science and Engineering (Common to CIVIL,MECH,EEE,ECE)	40	60	100	3	0	0	3
3	23PTC103	Engineering Mechanics	40	60	100	3	0	0	3
4	23PTC104	Fluids Mechanics and Machinery (Common to CIVIL and MECH)	40	60	100	3	0	0	3
PRACTICAL									
5	23PTC105	Fluid Machines Laboratory	60	40	100	0	0	3	1.5
TOTAL					**500**				**13.5**

SECOND SEMESTER

Sl. No.	Subject Code	Course Title	CA Marks	End Sem. Marks	Total Marks	Hours/week			
						L	T	P	C
THEORY									
1	23PTC201	Construction Materials	40	60	100	3	0	0	3
2	23PTC202	Plane and Geodetic Surveying	40	60	100	3	0	0	3
3	23PTC203	Strength of Materials	40	60	100	3	0	0	3
4	23PTC204	Engineering Geology	40	60	100	3	0	0	3
PRACTICAL									
5	23PTC205	Materials Testing Laboratory	60	60	100	0	0	3	1.5
TOTAL					**500**				**13.5**

THIRD SEMESTER

Sl. No.	Subjec tCode	Course Title	CA Marks	End Sem Marks	Total Marks	Hours/week			
						L	T	P	C
THEORY									
1	23PTC301	Construction Technology	40	60	100	3	0	0	3
2	23PTC302	Water Supply Engineering	40	60	100	3	0	0	3
3	23PTC303	Basic Structural Design - I (Steel)	40	60	100	3	0	0	3
4	23PTC304	Geotechnical Engineering - I	40	60	100	3	0	0	3
PRACTICAL									
5	23PTC305	Soil Mechanics Laboratory	60	40	100	0	0	3	1.5
TOTAL					**500**				**13.5**

FOURTH SEMESTER

Sl. No.	Subject Code	Course Title	CA Marks	End Sem. Marks	Total Marks	Hours/week			
						L	T	P	C
THEORY									
1	23PTC401	Theory of Structures - I	40	60	100	3	0	0	3
2	23PTC402	Concrete Technology	40	60	100	3	0	0	3
3	23PTC403	Basic Structural Design - II (Concrete)	40	60	100	3	0	0	3
4	23PTC404	Wastewater Engineering	40	60	100	3	0	0	3
5	23PTC405	Geotechnical Engineering - II	40	60	100	3	0	0	3
TOTAL					**500**				**15**

FIFTH SEMESTER

Sl. No.	Subject Code	Course Title	CA Marks	End Sem. Marks	Total Marks	Hours/week			
						L	T	P	C
THEORY									
1	23PTC501	Theory of Structures - II	40	60	100	3	0	0	3
2	23PTC502	Construction Engineering and Management	40	60	100	3	0	0	3
3	23PTC503	Concrete Structures	40	60	100	3	0	0	3
4	23PTC504	Estimation and Quantity surveying	40	60	100	3	0	0	3
5	E1	Elective I	40	60	100	3	0	0	3
		TOTAL			**500**				**15**

SIXTH SEMESTER

Sl. No.	Subject Code	Course Title	CA Marks	End Sem. Marks	Total Marks	Hours/week			
						L	T	P	C
THEORY									
1	23PTC601	Water Resources Engineering	40	60	100	3	0	0	3
2	23PTC602	Design and Detailing of Irrigationand Environmental Engineering Structures	40	60	100	3	0	0	3
3	23PTC603	Highway and Railway Engineering	40	60	100	3	0	0	3
4	23PTC604	Prestressed Concrete Structures	40	60	100	3	0	0	3
5	E2	Elective II	40	60	100	3	0	0	3
TOTAL					**500**				**15**

SEVENTH SEMESTER

Sl. No.	Subject Code	Course Title	CA Marks	End Sem. Marks	Total Marks	Hours/week			
						L	T	P	C
THEORY									
1	23PTC701	Design and Detailing of Concrete and Steel Structures	40	60	100	3	0	0	3
2	23PTC702	Air pollution Management	40	60	100	3	0	0	3
3	23PTC703	Town Planning and Architecture	40	60	100	3	0	0	3
4	E3	Elective III	40	60	100	3	0	0	3
PRACTICAL									
5	23PTC704	Software Application Laboratory	60	40	100	0	0	3	1.5
TOTAL					**500**				**13.5**

EIGHTH SEMESTER

Sl. No.	Subject Code	Course Title	CA Marks	End Sem. Marks	Total Marks	Hours/week			
						L	T	P	C
THEORY									
1	23PTC801	Professional Practices, Ethics and Building Bye-Laws	40	60	100	3	0	0	3
2	23PTC802	Housing Planning and Management	40	60	100	3	0	0	3
3	E4	Elective IV	40	60	100	3	0	0	3
PRACTICAL									
4	23PTC803	Project Work	100	100	200	0	0	6	3
TOTAL					**500**				**12**

Total Credits : 111

LIST OF ELECTIVE SUBJECTS

FIFTH SEMESTER

ELECTIVE 1

Sl. No.	Subject Code	Course Title	CA Marks	End Sem. Marks	Total Marks	Hours/week			
						L	T	P	C
1	23PTC5E1	Industrial Wastewater Management	40	60	100	3	0	0	3
2	23PTC5E2	Sustainable Engineering and Technology	40	60	100	3	0	0	3
3	23PTC5E3	Traffic Engineering and management	40	60	100	3	0	0	3
4	23PTC5E4	Hydrology	40	60	100	3	0	0	3
5	23PTC5E5	Safety In Civil Engineering Practices	40	60	100	3	0	0	3

SIXTH SEMESTER

ELECTIVE 1I

Sl. No.	Subject Code	Course Title	CA Marks	End Sem. Marks	Total Marks	Hours/week			
						L	T	P	C
1	23PTC6E1	Fundamentals of Remote Sensing and GIS Applications	40	60	100	3	0	0	3
2	23PTC6E2	Energy Conservation Techniques in Construction	40	60	100	3	0	0	3
3	23PTC6E3	Maintenance And Rehabilitation of Structures	40	60	100	3	0	0	3
4	23PTC6E4	Experimental Stress Analysis	40	60	100	3	0	0	3
5	23PTC6E5	Pavement Engineering	40	60	100	3	0	0	3

SEVENTH SEMESTER

ELECTIVE 1II

Sl. No.	Subject Code	Course Title	CA Marks	End Sem. Marks	Total Marks	Hours/week			
						L	T	P	C
1	23PTC7E1	Advanced Concrete Design	40	60	100	3	0	0	3
2	23PTC7E2	Smart Materials and Smart Structures	40	60	100	3	0	0	3
3	23PTC7E3	Airport, Docks and Harbour Engineering	40	60	100	3	0	0	3
4	23PTC7E4	IOT Platform for smart city planning	40	60	100	3	0	0	3
5	23PTC7E5	Irrigation Engineering and Hydraulic Structures	40	60	100	3	0	0	3

EIGHTH SEMESTER

ELECTIVE 1V

Sl. No.	Subject Code	Course Title	CA Marks	End Sem. Marks	Total Marks	Hours/week			
						L	T	P	C
1	23PTC8E1	Basics of Dynamics and Aseismic design of Structures	40	60	100	3	0	0	3
2	23PTC8E2	Ground Improvement Techniques	40	60	100	3	0	0	3
3	23PTC8E3	Prefabricated Structures	40	60	100	3	0	0	3
4	23PTC8E4	Bridge Engineering	40	60	100	3	0	0	3
5	23PTC8E5	Environmental Management	40	60	100	3	0	0	3

23PTC1Z1	APPLIED MATHEMATICS - I *(Common to CIVIL, MECH, EEE, ECE Branches)*	SEMESTER I			
PREREQUISITES		**L**	**T**	**P**	**C**
NIL		**3**	**0**	**0**	**3**
Course Objectives	This course mainly deals with topics such as linear algebra, single variable calculus and numerical methods and plays an important role in the understanding of engineering science.				
UNIT – I	**LINEAR ALGEBRA**				**9 Periods**
Consistency of System of Linear Equations, Eigenvalues and eigenvectors, Diagonalization of matrices by orthogonal transformation, Cayley-Hamilton Theorem, Quadratic form to canonical forms.					
UNIT – II	**DIFFERENTIAL CALCULUS**				**9 Periods**
Radius of curvature, Centre of curvature, Circle of curvature , Evolutes of a curve, Envelopes					
UNIT – III	**INTEGRAL CALCULUS**				**9 Periods**
Evaluation of definite and improper integrals, Applications: surface area and volume of revolution (Cartesian coordinates only).					
UNIT – IV	**NUMERICAL SOLUTION OF EQUATIONS**				**9 Periods**
Algebraic and Transcendental equation: Fixed point iteration method, Bisection method, Newton-Raphson method, Simultaneous equation: Gauss elimination method, Gauss-Jordan method, Gauss Seidal method.					
UNIT – V	**NUMERICAL INTERPOLATION**				**9 Periods**
Equal interval: Newton's forward and Backward difference interpolation formulae, Gauss forward and Backward difference interpolation formulae, Unequal interval: Lagrange's interpolation, Newton's divided difference interpolation.					
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 60 Periods**					

TEXT BOOK

1	*VeerarajanT., **"Engineering Mathematics I"**, Tata McGraw-Hill Education(India)Pvt. Ltd, New Delhi,2015.*
2	*P. Kandasamy, K. Thilagavathy, K. Gunavathi, **"Numerical Methods"**, S. Chand & Company, 3rd Edition, Reprint 2013.*

REFERENCES

1	*B.S.Grewal, **"Higher Engineering Mathematics"**, Khanna Publishers, 44th Edition, 2017.*
2	*David C.Lay, **"Linear Algebra and Its Application"**, Pearson Publishers, 6th Edition, 2021.*
3	*Howard Anton, **"Elementry Linear Algebra"**, 11th Edition, Wiley Publication, 2013.*
4	*Narayanan.S and Manicavachagom Pillai. T.K. – **"Calculas Vol I and Vol II",** S.chand & Co, Sixth Edition, 2014.*
5	*S.S. Sastry, **"Introductory methods of numerical analysis"**, PHI, New Delhi, 5th Edition, 2015.*
6	*Ward Cheney, David Kincaid, **"Numerical Methods and Computing",** Cengage Learning, Delhi, 7th Edition 2013.*
7	*Jain R.K. and Iyengar S.R.K., - **"Advanced Engineering Mathematics"**, Narosa Publicaitons, Eighth Edition, 2012.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Use the essential tool of matrices and linear algebra in a comprehensive manner.	K3
CO2	Explain the fallouts of circle of curvature, evolute and envelops that is fundamental to application of analysis to Engineering problems.	K3
CO3	Interpret the integral calculus to notions of definite and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.	K3
CO4	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to polynomial and transcendental equations.	K3
CO5	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations.	K3

23PTC1Z2	ENVIRONMENTAL SCIENCE AND ENGINEERING *(Common to CIVIL, MECH, EEE, ECE)*	**SEMESTER I**

PREREQUISITES	**L**	**T**	**P**	**C**
NIL	**3**	**0**	**0**	**3**

Course Objectives	The course is aimed at creating awareness among the students and also inseminates the critical ideas of preserving environment.

UNIT – I	**ENVIRONMENTAL ENERGY RESOURCES**	**9 Periods**

Food-effects of modern agriculture, fertilizers, pesticides, eutrophication & biomagnifications-Energy resources: renewable resources - Hydro Energy, Solar & Wind. Non-renewable resources – Coal and Petroleum - harnessing methods.

UNIT – II	**ECO SYSTEM AND BIODIVERSITY**	**9 Periods**

Eco system and its components - biotic and abiotic components. Biodiversity: types and values of biodiversity, hot spots of biodiversity, endangered and endemic species, conservation of biodiversity: In situ and ex situ conservation. Threats to biodiversity-destruction of habitat, habit fragmentation, hunting, over exploitation and man-wildlife conflicts. The IUCN red list categories.

UNIT – III	**ENVIRONMENTAL POLLUTION**	**9 Periods**

Air pollution, classification of air pollutants – sources, effects and control of gaseous pollutants SO_2, NO_2, H_2S, CO, CO_2 and particulates. Water pollution - classification of water pollutants, organic and inorganic pollutants, sources, effects and control of water pollution. Noise pollution - decibel scale, sources, effects and control.

UNIT – IV	**ENVIRONMENTAL THREATS**	**9 Periods**

Global warming-measure to check global warming - impacts of enhanced Greenhouse effect, Acid rain- effects and control of acid rain, ozone layer depletion- effects of ozone depletion, disaster management - flood, drought, earthquake and tsunami.

UNIT – V	**SOCIAL ISSUES AND ENVIRONMENT**	**9 Periods**

Water conservation, rain water harvesting, e-waste management, Pollution Control Act, Wild life Protection Act. Population growth - exponential and logistic growth, variation in population among nations, population policy. Women and Child welfare programs. Role of information technology in human and health, COVID-19 - effects and preventive measures.

Contact Periods:
Lecture:45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total:45 Periods**

TEXT BOOK:

1	*Sharma J.P., **"Environmental Studies"**, 4th Edition, University Science Press, New Delhi 2016.*
2	*AnubhaKaushik and C.P.Kaushik**, "Environmental Science and Engineering"**, 7th Edition, New age International Publishers, New Delhi, 2021.*

REFERENCES:

1	*A k de, **"Environmental Chemistry"**, eight edition, new age international publishers, 2017.*
2	*G. Tyler miller and scott e. Spoolman, **"Environmental Science"**, cengage learning indiapvt, ltd, delhi, 2014.*
3	*ErachBharucha, **"Textbook of Environmental Studies"**, Universities Press(I) Pvt, Ltd, Hydrabad, 2015.*
4	*Gilbert M.Masters**, "Introduction to Environmental Engineering and Science"**, 3rd Edition, Pearson Education, 2015.*

COURSE OUTCOMES: upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Recognize and understand about the various environmental energy resources and the effective utility of modern agriculture.	K2
CO2	Acquire knowledge about the interaction of biosphere with environment and conservation methods of bio diversity.	K2
CO3	Be aware of the sources of various types of pollution, their ill effects and preventive methods.	K2
CO4	Identify and take the preventive measures to control the environmental threats and effects of Global warming, Ozone depletion, Acid rain, and natural disasters.	K2
CO5	Demonstrate an idea to save water and other issues like COVID -19.	K2

23PTC103	ENGINEERING MECHANICS	SEMESTER I

PREREQUISITES :	L	T	P	C
NIL	3	0	0	3

Course Objectives	To expose the students to use the basic principles of mechanics in engineering applications.

UNIT – I	BASIC CONCEPTS OF FORCES	9 Periods

Basic Concepts and Principles of Forces – Laws of Mechanics – System of forces in Plane – Free body Diagrams - resultant of a force system – resolution and composition of forces – Lami's theorem – moment of a force – physical significance of moment - Varignon's theorem – resolution of a force and couple system– forces in space – addition of concurrent forces in space – equilibrium of a particle in space.

UNIT – II	STATIC AND DYNAMIC FRICTION	9 Periods

Frictional resistance – classification of friction- laws of friction – coefficient of friction-angle of friction – angle of repose — cone of friction – advantages - equilibrium of a body on a rough inclined plane – ladder friction – rope friction – wedge friction.

UNIT – III	PROPERTIES OF SECTION	9 Periods

Centroid and Centre of Gravity for simple & Composite sections – theorems of moment of inertia Determination of moment of inertia of various sections – Product of Inertia – Principal moment of inertia of plane areas.

UNIT – IV	BASICS OF DYNAMICS - KINEMATICS	9 Periods

Kinematics and kinetics – displacements, velocity and acceleration - Equations of motion – Rectilinear motion of a particle with uniform velocity, uniform acceleration, varying acceleration – motion under gravity – relative motion – curvilinear motion of particles – projectiles– angle of projection – range – time of flight and maximum height.

UNIT – V	BASICS OF DYNAMICS - KINETICS	9 Periods

Newton's second law of motion – linear momentum – D'Alembert's principle, Dynamic equilibrium – equation of particles - principle of work and energy – law of conservation of energy – Principle of impulse and momentum – Equations of momentum – Laws of conservation of momentum. Impact – Time of compression, restitution, collision – Co-efficient of restitution – types of impact – collision of elastic bodies by direct central impact and oblique impact – collision of small body with a massive body – Kinetic energy of a particle.

Contact Periods:
Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

TEXT BOOK:

1	*F.B. Beer and E.R. Johnson, **"Vector Mechanics for Engineers"**, Tata Mc.Graw Hill Pvt Ltd,11th Edition, 2013.*
2	*Rajasekaran S & Sankara Subramanian, **"Fundamentals of Engineering Mechanics"**, Vikas Publishing House Pvt Ltd. 3rd Edition, 2017.*

REFERENCES:

1	*S. Timoshenko and Young, **"Engineering Mechanics",** McGraw Hill, 4th Edition, 2017.*
2	*Bansal R.K, **"A Text Book of Engineering Mechanics"**, Laxmi Publications, 2015.*
3	*R.C. Hibbeller, **"Engineering Mechanics",** Prentice Hall of India Ltd, 14th Edition, 2017.*
4	*Dr.N.Kottiswaran **"Engineering Mechanics"** Sri Balaji Publications,2017.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Familiarize the principles and Concepts of Mechanics	K3
CO2	Calculate the friction force acting on a plane under various conditions.	K2
CO3	Determine the centre of gravity and moment of inertia for different sections.	K2
CO4	Predict the Rectilinear and curvilinear motion of particles.	K3
CO5	Evaluate the dynamics of particles using kinetic principles.	K3

23PTC104	FLUID MECHANICS AND MACHINERY	SEMESTER I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	To impart knowledge on properties and behaviour of fluid at static and dynamic conditions and also study the performance of turbines and pumps

UNIT – I	**BASIC CONCEPTS AND FLUID STATICS**	**9 Periods**

Dimensions and Units - Properties of fluids - Density, specific gravity, viscosity, surface tension, capillarity, elasticity, compressibility, vapour Pressure - Fluid statics – Pascal's Law - Pressure measurement - Piezometer and Manometers – Hydrostatic forces on plane and curved surfaces

UNIT – II	**FLUID KINEMATICS AND DYNAMICS**	**9 Periods**

Classification of fluid flow – Continuity equation - one dimensional and three dimensional –Velocity potential and stream functions - Energy equation – Euler's and Bernoulli's equation – Applications - Venturimeter, Orifice meter and Pitot tube

UNIT – III	**FLOW THROUGH CONDUITS AND BOUNDARY LAYER CONCEPT**	**9 Periods**

Laminar flow between parallel plates – laminar flow in pipes - Hagen Poiseuille equation for flow through circular pipes - Turbulent flow in pipes – Darcy - Weisbach formula for flow through circular pipes - Boundary layer - Definition - Boundary layer thickness - Displacement, energy and momentum thickness

UNIT – IV	**MOMENTUM PRINCIPLE**	**9 Periods**

Impulse momentum Principle - impact of Jet – force exerted by a jet on normal, inclined and curved surfaces for stationary and moving vanes- Angular momentum principle - construction of velocity vector diagrams

UNIT – V	**HYDRAULIC TURBINES AND PUMPS**	**9 Periods**

Turbines - classification – construction – working principles and design of Pelton wheel and Francis Turbines – wok done and efficiency – specific speed – operating characteristics – Classification of pumps - Centrifugal pump - Work done and Efficiency

Contact Periods:
Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total:45 Periods**

TEXT BOOKS:

1	*P.N.Modi and S.M.Seth,* ***"Hydraulics and Fluid Mechanics, Including Hydraulic Machines"****, Standard Book House, New Delhi, 2019.*
2	*R.K.Bansal,* ***"Fluid Mechanics and Hydraulic Machines"****, Laxmi Publications (P) Ltd., New Delhi, 2018.*

REFERENCES:

1	*R.K.Rajput,* ***"A Text Book of Fluid Mechanics and Hydraulic Machines",*** *S.Chand and Company, New Delhi, 2015.*
2	*K.L.Kumar,* ***"Engineering Fluid Mechanics",*** *Eurasia Publishing House (P) Ltd., New Delhi, 2018.*
3	*Jagdish Lal,* ***"Fluid Mechanics & Hydraulic With Computer Applications",*** *Tata McGraw Hill, New Delhi, 2008.*
4	*M.K.Natarajan* ***"Principles of Fluid Mechanics"****, Anuradha Agencies, VidayalKaruppur, Kumbakonam, 2008.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Identify the properties of fluids and fluid statics	K2
CO2	Apply the continuity equation, Euler's equation and Bernoulli's equation for solving fluid flow problems.	K3
CO3	Examine the fluid flow behaviour for laminar and turbulent flows and also determine boundary layer thickness	K3
CO4	Apply the momentum principle for the determination of hydrodynamic forces	K3
CO5	Acquire knowledge in selection and design of turbines and pumps based on head and discharge requirements.	K3

23PTC105	FLUID MACHINES LABORATORY	SEMESTER I

PREREQUISITES	L	T	P	C
Mechanics of Fluids	0	0	3	1.5

Course Objectives	To impart knowledge in solving problems occurring in a pipes due to losses, the verification of bernoulli's theorem and its applications and conducting performance tests on different types of pumps and turbines.

LIST OF EXPERIMENTS:

1. Determination of Darcy's friction factor
2. Verification of Bernoulli's Theorem
3. Calibration of Venturimeter
4. Flow over V-Notches
5. Flow through Mouthpiece
6. Performance Study of Rotodynamic pumps
7. Performance Study of Positive displacement pumps
8. Load test on Pelton wheel, Francis turbine and Kaplan Turbine.

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Obtain the knowledge on conducting different type of experiments.	K2
CO2	Solve different problems in pipes due to losses.	K3
CO3	Verify the Bernoulli's theorem and its applications.	K3
CO4	Do performance tests on different types of pumps.	K3
CO5	Do performance tests on different types of turbines.	K3

23PTC201	CONSTRUCTION MATERIALS	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	To learn the testing procedures and applications of materials used for building construction.

UNIT – I	STONES, BRICKS AND TIMBER	9 Periods

Stone as building material – Tests on stones – Deterioration of stone work – Bricks – Classification – Manufacturing of bricks – Tests onbricks – Timber – Classification – Seasoning – Defects in Timber–Particle boards.

UNIT – II	LIME, CEMENT, AGGREGATES ANDMORTAR	9 Periods

Lime – Lime mortar – Cement –Manufacturing process –Bogue's Compounds – Types and Grades – Cement and Cement Mortar properties – Tests on Cement and Cement Mortar – Aggregates – Requirements of good aggregate –Classifications– Tests on aggregates.

UNIT – III	CONCRETE	9 Periods

Concrete – Ingredients – Manufacturing Process – Batching plants – Mixing – Transporting – Placing and Compaction of concrete – Curing and Finishing – MixDesignandProportion–Tests on fresh and hardened concrete – Destructive, Semi-destructive and Non-destructive Testing on Concrete.

UNIT – IV	OTHER CONSTRUCTIONMATERIALS	9 Periods

Steel – Types and Tests – Glass – Types and Applications – Floor Finish Materials –Roofing Materials–Paints and Varnishes – Constituents and types–Acoustic Materials –Pavement Materials – Water Proofing Materials –Sealants for joints.

UNIT – V	MODERN CONSTRUCTION MATERIALS	9 Periods

Composite Materials – Types and Applications–Fibre Reinforced Plastics – Polymer based building materials – Clay Products –Aluminum Products –Insulation Materials –Properties and Applications– Smart Materials –Sustainable building materials.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOK

1	*G.S.Birdie, T.D.Ahuja,* ***"Building Construction and Construction Materials",*** *Dhanpatrai publishing company, New Delhi, 2012.*
2	*Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain,* ***"Building Construction",*** *Laxmi Publications Pvt.Ltd., 2016.*

REFERENCES

1	*Varghese.P.C,* ***"Building Materials",*** *PHI Learning Pvt. Ltd, New Delhi, 2015.*
2	*Gambhir. M.L., &NehaJamwal.,* ***"Building Materials, Products, Properties and Systems",*** *Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012.*
3	*Sushil Kumar,* ***"Building Construction",*** *Standard Publications, New Delhi, 2016.*
4	*Shetty,M.S&Jain,A.K,* ***"Concrete Technology: Theory and Practice",****S.Chand and Company Ltd, New Delhi, 2019.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Examine and compare the properties of most common and advanced building materials.	K2
CO2	Identify the appropriate quality of lime, cement, and aggregates.	K2
CO3	Demonstratethe specifications, productionandtesting methodsof concrete.	K1
CO4	Recognize the characteristics and applications of construction materials.	K2
CO5	Select the suitable modern materials for construction.	K3

23PTC202	PLANE AND GEODETIC SURVEYING	SEMESTER II

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To understand the basic principle and concepts of different surveying methods to calculate various measurements using survey instruments.

UNIT – I	INTRODUCTION, LEVELLING AND CONTOURING	9 Periods

Definition- Principles - Classification – Field and Office work – Scales – Conventional Signs. Basic Terms - Types of Level – Fundamental Axes - Levelling staff – Bench Marks – Temporary and Permanent Adjustments – Types of Levelling - Curvature and Refraction correction –Reciprocal Levelling–Calculation of Areas and Volumes. Contouring– Characteristics and Uses of Contours –Methods of contouring.

UNIT – II	THEODOLITE SURVEYING	9 Periods

Theodolite–types–Terms-Temporary and Permanent Adjustments–Measurement of Horizontal Angles by Repetition and Reiteration – Closing Error and Distribution – Omitted measurements.

UNIT – III	CURVES AND HYDROGRAPHIC SURVEYING	9 Periods

Simple curves-Elements-Setting out of curves-Linear and angular methods.
Shore line survey–Sounding–Equipment– Methods of Locating.

UNIT – IV	TRIANGULATION	9 Periods

Triangulation-classification –Routine- Intervisibility -Signals and Towers.
Trigonometrical Levelling - Geodetical observations-Curvature correction- Refraction correction – Axis signal correction–Difference in elevation.

UNIT – V	MODERN SURVEYING INSTRUMENTS	9 Periods

Total Station-Principle-classification-working. Drone Surveying – Introduction - Applications. GPS-Developments –Basic Concepts–Segments –Applications. DGPS – Introduction.

Contact Periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOK:

1	*Punmia B.C, Ashok K Jain, Arun K Jain.* ***"Surveying, Vol. I &II"****, Lakshmi Publications, 2022.*
2	*Basak N.N,* ***"Surveying and Levelling"****, Tata McGraw-Hill, Publishing Company, 2nd edition, 2014.*

REFERENCES:

1	*Kanetkar.T.P, and Kulkarni.S.V,* ***"Surveying and Levelling, Vol. I & II"****, Pune Vidyarthi Griha Prakashan,2014.*
2	*Bhavikatti S.S,****"Surveying and Levelling, Vol.I&II"****, I.K. International Pvt. Ltd., 2016.*
3	*Duggal S.K****. "Surveying, Vol.I&II"****, Tata McGraw-Hill Publishing Company,2017.*
4	*Charles D Ghilani, Paul R Wolf.,* ***"Elementary Surveying"****, PrenticeHall,2012.*
5	*Chandra A.M.,* ***"Plane Surveying"****, New Age International Pvt. Ltd, 2015.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply different survey method, Interpret level data using different types of levelling techniques and plot contour map by various contouring methods.	K3
CO2	Determine the horizontal distances, vertical distances and area by using theodolite.	K3
CO3	Set out the curves using survey instruments and apply the principles of hydrographic surveying.	K3
CO4	Execute triangulation method, Trigonometric levelling to find horizontal distance, difference in elevation and area.	K3
CO5	Apply modern surveying principles and techniques in civil engineering applications.	K3

23PTC203	STRENGTH OF MATERIALS	SEMESTER II

PREREQUISITES	CATEGORY	L	T	P	C
ENGINEERING MECHANICS	ES	3	0	0	3

Course Objectives

- To learn the basics of shear and bending stresses and evaluate complex stress problems.
- To understand the behaviour of beams in bending and twisting.
- To impart knowledge on different methods of finding deflection of beam.
- To get the concepts on analysis of stresses in cylinders and columns.

UNIT – I **SIMPLE AND COMPLEX STRESSES** **9 Periods**

Simple Stresses: Axial Members - Deformation, strain, simple stress, Elastic constants - Compound Bars – Thermal Stresses

Compound Stresses: Two mutually Perpendicular direct stresses – Principal Planes and Principal Stresses –Two-Dimensional Stress System – Mohr's circle

UNIT – II **BEAMS** **9Periods**

Beams under bending: Beams and Bending – supports and loads - Shear Force and Bending Moment Diagrams for determinate beams – Relationship between rate of Loading, Shear Force and Bending Moment – Point of Contra Flexure.

Bending and shear stresses: Bending Stress – Combined Direct and Bending Stresses - Shearing stress.

UNIT – III **DEFLECTION OF BEAMS** **9 Periods**

Deflection of beams: Deflection Curve – Differential Equation – Double Integration Method – Macaulay's Method – Conjugate Beam Method.

UNIT – IV **TORSION AND CYLINDERS** **9 Periods**

Torsion: Torsion of Circular and Hollow Shafts –Elastic Theory of Torsion - Stresses and Deformation in Circular Solid and Hollow Shafts – Stepped Composite Shafts – Combined Bending Moment and Torsion on Shafts –Power Transmitted to a Shaft – Shafts in Series and Parallel.

Thin Cylinders: Hoop and Longitudinal stresses – Volumetric Strain.

UNIT – V **COLUMNS AND THEORIES OF ELASTIC FAILURE** **9 Periods**

Columns: Theory of Columns. - eccentric load – Slenderness Ratio – End Conditions – Buckling Load for Columns- Euler's Theory – Assumptions and Limitations – Rankine's Formula – Combined bending and axial load.

Theories of Elastic Failure: Failure theories – Factor of Safety – Graphical Representation of Theories for Two Dimensional Stress System.

Contact Periods: 45 Periods

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

TEXT BOOK

1	Rajput R.K**. "Strength of Materials (Mechanics of Solids"**, S.Chand & company Ltd., New Delhi, 7th edition, 2018.
2	Vaidyanathan.R, Perumal.P and Lingeswari.S, **"Mechanics of Solids and Structures, Volume I",** Laxmi Publications Pvt Ltd, Chennai, 2017.

REFERENCES

1	Ferdinand Beer, E.Russell Johnston and John Dewolf, **"Mechanics of Materials",** Mc Graw Hill Education, 2015
2	Daniel Schodek and Martin Bechthold, **"Structures",** Pearson India Education Services Pvt Ltd, 2015
3	Singh. D.K., **"Strength of Materials",** Ane Books Pvt Ltd., New Delhi, 2021.
4	Beer. F.P. & Johnston. E.R. **"Mechanics of Materials",** Tata McGraw Hill, 8th Edition, New Delhi 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Describe the fundamental concepts of stress, strain and principal stresses.	K2
CO2	Plot shear force and bending moment diagrams and determine bending stress distribution in beams.	K3
CO3	Determine the deflection of beams.	K3
CO4	Analyze the shaft subjected to twisting.	K3
CO5	Identify the stresses in cylinders, behavior of columns and theory of elastic failures.	K3

23PTC204	ENGINEERING GEOLOGY	SEMESTER II

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To understand the importance of geological knowledge such as earth, minerals, rocks and apply Geological Knowledge in projects such as dams, tunnels, bridge constructions.

UNIT – I	**GENERAL GEOLOGY**	**9 Periods**

Interrelationship between Geology and civil engineering – Branches of Geology – Earth Structure and composition –Geological processes – Weathering – work of rivers, sea, wind and their Engineering significance- Earthquakes –Earthquake Zones in India - Volcanoes – Ground water – Origin, Occurrence, Properties of rock – Geological work of ground water – Importance in Civil Engineering.

UNIT – II	**MINERALOGY**	**9 Periods**

Elementary knowledge on symmetry elements of important Crystallographic systems – Physical properties of minerals – Study of the following rock forming minerals – Quartz family, Felspar family, Augite, Hornblende, Biotite , Muscovite, Calcite, Garnet. Ore minerals - Haematite, Magnetite, Bauxite, Graphite, Magnesite – Clay minerals – Properties and Engineering significance.

UNIT – III	**PETROLOGY**	**9 Periods**

Formation and Classification of rocks and their distinctive properties – Description, Occurrence, Engineering properties and Distribution of the following rocks – Igneous rocks – Granite, Syenite, Diorite, Gabbro, Pegmatite, Dolerite and Basalt. Sedimentary rocks- Sandstone, Limestone, shale, Conglomerate, and Breccia – Metamorphic rocks – Quartzite, Marble, Slate, phyllite, Gneiss and schist.

UNIT – IV	**STRUCTURAL GEOLOGY**	**9 Periods**

Attitude of beds Dip and Strike - Uses of Clinometer compass – Outcrops – Geological maps – their uses – Structural features – Folds, Faults, Unconformities and Joints – their significance on engineering constructions.

UNIT – V	**GEOLOGICAL INVESTIGATIONS**	**9 Periods**

Geophysical investigations – Seismic and electrical resistivity methods – Aerial Photo and satellite imageries-Interpretation of remote sensing data-Exploration for ground water – Geological investigations pertaining to Dam and Reservoir, Tunnels and Road cuttings – Landslides – causes and prevention – Sea erosion and coastal protection**.**

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOK

1	*Parbin Singh,* ***"Engineering and General Geology"****, Eighth Revised Edition S.K.Kataria & Sons New Delhi. 2015*
2	*Varghese, P.C.,* ***"Engineering Geology for Civil Engineering"*** *PHI Learning Private Limited, New Delhi, 2012.*

REFERENCES

1	*F.G.Bell.* ***"Fundamentals of Engineering Geology"****, B.S. Publications. Hyderabad 2011*
2	*N. Chenna Kesavulu.* ***"Textbook of Engineering Geology"****, Macmillan India Ltd., 2009.*
3	*Venkatareddy. D.* ***"Engineering Geology"****, Vikas Publishing House Pvt. Ltd. 2010*
4	*KVGK Gokhale,* ***"Principles of Engineering Geology"****, BS Publications, Hyderabad 2011.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Understand the internal structure of earth and its relation to volcanism and the various geological agents.	K1,K2
CO2	Identify the properties and uses of Minerals.	K1
CO3	Understand the formation and Engineering properties of rocks.	K1,K2
CO4	Apply fundamental knowledge in structural geology like fault, fold and Joints	K1,K2
CO5	Knowledge in design and construction of major civil engineering structures.	K1,K2

23PTC205	MATERIALS TESTING LABORATORY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objectives	To deal with experimental determination and evaluation of mechanical characteristics and behaviour of construction materials and to familiarize experimental procedures and common measurement instruments, equipment and devices.

***LIST OF EXPERIMENTS**

1. Mechanical properties of tor steel rod as per IS Code 1786 (2008)
2. Weight per running metre of steel rod
3. Tension and compression test on springs.
4. Test on Bricks: Visual observation, Compression test, Water absorption test and Efflorescence test as per IS 3495-1 to 4 (1992)
5. Hardness test on different metals.
6. Deflection test on simply supported beams (for different metals).
7. Deflection test on cantilever beams (for different metals).
8. Bending test on rolled steel joist
9. Flexure test on tiles
10. Compression test on Hallow/Concrete Blocks

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: On completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Determine the tensile strength of materials	K3
CO2	Obtain bending properties of structural materials	K3
CO3	Determine the hardness properties of the materials	K3
CO4	Predict the compressive strength of the materials	K3

23PTC301	CONSTRUCTION TECHNOLOGY	SEMESTER III

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To learn the technologies and practices used for building construction.	
UNIT – I	**MASONRY AND PLASTERING**	**9 Periods**
Stone masonry – Brick masonry – Composite masonry – Types of wall – Arches – Lintels. Plastering – Materials – Methods of plastering –Types of plastering – Defects in plastering – Pointing.		
UNIT – II	**FLOORING AND ROOFING**	**9 Periods**
Floors – Floor finishing materials – Terrazzo flooring – Cement concrete flooring – Damp Proof Course – Causes and effects of dampness – Materials and Methods of damp proofing – Anti-termite treatment. Roofs – Roofing materials –Types – Pitched roof – Flat roof – Flat and Ribbed slab. Stairs and Staircases – Ramps and Escalators.		
UNIT – III	**DOORS,WINDOWS AND PAINTING**	**9 Periods**
Doors and Windows – Types – Fixtures and Fastening – Ventilators. Painting – Classification of paints – Painting on new and old surfaces of steel, timber and masonry wall.		
UNIT – IV	**CONSTRUCTION PRACTICES**	**9 Periods**
Centering and shuttering – Materials and Methods – Formwork – Insulating concrete formwork technique – Scaffolding – Plumbing Services – Erection of steel trusses – Frames – Launching girders – Tunneling Techniques.		
UNIT – V	**MODERN CONSTRUCTION TECHNIQUES**	**9 Periods**
Pre-Engineered/Precast flat panel system – Mivan Construction Technology – Modular Construction – Raised access flooring – Hybrid construction – Introduction to Automation in construction – Augmented Reality and Virtual Reality – Lean Construction – Digital Twins in Construction.		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXT BOOKS

1	*Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain,* ***"Building Construction",*** *Laxmi Publications Pvt.Ltd., 2016.*
2	*Rajesh Kumar K.,* ***"Construction Technology",*** *Jyothis Publishers, 2020.*

REFERENCES

1	*Subin K. Sarkar & Subhajit Saraswati,* ***"Construction Technology"****, OUP Higher Education Division, 2008.*
2	*Eric Fleming,* ***"Construction Technology – An Illustrated Introduction"****, Wiley publications, 2009.*
3	*E. Keith Blankenbaker,* ***"Construction and Building Technology",*** *G-W publishers, 2013.*
4	*Sushil Kumar,* ***"Building Construction",*** *Standard Publications, New Delhi, 2016.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Outline the different types of masonry and plastering works.	K2
CO2	Select the suitable type of floors, roofs, stairs and dampness preventing methods for practical applications.	K3
CO3	Choose suitable doors, windows and paints for buildings.	K3
CO4	Summarize the different construction practices existing in construction.	K2
CO5	Identify modern construction techniques used for construction field.	K2

23PTC302	WATER SUPPLY ENGINEERING	SEMESTER III

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To conversant with sources of water, demand of water, characteristics of water and Conveyance of Water. To expose the students to understand the design of water Treatment processes and distribution of water supply	
UNIT – I	**QUANTITY OF WATER AND SOURCES OF WATER**	**9 Periods**
Introduction of Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality.		
UNIT – II	**QUALITY OF WATER AND TRANSPORTATION**	**9 Periods**
Quality of water - sampling - Characterization – Significance – analysis of water – water borne diseases – quality standards of water as per IS 10500. Intakes – types – intake tower – Transportation of water – types of conduits – Hydraulics of pipe flow – design – materials of pressure pipes – pipe corrosion – Theories, effect and prevention – Laying, jointing and testing of pipe lines. Pumps – Types of pumps – pumping stations.		
UNIT – III	**WATER TREATMENT**	**9 Periods**
Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators, flash mixers, Coagulation and flocculation – Clarifloccuator - Plate and tube settlers - Pulsator clarifier – Rapid and slow sand filters - Disinfection - Residue Management – Construction, Operation and Maintenance of treatment units- Recent advances.		
UNIT – IV	**ADVANCED WATER TREATMENT**	**9 Periods**
Water softening - Desalination - R.O. Plant - demineralization – Adsorption - Ion exchange - Membrane Systems - RO Reject Management - Iron and Manganese removal –Fluoridation and Defluoridation - Construction , Operation and Maintenance of treatment units – Recent advances.		
UNIT – V	**WATER DISTRIBUTION SYSTEM**	**9 Periods**
Distribution of water - requirements of good distribution system - method of distribution system - layouts of distribution system - Requirements of water distribution – Components – Selection of pipe material – Service reservoirs – Functions – Network design – Analysis of distribution networks - Computer applications – Appurtenances – Leak detection. Principles of design of water supply in buildings – House service connection – Fixtures and fittings, systems of plumbing and types of plumbing.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total:45 Periods**		

TEXT BOOKS :

1	*Garg. S. K., **"Water Supply Engineering"**, Khanna Publishers, Delhi, 2014.*
2	*Punmia B.C, Jain A.K and Jain A.K, "**Water Supply Engineering**" Laxmi Publications, New Delhi 2014.*

REFERENCES :

1	*Dr. P.N. Modi., "**Water Supply Engineering Volume**" Rajson Publications, New Delhi, 2018.*
2	*D. Lal & A.K. Upadhyay, "**Water Supply and Waste Water Engineering**" S. K. Kataria & Sons, 2013*
3	*Mackenzie L Davis., "**Water and Waste Water Engineering Design Principles and Practice**", McGraw Hillbook education, 2010.*
4	***NPTEL "**Water and Waste Water Engineering**" by Dr.P.Bose , IIT Kanpur.***

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Recall the principles of water supply and characteristics of water.	K2
CO2	Examine quality of water and its design conveyance system	K2
CO3	Design various water treatment units.	K3
CO4	Choose advanced water treatments	K2
CO5	Plan and design distribution system of water	K3

23PTC303	BASIC STRUCTURAL DESIGN - I (STEEL)	SEMESTER III

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To design the tension and compression steel elements and their connections and to design the components of industrial buildings.

UNIT – I	SIMPLE STEELCONNECTIONS	9 Periods

Steel standard sections – properties – Introduction to Limit State Design. Bolted connections Types of bolts – permissible stresses for black bolt, HSFG bolts– Design of a bolt in single shear, double shear and bearing. Welded connections Principle of welding – weld symbols – types of welded joints – strength of fillet and butt weld – design of welded connections for lap and butt joint – detailing of weld.

UNIT – II	ECCENTRIC CONNECTIONS AND TENSION MEMBER	9 Periods

. Eccentric Connections: Bracket Connection Type I and Type II. Tension Members: design of simple and built up members subjected to tension – effective area of angle and Tee sections connected to Gussets –Tension splice – lug angle.

UNIT – III	COMPRESSION MEMBERS	9 Periods

Axially loaded columns – effective length of compression members –slenderness ratio –strength of compression members – design of columns – built up columns – design of lattices and battens – design of slab base – Gusseted base.

UNIT – IV	BEAMS	9 Periods

Introduction to plastic analysis - Beams - permissible bending stress - section classification– Design of laterally supported and unsupported simply supported beams – Design of built up beams –connection between flange plate and beam – need for lateral support of compression flange and design – strength of beams in shear.

UNIT – V	ROOF TRUSSES AND INDUSTRIAL BUILDINGS	9 Periods

Design of industrial building - roofing, cladding and wall material - structural components and framing - types of roof trusses - components - wind load estimation as per IS875 part 3 - design of purlins and wall girts using Channel and Angle sections.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1	*Duggal.S.K, "**Limit State Design of Steel Structures**", McGraw Hill Education India (P) Ltd, New Delhi, 2014.*
2	*Subramanian.N, **"Design of Steel Structures"**, Oxford University Press, New Delhi, 2016.*

REFERENCES:

1	*Gambhir M.L. **"Fundamentals of Structural Steel Design",** McGraw Hill Publications Pvt. Ltd, 2013.*
2	*B.C.Punmia, Ashok Kumar Jain and Arun kumar Jain, **"Design of Steel Structures**, Vol. I & II", Laxmi Publications (P) Ltd, 2014*
3	*IS: 800 – 2007, "**General Construction in Steel**" — Code of Practice*
4	*SP 6(I) – 1964, "**Handbook for Structural Engineers**".*
5	*IS 875- 2015**," Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Part 3 : Wind Loads"***

COURSEOUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Identify the different failure modes of bolted and welded connections and design connections subjected to axial load	K2
CO2	Analyse and design the eccentric connections and tension members	K3
CO3	Design compression members and bases.	K3
CO4	Design laterally supported and unsupported beams.	K3
CO5	Design the structural components of industrial buildings	K3

23PTC304	GEOTECHNICAL ENGINEERING - I	SEMESTER III

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To understand the physical and engineering characteristics of soil, evaluate stresses in soils, learn Compaction and Consolidation of soils and to determine the shear parameters of soil.	
UNIT – I	**BASIC PROPERTIES OF SOILS**	**9 Periods**
Origin and classification of soils-Soil deposits of India- Physical properties of soil – inter-relationship among the properties-Phase relations –Index properties- Soil classification system –Unified Soil classification system and IS Classification system-significance-simple field tests.		
UNIT – II	**STRESSES IN SOILS**	**9 Periods**
Soil water statics - effective and neutral stresses –effect of water table- Capillary phenomenon – stresses in soil from external loads – Boussinesq's theory– Newmark's chart - Approximate methods – Pressure bulb – Westergaard's equation.		
UNIT – III	**PERMEABILITY AND SEEPAGE**	**9 Periods**
One dimensional flow through soil – Permeability – Darcy's law – Laboratory and field methods – Factors influencing permeability – Flow through stratified soil – Seepage Analysis-Introduction, stream function and potential function-Seepage pressure – Quick sand condition – Two dimensional flow – Laplace equation – Flow net –Methods of construction - Electrical analogy– Properties – Applications – Sheet pile cutoff –flow through dams.		
UNIT – IV	**COMPACTION AND CONSOLIDATION**	**9 Periods**
Compaction – Laboratory tests – Factors affecting compaction – Field compaction methods – Compaction control. Consolidation – types- Laboratory test – Interpretation of consolidation test results-Determination of Cv by curve fitting methods – Terzaghi's theory of consolidation – Consolidation settlement-Maximum past stress, OCR – Pre-consolidation pressure – pressure void ratio relationship– Time factor – Time rate of consolidation.		
UNIT – V	**SHEAR STRENGTH**	**9 Periods**
Mohr's circle – Characteristics- Principal stresses- Mohr-Coulomb's strength criterion – Factors affecting shear strength – Types of shear tests– Direct shear – stress strain relationship- Triaxial compression– Drainage conditions – UCC –-Vane shear test.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Gopal Ranjan and Rao, A.S.R.,* ***"Basic and Applied Soil Mechanics",*** *New Age International Publishers, Third Edition, New Delhi, 2019.*
2	*Palanikumar, M.,* ***"Soil Mechanics"****, PHI Learning Pvt. Ltd., 2013.*

REFERENCES:

1	*Murthy, V.N.S.,* ***"Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering"****, CBS Publishers' 2018.*
2	*Braja M.Das and N.Sivakugan* ***"Introduction to Geotechnical Engineering",*** *Cengage Learning Second edition, 2015.*
3	*Muni Budhu ,* ***"Soil Mechanics and Foundations",*** *Wiley Publishers Third Edition, 2016.*
4	*Cudoto, D.P., Kitch W.A., and Yeung M.R.,* ***"Geotechnical Engineering: Principles and Practices",*** *Pearson India Education Services, 2018.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Identify different types of soils, perform laboratory experiments to assess the physical, engineering properties of soil and to classify the soil.	K2
CO2	Plot stress distribution diagrams and compute vertical stress due to various loading conditions.	K2
CO3	Evaluate the permeability and seepage through soils.	K2
CO4	Examine compaction process and interpret consolidation characteristics of soils.	K2
CO5	Determine graphically and analytically the shear stresses in any plane	K2

23PTC305	SOIL MECHANICS LABORATORY	SEMESTER III

PREREQUISITES	L	T	P	C
NIL	0	0	3	1.5

Course Objectives	To impart practical knowledge on testing of soil for various physical properties and to evaluate the engineering properties of the soil and determine the swell-shrink behaviour of soils.

LAB EXPERIMENTS / PROGRAMS

1. Moisture content determination

2. Specific gravity and relative density test for sand.

3. Sieve analysis for coarse grained soil.

4. Consistency limits.

5. Field density tests (Sand replacement method and core cutter method).

6. Permeability tests (Constant Head method and variable Head method).

7. Direct Shear test.

8. Unconfined compression test for Soil.

9. Vane Shear Test for Cohesive Soil.

10. Standard Proctor's Compaction Test.

11. Differential free swell tests.

12. Swell Pressure Test.

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Gain adequate knowledge on the physical properties and classify soil based on physical properties.	K2
CO2	Familiarize with the engineering properties of soil and classify soil based on the engineering properties of soil.	K2
CO3	Gain thorough knowledge on the swell characteristics of soils.	K3
CO4	Judge the suitability of soil for different types of foundations.	K3

23PTC401	THEORY OF STRUCTURES - I	SEMESTER IV			
PREREQUISITES		**L**	**T**	**P**	**C**
NIL		**3**	**0**	**0**	**3**

Course Objective	To demonstrate the fundamentals of analyzing various types of structures, cables, and suspension bridges; also, the influence line for beams, trusses, and arches will be explored.	
UNIT – I	**STATICALLY INDETERMINATE BEAMS**	**9 Periods**
Propped Cantilever Beams – Fixed Beams – Continuous Beams – Theorem of Three Moments – Calculation of reactions, Bending Moments and Shear Force – Shear Force and Bending Moment Diagrams (for all Types of Loadings, Couple)		
UNIT – II	**ENERGY METHODS**	**9 Periods**
Static and Kinematic Indeterminacy – Beams, Trusses and Frames –Equilibrium and Kinematic Stability — Energy principles – Strain energy and Complementary Energy – Principle of Virtual Work – Castigliano's First and Second Theorem –Theorem of least work – Clark Maxwell's reciprocal theorem – Application to simple problems of statically determinate beams, trusses and frames.		
UNIT – III	**ARCHES**	**9 Periods**
Three hinged arch – Two hinged arch – symmetrical and unsymmetrical - parabolic and circular arches under concentrated loads and uniformly distributed - Temperature effects – Rib shortening. Introduction to Fixed Arch.		
UNIT – IV	**CABLES AND SUSPENSION BRIDGES**	**9 Periods**
Suspension bridges - Components and their Functions – Equilibrium of a loaded chord- Types of cable supports – Analysis of forces on Piers -Three hinged and Two-hinged stiffening girders.		
UNIT – V	**ROLLING LOADS FOR DETERMINATE BEAMS AND ARCHES**	**9 Periods**
Rolling loads - Single concentrated load– UDL longer than the span – UDL shorter than the span– Two concentrated loads – Series of concentrated loads – Equivalent UDL. Influence lines for all types of loads (Determinate beams only). Influence lines for Symmetrical and Unsymmetrical arches – single rolling load and uniformly distributed load.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical : 0 Periods Total: 45 Periods**		

Text Book:

1	*Dr.R. Vaidyanathan, Dr.P. Perumal., "**Structural Analysis I**", Laxmi Publications, 2019.*
2	*Reddy C.S., "**Basic Structural Analysis**", Tata McGraw Hill Publishing Co., 2015.*

REFERENCES:

1	*R C Hibbler, **"Structural Analysis"** Pearson education,2017.*
2	*Dr.R. Vaidyanathan, Dr.P. Perumal., **"Structural Analysis II"**, Laxmi Publications, 2017.*
3	*Punmia B.C, Er. Ashok K Jain, Dr. Arun K Jain, "**Theory of Structures, SMTS.II**", Laxmi publications, 2017*
4	*Ramamurtham. S, "**Theory of structures**", Dhanpat Rai & Sons, New Delhi, 2018.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Predict the behaviour of indeterminate beams using the Theorem of three moments	K3
CO2	Analyze and predict the behaviour of beams, Trusses, and Frames with various loads by energy principles	K2
CO3	Evaluate the internal forces and examine various arch forms under varied loads.	K2
CO4	Examine and ensure structural integrity, and performance of suspension bridges and cables, under diverse loads.	K3
CO5	Resolve the determinate beams and arches with rolling loads and influence line diagrams	K3

23PTC402	CONCRETE TECHNOLOGY	SEMESTER IV

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To understand about various materials for concrete production, the properties of fresh and hardened concrete, special concrete and mix design for concrete.	
UNIT – I	**INGREDIENTS OF CONCRETE**	**9 Periods**
Cement – constituents – hydration - Tests on cement - Types of cement - Aggregates properties and uses - Classification of aggregates - Properties and test on aggregates - gradation - Quality of water - Admixtures - Chemical Admixtures and mineral admixtures.		
UNIT – II	**CONCRETING OPERATIONS**	**9 Periods**
Concreting operations: Batching, mixing, transportation, placing, compaction, curing and finishing of concrete. Forms for Concreting: Different types of formworks for beams, slabs, columns - materials used for form work - requirement of good form work - Stripping time for removal of form works as per IS456 - 2000 provision for different structural members - Water Proofing: Importance and need of water proofing - Methods of water proofing - materials used for water proofing - Joints in Concrete Construction: Types of joints - joining old and new concrete - Methods of joining - materials used for filling joints.		
UNIT – III	**PROPERTIES OF CONCRETE**	**9 Periods**
Properties of fresh concrete – Workability - Segregation Bleeding - Test for fresh concrete properties - Properties of hardened concrete - Strength - Stress - Strain characteristics - Modulus of Elasticity - Shrinkage - Creep - Thermal properties - Permeability - Test for hardened concrete properties - Introduction to micro structural properties of concrete· Non- Destructive Test. .		
UNIT – IV	**MIX DESIGN AND QUALITY CONTROL OF CONCRETE**	**9 Periods**
Quality Control- Frequency of sampling - Statistical analysis of test results - standard deviation - Coefficient of variation - Characteristic strength - Acceptance and rejection Criteria - Importance of water cement ratio - Importance of cover to concrete. Nominal mixes - Design Mixes factors influencing the design mix - Mix Design by ACI method, IS method and DOE method.		
UNIT – V	**SPECIALCONCRETES AND CONCRETING M ETHODS**	**9 Periods**
High Performance Concrete - Lightweight Concrete - Self Compacting Concrete - Polymer concrete - Fibre Reinforced Concrete - 3D printing of concrete. Special Concreting Methods: Pumped Concrete - Ready mix Concrete – Under water Concrete - Hot and Cold weather Concreting - Precast Concrete - Pre-placed Concrete.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Shetty M.S and Jain A. K,* ***"Concrete Tecltnology - Theory and Practice "****, S. Chand & Company, New Delhi, 2018.*
2	*Santha kumar A.R ,* ***"Concrete Technology "****,S.Chand Publishers, 2018.*

REFERENCES

1	*Gambhir M.L,* ***"Concrete Technology - Theory and Practice "****, Tata Mc-Graw Hill Company, 2013.*
2	*IS I 0262 -20 19, Concrete Mix Proportioning - Guidelines.*
3	*ACI 211. 1-91, Standard Practice for Selecting Proportions for Normal, heavy weight and Mass Concrete, American Concrete Institute.*
4	*Neville A .M* ***"Properties of Concrete ",*** *Pearson Education lndia,.20 12*
5	*Povindar K. Mehta, Paulo J . M. Monteiro,* ***"Concrete: Microstructure, Properties and Materials"****, Mc-Graw Hill Company, 2014.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Identify the properties and role of ingredients like cement, aggregate, admixtures in concrete.	K2
CO2	Choose the suitable formwork and methods of concrete production for construction.	K3
CO3	Infer the behaviour of fresh and hardened concrete.	K2
CO4	Proportion the concrete using various mix design concepts.	K3
CO5	Select appropriate types of concrete for specific requirements.	K3

23PTC403	BASIC STRUCTURAL DESIGN – II (CONCRETE)	SEMESTER IV

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To understand the behavior and design of reinforced concrete basic structural elements subjected to gravity loads according to Indian Standard building code requirements	
UNIT – I	**REINFORCED CONCRETE MATERIALS**	**9 Periods**
Introduction to R.C structures – Review of basic material properties - Concrete and Reinforcing steel - Objectives of structural Design- Stages in RCC structural design process for a building- Types of load on structures and load combinations –Load transfer in framed structures - Design philosophies – Basic design concepts –working stress, ultimate load and limit state methods.		
UNIT – II	**LIMIT STATE DESIGN OF BEAMS**	**9 Periods**
Analysis and Design of singly and doubly reinforced rectangular and flanged sections – Design of beams for bending, shear and torsion – bond and anchorage – deflection.		
UNIT – III	**LIMIT STATE DESIGN OF SLABS AND STAIRS**	**9 Periods**
Behaviour of one way and two way slabs – Design and detailing of one way and two way slabs subjected to uniformly distributed load - Design of lintel and lintel cum sunshade – Stairs – Loads on Stairs – Design of Dog legged staircase.		
UNIT – IV	**LIMIT STATE DESIGN OF COLUMNS**	**9 Periods**
Types of columns – Analysis and Design of rectangular and circular columns for axial load, uniaxial and biaxial bending – Use of interaction charts.		
UNIT – V	**LIMIT STATE DESIGN OF FOOTINGS**	**9 Periods**
Types of Footings - Design of isolated footing for axially loaded columns - Design of wall footing for axial and eccentric load.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Pillai, S. U.and Menon, D,"**Reinforced Concrete Design**", Tata McGraw Hill, 2021.*
2	*Subramanian N, "**Design of Reinforced Concrete Structures**", Oxford University Press, 2014.*

REFERENCES:

1	*Dayaratnam P., "**Design of Reinforced Concrete Structures**", Oxford & IBH publishing Co. Pvt.Ltd., 2018.*
2	*Shah V.L and Karve S.R, "**Limit State Theory and Design of Reinforced Concrete**", Structures Publications, 2018.*
3	*Krishnaraju N, "**Design of Reinforced Concrete Structures**", CBS Publishers and Distributors Pvt Ltd, 2019.*
4	*VargheseP.C, "**Limit State Design of Reinforced Concrete**", Prentice hall of India Pvt. Ltd., 2010.*
5	*IS: 456-2000 (R2016), "**Plain and Reinforced Concrete - Code of practice**".*
6	*SP: 16-1980, "**Design Aids for Reinforced Concrete to IS 456:(1978)**".*
7	*IS: 875-2015, "**Code of Practice for design loads for buildings and structures**".*
8	*SP: 34-1987, "**Handbook on Concrete Reinforcement and Detailing**".*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply the concepts of working stress method and limit state methods and estimate the design loads on various structural elements.	K2
CO2	Analyse and design the beams using Limit State Method.	K3
CO3	Design of rectangular slabs and staircases by limit state method and prepare detailing drawing.	K3
CO4	Design the columns subjected to both axial and eccentric loads	K3
CO5	Design the isolated and wall footings.	K3

23PTC404	WASTEWATER ENGINEERING	SEMESTER IV

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To study about sewage composition, their characteristics, sewer design and sewage treatment processes along with their disposal methods.	
UNIT – I	**QUANTITY AND HOUSE DRAINAGE**	**9 Periods**
Necessity and objectives of sanitary engineering projects-Definitions-systems of sewerage -quantity of sewage - Fluctuations in flow pattern - Estimation of storm runoff - DWF and WWF-Design flow for separate and combined systems – General layout of house drainage - Principles of house drainage, pipes and traps- one pipe system, two pipe system.		
UNIT – II	**SEWER AND SEWER APPURTENANCES**	**9 Periods**
Hydraulics of sewers - Self cleansing velocities – Design of sewer – principle and procedure full flow / partial flow conditions - sewer sections - materials for sewers - sewer joints – laying of sewerage system – sewer cleaning and maintenance- sewage pumping-types of pumps - underground drainage system.		
UNIT – III	**QUALITY OF SEWAGE AND PRIMARY TREATMENT**	**9 Periods**
Characteristics and composition of sewage - physical and chemical analysis - DO, BOD, COD and their significance - cycles of decomposition - Objectives and basic principles of sewage treatment -primary treatment- screens - Grit chamber - principles of sedimentation - Design of settling tanks.		
UNIT – IV	**BIOLOGICAL TREATMENT OF SEWAGE**	**9 Periods**
Basic principles of biological treatment - Filtration - contact beds - Sand Filters – trickling filters - Description and principles of operation of standards / high-rate filters - diffuser /Mechanical aeration - Conventional, high rate and extended aeration process – recirculation - activated sludge process – oxidation pond– Membrane Bioreactor – UASB, stabilization ponds-aerated lagoons- Septic tanks and effluent disposal system- Recent Advances in Sewage Treatment.		
UNIT – V	**SEWAGE DISPOSAL AND SLUDGE MANAGEMENT**	**9 Periods**
Objectives of sludge treatment-properties and characteristics of sludge-Thickening- bio digester – sludge digestion - drying beds - conditioning and dewatering - sludge disposal - Eutrophication - recycle & reuse of waste effluents -self-purification of streams –oxygen sag curve-land disposal –sewage farming.		
Contact Periods **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45Periods**		

TEXT BOOKS:

1	*Garg S.K., **"Sewage Disposal and Air Pollution Engineering"**, Khanna Publishers, New Delhi,2021*
2	*S. C. RangwalaandK. S. Rangwala, **"Water Supply and Sanitary Engineering"**, CharotarPublishinghouse2022*

REFERENCES:

1	*Punmia B.C, Jain A.K and Jain A.K, **"Environmental Engineering, Vol-II"** LaxmiPublications,2016*
2	*Hussain.S.K., **"Text Book of Water Supply and Sanitary Engineering"**, Oxford and IBH Publishing, 2017.*
3	*MetcalfandEddy**"WasteWaterEngineering-TreatmentandReuse"**TataMcGrawHillCompany, NewDelhi 2017*
4	*Duggal.K.N., **"ElementsofpublicHealthEngineering"**,S.ChandandCo,2007.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Attain knowledge on sewage production and house drainage.	K2
CO2	Design of sewerage system.	K3
CO3	Analyse the quality of sewage and design of primary treatments of sewage.	K2
CO4	Plan and design the biological treatments of sewage.	K2
CO5	Apply suitable sludge treatment and disposal method.	K2

23PTC405	GEOTECHNICAL ENGINEERING - II	SEMESTER VI

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To acquire knowledge on different soil investigation methods, evaluate bearing capacity and settlement of foundations, understand design principles of shallow foundations, calculate load carrying capacity of piles and to study earth pressure and slope stability analysis.	
UNIT – I	**SITE INVESTIGATION AND SELECTION OF FOUNDATION**	**9 Periods**
Scope and objectives — Methods of exploration — Auguring and boring — Wash boring and rotary drilling —Geophysical methods- Depth and spacing of bore holes - Codal provisions-— Soil samples — Representative and undisturbed — Sampling methods — samplers-types— Penetration tests (SPT and CPT) — Data interpretation — Bore log report and Selection of foundation.		
UNIT – II	**SHALLOW FOUNDATION**	**9 Periods**
Location and depth of foundation — Codal provisions — Bearing capacity of shallow foundation on homogeneous deposits — Terzaghi`s method and BIS method — Factors affecting bearing capacity — Bearing capacity from in-situ tests - plate load test — Allowable bearing pressure — Determination of Settlement of foundations on granular and clay deposits — Total and differential settlement — Allowable settlement — Codal provision — Methods of minimizing total and differential settlements.		
UNIT – III	**FOOTINGS AND MACHINE FOUNDATIONS**	**9 Periods**
Types of Isolated footing- Combined footing- Strip and Strap footings-Mat foundation -types- Contact pressure and settlement distribution —Rigid and Flexible foundation- Proportioning of shallow foundations —Design steps-Compensated foundation — Codal provision.		
UNIT – IV	**PILE FOUNDATION**	**9 Periods**
Types of piles -functions— Factors influencing selection of pile — Carrying capacity of single pile in granular and cohesive soil — Static formula — Dynamic formulae (Engineering news and Hiley's methods) — Capacity from penetration tests—Group capacity-Efficiency of pile groups- Feld's rule-Converse — Labarre formula-Negative skin friction —Settlement of pile groups - Under -reamed piles — Construction and Use.		
UNIT – V	**SLOPE STABILITY AND EARTH PRESSURE**	**9 Periods**
Stability of slopes – Types - failure mechanisms – Analysis of finite and infinite slopes- Types of failure – Slip circle method – Friction circle method –Stability numbers and charts. 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`s Graphical method — Pressure on the wall due to line load — Stability analysis of retaining walls — Codal provisions.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS

1	*Varghese P.C.,* ***"Foundation Engineering",*** *Prentice Hall of India Pvt. Ltd., New Delhi, 2006.*
2	*Venkatramiah.C.,* ***"Geotechnical Engineering",*** *New Age International (P) Ltd. publishers, NewDelhi, 2006.*
3	*Narasimha Rao A.V and Venkatramaiah C.,* ***"Geotechnical Engineering",*** *Universities Press (India) Limited, 2000.*

REFERENCES:

1	*Cuduto., D.P., Yeung, M.R and Kitch, W.A.,* ***"Geotechnical Engineering Principles and Practices",*** *Pearson Education Inc., New Jerse, 2011.*
2	*Shashi K.Gulhati and Manoj Datta,* ***"Geotechnical Engineering",*** *Tata McGraw HillPublishing Company Ltd., NewDelhi, 2017.*
3	*Das, B.M.,* ***"Principles of Foundation Engineering",*** *Cengage Learning, NewDelhi 2011.*
4	*Holtz, R.D., Kovacs, W.D and Sheahan, T.C.,* ***"An introduction to Geotechnical Engineering",*** *Second Edition, Pearson Publications, 2010.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Identify various methods of soil exploration, field testing and prepare soil investigation report.	K2
CO2	Estimate bearing capacity and settlement of foundations.	K2
CO3	Proportion shallow foundations and draw contact pressure distribution.	K2
CO4	Select piles for different soil conditions and calculate the load carrying capacity.	K3
CO5	Analyse stability of slopes and calculate earth pressure on retaining walls.	K3

23PTC501	THEORY OF STRUCTURES - II	SEMESTER V

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To learn slope deflection method, moment distribution method, matrix methods and plastic analysis in solving indeterminate structures.	
UNIT – I	**SLOPE DEFLECTION METHOD**	**9 Periods**
Analysis of continuous beams - Sinking of Supports - Analysis of single storey and single bay rectangular frames with and without sway.		
UNIT – II	**MOMENT DISTRIBUTION METHOD**	**9 Periods**
Distribution factor - Carry over factor - Analysis of continuous beams – Sinking of Supports - Analysis of single storey and single bay rectangular frames with and without sway.		
UNIT – III	**MATRIX FLEXIBILITY METHOD**	**9 Periods**
Analysis of continuous beams, indeterminate frames and trusses with maximum two degrees of static indeterminacy.		
UNIT – IV	**MATRIX STIFFNESS METHOD**	**9 Periods**
Analysis of continuous beams, indeterminate frames and trusses with maximum three degrees of kinematic indeterminacy.		
UNIT – V	**PLASTIC ANALYSIS**	**9 Periods**
Plastic analysis: Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Punmia B.C,* ***"Strength of Materials and Mechanics of Structures, Vol.II."****, Standard Publishers, 2018*
2	*Vaidyanathan.R, Perumal.P.,* ***"Structural Analysis II"****, Laxmi Publications, 2019.*

REFERENCES:

1	*Manickaselvam.V.K,* ***"Elementary Matrix Analysis of Structures"****, Khanna Publishers, New Delhi, 1998.*
2	*Bhavikatti.S.S,* ***"Structural Analysis"****, Vol.I and II, Vikas Publishing House Pvt. Ltd., 2021.*
3	*Negi, L.S. and Jangid, R.S,* ***"Structural Analysis"****, Tata McGraw-Hill Publications, 2008.*
4	*Reddy.C.S,* ***"Basic Structural Analysis"****, Third Edition, Tata McGraw-Hill Publications, 2017.*
5	*Pandit.G.S.andGuptaS.P.,* ***"Theory of Structure, Vol.I"****, TataMcGraw–Hill,NewDelhi, 2017.*
6	*NPTEL notes - https://nptel.ac.in/courses/105105109.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Analyse beams and frames using slope deflection method.	K2
CO2	Analyse beams and frames using moment distribution method.	K2
CO3	Analyse beams, frames and trusses by flexibility method.	K2
CO4	Analyse beams, frames and trusses by Stiffness method.	K2
CO5	Do plastic analysis in beams and frames.	K2

23PTC502	CONSTRUCTION ENGINEERING AND MANAGEMENT	SEMESTER V

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To plan, schedule, execution of construction projects using the basic concepts of management with the available materials, manpower, equipment and cost by software applications.	
UNIT – I	**PROJECT MANAGEMENT CONCEPTS AND PLANNING**	**9 Periods**
Basics of Construction – Unique features of construction – Principles of Management – Role of project manager – Types, features and phases of construction projects – Stakeholders – Functions of Management – Types of organization – Types of Business Operations – Sole proprietorship, Partnership, Joint ventures – Construction Planning – Pre-tender planning, Pre-construction planning and detailed construction planning – Modern Project Management systems such as Lean Construction.		
UNIT – II	**CONSTRUCTION SCHEDULING**	**9 Periods**
Work Breakdown Structure – Estimation of activity duration – Construction Scheduling – Scheduling techniques – Bar charts – Network techniques – Critical Path Method – PERT – Line of Balance method – Precedence Network Analysis – Crashing of Cost and Time – Resource Aggregation, Allocation, Smoothening and Levelling.		
UNIT – III	**MATERIALS AND EQUIPMENT MANAGEMENT**	**9 Periods**
Materials Management – Functions – Materials Planning – Procurement – Inventory Control – ABC Analysis, VED analysis, FSN analysis, SDE analysis and HML analysis – Economic Order Quantity. Construction Equipment – Earth-moving, Compacting, Concrete mixing, transporting and placing, Hauling and Hoisting Equipment – Dewatering Equipment – Equipment for Demolition – Use of Drones for spread out sites – Use of robots for repetitive activities.		
UNIT – IV	**HUMAN RESOURCE MANAGEMENT**	**9 Periods**
Importance, Functions and objectives – Manpower policy and planning – Recruitment and selection – Training Performance appraisal – Labour's Wage Policy and Compensation systems – Company union relationship and Collective bargaining – Safety, Health and Environment on project sites: Accidents, causes, effects and preventive measures – Absenteeism and Labour Turn over – Grievances/Conflicts – Identification and resolution.		
UNIT – V	**COST MANAGEMENT AND SOFTWARE APPLICATIONS**	**9 Periods**
Cost Management – Classification of construction cost – Cost coding – Cost Estimation – Project Budget – Cost control – Common causes of time and cost overruns and corrective measures – Funds: sources, S-Curves, cash flow. Software Applications: Project Management software – Introduction to MS Project and Primavera – Use of Building Information Modelling (BIM), Augmented Reality and Virtual Reality in Project Management.		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXT BOOK

1	*Chitkara, K.K., **"Construction Project Management Planning, Scheduling and Controlling"**, Tata McGraw-Hill Publishing Company Ltd., 2014.*
2	*Kumar Neeraj Jha, **"Construction Project Management: Theory and Practices"**, Pearson Publications, 2015.*

REFERENCES

1	*Joy P.K.,* ***"Total Project Management - The Indian Context, New Delhi",*** *Macmillan India Ltd., 2017.*
2	*Peurifoy R L,* ***"Construction Planning Equipment and Method"****, Tata McGraw Hill Publication, New Delhi, 2010.*
3	*Seetharaman S,* ***"Construction Engineering and Management",*** *Umesh Publications, 2017.*
4	*Sharma .S.C.,* ***"Construction Engineering and Management"****, Khanna Publishers, 2008.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Plan the construction projects with the available resources using the basic concepts of management.	K2
CO2	Schedule the construction projects using network techniques.	K2
CO3	Utilize the materials, equipment, manpower and cost effectively in construction industry.	K3
CO4	Maintain proper financial accounting systems in construction projects.	K3
CO5	Apply of project management software during execution of project.	K3

23PTC503	CONCRETE STRUCTURES	SEMESTER V

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To get more familiar with the behaviour, design, and detailing of reinforced concrete footings, retaining walls, flat slabs, also to apply the ductile detailing and earthquake-resistant design of structures.	
UNIT – I	**FOOTINGS**	**9 Periods**
Design of Eccentrically loaded footings for columns – Combined rectangular footings – Combined trapezoidal footings for an axially loaded column - Strap beam footings – Detailing of Reinforcement - Design steps of raft foundations.		
UNIT – II	**EARTH RETAINING STRUCTURES**	**9 Periods**
Types of retaining walls – Applications- Structural behaviour of retaining walls- Stability requirements of retaining wall - Design of Cantilever retaining wall and Counterfort retaining wall – detailing of reinforcement.		
UNIT – III	**FLAT SLAB DESIGN**	**9 Periods**
Design loads other than earthquake loads (only an introduction) – Imposed loads, wind loads, construction loads – Types of flat slab – Equivalent frame method – Introduction to yield line theory.		
UNIT – IV	**LIQUID RETAINING STRUCTURES**	**9 Periods**
Water Tank - Resting on the ground- Underground Tank- Rectangular and Circular tanks as per IS code (Working Stress design method) – Design principles of overhead tanks including staging and foundation. Introduction to Limit State Design (Principles Only)		
UNIT – V	**EARTHQUAKE FORCES – DUCTILE DETAILING**	**9 Periods**
Earthquake forces – Bureau of Indian Standards for Earthquake resistant design – Earthquake magnitude and intensity – Basic seismic coefficients and seismic zone factors – Design forces – Design factors – Analysis of structures (Portal Method and Cantilever method)– Choice of method for multistoried buildings. Ductile detailingof frames for seismic forces – General principles.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXTBOOKS:

1	*Pillai and Menon, **"Reinforced Concrete Design"**, McGraw Hill Education (India) PrivateLtd., 2021.*
2	*Pankaj Agarwal and Manish ShriKhande, **"Earthquake Resistant Design of Structures"**, Prentice-Hall of India, New Delhi, 2011.*

REFERENCES:

1	*Sinha.S.N., **"Reinforced Concrete Design"**, Tata McGraw Hill publishing company Ltd., 2017.*
2	*Ramachandra, **"Design of Concrete Structures – Vol 1"**, Standard Book House, Delhi-6, 2007.*
3	*V.L.Shah and S.R.Karve **"Limit state theory and design of reinforced concrete"**, StructurePublications, 2005.*
4	*Vazirani & Ratwani, **"Design of R.C.C Structures"**, Khanna Publishers, 2006.*
5	IS:456-2000 (R2016), "***Plain and Reinforced Concrete - Code of practice***".
6	SP:16-1980, "***Design Aids for Reinforced Concrete to IS 456:(1978)".***
7	IS:3370-2021***, "Code of practice Concrete Structures for Storage of Liquids".***
8	IS 13920(2016), *Indian Standard Code of practice for "**Ductile detailing of Reinforced concrete structures subjected to seismic forces".***
9	BIS 1893-2016- ***Indian Standard Code of practice for Criteria for Earthquake resistant design of structures.***

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Identify the type of foundation and design as per BIS code.	K3
CO2	Select suitable retaining walls and design as per the BIS code.	K3
CO3	Design of Flat slabs as per BIS code.	K3
CO4	Design water tanks following BIS requirements.	K3
CO5	Apply the provisions of earthquake-resistant design and ductile detailing of structures	K2

23PTC504	ESTIMATION AND QUANTTY SURVEYING	SEMESTER V

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To acquire knowledge to estimate the quantities of item of works in buildings, water supply, sanitary works, road works and to do rate analysis and valuation, prepare tender, contract documents and to write report.	
UNIT – I	**FUNDAMENTALS AND ESTIMATION OF BUILDINGS**	**9 Periods**
Fundamentals of Estimation – Different types of estimates – Methods of Estimation – Estimation of Buildings: Load bearing and framed structures with flat roof – Calculation of quantities of brick work, stone masonry, brick masonry, Plain Cement Concrete, Plastering, white washing, colour washing and painting – Estimation of doors and windows.		
UNIT – II	**ESTIMATION OF RCC WORKS AND OTHER STRUCTURES**	**9 Periods**
Bar bending schedules – Beam, Slab and Column, Foundation – Estimation of Septic Tank, Soak Pit, Retaining wall, Water Supply and Sanitary Installations – Bituminous Roads.		
UNIT – III	**RATE ANALYSIS**	**9 Periods**
Data – Types of Data – Scheduled of Rates – Lead statement – Analysis of Rates for Lime Mortar, Cement Mortar, Brick Masonry, Cement Concrete, Reinforced Cement Concrete, Damp Proof Course, Plastering, Painting and Flooring.		
UNIT – IV	**SPECIFICATION, TENDERS AND CONTR ACTS**	**9 Periods**
Specifications – Principles of specifications – Importance – Types of specifications – Specification for Excavation, Cement Concrete, Masonry Work. Tenders – E-Tendering – Contracts – Types of Contracts – Contract document.		
UNIT – V	**VALUATION AND REPORT WRITING**	**9 Periods**
Valuation – Necessity – Market Value – Book Value – Scrap Value – Salvage Value – Annuity – Capitalized Values – Sinking Fund –Depreciation – Escalation – Methods of Valuation – Valuation of a Building – Rent Fixation – Mortgage – Lease. Principles for report preparation – report on estimate of residential building.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Dutta, B.N., **"Estimating and Costing in Civil Engineering"**, UBS Publishers and Distributors Private (Ltd) 2020.*
2	*Kohli D.D. and Kohli R.C., **"A Text Book on Estimating, Costing (Civil)"**, S. Chand and Co, New Delhi, 2013.*

REFERENCES:

1	*Rangwala S.C., **"Estimating and Costing",** Charotar Publishers & Co., New Delhi, 2017.*
2	*Chakraborthi M, **"Estimation, Costing and Specifications",** Laxmi Publications, 2006.*
3	*Banerjee D.N., **"Principles and Practices of Valuation",** Eastern Law House, 2015.*
4	*Birdie G. S., **"Estimating and Costing",** DhanpatRai Books Publishers, 2014.*
5	*CPWD Specifications and Schedule of Rates.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Find out the quantity of various items of works.	K2
CO2	Prepare the detailed estimates of different structures.	K2
CO3	Arrive the cost of various construction works.	K3
CO4	Identify the specification of works and Prepare tender and contract document.	K3
CO5	Estimate the value of a property and prepare reports.	K3

23PTC601	WATER RESOURCES ENGINEERING	SEMESTER VI

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To provide knowledge on hydrological cycle, water resources and its transportation	
UNIT – I	**SURFACE WATER HYDROLOGY**	**9 Periods**
Hydrological Cycle – Precipitation – forms and types – Average rainfall over a basin – Arithmetic mean, Thiessen polygon and Isohyetal method – missing precipitation – optimum numbers. Abstractions from Precipitation – Runoff process – Estimation of Surface Runoff – Empirical formulae, Infiltration Indices and Unit Hydrograph method.		
UNIT – II	**CROP WATER REQUIREMENT AND RESERVOIR PLANNING**	**9 Periods**
Crop water requirement – capacity of canals – types of reservoirs – Investigation for reservoir planning – Selection of site for a reservoir – Zones of storage in reservoirs –Yield of a reservoir – Safe, secondary and average yield – mass curve and demand curve – Calculation of safe yield from a reservoir of a given capacity – Determination of reservoir capacity for a specified yield.		
UNIT – III	**GRAVITY DAM**	**9 Periods**
Forces acting and their computation – Modes of failures – Elementary profile of a gravity dam – Practical profile – High and Low gravity dams – Stresses acting on dam – Design procedure for a gravity dam – Problems to check stability Analysis.		
UNIT – IV	**DISTRIBUTION SYSTEM**	**9 Periods**
Classification of Canals – canal alignment – Design procedure for an unlined irrigation channel - Kennedy's theory – Wood table – Lacey's theory – Comparisons of the two theories – Uses of Garret's diagram in channel design – Balancing depth of cutting – component parts of a canal cross section – design of lined canals – Problems.		
UNIT – V	**GROUND WATER HYDROLOGY**	**9 Periods**
Occurrence of ground water – types of aquifers – Storage coefficient – coefficient of transmissibility and permeability – types of open and tube wells. Steady radial flow into a well –Yield estimation of unconfined and confined aquifers – Yield from an open well by constant level pumping test and recuperation test – well loss – Site selection for a tube well – Problems.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total:45 Periods**		

TEXT BOOK :

1	*Punmia.B.C. and Pande B.B. Lal,* ***"Irrigation and Water Power Engineering"****, Laxmi Publications Pvt. Ltd, New Delhi, 2021.*
2	*Santosh Kumar Garg,* ***"Irrigation Engineering and Hydraulics Structures"****, Khanna Publishers, New Delhi, 2023.*

REFERENCES :

1	*P.N.Modi,* ***"Irrigation water resources and Water Power engineering"****, Standard book House, New Delhi, 2020.*
2	*Duggal .K.N and Soni. J.P,* ***"Elements of Water Resources Engineering"****, New Age International Pvt. Ltd, New Delhi, 2011.*
3	*Gupta. B. L and Amit Gupta,* ***"Water resources System and Management"****, Standard Publishers Distributors, New Delhi, 2008.*
4	*Satya N Murthy, chella****, "Water Resources Engineering : Principles and Practice",*** *New age Publishers, 2020*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Explain the hydrological cycle, equations and its components	K2
CO2	Fix the reservoir capacity and their yield predictions for a demand	K2
CO3	Check the forces acting and stability analysis of gravity dam.	K2
CO4	Design the section of lined and unlined canals	K3
CO5	Conduct the yield tests in open and tube wells in real fields.	K2

23PTC602	DESIGN AND DETAILING OF IRRIGATION AND ENVIRONMENTAL ENGINEERING STRUCTURES	SEMESTER VI

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To design and detail the different Irrigation Engineering and Environmental Engineering structures.
PART A :	**IRRIGATION ENGINEERING**
Tank Surplus Weir (Type A and D) -Tank Sluice with a Tower Head -Direct Sluice - Notch type Canal Drop - Canal Regulators and river regulators- Cross-Drainage Works (Syphon Aqueduct type II &III)	
PART B :	**ENVIRONMENTAL ENGINEERING**
Intake tower - Screening device - Primary sedimentation tank – Clariflocculator - Slow and Rapid sand filters – Secondary settling tanks-Trickling filter-Activated sludge process-Sludge digestion tank- Septic tank with dispersion trench and soak pit- Infiltration gallery.	
Contact Periods: **Lecture: 45 Periods Tutorial:00 Periods Practical: 0 Periods Total:45 Periods**	

TEXT BOOK :

1	*Sathya Narayana Murthy Challa,* ***"Water Resources Engineering Principles and Practice"****,New Age International(P)Ltd., New Delhi,2009.*
2	*Rangwala.S.C,* ***"Water Supply and Sanitary Engineering"****, Charotar Publishing, New Delhi, 2016.*
3	*Punmia B.C, Jain A.K and Jain A.K,* ***"Water Supply Engineering"****, Laxmi Publications, New Delhi 2014.*
4	*P.N.Modi,* ***"Irrigation water resources and Water Power engineering"****, Standard book House, New Delhi, 2020.*

REFERENCES :

1	*Santosh Kumar Garg,* ***"Irrigation Engineering and Hydraulics Structures"****, Khanna Publications Pvt. Ltd, New Delhi, 2017.*
2	*Birde.G.S and Birde.J.S,* ***"Water Supply and Sanitary Engineering"****, Dhanpat Rai Publications Pvt. Ltd, New Delhi, 2018.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Design the different Hydraulic structures in the field.	K3
CO2	Acquire hands on experience in preparation of drawings for Irrigation Structures.	K3
CO3	Design the different Environmental Engineering structures in the field.	K3
CO4	Acquire hands on experience in preparation of drawings for Environmental Structures.	K3
CO5	Recall the importance of the Irrigation and Environmental Structures in real life.	K2

23PTC603	HIGHWAY AND RAILWAY ENGINEERING	SEMESTER VI

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	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 DEVELOPMENT, PLANNING AND GEOMETRICS**	**9 Periods**
Highway development and planning, Classification of Highways, Highway alignment. Highway Geometric Design– Typical cross sections -Cross sectional elements-Sight distance- Horizontal alignments-Vertical alignments.		
UNIT – II	**DESIGN, CONSTRUCTION AND MAINTENANCE OF PAVEMENTS**	**9 Periods**
Pavements – types –Components-functions- Design factors- Design of flexible pavements- Design of rigid pavements- Design of joints-IRC recommendations only. Construction of roads – W.B.M. roads –Bitumen roads –Cement concrete roads. Application of geotextile in the construction of road. Failure of pavements. Maintenance of highway – Evaluation - Strengthening of pavements-Types of overlays.		
UNIT – III	**TRAFFIC STUDIES AND CONTROL**	**9 Periods**
Traffic Characteristics. Traffic studies - traffic volume studies - Speed studies - origin and destination study - traffic flow characteristics - traffic capacity study - parking study - Accidental studies. Traffic operations - traffic regulations - traffic control devices - road markings. Design of road intersections. Design of parking facilities. Highway lightings.		
UNIT – IV	**RAILWAY MATERIALS, PLANNING AND DESIGN**	**9 Periods**
Location surveys and alignment - Conventional and Modern methods. Permanent way - Gauges - Components - Functions and requirements - Coning of Wheels. Geometric design- Gradients-Grade Compensation - Super-Elevation- Transition Curves- Widening of Gauges.		
UNIT – V	**RAILWAY TRACK OPERATION AND MAINTENANCE**	**9 Periods**
Points and Crossings - Turnouts – Types - Working Principle. Signalling, Interlocking and Track Circuiting. Construction and Maintenance – Conventional and Modern methods. Railway Stations and Yards. Modern developments in railways, urban railways–Basic planning for MRTS and Suburban railways.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*S.K.Khanna, C.E.G.Justo and Dr.A.Veeraraghavan, "**Highway Engineering**", Nemchand and Bros,Tenth Edition,2013*
2	*Saxena S.C and Arora S.P., **"Railway Engineering"**, DhanapatRai Publications, 6th Edition, 2010*

REFERENCES:

1	*Satishchandra & MM Agarwal., "**Railway Engineering**", Oxford University Press, Second Edition, 2013.*
2	*Sharma S.K, **"Principles, Practice& Design of Highway Engineering"**, S.Chand and Co,2014.*
3	*Rangwala S.C & K.S. **"Railway Engineering"**, Charotar Publications, 14th Edition, 2008*
4	*K.P.Subramanian, **"Transportation Engineering: Highway Railway Airport & Harbour Engineering"**, Scitech publications (India) Pvt. Ltd, 2010*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Illustrate the development, planning and geometric design standards for highways.	K3
CO2	Design, construct and maintenance of flexible and rigid pavements.	K3
CO3	Apply the knowledge of the traffic studies and implement traffic regulation and control measures and intersection design	K3
CO4	Outline the planning of railways and perform geometric design	K3
CO5	Summarize the process of operation, maintenance of railway track and modern development in railway.	K2

23PTC604	PRESTRESSED CONCRETE STRUCTURES	SEMESTER VI

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To comprehend the basic concepts, principles, and methods of prestressing and become familiar with the codal provisions for designing prestressed concrete elements, pipes, and composite constructions.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Principles – Pretensioning – Posttensioning – Advantages and types of prestressing – Systems of prestressing – Materials for prestressed concrete - Calculation of fibre stresses for various section (Rectangle, I, T) of simply supported beam - Stress method – Moment of resistance method – Load balancing method.		
UNIT – II	**LOSSES AND DEFLECTION**	**9 Periods**
Various losses in prestressed concrete members – Deflection of prestressed concrete flexural members – Calculation of long-term deflection.		
UNIT – III	**DESIGN OF FLEXURAL MEMBERS AND ENDBLOCK**	**9 Periods**
Pre tensioned and post tensioned simply supported rectangle, I, T sections –Calculation of ultimate flexural strength of section using IS code - Stress method – Design for flexure -Design for shear. End block – Analysis - Anchorage zone stresses-Guyon -Magnel's method – IS Code method - Design of End zone reinforcement		
UNIT – IV	**DESIGN FOR TENSION AND COMPRESSION**	**9 Periods**
Design of prestressed tension members subjected to axial load – Design of compression members – Design of sleepers and poles – Analysis and Design of circular pipes.		
UNIT – V	**COMPOSITE CONSTRUCTION**	**9 Periods**
Types of composite construction – Transformation of composite sections – Flexural analysis of composite simply supported beams – Differential Shrinkage – Limit state design criteria – partial prestressing – non-prestressed reinforcements		
Contact Periods: **Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**		

TEXT BOOKS :

1	*Krishnaraju.N, **"Prestressed concrete"**, 6th edition, Tata McGraw Hill Publishing company Ltd., New Delhi, 2018.*
2	*Sinha. N.C and Roy.S.K, **"Fundamentals of prestressed concrete"**, S.Chand and Co. Ltd 2011.*

REFERENCES :

1	*Muthu K. U., Ibrahim Azmi, JanardhanaMaganti, Vijayanand M, **"Prestressed Concrete"**, PHI Learning Pvt. Ltd., 2016.*
2	*NPTEL notes - https://nptel.ac.in/courses/105106117.*
3	*Lin .T.Y., and Ned H. Burns., **"Design of prestressed concrete structures"**, John Wiley & Sons, International Edition, New York, 2015.*
4	*Dayaratnam.P., **"Prestressed Concrete Structures"**, Oxford and IBH Publishing Company pvt,Ltd, New Delhi, 2008.*
5	*N.Rajagopalan, **"Prestressed Concrete"**, Narosana Publications, 2006.*
6	*Guyon, Y. **"Limit State Design of Prestressed Concrete Vols. I & II"**, Applied Science Publishers, London, 1974.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Describe the systems and obtain the internal forces due to prestressing	K1
CO2	Propose an appropriate system to prestress a particular structure and to design the prestressed concrete beam elements and end blocks.	K2
CO3	Design tension and compression prestressed concrete members, pipes & liquid retaining structures.	K3
CO4	Evaluate the initial and time dependent losses and deflection of prestressed elements.	K3
CO5	Determine the resultant stresses of composite section.	K3

23PTC701	DESIGN AND DETAILING OF CONCRETE AND STEEL STRUCTURES	SEMESTER VII

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To gain familiarity with the codal provisions governing the design and detailing of reinforced concrete and steel structures.

PART A

Detailed design and detailing of the following concrete structures:

1. Beams – Simply supported, Continuous, Cantilever. (Singly reinforced, Doubly reinforced and T beams)
2. Slabs – Simply supported, Continuous. (One way, Two way and Flat slabs)
3. Footings – Isolated and Combined footings (Rectangular, Trapezoidal)
4. Retaining Wall - Cantilever and Counterfort types.
5. Water Tank – Circular and Rectangular. (Design up to Base slab).

PART B

Detailed design and detailing of the following Steel structures:

1. Column base – Slab base and Gusseted base.
2. Seated connections – stiffened and unstiffened.
3. Moment resistant connections.
4. Welded Plate Girder
5. Simple trusses with connections.

Contact Periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1	*Pillai and Menon, "**Reinforced Concrete Design**", McGraw Hill Education (India) Private Ltd., 2016.*
2	*Duggal .S.K, "**Design of steel structures**", Tata Mcgraw Hill Publishing company Ltd, 2009.*

REFERENCES:

1	*Ramchandra, "**Limit State Design**", Standard Book House, Delhi-6, 2005.*
2	*Sinha.S.N, "**Reinforced Concrete Design**", Tata McGraw Hill publishing company Ltd., 2005.*
3	*Krishna Raju N and Pranesh, R.N., "**Reinforced Concrete Design – IS 456 – 2000 Principles and Practice**", New Age International Publishers, New Delhi, 2003.*
4	*N.KrishnaRaju, "**Structural Design and Drawing**", University Press, 2005.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Design and develop detailed drawings for RCC beams and slabs.	K3
CO2	Execute detailed design and drawing of footings and retaining walls.	K3
CO3	Prepare design and detailing drawings for water tanks.	K3
CO4	Design and draft various types of seated and moment-resistant connections.	K3
CO5	Design and illustrate the drawings of plate girders and trusses.	K3

23PTC702	AIR POLLUTION MANAGEMENT	SEMESTER VII

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	Aimed at imparting knowledge of sources and effects of air pollution and to understand the control measure adopted for removal of air pollutant.	
UNIT – I	**FUNDAMENTAL OF AIR POLLUTION**	**9 Periods**
Atmosphere as a place of disposal of pollutants – Definition- Air Pollution – AirPollutants – Source and classification of pollutants – Units of measurements of pollutants -Ambient air quality standards - Air pollution indices - Air pollution and its effects on human beings, plants and animals - Economic effects of air pollution – Air Pollution Episodes.		
UNIT – II	**METEOROLOGY AND SAMPLING OF AIR POLLUTION**	**9 Periods**
Meteorology - temperature lapse rate– Adiabatic lapse rate – WindRose - Inversion – Wind velocity and turbulence –Atmospheric stability and mixing heights, Plume behavior – Windrose. Ambient air sampling and measurement of particulate and gaseous pollutants Environmental factors - Stack sampling - Plume behaviour - Dispersion of air pollutants - Maximum mixing depth - Estimation of plume rise - Stack design.		
UNIT – III	**CONTROL OF PARTICULATE CONTAMINANTS**	**9 Periods**
Factors affecting Selection of Control Equipment – Working Principle of Gravity Separators, cyclones, Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations.		
UNIT – IV	**CONTROL OF GASEOUS CONTAMINANTS**	**9 Periods**
Factors affecting Selection of Control Equipment – Working principle of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters - Operational Considerations		
UNIT – V	**INDOOR AIR QUALITY**	**9 Periods**
Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness Sources and Effects of indoor air Pollution – Measurement – Standards –Control and Preventive measures.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXTBOOKS:

1	*Noel de Nevers, **"Air Pollution Control Engineering",** Waveland press,Inc 2017.*
2	*Dr. Y. Anjaneyulu, **"Air Pollution: Prevention and Control Technologies",** BS publications (P) Ltd., 2nd edition,2020.*

REFERENCES:

1	*Noel de Nevers, "**Air Pollution Control Engg**", McGraw Hill, New York, 2016.*
2	*Air Pollution, Climate Change, and Human Health in Indian Cities: A Brief Review, August 2021*
3	*Howard S. Peavy, Donald R. Rowe and GerogeTchobanoglous, "**Environmental Engineering**", McGraw - Hill Co., 2013.*
4	*M.N Rao and HVN Rao, **"Air Pollution**",TataMcgraw Hill Publishing Company limited,2007.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Extract the status of global and analysis of air pollutant scenario and their effects.	K2
CO2	Classify the meteorological condition to prevail for the dispersion air pollution.	K2
CO3	Implement the concepts of control strategies adopted for removal of Particulate pollutants.	K2
CO4	Implement the concepts of control strategies adopted for removal of gaseous pollutants.	K2
CO5	Identify the causes of indoor air pollution and their effects.	K2

23PTC703	TOWN PLANNING AND ARCHITECTURE	SEMESTER VII

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To study and analyse the various typologies of housing related to Architectural design, area distribution and various land uses of a housing layout.	
UNIT – I	**TOWN PLANNING**	**9 Periods**

History of evolution of town- Town and environment – Elements of city plan- Importance of Climate, humidity, wind and radiation - surveys and data collection – Residential neighbourhood – Industrial areas – Public buildings – Housing and slum clearance.

UNIT-II	BUILDING RULES AND GUIDELINES	9 Periods

General – Zoning regulation – regulation regarding layouts – master plan – regional plan- structural plan – building regulations-Rules for special types of buildings- Floor space index- minimum plot size and building front age- Open spaces- Minimum standard dimensions of building elements- Provision for lighting and ventilation- Provision for means of access - Land use classification- Town planning standards.

UNIT – III	ELEMENTS OF ARCHITECTURE	9 Periods

Introduction of Architecture- Definition- factors influencing architectural development - Mass and Space visual effects of geometric forms and their derivatives- The sphere, the cube, the pyramid, the cylinder and cone- The aesthetic qualities of Architecture- Proportion, scale, balance, symmetry, rhythm and axis-contrast in form- Harmony.

UNIT – IV	PRINCIPLES OF ORIENTATION AND PLANNING OF BUILDINGS	9 Periods

General- Factors affecting orientation- Sun- Wind- Rain- Orientation criteria for Indian conditions- Principles governing the theory of planning- Planning of Residential buildings- Electrification of buildings ,Intelligent buildings.

UNIT – V	INTRODUCTION TO INTERIOR DESIGN	9 Periods

General – decorative materials – cement Bonded Board (BISTON PANEL), water proof cement paint, Industrial glazing and Roofing, unit masonry, plaster and dry wall, Wall surface materials, Effect of colour on architecture- Home furnishing- Plans in rooms. Estimation, specifications, valuations, professional practices, House furnishing-Plans in rooms.

Contact Periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXTBOOKS:

1	*Margaret Roberts, **"An Introduction to Town Planning Techniques"**, Hutchinson, London, 1990.*
2	Edward D. Mills, **"Planning the Architects Handbook"**, Butterworth London, 1995.

REFERENCES:

1	*Hiraskar, G.K., **"Fundamentals of Town Planning"**, Dhanpat Rai Publications, 1992.*
2	*NBC, local town planning authority rules and regulations*
3	*Francis D.K. Ching, **"Architecture: Form, Space and order"**, VNR, N.Y., 1999.*
4	*A.Bandopadhyay, **"Town Planning"** , Books and Allied, Calcutta 2000*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Describe the importance of various components of town planning.	K2
CO2	Execute the town planning standards and guidelines.	K3
CO3	Apply the suitable elements in architectural design.	K3
CO4	Plan a building based on orientation criteria.	K3
CO5	Select the decorative materials for interior design.	K3

23PTC704	SOFTWARE APPLICATION LABORATORY	SEMESTER VII

PREREQUISITES	L	T	P	C
NIL	0	0	3	1.5

Course Objectives	To familiarize the programming skills for analysis, and design of various 2D and 3D Truss, Frames using the software, detailing as per code.

LIST OF EXPERIMENTS

DEVELOPMENT AND IMPLEMENTATION OF PROGRAM USING SOFTWARE

1. Design of singly and doubly reinforced beam
2. Design of Flanged beam
3. Design of one-way and two-way slab
4. Design of cantilever slab
5. Design of columns (axially load, Uni-axial and biaxial load)
6. Design of isolated and combined footings

DEVELOPMENT AND IMPLEMENTATION OF THE PROGRAM USING STAAD PRO. SOFTWARE

1. Analysis and Design of 2D Truss
2. Analysis and Design of 3D Truss
3. Analysis and Design of 2D Frame
4. Analysis and Design of a full PEB frame
5. Analysis and Design of RCC (G+1) building (Residential and Commercial)

Detailing of beams, slabs, columns, and foundations as per SP34 using AutoCAD.

Contact Periods:
Lecture: 00 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Perform the design and detailing of structural elements using IS code.	K3
CO2	Analyze the structural systems under gravity and lateral loads.	K3
CO3	Analysis and design of steel and reinforced concrete structures as per IS Code.	K3
CO4	Compute the design loads on industrial structures.	K3
CO5	Interpret the behavior of structural systems and detailing using the software.	K3

23PTC801	PROFESSIONAL PRACTICES, ETHICS AND BUILDING BYE-LAWS	SEMESTER VIII

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To create an awareness on Human Values, Engineering Ethics, contracts management, various legal aspects related to Civil Engineering and the knowledge of Building bye-laws.	
UNIT – I	**HUMAN VALUES AND PROFESSIONAL ETHICS**	**9 Periods**
Introduction human values – Morals – Civic virtue – Ethics – Work ethics – Engineering Ethics – Professional Ethics – Business Ethics – Corporate Ethics – Engineering Ethics – Personal Ethics – Code of Ethics by Institution of Engineers (India) – Uses of Ethical Theories – Profession and Professionalism – Professional Responsibility – Conflict of Interest – Gift Vs Bribery – Environmental breaches – Negligence – Deficiencies in state of the art – Vigil Mechanism – Whistle blowing – Protected disclosures.		
UNIT – II	**PROFESSIONAL PRACTICES**	**9 Periods**
Respective roles of various stakeholders: **Government** (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens) – **Standardization Bodies** (BIS, IRC) (formulating standards of practice) –**Professional bodies** (Institution of Engineers (India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies / Planning Authorities) (certifying professionals and offering platforms for interaction) –**Clients/ owners** (role governed by contracts) – **Developers** (role governed by regulations such as RERA) –**Consultants** (role governed by bodies such as CEAI) –**Contractors** (role governed by contracts and regulatory Acts and Standards) – **Manufacturers/ Vendors/ Service agencies** (role governed by contracts and regulatory Acts and Standards).		
UNIT – III	**CONTRACT, LABOUR AND CONSTRUCTION LAW**	**9 Periods**
Indian Contract Act (1972) and amendments covering General principles of contracting–Contract Formation and Law – Privacy of contract– Industrial Disputes Act (1947) – Industrial Employment (Standing Orders) Act (1946) –Workmen's Compensation Act (1923) – Building and Other Construction Workers (Regulation of employment and conditions of service) Act (1996) and Rules (1998) – RERA Act (2017) – National Building Code (2017).		
UNIT – IV	**ARBITRATION AND INTELLECTUAL PROPERTY RIGHTS**	**9 Periods**
Arbitration – Matters for reference to arbitration – Kinds of Arbitration– Arbitrator – Appointment, powers, disabilities – Arbitration agreements– Process – Arbitration Award – Dispute Resolution Methods. Intellectual Property Rights (IPR): Introduction – Forms of IP– Law relating to Copyright in India– Patentable inventions – Process of obtaining patent – Law and policy relating to Patents – Infringement and related remedies.		
UNIT – V	**BUILDING BYE-LAWS**	**9 Periods**
General – Objective – Importance – Applicability – Principles – Standard guidelines of building elements – Provision for access, Lighting and Ventilation, Fire protection, Drainage and sanitation – Requirement for parking, Landscaping, Low income housing –Building bye-laws for various types of buildings.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Govindarajan M,Natarajan S, Senthil Kumar V. S, **"Engineering Ethics"**, Prentice Hall ofIndia, New Delhi, 2004.*
2	*Dr.Kumaraswamy, A.K.Kameswara Rao, **"Building Planning and Drawing"**, Charotar Publishing Housing Pvt. Ltd., 2015.*

REFERENCES:

1	*Mike W. Martin and Roland Schinzinger,* ***"Ethics in Engineering"****, Tata McGraw Hill, New Delhi, 2003*
2	*Neelima Chandiramani,* ***"The Law of Contract: An Outline"****, Avinash Publications Mumbai, 2000.*
3	*T. Ramappa,* ***"Intellectual Property Rights Law in India"****, Asia Law House, 2010.*
4	*National Building Code – 2016.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply the knowledge of Human Values and Professional ethics.	K2
CO2	Describe various professional practices and roles of various stakeholders.	K2
CO3	Implement the Contract, Labour and Construction Laws in Civil Engineering profession.	K3
CO4	Apply the knowledge on Arbitration and Intellectual Property Rights.	K2
CO5	Develop good insight into Building by-laws.	K2

23PTC802	HOUSING PLANNING AND MANAGEMENT	SEMESTER VIII

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	to have a comprehensive knowledge of planning, design, evaluation, construction and financing of housing projects in sustainer manner.	
UNIT – I	**INTRODUCTION TO HOUSING**	**9 Periods**
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 Periods**
Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods, Open Development Plots, Apartments, Gated Community , Township , Rental Housing, Co-operative Housing, Slum Improvement , Slum Housing Programmes, Role of Public, Private and Non-Government Organisations.		
UNIT – III	**PLANNING AND DESIGN OF HOUSING PROJECTS**	**9 Periods**
Formulation of Housing project - Base map preparation - survey techniques - Analytical methods - region classification - Demographic methods - population forecasting. Introduction of Remote sensing, GIS and GPS in urban planning context - Regional planning		
UNIT – IV	**CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS**	**9 Periods**
New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation		
UNIT – V	**HOUSING FINANCE AND PROJECT APPRAISAL**	**9 Periods**
Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Public Private partnership projects- Viability Gap Funding Pricing of Housing Units, Rents, Recovery Pattern.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total:45 Periods**		

TEXT BOOK

1	*Meera Mehta and Dinesh Mehta,* ***Metropolitan Housing Markets****, Sage Publications Pvt. Ltd., New Delhi, 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.
4	Peter Hall, Mark Tewdwr-Jones***, Urban and Regional Planning***. Taylor & Francis, (2010).

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Know basic terms of housing, housing laws and control regulations.	K2
CO2	identify the role of public, private and non-government organizations.	K2
CO3	identify the different types of sites and improve their knowledge in design and evaluation.	K2
CO4	choose the effective materials for construction.	K2
CO5	Know the use of the finance assistance given by government.	K2

23PTC803	PROJECT WORK	SEMESTER VIII

PREREQUISITES	L	T	P	C
NIL	0	0	6	3

Course Objective	To enable the students to apply the theoretical knowledge in practice, improve the design capability and provide an opportunity of in-depth exploration of a particular topic in the Civil Engineering.

COURSE CONTENT:

It will be assigned by the Department for maximum of four students in a group, under the guidance of a Supervisor. This course envisages a design problem or experimental work in any one of the disciplines of Civil Engineering.

The Project work includes:

- Survey and collection of relevant data on the assigned topic
- Working out a preliminary Drawings to the Problem relating to the topic
- Conducting preliminary & detailed Analysis/ Modeling / Simulation / Design / Feasibility
- Preparing a Written Report on the Study conducted
- Final Seminar as oral Presentation before a Departmental Committee

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 90 Periods Total: 90 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Identify Civil Engineering Analytical Problems based on present scenario	K2
CO2	Describe the IS Codes & Develop the general arrangement drawings.	K3
CO3	Do detailed Analysis/Modelling, produce detailed design & drawings.	K3
CO4	Produce a bill of quantities and calculate approximate project cost.	K3
CO5	Prepare the final detailed project report.	K3

23PTC5E1	INDUSTRIAL WASTEWATER MANAGEMENT	SEMESTER V

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To understand the qualitative and quantitative assessment of industrial wastewater and the principles of waste minimization technique on environment and the effect of disposal of various industrial wastewater and their treatment technologies.

UNIT – I	SOURCES OF INDUSTRIAL WASTE	9 Periods

Industrial waste survey – Sources & effects measurement of Industrial wastewater Flow-generation rates - Sampling and preservation of samples for analysis -Wastewater Characterization-Toxicity of industrial effluents- Prevention vs Control of Industrial Pollution – Source reduction techniques - effect of Industrial Effluents on Streams, Sewer and Human health – Industrial scenario in India – Industrial activity and environment.

UNIT – II	TREATMENT AND CONTROL TECHNOLOGIES	9 Periods

Waste minimization - Equalization - Neutralization – Oil separation – Flotation – Precipitation – Heavy metal removal – Adsorption – Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors - Chemical oxidation – Ozonation – Photocatalysis – Wet Air Oxidation - Evaporation – Ion Exchange – Membrane Technologies – management of RO reject - Nutrient removal – Implementing and promoting pollution prevention programs in industries.

UNIT – III	INDUSTRIAL WASTEWATER DISPOSAL	9 Periods

Individual and Common Effluent Treatment Plants – Advantages – Joint treatment of Industrial and domestic wastewater – Recirculation of Industrial Waste – Disposal of effluent into streams, lakes and oceans and associated problems – Effluent disposal methods – Sludge disposal technique.

UNIT – IV	INDUSTRIAL PROCESS AND TREATMENT-I	9 Periods

Industrial manufacturing process and source, wastewater characteristics, effects and treatment methods of liquid waste from Textile industry - Sugar mill– Coal and Gas based power plants – Fertilizer industry – Dairy and food processing industries.

UNIT – V	INDUSTRIAL PROCESS AND TREATMENT-II	9 Periods

Industrial manufacturing process and source, wastewater characteristics, effects and treatment methods of liquid waste from Pulp and Paper mill - Iron and Steel industries - Automobile Industry- Pharmaceutical industry- Industrial estates and Industrial Clusters.

Contact Periods:
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXTBOOKS

1	*Garg S.K., "**Sewage Disposal and Air Pollution Engineering**", Khanna Publishers, New Delhi, 2018*
2	*Patwardhan, A.D., **"Industrial Waste Water Treatment**", PHI Learning, 2017*

REFERENCES

1	*Eckenfelder, W.W., "**Industrial Water Pollution Control",** McGraw-Hill, 2014.*
2	*Soli. J Arceivala, Shyam. R Asolekar "**Wastewater Treatment for Pollution Control and Reuse**", McGraw-Hill, 2006.*
3	*Frank Woodard, **"Industrial waste treatment Handbook**", Butterworth Heinemann, New Delhi, 2006.*
4	*Nemerow N. L., "**Industrial Water Pollution",** Addison - Wesley Publishing Company Inc., USA, 2007.*
5	*Mahajan S. P. **"Pollution Control in process industries**", Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008.*
6	*Metcalf and Eddy, "**Waste Water Engineering- Treatment and Reuse**", Tata Mc-Graw Hill Company, New Delhi 2007*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Carry out qualitative and quantitative assessment of industrial wastewater	K2
CO2	Analyze the principles of waste minimization techniques	K2
CO3	Identify and select appropriate disposal methods	K2
CO4	Manage the effluent treatment from major industries	K2
CO5	Examine the manufacturing and treatment processes and the concept of industrial clusters	K2

23PTC5E2	SUSTAINABLE ENGINEERING AND TECHNOLOGY	SEMESTER V

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To establish a clear understanding sustainable development, methods & tools and also the role and impact of various aspects of engineering decisions on environmental, societal, and economic problems.	
UNIT – I	**INTRODUCTION TO SUSTAINABILE DEVELOPMENT**	**9 Periods**
Sustainability - Introduction, Need and concept of sustainability, Social environmental and economic sustainability concepts. Evolution of Sustainable Development – Brundtland Commission, 1987, Agenda 21, MDGs and SDGs; United Nations summits and their outcomes. Multilateral Environmental Agreements, Conventions and Protocols. Challenges for Sustainable Development. Clean Development Mechanism (CDM). An overview of Sustainable Development Goals and Targets: Global and Indian perspective.		
UNIT – II	**ENVIRONMENTAL ISSUES**	**9 Periods**
Local Environmental Issues- Solid waste, impact of solid waste on natural resources, zero waste concept and three R concept, Air Pollution, water pollution sources and Effects. Global Environmental Issues- Resource degradation: deterioration of water resources, land degradation, air pollution, climate change and global warming, ozone layer depletion, carbon footprint, carbon trading.		
UNIT – III	**LIFE CYCLE ANALYSIS AND ENVIRONMENT IMPACT ASSESSMENT**	**9 Periods**
Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Environment Impact Assessment (EIA) - Procedures of EIA in India. Environmental legislations in India - Water Act, Air Act.		
UNIT – IV	**SUSTAINABLE HABITAT**	**9 Periods**
Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification, Methods for increasing energy efficiency of buildings. Sustainable cities, Sustainable transport.		
UNIT – V	**SUSTAINABLE ENERGY SOURCES**	**9 Periods**
Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, biofuels, Energy derived from oceans, Geothermal energy.		
Contact Periods **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45Periods**		

TEXTBOOKS:

1	*Allen, D. T. and Shonnard, D. R., "**Sustainability Engineering: Concepts, Design and Case Studies**", Prentice Hall, 2011.*
3	*Bradley. A.S; Adebayo, A.O., Maria, P. **"Engineering applications in sustainable design and development**", Cengage learning, 2015.*

REFERENCES:

1	*ECBC Code 2007, "**Bureau of Energy Efficiency**", New Delhi Bureau of Energy Efficiency Publications*
2	*Ni bin Chang, "**Systems Analysis for Sustainable Engineering: Theory and Applications**", McGraw-Hill Professional, 2010.*
3	*Bhavik R. Bakshi,"**Sustainable Engineering: Principles and Practice**",Cambridge University Press, 2019*
4	*https://www.globalreporting.org/*
5	*https://www.sustainabilityconsortium.org/*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Summarize the different environmental agreements and protocols for the sustainable development.	K2
CO2	Identify different types of local and global environmental issues and their sustainable solutions	K2
CO3	Perform Life Cycle Analysis and Environment Impact Assessment	K2
CO4	Apply the concepts of sustainable habitat while designing an infrastructure	K2
CO5	Relate the different renewable energy resources and methods to implement green technology	K2

23PTC5E3	TRAFFIC ENGINEERING AND MANAGEMENT	SEMESTER V

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To gain knowledge on the traffic surveys, signals, safety aspects and traffic management projects	
UNIT – I	**INTRODUCTION**	**9 Periods**
Scope– Properties of traffic engineering elements – vehicle, driver and road characteristics - skid resistance and breaking efficiency – simple problems. Components of traffic Engineering – control mechanisms.		
UNIT – II	**TRAFFIC SURVEYS**	**9 Periods**
Surveys – Classification - Volume, Speed and delay, origin and destination - parking, accidents – stastical methods for traffic engineering – simple problems – analysis-capacity of roads-level of service – interpretation of traffic studies and conclusions.		
UNIT – III	**TRAFFIC CONTROL**	**9 Periods**
Traffic signs – location and design recommendations - Road markings – Classification and design of traffic signals –signal co-ordination – Traffic islands and rotaries – Traffic control aids and street furniture – Regulation of traffic –Modern methods of traffic control.		
UNIT – IV	**TRAFFIC SAFETY AND MANAGEMENT**	**9 Periods**
Road accidents – types - causes and prevention with emphasis on engineering factor s – Traffic management, Transport system management (TSM) and Transport Demand Management (TDM), restrictions on turning movements, one way streets, traffic segregation, tidal flow operation, exclusive bus lanes and other management measures – introduction to intelligent transport systems (ITS).		
UNIT – V	**TRAFFIC MANAGEMENT PROJECTS**	**9 Periods**
Design of parking facilities, on street and off street parking – case studies on area traffic management – street lighting –noise and air pollution abatement – Basis of comprehensive traffic and transport studies – intersection improvements including design of roundabouts.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 00 Periods Total: 45 Periods**		

TEXT BOOKS :

1	*Kadiyali.L.R,* ***"Traffic Engineering and Transport planning"****, Khanna Publishers, 2011.*
2	*Salter.R.I., and Hounsell.N.B,* ***"Highway Traffic Analysis and Design"****, Macmillan Press Ltd., 2000.*

REFERENCES :

1	*Manual of Transportation Engineering studies, Institution of Transportation Engineering, Prentice hall Publications, 1994.*
2	*Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning And Management*
3	*John.E.Tyworth.,* ***"Traffic Management Planning"****, Operation and Control, Addison Wesley Publishing Company, 1997.*
4	*Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski,* ***"Principles of Highway Engineering and Traffic Analysis"****, Wiley India Pvt. Ltd., New Delhi,2011.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Express the details of traffic elements and their characteristics.	K2
CO2	Conduct various traffic surveys.	K2
CO3	Perform design of traffic signals.	K3
CO4	Analyse the causes and control measures of road accidents.	K3
CO5	Design of parking facilities with improved intersection points.	K2

23PTC5E4	HYDROLOGY	SEMESTER V

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To obtain the knowledge on the spatial and temporal variations of rainfall and their analysis, design of well system and predict the future floods and identify their routing.	
UNIT – I	**HYDROMETEOROLOGY**	**9 Periods**
Hydrological cycle – processes and budget - Hydro meteorological factors – Cloud formation – Winds and their movement –Types of precipitation– Forms of precipitation – Indian monsoon system–Density and Adequacy of rain gauges– Recording and non- recording raingauges–Optimum number of raingauges.		
UNIT – II	**PRECIPITATION AND ABSTRACTIONS**	**9 Periods**
Spatial distribution – Consistency analysis – Frequency analysis – Intensity, duration, frequency relationships – Evaporation– Infiltration – Horton's equation – Infiltration indices – measurement of infiltration–abstraction loss.		
UNIT – III	**STREAM FLOW**	**9 Periods**
Runoff process –measurement of stream flow– factors affecting stream flow– Stage-discharge relationship– Peak discharge estimation– hydrograph analysis– base flow separation– unit hydrograph for stream flow estimation– synthetic unit hydrograph– hydrological modeling.		
UNIT – IV	**GROUND WATER HYDROLOGY**	**9 Periods**
Occurrence of ground water – Types of aquifer – Dupuit's assumptions – Darcy's law – Estimation of aquifer parameters – Pump tests – Steady and unsteady state conditions - Discharge in a Confined and Unconfined Aquifers–Leaky aquifer–well loss–aquifer loss–problems.		
UNIT – V	**FLOOD ANALYSIS**	**9 Periods**
Flood estimation – Gumbel's method – Log Pearson type III method – Reservoir flood routing –Channel routing – Types of streams – Stage discharge relationships - Flow measurements – Current meter method for velocity measurements.		
Contact Periods: **Lecture:45 Periods Tutorial: 0 Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS :

1	*Santosh Kumar Garg,* ***"Irrigation Engineering and Hydraulics Structures"****,Khanna Publishers, New Delhi,2023.*
2	*Jayaramy Reddy. P.,* ***"Hydrology"****,Tata McGraw-Hill Publications Pvt. Ltd, New Delhi, 2016*

REFERENCES :

1	*Subramanya. K.,* ***"Engineering Hydrology"****, Tata McGraw-Hill Publications Pvt. Ltd, New Delhi,2017*
2	*Warren Viessman and Gary L. Lewis,* ***"Introduction to Hydrology"****, Prentice Hall of India Pvt. Ltd, NewDelhi,2003*
3	*David K. Todd and Larry W. Mays,* ***"Groundwater Hydrology"****, Wiley Publications Pvt. Ltd, New Delhi,2011*
4	*Asawa G.L.,* ***"Irrigation and Water Resources Engineering"****, New Age International Publications, New Delhi, 2006.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Summarise the types of rain gauges and estimate optimum number of raingauges.	K2
CO2	Present the meteorological data for forecasting analysis.	K2
CO3	Identify the needs and importance of hydrographs in Run-off studies	K2
CO4	Design the open and tube wells for different aquifers	K2
CO5	Predict the future floods and identify the importance of flood routing	K2

23PTC5E5	SAFETY IN CIVIL ENGINEERING PRACTICES	SEMESTER V

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To execute various safety measures in construction site during pre- construction, construction stage and to carefully execute the protection measures during formwork, concrete pouring, and roof work along with the safety measures to handle the various equipment in construction site so as to avoid the construction hazards.	
UNIT – I	**SAFETY AT PRE-CONSTRUCTION STAGE**	**9 Periods**
Basic Terminologies – Safety, Hazard, Risk, Accident - Risk Planning and scheduling – Housekeeping – Safe access – Site safety – Basic checklist – Electrical Safety – Electrical power lines –Temporary Wiring – Overhead high-voltage and low-voltage electricity – Underground electrical hazards		
UNIT – II	**SAFETY DURING CONSTRUCTION**	**9 Periods**
Personal Safety – Basic personal protective equipment and clothing – Eye and Face protection, Foot protection, Hand protection, Head protection and Hearing protection – Safety related work practices. Safety measures during Excavation – General requirements for trenches and excavations, Sloping and shoring requirements, Underground construction.		
UNIT – III	**FORMWORK AND ROOFWORK**	**9 Periods**
Safety measures for Formwork – Slip forms – Working platforms – Materials Hoist – Concrete pouring and pumping – General framing – Guardrails – Floor and roof openings – Lifting appliances -Fall protection- Roof work – Roof jacks and toe-holds (slide guards) Scaffolds – General provision – Guardrails, Toe boards for scaffolds – Erection requirements – Wood scaffolds erection guidelines – Other types of scaffolds – Truss erection.		
UNIT – IV	**EQUIPMENT SAFETY**	**9 Periods**
Ladders Safety – General requirements – Job-built ladders, Stepladders – Portable tools – Hand tools, Pneumatic tools, Power tools-saws – Compressed air for cleaning – Pneumatic nailing and stapling equipment, Construction site hazards.		
UNIT – V	**CONSTRUCTION SAFETY PROGRAM**	**9 Periods**
Elements of effective safety program - Job safety analysis - Fault tree analysis - Job-site safety assessment - Safety regulations at construction sites - Human factors in construction safety - Safety meetings - Safety incentives - Safety training - Safety policy - Safety committees - Safety inspection - Safety audit.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total:45 Periods**		

TEXT BOOKS :

1	*Bhattacharjee, S.K. ,**"Safety Management in Construction"**, Khanna Publishers, 2011.*
2	*Li, R.Y.M. & Poon, S.W. "Construction Safety", Springer Publishers, 2013.*

REFERENCES:

1	*Jimmy W. Hinze, **"Construction Safety",** Prentice Hall Inc., 2012.*
2	*Richard J. Coble, Jimmie Hinze and Theo C. Haupt, **"Construction Safety and Health Management"**, Prentice Hall Inc., 2011.*
3	*John Schaufelberger, **"Construction Project Safety"**, Wiley Publications, 2013.*
4	*Indian Standard Codes: SP 70:2001, **"Handbook on Construction Safety Practices"**, Bureau of Indian Standards, New Delhi.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Implement the basic safety measures during pre-construction work.	K2
CO2	Utilize the personal protective equipments in an appropriate manner and execute the safety precautions during construction stage.	K2
CO3	Assess the safety measures required during formwork, concreting work and roof work.	K3
CO4	Safely handle the equipment and tools for various construction works.	K3
CO5	Implement the safety policy in construction sector.	K3

23PTC6E1	FUNDAMENTALS OF REMOTE SENSING AND GIS APPLICATIONS	SEMESTER VI

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	Familiarize the concepts and principles of various components of remote sensing, GIS and its practical applications in the fields of civil engineering ,water resources, land use studies, soil science, Agriculture, forestry and Oceanography.	
UNIT – I	**PRINCIPLES OF REMOTE SENSING**	**9 Periods**
Components of Remote Sensing – Energy, Sensor, Interacting Body - Active and Passive Remote Sensing – Platforms – Aerial and Space Platforms – Balloons, Helicopters, Aircraft and Satellites – Synoptivity and Repetivity – Electro Magnetic Radiation (EMR) – EMR spectrum – Visible, Infra-Red (IR), Near IR, Middle IR , Thermal IR and Microwave – Black Body Radiation - Planck's law – Stefan-Boltzman law.		
UNIT – II	**EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIALS**	**9 Periods**
Atmospheric characteristics – Scattering of EMR – Raleigh, Mie, Non-selective and Raman Scattering – EMR Interaction with Water vapour and ozone – Atmospheric Windows Significance of Atmospheric windows – EMR interaction with Earth Surface Materials – Radiance, Irradiance, Incident, Reflected, Absorbed and Transmitted Energy – Reflectance – Specular and Diffuse Reflection Surfaces- Spectral Signature – Spectral Signature curves – EMR interaction with water, soil and Earth Surface.		
UNIT – III	**OPTICAL AND MICROWAVE REMOTE SENSING AND IMAGE PROCESSING**	**9 Periods**
Satellites - Classification – Based on Orbits – Sun Synchronous and Geo Synchronous – Based on Purpose – Earth Resources Satellites, Communication Satellites, Weather Satellites, Spy Satellites – Satellite Sensors - Resolution – Spectral, Spatial, Radiometric and Temporal Resolution – Description of Multi Spectral Scanning – Along and Across Track Scanners – Description of Sensors in Landsat, SPOT, IRS series – Current Satellites - Radar – Speckle – Back Scattering – Side Looking Airborne Radar – Synthetic Aperture Radar – Radiometer – Geometrical characteristics of digital image processing – Pre-processing image enhancement–Filtering–Classification.		
UNIT – IV	**GEOGRAPHIC INFORMATION SYSTEM**	**9 Periods**
GIS – Components of GIS – Hardware, Software and Organizational Context – Data – Spatial and Non-Spatial – Maps – Types of Maps – Projection – Types of Projection - Data Input – Digitizer, Scanner – Editing – Raster and Vector data structures – Comparison of Raster and Vector data structure – Analysis using Raster and Vector data – Retrieval, Reclassification, Overlaying, Buffering – Data Output – Printers and Plotters.		
UNIT – V	**SATELLITE IMAGERY AND GIS APPLICATIONS**	**9 Periods**
Application of satellite imagery – Merits – Limitations – Comparison with aerial photographs – Visual interpretation of satellite imagery – Elements of interpretation – Interpretation keys GPS and its Applications- Application of remote sensing and GIS in Surveying, Water resources exploration – Land use/Land cover studies – Geology –Agriculture, Disaster Management, Coastal zone Management and Environmental Engineering.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*A M Chandra, S.K.Ghosh,* ***"Remote Sensing and Geographical Information system"****, Narosa, Publishing house New Delhi, 2006.*
2	*Patel A.N and Surendrasingh,* ***"Remote Sensing Principles and applications"****, Scientific Publishers, Jodhpur , 2001*
3	*AnjiReddy,* ***"Remote Sensing and Geographical Information system"****, BS Publications 2014*

REFERENCES:

1	*M.G. Srinivas, (Edited by)* ***" Remote sensing applications"****, Narosa publishing House, 2001.*
2	*Thomas M.Lille sand & Raiph W.Kiefer,* ***"Remote sensing and Image Interpretation"****, John Wiley Sons,2004*
3	*Burrough P.A, Principles of GIS for land resources assessment, Oxford, 2002.*
4	Fundamentals of Remote sensing, S.C.Bhatia, Atlantic Publishers & Distributions (P) Ltd, 2008.

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Know the principles and methods of remote sensing**.**	K1
CO2	To gain the knowledge on electromagnetic radiation waves interaction with materials.	K2
CO3	Apply the concept of satellite remote sensing, Data acquisition and image processing.	K2
CO4	Categorize the hardware and software of GIS.	K3
CO5	Utilize the application of GIS in the areas of water resources, land use studies, soil science, Agriculture, forestry and Oceanography.	K3

23PTC6E2	ENERGY CONSERVATION TECHNIQUES IN CONSTRUCTION	SEMESTER VI

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To facilitate learners to understand sustainable building designs and its parameters such as energy and water efficiency, Comfort in buildings, and waste management.	
UNIT – I	**INTRODUCTION TO SUSTAINABILITY AND HEAT TRANSFER IN BUILDING**	**9 Periods**
Overview of Sustainability and Green buildings, Selection of site – preservation and planning, Influence of climate on buildings, Basics of climatology, Earth – Sun relationship, Solar angles and sun path diagram, Design of shading systems. Basics of Thermodynamics, Convection/radiation heat transfer, Heat gain through various elements of a building.		
UNIT – II	**INDOOR ENVIRONMENTAL QUALITY MANAGEMENT**	**9 Periods**
Thermal comfort – Psychrometry and its applications, Thermal comfort models and case studies Acoustics – Building acoustics, measures, defects and prevention of sound transmission. Indoor Air Quality – Effects, design consideration and integrated approach for IAQ management. Visual comfort – Enhancement strategies for Daylighting and Artificial lighting.		
UNIT – III	**RESOURCE MANAGEMENT IN BUILDING**	**9 Periods**
Energy efficiency – Energy efficiency in building envelope, energy simulation, Energy management system – lighting and renewable energy and Energy Audit. Water Efficiency – Planning and design of water management system, Rain water harvesting, Water efficient design and fixtures, Treatment and reuse and Water efficient landscape system.		
UNIT – IV	**WASTE MANAGEMENT IN BUILDING**	**9 Periods**
Waste management – Types of waste and its treatment methods, Construction and demolition waste management, Waste management in residential, commercial buildings, healthcare facilities. Materials – Green product certifications, Features of sustainable building materials and sustainable alternatives.		
UNIT – V	**LIFE CYCLE ASSESSMENT AND RATING SYSTEM**	**9 Periods**
Life cycle assessment and its types – Modelling and Analysis, Greenhouse gas emission. Different phases of Green building project management. Green building rating systems- LEED, BREEAM and others, Indian Green building rating systems – IGBC & GRIHA, IGBC criteria for certification.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	*Kibert, C.* ***"Sustainable Construction: Green Building Design and Delivery",*** *John Wiley & Sons, 4th Edition, 2016.*
2	*Satyajit Ghosh, Abhinav Dhaka,* ***"Green structures: Energy efficient buildings",*** *2015.*

REFERENCES:

1	*NPTEL* ***"Energy efficiency acoustics and day lighting in building****", Prof.B.Bhattacharjee., IIT Delhi.*
2	*NPTEL* ***"Energy Efficiency and Simulation",*** *Prof.E.Rajsekar., IIT Roorkee.*
3	*Baird, George,* ***"Energy performance of Buildings"*** *C R C Publisher, 2011.*
4	*Ganesan T P,* ***"Energy Conservation in Buildings",*** *ISTE Professional Center, Chennai,1999*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Comprehend sustainable design, climatology, shading system and analyze heat transfer mechanism in buildings.	K2
CO2	Assess the design considerations and parameters for thermal comfort, visual comfort, indoor air quality and acoustics.	K2
CO3	Identify solutions for energy efficiency and water efficiency	K2
CO4	Assess the various waste management in buildings	K2
CO5	Outline the life cycle assessment and rating system	K2

23PTC6E3	MAINTENANCE AND REHABILITATION OF STRUCTURES	SEMESTER VI

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To make the students to inspect the distressed structures and apply the suitable repair materials and rehabilitation techniques.	
UNIT – I	**MAINTENANCE AND REPAIR STRATEGIES**	**9 Periods**
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	**REPAIR FOR DISTRESSED MEMBERS**	**9 Periods**
Types, Causes and effects of cracks – effects due to corrosion, climate, temperature, chemicals and aggressive environment - Cover thickness requirements - Repairs to overcome deflection, cracking, chemical disruption, corrosion, wear, fire, leakage and marine exposure.		
UNIT – III	**MATERIALS AND SPECIAL CONCRETE FOR REPAIR**	**9 Periods**
Selection of Materials- Admixtures used as repair materials - Concrete chemicals - Expansive cement - Ferro cement - FRP sheet, Fibre composites - special concrete: Sulphur infiltrated concrete - High strength concrete - Foamed concrete – Geopolymer concrete, Reactive powder concrete - Vacuum concrete.		
UNIT – IV	**TECHNIQUES FOR REPAIR AND CORROSION PROTECTION METHODS**	**9 Periods**
Non-destructive Testing Techniques – load test for stability - Epoxy injection - Guniting and Shotcreting – Shoring and Underpinning - Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.		
UNIT – V	**REHABILITATION AND STRENGTHENING OF STRUCTURES**	**9 Periods**
Strengthening of Super Structures - Jacketing - Reinforcement addition, Plating, Conversion to composite construction - Post stressing - Strengthening of substructures – Case studies: Transportation of structures from one place to other - Demolition Techniques – Engineered demolition methods – automated demolition techniques.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Dr. B. Vidivelli,* ***"Rehabilitation of concrete structures"****, Standard Publishers, 2021*
2	*Hand Book on* ***"Repairs and Rehabilitation of RCC Buildings"*** *Central Public Works Department, Govt. ofIndia, New Delhi, 2011.*

REFERENCES:

1	*Bhattecharjee,* ***"Concrete Structures Repair Rehabilitation and Retrofitting"****, CBS Publishersand Distributors, New Delhi, 2019.*
2	*Poonam I. Modi, Chirag N. Patel,* ***"Repair & Rehabilitation of Concrete Structures"****, PHILearning Pvt. Ltd., New Delhi, 2016.*
3	*Dr. R. Saravanan R. Dineshkumar,* ***"Repair and Rehabilitation of Structures"****, Lakshmi Publications, Chennai, 2018.*
4	*M. S. Shetty,* ***"Concrete Technology – Theory and Practice"****, S. Chand and Company, NewDelhi, 2019.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Identify the causes of deterioration and evaluate a damaged structure.	K2
CO2	Do repair works for distressed members in a structures.	K3
CO3	Propose the appropriate materials and concrete for various repair conditions.	K3
CO4	Execute various techniques for repair and protection methods.	K3
CO5	Rehabilitate and strengthen the various elements of a structure subjected to deterioration.	K3

23PTC6E4	EXPERIMENTAL STRESS ANALYSIS	SEMESTER VI

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To understand the different methods of experimental stress analysis and to gain knowledge on various strain gauges, non-destructive testing methods, distress measurement and the principles of photoelasticity.	
UNIT – I	**PRINCIPLES OF EXPERIMENTAL APPROACH**	**9 Periods**
Introduction - Merits of experimental stress analysis - Applications of experimental stress analysis - Different methods –Simplification of problems.		
UNIT – II	**STRAIN MEASUREMENT USING STRAIN GAUGES**	**9 Periods**
Definition of strain - Properties of Strain Gauge Systems-Types of Strain Gauges –Mechanical, Acoustic and Optical Strain Gauges. Introduction to Electrical strain gauges -Inductance strain gauges – LVDT –Resistance strain gauges –various types –Gauge factor.		
UNIT – III	**NON-DESTRUCTIVE TESTING METHODS**	**9 Periods**
Load testing on structures, buildings, bridges and towers - Rebound hammer- Acoustic emission- Ultrasonic testing, Principles and applications - Holography - Use of laser for structural testing.		
UNIT – IV	**DISTRESS MEASUREMENTS**	**9 Periods**
Diagnosis of distress in structures- crack observation and measurement- Corrosion of reinforcement in concrete- Half cell, construction and use- damage assessment - controlled blasting for demolition.		
UNIT – V	**PHOTOELASTIC METHODS OF STRESS ANALYSIS**	**9 Periods**
Introduction – Stress-Optic Law – Effects of a Stressed Model in a Plane Polariscope– Effects of a Stressed Model in a Circular Polariscope– Tardy Compensation – Two-Dimensional Photoelastic Stress Analysis – Fringe Multiplication and Fringe Sharpening – Properties of Commonly Employed Photoelastic Materials – Material Calibration – Introduction to Three-Dimensional Photoelasticity and digital photo elasticity.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	J. W. Dally & W. F. Riley, "Experimental Stress Analysis" College House Enterprises, 2005.
2	U.C.Jindal, “Experimental Stress analysis”,Pearson Publications, 2012.

REFERENCES:

1	Sadhu Singh, “Experimental Stress Analysis”, Khanna publishers, New Delhi, 1996.
2	Dalley and Riley, “Experimental Stress Analysis”- McGraw Hill Book Company, New York 1991.
3	L.S.Srinath. “Experimental Stress Analysis”, Tata McGraw Hill company Book Ltd., NewDelhi. 1984
4	Bray and Stanley, “Non-Destructive Evaluation”, McGraw Hill Publishing co., New York,1989

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom’s Taxonomy Mapped**
CO1	Demonstrate the principles of experimental approach.	K2
CO2	Use strain gauges for the measurement of strain.	K2
CO3	Perform Non-destructive testing methods on the existing structures.	K3
CO4	Diagnose the distressed structures using advanced damage assessing techniques.	K3
CO5	Apply the principles of photoelasticity in stress analysis techniques.	K2

23PTC6E5	PAVEMENT ENGINEERING	SEMESTER VI

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To gain knowledge on various IRC guidelines for designing flexible, rigid pavements, to assess the quality, serviceability conditions of roads, evaluation of pavements and strengthening methods	
UNIT – I	**BASIC CONCEPTS**	**9 Periods**
Pavement – Types and components – Function of components - Historical developments – Approaches to pavement design–Vehicle traffic considerations– Behaviour of road materials under repeated loading consideration-Stresses and deflections in Layered systems.		
UNIT – II	**FLEXIBLE PAVEMENT**	**9 Periods**
Factors affecting flexible pavement-Various approaches of design – Empirical, Semi-empirical and theoretical methods – Applications of different pavement design methods- Design procedure as per IRC design guidelines-Failure criteria for bituminous pavement.		
UNIT – III	**RIGID PAVEMENT**	**9 Periods**
Cement concrete pavement-Factors affecting CC Pavement – Modified Westergaard approach–Design procedure as per IRC design guidelines– Types of joints and their functions– Design of joints.		
UNIT – IV	**PAVEMENT MATERIALS**	**9 Periods**
Pavement materials – Aggregate characteristics and test – Crushing – Abrasion – Impact Tests – Water absorption – Flakiness and Elongation indices. Field compaction – Rammers – Rollers – Compaction control – In-situ density –- Bitumen Emulsion and cutback –Preparation and characteristics uses and tests, mechanism of stripping, adhesion failure–. Bituminous mixes: preparation, design and testing.		
UNIT – V	**EVALUATION AND REHABILITATION**	**9 Periods**
Pavement evaluation – Distress in flexible and rigid pavements –Evaluation based on surface Appearance, Cracks, Patches, potholes and skid resistance - Structural evaluation – Evaluation by deflection measurements - Present Serviceability Index — Strengthening of pavements –Flexible and rigid overlays.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*S.K.Khanna, C.E.G.Justo and Dr.A.Veeraraghavan, **"Highway Engineering"**, Khanna Publishers,Tenth Edition,2013*
2	*Yoder, E.J and Witchak, M.W, **"Principles of Pavement Design"**, e print, Newyork wiley, 2010.*

REFERENCES :

1	*Kadiyali, L.R and N.B.Lal., **"Transport planning & Traffic Engineering"**, Khanna Publishers,2016.*
2	*S.K Sharma, **"Principles, Practice and Design of Highway Engineering"**, S. Chand & Co.,Ltd., New Delhi, 2014.*
3	*Guidelines for the Design of Flexile Pavements, IRC: 37-2012, The Indian roads congress, New Delhi*
4	*Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, IRC: 58-2015, The Indian Roads Congress, New Delhi*
5	*IRC SP20-2002, Design and specification of Rural Roads (Manual), Ministry of rural roads, Government of India, New-Delhi, Reprint 2013.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explore the pavement categories, aspects, and stresses in flexible pavement.	K2
CO2	Implement different methods when designing flexible pavements.	K3
CO3	Analyze the stresses and apply IRC standards for rigid pavement design.	K3
CO4	Develop adequate knowledge of the different quality control tests.	K1
CO5	Evaluate the various pavement distresses and strengthening techniques.	K2

23PTC7E1	ADVANCED CONCRETE DESIGN	SEMESTER VII

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To create an awareness on yield line theory of slabs, design principles of Grid floors, ribbed slabs, bunkers , silos and the design of slender columns, RC walls, bridges and deep beams.	
UNIT – I	**YIELD LINE THEORY OF SLABS AND INELASTIC BEHAVIOUR OF CONCRETE BEAMS**	**9 Periods**
Yield line theory - Assumptions made in analysis – analysis of isotropically and orthotropically reinforced slabs – virtual work method and equilibrium method. Inelastic behavior of concrete beams moment rotation curves–moment redistribution		
UNIT – II	**DESIGN OF SPECIAL RC ELEMENTS**	**9 Periods**
Design of slender columns – Braced and Unbraced columns – design considerations of RC walls– design of deep beams.		
UNIT – III	**GRID FLOORS AND RIBBED SLABS**	**9 Periods**
Grid floors– design principles– analysis of grid floor by approximate method–Ribbed slabs–analysis and design of ribbed slab for moment and shear.		
UNIT – IV	**BUNKERS AND SILOS**	**9 Periods**
Design of Bunkers – Design of Silo – Detailing of reinforcements.		
UNIT – V	**DESIGN OF BRIDGES**	**9 Periods**
Types of bridges – IRC loadings – Design of single span slab bridge deck for class A loading– Design of T – beam bridge for class AA loading.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK

1	*Varghese.P.C,* ***"Advanced Reinforced Concrete Design"****, PrenticeHall of India Private Ltd,NewDelhi,2010.*
2	*Krishnaraju,* ***"Advanced Reinforced Concrete Design–S.Iunits"****,C.B.S.,NewDelhi,2017.*

REFERENCES

1	*IS456-2000,* ***"Indian standard code of practice for plain and reinforced concrete",*** *BIS, NewDelhi.*
2	*SP34(1987),* ***"Hand book on Concrete Reinforcement and Detailing"****, BIS, NewDelhi.*
3	*IRC6–2014, Standard Specifications and Code of Practice for Road Bridges*
4	*Pillai, S. U. and Menon, D,* ***"Reinforced Concrete Design"****,Tata McGraw Hill,2017*
5	*DayaratnamP.,* ***"Design of Reinforced Concrete Structures"****, Oxford & IBH publishing Co.Pvt.Ltd., 2011.*
6	*Subramanian N,* ***"Design of Reinforced Concrete Structures"****, Oxford University Press, 2014.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Analyse slabs using yield line theory and know the concepts of inelastic behavior of beams.	K3
CO2	Analyse and design slender columns, RC walls and deep beams as per Indian Standards.	K3
CO3	Design Grid floors and ribbed slabs using various methods.	K3
CO4	Design bunkers and silos.	K3
CO5	Perform analysis and design of bridges as per Indian Standards.	K3

23PTC7E2	SMART MATERIALS AND SMART STRUCTURES	SEMESTER VII

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To gain the knowledge on strain measuring techniques, applications of smart materials and signal processing and control system.	
UNIT – I	**INTRODUCTION AND MEASURING TECHNIQUES**	**9 Periods**
Introduction to Smart Materials and Structures -Examples of intelligent materials, structural materials, Electrical materials. Strain Measuring Techniques using Electrical strain gauges, Types - Resistance – Capacitance – Inductance - Wheatstone bridges - Pressure transducers - Load cells - Temperature Compensation - Strain Rosettes.		
UNIT – II	**SENSORS**	**9 Periods**
Sensing Technology - Types of Sensors - Physical Measurement using Piezo Electric Strain measurement - Inductively Read Transducers - The LVDT - Fiber optic Techniques. Chemical and Bio - Chemical sensing in structural Assessment - Absorptive chemical sensors - Spectroscopes - Fibre Optic Chemical Sensing System and Distributed measurement.		
UNIT – III	**ACTUATORS**	**9 Periods**
Actuator Techniques - Actuator and actuator materials - Piezoelectric and Electrostrictive Material - Magneto structure Material - Shape Memory Alloys - Electro-rheological Fluids - Electromagnetic actuation - Role of actuators and Actuator Materials.		
UNIT – IV	**SIGNAL PROCESSING AND CONTROL SYSTEMS**	**9 Periods**
Data Acquisition and Processing - Signal Processing and Control for Smart Structures - Sensors as Geometrical Processors - Signal Processing - Control System - Linear and Non- Linear.		
UNIT – V	**APPLICATIONS IN CIVIL ENGINEERING**	**9 Periods**
Application of Shape Memory - Alloys in Bridges – Concept of Smart Bridges – Application of ER Fluids - Application of MR Dampers in Different Structures – Application of MR Dampers in Bridges and High Rise Structures – Structural Health Monitoring - Application of Optical Fibres - Concept of Smart Concrete.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Brain Culshaw,* ***"Smart Structure and Materials"*** *Artech House - Borton, London, 2003.*
2	*Srinivasan, A.V. and Michael McFarland, D.* ***"Smart Structures: Analysis and Design".*** *Cambridge University Press, 2010*

REFERENCES

1	*L.S. Srinath,* ***"Experimental Stress Analysis"*** *Tata McGraw Hill, 2004.*
2	*Jayant Sirohi* ***"Smart Structure theory"*** *2013*
3	*Adaptronics* ***"Smart materials & Structures"*** *Michael Sinapius, 2020*
4	*Zengtao* ***"Advanced Thermal stress Analysis of Smart materials and structures"*** *2019*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply the various structural materials and measuring techniques in the field.	K3
CO2	Use the suitable sensors based on the field requirements.	K3
CO3	Employ appropriate actuator materials and actuators.	K3
CO4	Handle the signal processing and control system for smart structures.	K2
CO5	Apply structure-integrated sensing devices in Structural health monitoring (SHM) work.	K3

23PTC7E3	AIRPORT, DOCKS AND HARBOUR ENGINEERING	SEMESTER VII

PREREQUISITES	L	T	P	C
NIL	3	0	3	3

Course Objectives	To explore the planning aspect, components design and construction of Airport, Docks and Harbour	
UNIT – I	**AIRPORT PLANNING AND RUNWAY**	**9 Periods**
Air transport-development in India – AAI-ICAO, Aircraft characteristics. Airport Planning –Regional planning-site selection – surveys- estimation of air traffic needs. Airport Obstructions – Classification- Approach zone-turning zone. Runways – Orientation – Wind rose diagram - Basic runway length-corrections – Geometric Design-runway patterns.		
UNIT – II	**TAXIWAY AND AIRPORT LAYOUTS**	**9 Periods**
Taxiway – Geometric design –exit taxiway-holding apron. Airport layouts - Apron –Hangars - Terminal buildings - Airports buildings - Passenger flow -Passenger facilities.		
UNIT – III	**VISUAL AIDS, PAVEMENTS AND AIRPORT DRAINAGE**	**9 Periods**
Visual Aids – Runway and Taxiway Markings-Runway and Taxiway Lightings - Air Traffic Control – Basic Actions. Runway pavements – types (Introduction) – construction (no design problems)- Failures of runway pavement – maintenance. Airport drainage (Introduction only).		
UNIT – IV	**HARBOUR, PORTS AND DOCKS**	**9 Periods**
Water transportation – Introduction. Tides. Harbour – classification – site selection Port – classification- Requirements-facilities. Docks – wet docks – dry docks.		
UNIT – V	**BREAK WATER, NAVIGATIONAL AIDS AND DREDGING**	**9 Periods**
Break water-Types-construction methods. Berthing structures – quays, piers, wharves, dolphins, jetties, fenders. Navigational aids- Necessity-Light houses –signals-Mooring- Mooring accessories. Dredging-Types.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	*S. K. Khanna, M. G. Arora, S. S. Jain **"Airport planning and design"**, S.Chand and bros, 2009.*
2	*Srinivasan.R., **"Harbour, Dock and Tunnel Engineering"**, Chartor publishing house, Anand,India,2004.*

REFERENCES :

1	*Rangwala , "**Airport Engineering**", 13th Edition, Charotar Publishing House Pvt. Ltd, Anand India, 2012.*
2	*Vazirani.V.N and Chandola.S.P., **"Transportation and Engineering, Vol.2"**, Khannapublishers, New Delhi,2005.*
3	*Subramanian K.P., **"Highways, Railways, Airport and Harbour Engineering"**, Scitech Publications (India), Chennai,2010.*
4	*Hasmukh P. Oza, Gautam H. Oza, **"Dock And Harbour Engineering",** 8th Edition,Charator publishing house private limited, Gujarat, 2016.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Prepare the select appropriate site for airport and design of runway	K3
CO2	Plan the airport layout and selection of components of airport	K3
CO3	Identify the visual aids of airport and also able to construct and maintenance of runway	K2
CO4	Prepare the layout and design of harbor, ports and dock	K3
CO5	Categorize the protection and berthing structures	K2

23PTC7E4	IOT PLATFORM FOR SMART CITY PLANNING	SEMESTER VII

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To develop basic IOT functional and networking aspects, their role in Smart Cities, apply the basic needs and planning concept to solve various Infrastructure problems using IOT.	
UNIT – I	**INTERNET OF THINGS**	**9 Periods**
Introduction to Internet of Things, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures – Sensors/ Devices, Connectivity, Data Processing.		
UNIT – II	**IOT STANDARDS AND SMART CITIES**	**9 Periods**
Introduction to smart cities- Definition, dimensions and scope of Smart Cities –Global Standards and Performance Benchmarks, Practice Code. India "100 Smart Cities" Policy and Mission – Worldwide policies for smart city - Government of India policy for smart city, Mission statement & guidelines, Smart cities in India.		
UNIT – III	**ADVANCEMENT IN SMART CITY INFRASTRUCTURE**	**9 Periods**
Energy and ecology, solar energy for smart city - Housing, sustainable green building, safety, security, disaster management, economy, cyber security, Project management - Storage and conveyance system of water, sustainable water and sanitation, sewerage system, flood management, conservation system.		
UNIT – IV	**SMART TRANSPORT PLANNING**	**9 Periods**
Introduction to smart transport, Intelligent transportation system (ITS), GIS and GPS positioning Navigation and Identification system, Smart Automobiles and sustainable fuels, smart pedestrian walkways and cycle tracks, solar roads, electronic fee payment technology, electronic speed determination technology, and smart signaling technology.		
UNIT – V	**IOT APPLICATIONS IN SMART CITIES**	**9 Periods**
Application of IOT in Smart energy– Smart water management - Smart Parking -Smart metering – Lighting as service - Smart solid waste management - Smart mobility – Smart governance - Case studies of the smart city.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Olivier Hersent, David Boswarthick and Omar Elloumi, "**The Internet of Things: Key Applications and Protocols**", Second Edition, Wiley Publisher, 2012.*
2	*Vincenzo Piuri , Rabindra Nath Shaw , Ankush Ghosh, "**AI and IoT for Smart City Appications (Studies in Computational Intelligence, , 1002)",** Springer ,1st edition, 2022.*

REFERENCES :

1	*K. Saravanan , G. Sakthinathan, "**Handbook of Green Engineering Technologies for Sustainable Smart Cities (Green Engineering and Technology)**" CRC Press,1st Edition, 2021.*
	*Shrimoyee Bhattacharya, Sujaya Rathi "**Reconceptualising Smart Cities: A Reference Framework For India**" India International Center , 2015*
2	*Surjeet Dalal, Vivek Jaglan , Dac-Nhuong Le**, "Green Internet of Things for Smart Cities: Concepts, Implications, and Challenges (Green Engineering and Technology)",** CRC Press, 1st Edition, 2021.*
3	*Massimo La Scala, Sergio Bruno Carlo Alberto Nucci S. Lamonaca, Ugo Stecchi "**From Smart Grids to Smart Cities: New Challenges in Optimizing Energy Grids**", Wiley-ISTE, 1st Edition, 2021.*
4	*Gerardus Blokdyk," **Smart City a Complete Guide,** 5STARCooks, 2019 Edition, 2021.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Summarize the concepts of the IoT.	K2
CO2	Interpret IOT standards to plan smart cities.	K3
CO3	Identify components and techniques of infrastructure in smart city planning.	K3
CO4	Develop smart transport systems for smart cities.	K2
CO5	Formulate smart city plans using IOT in different sectors.	K2

23PTC7E5	IRRIGATION ENGINEERING AND HYDRAULIC STRUCTURES	SEMESTER VII

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To impart knowledge on mode of irrigation practiced in Tamil Nadu, functions and design of different hydraulic structures	
UNIT – I	**IRRIGATION PRACTICE**	**9 Periods**
Necessity – Advantages and types of irrigation – methods of irrigation – Soil- water- plant relations - main crops and their seasons – saline, alkaline soils and their reclamation – root zone depth – Duty and Delta – relationship – Factors affecting duty – optimum utilization of water – Consumptive use of water by a crop – Estimation – assessment of irrigation water – Irrigation efficiencies – Problems.		
UNIT – II	**DIVERSION HEAD WORKS**	**9 Periods**
Functions of diversion head works – Types – Layout of diversion head works – Component parts – functions - Weir – types – Causes of failure of weirs and their remedies – Design of impervious floorby Creep theories – Bligh's theory - Khosla's theory – Design of a vertical drop weir – Design principles for undersluices.		
UNIT – III	**ARCH, BUTTRESS AND EARTH DAMS**	**9 Periods**
Types of Arch dams – forces acting on it – advantages - Buttress dams – types and uses of buttress dams. Earth dam - types of earth dams – Method of construction - Section of earth dams – Causes of failure of earth dams – criteria for safe design of earth dams–Cross sections of earth dam according to materials - seepage control measures in earth dam		
UNIT – IV	**CANAL REGULATION WORKS**	**9 Periods**
Canal falls – types – Design of vertical drop fall – Functions of Regulators - Design of head and crossregulators – Cross drainage works – types of cross drainage works – Selection of suitable types of cross drainage works – Classification of aqueducts and syphon aqueducts – Design procedure of cross drainage works.		
UNIT – V	**WATER LOGGING, DRAINAGE AND RIVER CONTROL**	**9 Periods**
Water logging – Causes and effects of water logging – Remedial measures– Land Drainage – Advantages–Types of drainage system–layout of tile drainage. Rivers – classifications – Meandering and cut-off – River training works - Objectives – Classification and Types of river training works.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	*Santosh Kumar Garg,**"Irrigation Engineering and Hydraulics Structures"**, Khanna Publications Pvt. Ltd. New Delhi,2023.*
2	*Punmia.B.C.and Pande B.B.Lal, **"Irrigation and Water Power Engineering"**, Laxmi Publications Pvt. Ltd, New Delhi, 2021.*

REFERENCES :

1	*Sharma. R.K. and Sharma T.K, **"Irrigation Engineering and Hydraulics Structures"**, S.Chand & Company Pvt. Ltd, New Delhi, 2017.*
2	*P.N.Modi,**"Irrigation water resources and Water Power engineering"**,Standard book House,New Delhi,2020.*
3	*Madan Mohan Das and Mimi Das Saikia, **" Irrigation and water power Engineering"**,PHI LearningLtd,Delhi,2014.*
4	*Asawa G.L.,**"Irrigation and Water Resources Engineering"**, New Age International Publications, New Delhi, 2006.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Discuss the necessity and methods of irrigation system	K2
CO2	Design the diversion head works in water distribution system	K2
CO3	Practice the design principles and importance of arch dam, buttress dam and earth dams.	K2
CO4	Select the appropriate type of canal regulation structures in different situations.	K2
CO5	Identify the remedy for water logging, importance of drainage and river control works.	K2

23PTC8E1	BASICS OF DYNAMICS AND ASEISMIC DESIGN OF STRUCTURES	SEMESTER VIII

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To understand the behaviour of structures under dynamic, earthquake loading and design the structures as earthquake resistant as per codal provisions.	
UNIT – I	**FREE VIBRATION SYSTEM**	**9 Periods**
Concept of inertia and damping – Types of damping – Difference between static forces and dynamic excitation –Degrees of freedom – D'Alemberts Principles – SDOF idealization – Equations of motion of SDOF system of mass as well as base excitation – Free vibration of damped and undamped structures		
UNIT – II	**FORCED VIBRATION SYSTEM**	**9 Periods**
Forced vibration of damped and undamped structures – Response to harmonic excitation –Force Transmission - Periodic loading– Impulse and response to unit impulse– Measurement of Damping - Duhamel integral.		
UNIT – III	**MULTIPLE DEGREE OF FREEDOM SYSTEM**	**9 Periods**
Two degree of freedom system – Normal modes of vibration – Natural frequencies – Mode shapes – Introduction to MODF systems – Decoupling of equations of motion – Concept of mode superposition (No derivations).		
UNIT – IV	**ELEMENTS OF SEISMOLOGY AND SEISMIC DESIGN CONCEPT**	**9 Periods**
Elements of Engineering Seismology – Definitions, Introduction to Seismic hazard, Earthquake phenomenon – Seismotectonics – Seismic Instrumentation – Effect of earthquake on different types of structures – Behaviour of RCC, Steel and prestressed Concrete Structures under earthquake loading- Soil Structure Interaction – Liquefaction of soils – Concept of earthquake resistant design – Guide lines for seismic resistant construction		
UNIT – V	**DESIGN METHODOLOGY & SEISMIC MITIGATION**	**9 Periods**
Importance of ductility – Methods of introducing ductility into RC structures - Response and design spectra – Design earthquake - IS 1893, IS 13920 and IS 4326 – Codal provisions – Design as per the codes – Base isolation techniques – Vibration control measures – Important points in mitigating effects of earthquakes on structures.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS :

1	*Chopra, A.K., "**Dynamics of structures – Theory and Applications to Earthquake Engineering",** Fifth Edition, Pearson Education, 2017.*
2	*Pankaj Agarwal & Manish Shrikhande, "**Earthquake Resistant Design of Structures**", PHI Learning privated Limited, NewDelhi, 2011.*

REFERENCES :

1	*Damodarasamy S. R, Kavitha S, "**Basics of Structural Dynamics and Aseismic Design**", PHI Learning Private limited, New Delhi, 2009.*
2	*Clough R.W, and Penzien J, "**Dynamics of Structures**", Second Edition, CBS publishers, 2015*
3	*Mario Paz, "**Structural Dynamics – Theory and Computations**", Third Edition, CBS publishers, 2012*
4	*S.K.Duggal, "**Earth Quake Resistant Design of Structures**", Oxford university Press, 2013.*
5	*C. A. Brebbia, "**Earthquake Resistant Engineering Structures VIII**",WIT Press, 2011*
6	*IS 4326: 2013 "Earthquake Resistant Design and Construction of Buildings – Code of Practice"* *IS 1893: 2016 "Criteria for Earthquake Resistant Design of Structures – Part 1 General Provisions and Buildings"* *IS 13920:2016 "Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice".*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Analyze the dynamic response of SDOF System under free vibration	K2
CO2	Determine response of SDOF system under forced Condition	K2
CO3	Illustrate the mode shapes of MDOF System subjected to different types of vibration	K3
CO4	Explain the behaviour of structure under seismic load and its design concept	K2
CO5	Apply Indian codal provisions in the planning, design and detailing of structures	K3

23PTC8E2	GROUND IMPROVEMENT TECHNIQUES	SEMESTER VIII

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To study different methods of improvement and to select the appropriate methods based on the soil type and ground conditions.	
UNIT – I	**DEWATERING**	**9 Periods**
Scope and necessity- Engineering properties of soft and compressible deposits – Classification of ground modification techniques -– Emerging trends in ground improvement-Selection based on soil conditions – Dewatering by well point system – Deep well-Vacuum and Electro - Osmotic method.- Heat treatment-ground freezing.		
UNIT – II	**COMPACTION AND VERTICAL DRAINS**	**9 Periods**
In-situ densification of granular soils and consolidation of cohesive soils – Shallow and deep compaction – Vibration methods – Vibrocompaction- Blasting- Vibroflotation – precompression and compaction piles –Heavy Tamping – Preloading -Vertical drains –-Sand drains, Wick drains –Relative merits and limitations.		
UNIT – III	**STONE COLUMN AND CONSOLIDATION**	**9 Periods**
Stone columns - lime piles-micropiles – Construction methods – merits and demerits – Pre-compression and consolidation – simple design-Dynamic consolidation – Electro-osmotic consolidation –Soil reinforcement – Geosynthetics-types –Applications- filtration – drainage – separation – reinforcement – Soil Nailing-Rock bolting.		
UNIT – IV	**STABILIZATION AND CONFINEMENT**	**9 Periods**
Stabilization methods – Mechanical, Chemical stabilization-Cement, Lime, flyash and Bitumen – Electro - kinetic stabilization – Stabilization of expansive clays-Stabilization using Industrial wastes. Concept of confinement, Gabion walls, Crib walls and fabric form work.		
UNIT – V	**GROUTING**	**9 Periods**
Types of grouts – Suspension and solution grouts –Basic requirements – Displacement grouting – Compaction grouting – Permeation grouting –Cement grouting-Lime grouting-Grouting equipment and methods – Grout monitoring schemes.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Purushothama Raj, P., **"Ground Improvement Techniques",** Laxmi Publications (P) Ltd., New Delhi, 2005*
2	*Nihar Ranjan Patra., **"Ground Improvement Techniques",** Vikas publishing House Pvt. Ltd., 2012.*

REFERENCES:

1	*Day,R.W., **"Foundation Engineering Handbook"**, Mc-Graw Hill Companies, Inc. 2006.*
2	*Manfred R .Haussmann **"Engineering Principles of ground modification"**, Mc Graw Hill, 2013.*
3	*Peter G. Nicholson, **"Soil Improvement and Ground Modification Methods",** Butterworth Heinemann, 2015*
4	*Klaus Kirsch and Alan Bell, **"Ground Improvement**," Third Edition, CRC Press, Taylor and Francis Group, 2013.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Select suitable ground improvement techniques and different dewatering techniques based on soil conditions.	K2
CO2	Assess various in-situ treatment of cohesionless and cohesive soils.	K2
CO3	Perform in the field with the use of stone column and earth reinforcement.	K2
CO4	Identify and adopt suitable stabilization methods.	K2
CO5	Select and apply different grouting techniques.	K2

23PTC8E3	PREFABRICATED STRUCTURES	SEMESTER VIII

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To impart knowledge on the design concepts of prefabricated elements, methods of construction and installation of precast elements.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Prefabrication- Need of prefabrication - Comparison with monolithic construction – Advantages and Disadvantages - Methods of prefabrication – site and plant prefabrication – Types of precast systems - Modular coordination – Standardization- Tolerance. Precast concrete – Materials-Cement, SCM, Aggregate, Water, chemical Admixtures, Pigments, reinforcement, Prestressing Tendons, Concrete and properties, Grouting and mortars.		
UNIT – II	**PREFABRICATED COMPONENTS**	**9 Periods**
Beams-Columns- Roof units- Floor units- wall panels – footings-Dimensions of prefabricated elements.		
UNIT – III	**PRODUCTION TECHNOLOGY**	**9 Periods**
Choice and planning of production setup – Manufacturing methods – Production process - Moulds – Acceleration of concrete hardening, Curing.		
UNIT – IV	**ANALYSIS, DESIGN AND JOINTS IN STRUCTURAL MEMBERS**	**9 Periods**
Loads-Load combination, Disuniting of structures- Analysis of precast frames- Design of inverted Tee beam and L beam Connection in precast building – Column to foundation connections, Wall panel to foundation connections, Beam to Column Connections, Column to column Connections, Floor to Beam Connections, Wall panel to Wall Panel Connection.		
UNIT – V	**HANDLING AND ERECTION**	**9 Periods**
Storage of precast elements - Equipments for hoisting and erection –Installation of precast element – Column, Wall, Beam, Slab – Transportation- Handling Equipments and Handling Devices - Vacuumlifting pads.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS :

1	*L. Mokk, **"Prefabricated Concrete for Industrial and Public Structures"**, Publishing House ofthe Hungarian Academy of Sciences, Budapest, 2007.*
2	*K.M. Elliott, **"Precast concrete structures"**, Butterworth Heinmann, 2002.*

REFERENCES :

1	*Structural Design Manual, **"Precast Concrete Connection Details"**, Society for the Studies inthe use of Precast Concrete, Netherland Betor Verlag, 2009.*
2	*Ganesan and Latha, **"Prefabricated structures"**, Sree Kamalamani Publications, Chennai,2014.*
3	***"Handbook on Precast Concrete Buildings"**, Indian Concrete Institute, 2016.*
4	*Lewitt,M. **"Precast Concrete- Materials, Manufacture, Properties And Usage"** ,CRC Press, 2019.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Select materials and methods of prefabrication.	K2
CO2	Outline the components of the prefabricated structures.	K2
CO3	Plan the production process and identify the methods of prefabricated elements.	K3
CO4	Carryout the analysis and design of members and joints of precast building.	K3
CO5	Monitor the handling and installation of elements.	K2

23PTC8E4	BRIDGE ENGINEERING	SEMESTER VIII

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objective	To familiarize with types and choice of bridges and understand the design concepts of bridge structures, culverts, bearing and sub structures.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Components of a bridge structure – inspection and site investigations for a bridge – Determination of linear waterway, design discharge and scour depth – Economical span – Types and choice of bridges. IRC loading classifications – simple problems.		
UNIT – II	**SLAB BRIDGE AND T- BEAM BRIDGES**	**9 Periods**
Slab Bridge - Distribution of concentrated loads by IRC and Pigeaud's Method – Design of T- beam bridge – design of main girder– Design of cross girders – Load distribution by Courbon's Method – Skew slab Bridge.		
UNIT – III	**BRIDGE AND BOX CULVERT**	**9 Periods**
Single span rigid frame bridge (barrel or slab type only) – box culvert (single vent only). Balanced cantilever RC bridges– Design of articulations.		
UNIT – IV	**PRESTRESSED CONCRETE BRIDGES & STEEL BRIDGES**	**9 Periods**
Introduction to Design of PSC bridges – PSC girders – Introduction to design of steel bridges - Plate girder bridges – Box girder bridges – Truss bridges – Vertical and Horizontal stiffeners.		
UNIT – V	**SUBSTRUCTURE, BEARING, AINTENANCE AND INSPECTION OF BRIDGES**	**9 Periods**
Bearings – types, functions – simple problems – substructures – abutment, pier – materials-stability requirements -Rebuilding of bridges – replacement – pier tops – girders – side sleeving and end launching methods – Joints in bridges. Case studies.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK :

1	*Krishna Raju.N* ***" Design of Bridges",*** *Oxford and IBH Publishing Co., New Delhi, 2015, 5th Edition.*
2	*Ponnuswamy.S,* ***"Bridge Engineering****", 3rd edition, Tata McGraw Hill Publishing Co., Ltd, New Delhi, 2017.*

REFERENCES:

1	*Jagadeesh. T.R. and Jayaram. M. A.,* ***"Design of Bridge Structures",*** *Second Edition, Prentice Hall of India Pvt. Ltd. 2009*
2	*Richard M. Barker & Jay A. Puckett,* ***"Design of Highway Bridges",*** *John Wiley & Sons, Inc., 2007*
3	*Johnson Victor, D.* ***"Essentials of Bridge Engineering"****, Sixth Edition, Oxford and IBH Publishing Co. New Delhi, 2018.*
4	*Demetrius E. Tonias, F. ASCE, Jim J. Zhao, "****Bridge Engineering : Design, Rehabilitation, and Maintenance of Modern Highway Bridges****", 3rd Edition, McGraw Hill, 2012.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply IRC codal provisions in the design of bridges	K3
CO2	Analyze and design short span bridges	K3
CO3	Analyze and design long span bridges	K3
CO4	Explain the design of PSC bridges, box girder bridges, truss bridges	K3
CO5	Design the sub structures.	K3

23PTC8E5	ENVIRONMENTAL MANAGEMENT	SEMESTER VIII

PREREQUISITES	L	T	P	C
NIL	3	0	0	3

Course Objectives	To understand the importance of nature and study about the water, air and soil pollution control as well as solid waste management.	
UNIT – I	**NATURE AND SCOPEOF ENVIRONMENTAL PROBLEMS**	**9 Periods**
Environment and sustainable development – Natural and human environmental disturbances – Global warming –acid rain – ozone depletion – effects and control - climate change conventions – Kyoto protocol– India's efforts for Environmental protection– Public policy and role of NGO's		
UNIT – II	**WATER POLLUTION AND CONTROL**	**9 Periods**
Fresh water and its pollution – Natural processes – sources and pollutants – pollution due to industrial, agricultural and municipal wastes – effects on streams - limitations of disposal by dilution – BOD consideration in streams – Oxygen Sag Curve – Strategies for sustainable water management Water management – Marine environment and its management– Water acts		
UNIT – III	**AIR AND NOISE POLLUTION**	**9 Periods**
Pollutant emissions - sources and sink – effects of air pollution on human health, vegetation and climate– Global effects – prevention and control of air pollution – Control of particulates – Air pollution surveys and sampling – Air quality monitoring - Air Act – Management of air pollution –Sound level–Effect of noise on people–Environmental noise control-noise pollution rules		
UNIT – IV	**SOLID WASTE MANAGEMENT AND SOIL POLLUTION**	**9 Periods**
Sources – Characteristics – Quantities – Collection methods – Processing and disposal techniques– OnsiteHandling,storageandprocessing–sanitarylandfill–Incineration and pyrolysis –Composting–aerobic and anaerobic of compositing – Recycling and reuse of solid wastes – Hazardous wastes –Definition – Sources& types only – The Basel conventional use and degradation –strategies for sustainable and management– soil pollution – wetland conservation		
UNIT – V	**ENVIRONMENTALMANAGEMENTSYSTEM**	**9 Periods**
Terminology – installation and common motives of EMS – Environmental standards – ISO 14000(Series) – basic principles – Environmental Audit – Environmental Impact assessment - Trade rules and environmental protection–Practices for Waste Minimization and Cleaner Production.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Rao, **"Air Pollution"**, Tata McGraw-Hill Education, 1 July, 2017.*
2	*N.K.Uberoi, **"Environmental Management"**, Excel Books, New Delhi, 2011.*

REFERENCES :

1	*S.Vigneshwaran, M.Sundaravadivel and D.S.Chaudhary, "**Environmental Management",** SCITECH Publications(India) Pvt.Ltd, Chennai & Hyderabad ,2010.*
2	*Technobanoglous, "**Environmental management**", Mc Graw Hill Book Company,2006.*
3	*Howard S. Peavy, Donald R. Rowe and GerogeTchobanoglous, "**Environmental Engineering**", McGraw - Hill Co., 2013.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Identify the common issues related with environment.	K2
CO2	Analyse the sources, causes and effects of water pollution and their control.	K2
CO3	Infer the air pollution and noise pollution.	K2
CO4	Implement the various management techniques of solid waste and soil pollution.	K2
CO5	Compare the status of Environmental Management Systems.	K2