

PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018

(AUTONOMOUS)

B.E. CIVIL ENGINEERING

REGULATIONS 2019

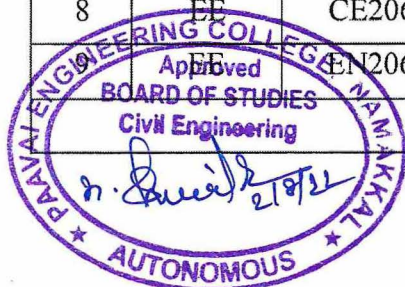
(For Students Admitted in the year 2020-2021)

SEMESTER V

S. No	Category	Course code	Course Title	L	T	P	C
Theory							
1	PC	CE20501	Structural Analysis I	3	0	0	3
2	PC	CE20502	Soil Mechanics	3	0	0	3
3	PC	CE20503	Design of Reinforced Cement Concrete Structures	3	0	0	3
4	PC	CE20504	Waste Water Engineering	3	0	0	3
5	PE	CE2015*	Professional Elective I	3	0	0	3
6	PE	CE2025*	Professional Elective II	3	0	0	3
Practical							
7	PC	CE20505	Soil Mechanics Laboratory	0	0	4	2
8	PC	CE20506	Water and Waste Water Analysis Laboratory	0	0	4	2
9	EE	EN20501	Career Development Laboratory I	0	0	2	1
Total				18	0	10	23

SEMESTER VI

S. No	Category	Course code	Course Title	L	T	P	C
Theory							
1	PC	CE20601	Structural Analysis II	3	0	0	3
2	PC	CE20602	Foundation Engineering	3	0	0	3
3	PC	CE20603	Railways, Airports and Harbour Engineering	3	0	0	3
4	PC	CE20604	Design of Steel Structures	3	0	0	3
5	PE	CE2035*	Professional Elective III	3	0	0	3
6	OE	CE2090*	Open Elective I	3	0	0	3
Practical							
7	PC	CE20605	Building and Structural Drawing	0	0	4	2
8	EE	CE20606	Survey Camp (2 weeks)	0	0	2	1
	EE	EN20601	Career Development Laboratory II	0	0	2	1
Total				18	0	8	22



LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE I

Category	Course Code	Course Title	L	T	P	C
PE	CE20151	Concrete Technology	3	0	0	3
PE	CE20152	Pavement Engineering	3	0	0	3
PE	CE20153	Green Buildings	3	0	0	3
PE	CE20154	Remote Sensing	3	0	0	3

PROFESSIONAL ELECTIVE II

Category	Course Code	Course Title	L	T	P	C
PE	CE20251	Construction Planning and Scheduling	3	0	0	3
PE	CE20252	Total Station and GPS Surveying	3	0	0	3
PE	CE20253	Advanced Construction Techniques	3	0	0	3
PE	CE20254	Environmental and Social Impact Assessment	3	0	0	3

PROFESSIONAL ELECTIVE III

Category	Course Code	Course Title	L	T	P	C
PE	CE20351	Structural Dynamics and Earthquake Engineering	3	0	0	3
PE	CE20352	Modern Construction Materials	3	0	0	3
PE	CE20353	Municipal Solid Waste Management	3	0	0	3
PE	CE20354	Traffic Engineering and Management	3	0	0	3

LIST OF OPEN ELECTIVES

OPEN ELECTIVE I

Category	Course Code	Course Title	L	T	P	C
OE	CE20901	Building Services	3	0	0	3
OE	CE20902	Housing Planning and Management	3	0	0	3



SEMESTER V

CE20501

STRUCTURAL ANALYSIS I

3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- gain knowledge on various methods of analysis.
- analyze the indeterminate structures by slope deflection method.
- analyze the indeterminate structures by moment distribution method.
- analyze statically indeterminate structures by imposing boundary conditions on flexibility matrix.
- analyze statically indeterminate structures by stiffness matrix method

Prerequisite: Nil

UNIT I ANALYSIS OF TRUSSES 9

Determinate and indeterminate trusses - Analysis of determinate trusses - Method of joints, Method of sections; Deflections of pin-jointed plane frames, lack of fit, change in temperature; Method of tension coefficient - application to space trusses.

UNIT II SLOPE DEFLECTION METHOD 9

Slope deflection equations - Equilibrium condition; Analysis of continuous beams and rigid frames, Support settlements, symmetric frames with symmetric and skew symmetric loadings.

UNIT III MOMENT DISTRIBUTION METHOD 9

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

UNIT IV FLEXIBILITY METHOD 9

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

UNIT V STIFFNESS METHOD 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyze the pin-jointed plane and space frames
- analyze the continuous beams and rigid frames by slope deflection method.
- analyze the continuous beams and rigid frames by moment distribution method
- compute the forces for continuous beams, frame and truss using flexibility method.
- determine the displacement for continuous beams, frame and truss using stiffness method

TEXT BOOKS

1. Bhavikatti. S.S, “Structural Analysis, Vol.1& Vol 2”, Vikas Publishing House Pvt. Ltd., New Delhi, 2014.
2. Vaidyanathan, R. and Perumal. P., “Comprehensive structural Analysis – Vol. I & II”, Laxmi Publications, 4th edition, New Delhi, 2016

REFERENCES

1. Rajput.R.K. Strength of Materials, S.Chand & Company Ltd., New Delhi 2015.
2. Punmia B.C., “Theory of Structures (SMTS) Vol II” Laxmi Publishing Pvt Ltd, New Delhi, 2005.
3. Vazirani.V.N. & Ratwani.M.M, “Advanced Theory of Structures and Matrix Methods of Analysis”, Khanna Publishers,2008
4. Bhavikatti.S.S, “Matrix Methods of Structural Analysis”, I.K.International Publishing House Pvt.Ltd.,2011.
5. Ramamrutham.S & Narayan.R, “Theory of Structures”, Dhanapat Rai Books Publishing, 2014.
6. Gambhir. M.L., “Fundamentals of Structural Mechanics and Analysis”, PHI Learning Pvt. Ltd., New Delhi, 2011.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	2	-	2	2	2	-	-	-	2	3	2
CO2	3	2	-	2	-	2	2	2	-	-	-	2	3	2
CO3	3	2	-	2	-	2	2	2	-	-	-	2	3	2
CO4	3	2	-	2	-	2	2	2	-	-	-	2	3	2
CO5	3	2	-	2	-	2	2	2	-	-	-	2	3	2



COURSE OBJECTIVES

To enable the students to,

- classify the soil based on index properties and engineering properties
- understand the concept of effective stress and permeability
- know about the components of settlement and behaviour of soils
- define the shear strength and pore pressure parameters
- understand the stress analysis and failure mechanisms

Prerequisite: Nil

UNIT I SOIL CLASSIFICATION AND COMPACTION 9

Sand, silt, clay particles - Particle behavior, Soil structure; Phase relationship - Index properties, Significance; BIS classification system; Unified classification system; Compaction of soils - Theory, Laboratory and field tests, Field Compaction methods, Factors influencing compaction of soils.

UNIT II EFFECTIVE STRESS AND PERMEABILITY 9

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

UNIT III STRESS DISTRIBUTION AND SETTLEMENT 9

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

UNIT IV SHEAR STRENGTH 9

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

UNIT V SLOPE STABILITY 9

Stability Analysis - Infinite slopes and finite slopes; Total stress analysis for saturated clay - Friction circle method, Use of stability number, Method of slices, Fellenious and Bishop's method; Slope protection measures; Introduction to Landslides.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- identify various types of soils and its properties, formulate and solve engineering Problems
- show the basic understanding of flow through soil medium and its impact of engineering solution
- determine the components of settlements and behavior of soils.
- perceive the concept of shear strength and its measurements.
- design both finite and infinite slopes, component and process as per needs and specifications

TEXT BOOKS

1. Murthy, V.N.S., “Soil Mechanics and Foundation Engineering”, CBS Publishers Distribution Ltd., New Delhi. 2015
2. Gopal Ranjan and Rao, A.S.R., “Basic and Applied Soil Mechanics”, New Age Ltd International Publisher New Delhi (India) 2006.

REFERENCES

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

CO PO MAPPING:

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Cos	Programme Outcomes (POs)												PSOs	
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CO1	3	3	-	-	-	2	2	2	-	-	-	3	3	2
CO2	3	2	-	-	-	2	2	2	-	-	-	3	3	2
CO3	3	3	-	-	-	2	2	2	-	-	-	3	3	2
CO4	2	3	-	-	-	2	2	2	-	-	-	3	3	2
CO5	3	3	-	-	-	2	2	2	-	-	-	3	3	2



COURSE OBJECTIVES

To enable the students to,

- understand the basic concepts of various design methods
- design beams for shear, bond, and torsion and serviceability
- determine the reinforcement for slabs and staircase using IS codes
- get the knowledge in the concept of RC columns and footings.
- calculate the different pressures acting on retaining wall and water tank

Prerequisite :Nil

UNIT I DESIGN CONCEPTS AND DESIGN OF BEAMS FOR FLEXURE 9

Design concepts - Concept of elastic method, ultimate load method and limit state method; Advantages of Limit State method over other methods; Design of rectangular beam section by working stress method; Limit state method of design of singly reinforced, doubly reinforced and flanged beams - use of design aids for flexure.

UNIT II LIMIT STATE DESIGN OF BEAMS FOR SHEAR, TORSION AND SERVICEABILITY 9

Limit state design of RC beams for shear and torsion; Design of RC beams for combined bending, shear and torsion - Use of design aids; Design requirement for bond and anchorage as per IS code; Detailing of reinforcement; Concept of Serviceability - Serviceability requirements for deflection.

UNIT III LIMIT STATE DESIGN OF SLABS AND STAIRCASE 9

Behaviour of one way and two way slabs - Design of one way simply supported, cantilever and continuous slabs; Design of two-way slabs for various edge conditions -Torsion reinforcement at corners; Design of flat slabs; Staircases - types, Design of dog-legged staircase.

UNIT IV LIMIT STATE DESIGN OF COLUMNS AND FOOTINGS 9

Types of columns - Design of short columns for axial load, combined axial load with uniaxial and biaxial bending, use of design aids; Design of footing for masonry and reinforced walls; Design of axially and eccentrically loaded square and rectangular footings; Design of combined rectangular footings for two columns.

UNIT V DESIGN OF MISCELLANEOUS STRUCTURES 9

Design of earth retaining structures - cantilever and counterfort retaining wall; RC water tanks - circular, rectangular.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- explain the various design concepts and design a beam under flexure
- design the beam under shear and torsion, and check the serviceability requirements.
- calculate the reinforcement details for slabs and staircase.
- use IS codes for design of columns and strips with reinforcement details.
- determine the earth pressure on various structures.

TEXTBOOKS

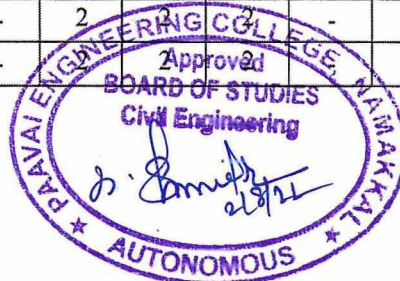
1. Punmia.B.C., Ashok K.Jain and Arun K.Jain, Limit State design of Reinforced Concrete, Laxmi Publications (P) Ltd., NewDelhi,2016.
2. Gambhir.M.L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2017.

REFERENCES

1. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design (Third Edition),Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition,2017.
2. Subramanian, Design of Reinforced Concrete Structures, Oxford University Press, New Delhi, 2014.
3. Varghese.P.C.Limit State Design of Reinforced Concrete, Prentice Hall of India, Pvt. Ltd., New Delhi, Second Edition, 2008.
4. Sinha.S.N. Reinforced Concrete Design, TataMcGraw-Hill, NewDelhi, 2002.
5. IS456:2000 Plain and Reinforced Concrete –Code of Practice
6. IS 875(1-5):1987 Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures.
7. SP16:1980, Design Aids for ReinforcedConcretetoIS456:1978.
8. SP34:1987, Hand book of concrete reinforcement and detailing.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	2	-	2	2	2	-	-	-	2	2	3
CO2	3	-	3	2	-	2	2	2	-	-	-	2	2	3
CO3	3	-	3	2	-	2	2	2	-	-	-	2	2	3
CO4	3	-	3	2	-	2	-	-	-	-	-	2	2	3
CO5	3	-	3	2	-	2	-	-	-	-	-	2	2	3



COURSE OBJECTIVES

To enable the students to,

- illustrate the principles of waste water supply, treatment and distribution.
- distinguish the concept of transport of waste water.
- estimate the load carrying capacity of the treatment.
- gain knowledge on various advanced wastewater treatment.
- identify disposal method of sewage and sludge.

Prerequisite: Water Supply Engineering

UNIT I PLANNING AND DESIGN OF SEWERAGE SYSTEM 9

Characteristics and composition of sewage - Population Equivalent-Sanitary sewage flow estimation; Sewer materials; Hydraulics of flow in sanitary sewers - Sewer design; Storm runoff estimation; Sewer appurtenances; Sewage pumping; Drainage in buildings - Plumbing systems for drainage; Discharge standards for Effluents.

UNIT II PRIMARY TREATMENT OF SEWAGE 9

Objectives - Unit Operations and Processes, Selection of treatment processes; Onsite sanitation - Septic tank, Grey water Harvesting; Primary treatment - Principles, functions and design of sewage treatment units - Screens, Grit chamber, Primary sedimentation tanks - Operation and Maintenance aspects.

UNIT III SECONDARY TREATMENT OF SEWAGE 9

Objectives - Selection of Treatment Methods - Principles, Functions; Activated Sludge Process and Extended aeration systems; Rotating biological contactors; Trickling filters; Waste Stabilization Ponds - Operation and Maintenance.

UNIT IV ADVANCES IN SEWAGE TREATMENT 9

Sequencing Batch Reactor; Moving bed bio film reactor; Membrane Bioreactor , UASB; Biogas recovery; Reclamation and Reuse of sewage; Constructed Wetland; Nutrient removal systems.

UNIT V SEWAGE DISPOSAL AND SLUDGE MANAGEMENT 9

Standards for disposal; Dilution - Self-purification of surface water bodies, Oxygen sag curve, Deoxygenation and reoxygenation; Land disposal – Sewage farming, sodium hazards, Soil dispersion system; Objectives – Sludge characterization , Sludge Thickening , Dewatering , Drying , Ultimate residue disposal.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- observe various waste water resources of India and Tamil Nadu
- apply the knowledge about the sewer design.
- have an elaborate knowledge about selection of waste water treatment process.
- explain planning, design, operation and maintenance of STP
- differentiate the proper disposal methods of sewage and sludge.

TEXT BOOKS

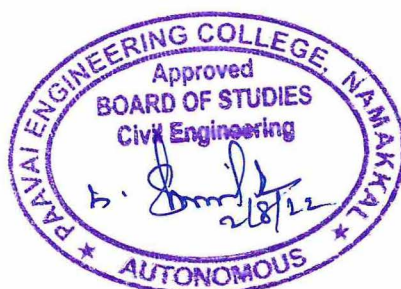
1. Garg, S.K., "Sewage Waste Disposal and Air Pollution Engineering (Environmental Engineering Vol. II), Khanna Publishers, New Delhi, 2015.
2. Duggal K.N., "Elements of Environmental Engineering" S.Chand and Co. Ltd., New Delhi, 2014.

REFERENCES

1. Punmia, B.C., Jain, A.K., and Jain.A.K., Environmental Engineering, Vol.II, Laxmi Publications, 2010.
2. Manual on Sewerage and Sewage Treatment Systems Part A,B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
3. Metcalf and Eddy- Wastewater Engineering--Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi, 2010.
4. Syed R. Qasim "Wastewater Treatment Plants", CRC Press, Washington D.C.,2010.

CO PO MAPPING:

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Cos	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	2	2	2	-	-	-	2	2	2
CO2	3	-	-	-	-	2	2	2	-	-	-	2	2	2
CO3	3	-	-	-	-	2	2	2	-	-	-	2	2	2
CO4	3	-	-	-	-	2	2	2	-	-	-	2	2	2
CO5	3	-	-	-	-	2	2	2	-	-	-	2	2	2



COURSE OBJECTIVES

To enable the students to,

- develop skills to test the soils for their index properties
- estimate optimum moisture content and maximum dry density.
- test the engineering properties of soil like shear strength and compressibility
- understand the concept of permeability and consolidation

Prerequisite: Soil Mechanics

LIST OF EXPERIMENTS**DETERMINATION OF INDEX PROPERTIES**

1. Specific gravity of soil solids
2. Grain size distribution – Sieve analysis
3. Liquid limit, Plastic limit and Shrinkage limit tests
4. Differential free swell tests

DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS

6. Field density Test (Sand replacement & core cutter method)
7. Determination of moisture– density relationship using standard proctor compaction test.

DETERMINATION OF ENGINEERING PROPERTIES

8. Permeability determination (constant head and falling head methods)
9. One dimensional consolidation test (Demonstration only)
10. Direct shear test in cohesion less soil
11. Unconfined compression test in cohesive soil
12. Laboratory vane shear test in cohesive soil
13. Tri-axial compression test in cohesionless soil (Demonstration only)
14. California Bearing Ratio Test

TOTAL PERIODS 60

COURSE OUTCOMES

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

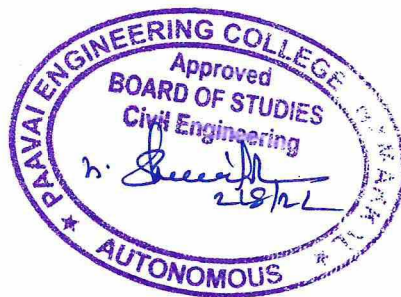
- classify the soil based on their index properties
- assess the optimum moisture content required in the field.
- conduct tests to determine the compressibility and shear strength of soils.
- explain the concepts of permeability and consolidation.

REFERENCES

1. Soil Engineering Laboratory Instruction Manual” published by Engineering College Cooperative Society, Anna University, Chennai, 2010.
2. “Saibaba Reddy, E. Ramasastri, K. “Measurement of Engineering Properties of Soils”, New age International (P) limited publishers, New Delhi, 2008.
3. Lambe T.W., “Soil Testing for Engineers”, John Wiley and Sons, New York, 1951. Digitized 2008.
4. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, New Delhi.
5. Braja M.Das., “Soil Mechanics: Laboratory Manual”, Oxford University Press, eighth edition, 2012.

CO PO MAPPING:

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Cos	Programme Outcomes (POs)												PSO1	PSO2
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		
CO1	3	-	-	2	-	2	2	2	3	-	-	-	2	2
CO2	3	-	-	2	-	2	2	2	3	-	-	-	2	2
CO3	3	-	-	2	-	2	2	2	3	-	-	-	2	2
CO4	3	-	-	2	-	2	2	2	3	-	-	-	2	2



COURSE OBJECTIVES

To enable the students to,

- impart the principles of sampling and preservation of water and wastewater
- acquire the knowledge on the principles of testing of water and wastewater
- learn different analysis methods for water and wastewater
- acquire knowledge about importance of bacteria in wastewater

Prerequisite: Water Supply Engineering & Wastewater Engineering

LIST OF EXPERIMENTS

1. Determination of
i) pH, ii) Turbidity
2. Determination of Total Hardness
3. Determination of Alkalinity
4. Determination of Total, Suspended and Dissolved Solids
5. Determination of Optimum Coagulant Dosage
6. Determination of Chlorides
7. Determination of available Ammonia Nitrogen
8. Biochemical Oxygen Demand (B.O.D.) test
9. Chemical Oxygen Demand (C.O.D.) test
10. Introduction to Bacteriological Analysis (Demonstration only)

TOTAL PERIODS 60

COURSE OUTCOMES

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

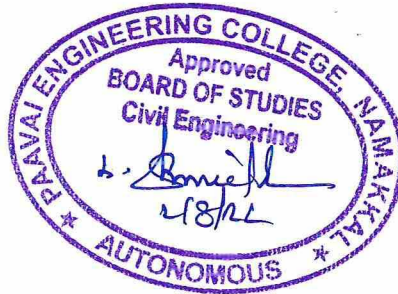
- determine the pH and turbidity of water and waste water.
- analyze the characteristics of water and waste water as per standards.
- examine different analysis methods of water and waste water.
- know about importance of bacteria in wastewater

REFERENCES

1. Garg, S.K., "Environmental Engineering Vol. I & II", Khanna Publishers, New Delhi, 2015
2. Modi, P.N., "Environmental Engineering Vol. I & II", Standard Book House, Delhi-6, 2008

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
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CO1	3	-	-	2	-	2	2	2	3	-	-	-	2	2
CO2	3	-	-	2	-	2	2	2	3	-	-	-	2	2
CO3	3	-	-	2	-	2	2	2	3	-	-	-	2	2
CO4	3	-	-	2	-	2	2	2	3	-	-	-	2	2



COURSE OBJECTIVES

To enable students to,

- enhance their writing skills.
- evaluate their presentation skill to face the corporate world.
- solve the quantitative aptitude problems and improve their mental ability.
- improve the critical thinking and reasoning skills.

UNIT I WRITING SKILLS 6

Writing Skills: The Essentials of Writing – The Importance of Structure – Types of Writing – Common Mistakes in Writing

Activities: Email Writing - Paragraph writing – Report Writing – Story Writing - Story Telling Session: 2 – JAM Session I

UNIT II PRESENTATION SKILLS AND GROUP DISCUSSION 6

Presentation Skills: Types of Presentation – Methods of Delivering Presentation – Ways to improve the Presentation – Presentation Aids; Group Discussion: Introduction – Types and Importance – Why GD – Types of GD- Evaluation Criteria – Do's and Don'ts of GD

Activities: Presentation Session I ,Group Discussion Session I, Role Play Session (Team): Level II – Personality Profile Session II – Company Profile Analysis Session II

UNIT III QUANTITATIVE APTITUDE 6

Simplification – Cubes and Cube Roots – Squares and Square Roots – Boats and Streams – Trains – Profit and Loss – Pipes and Cisterns

UNIT IV LOGICAL REASONING - I 6

Series Completion – Letter Series – Symbol Series – Number Series – Arithmetic Reasoning

UNIT V LOGICAL REASONING - II 6

Blood Relations – Seating Arrangement - Character Puzzle

TOTAL PERIODS 30

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- excel in drafting mails and speaking
- demonstrate the participative skills in group discussions.
- solve problems based on quantitative aptitude.
- enhance their logical and verbal reasoning.

TEXTBOOKS

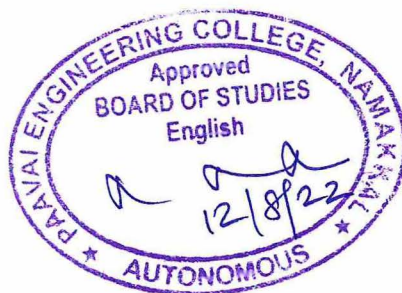
1. Agarwal, R.S. "A Modern approach to Verbal and Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi 2015.
2. Agarwal, R.S. "Objective General English", S.Chand & Co 2016.

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude", Tata-Mcgraw Hill 2015.
2. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications 2016.
3. Johnson, D.W. Reaching out – Interpersonal Effectiveness and self actualization. Boston: Allyn and Bacon 2019.
4. Infosys Campus Connect Program – students' guide for soft skills 2015.

CO PO MAPPING:

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CO's	Programme Outcomes (PO's)													
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CO1	3	2	2	3	3	1	-	-	-	-	-	-	3	2
CO2	-	2	3	-	2	-	2	-	-	-	-	-	3	2
CO3	3	2	2	-	-	1	-	-	-	-	2	-	2	3
CO4	2	3	3	2	1	3	3	1	-	1	2	-	2	3



SEMESTER VI

CE20601

STRUCTURAL ANALYSIS II

3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- impart knowledge on influence lines for determinate structures.
- impart knowledge on influence lines for different types of indeterminate beams.
- analyze and solve arched structures
- analyze a cable structures and stiffening girders.
- understand the concepts of approximate methods.

Prerequisite: Structural Analysis I

UNIT I INFLUENCE LINES FOR DETERMINATE STRUCTURES 9

Influence lines for reactions in statically determinate structures - Influence lines for shear force and bending moment in beam sections, Calculation of critical stress resultants due to concentrated and distributed moving loads, Influence lines for member forces in pin jointed plane frames.

UNIT II INFLUENCE LINES FOR INDETERMINATE BEAMS 9

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

UNIT III ARCHES 9

Arches - Types of arches, Analysis of three hinged, two hinged and fixed arches, Parabolic and circular arches; Settlement and temperature effects.

UNIT IV SUSPENSION BRIDGES 9

Cable – Equilibrium, length of cable, anchorage of suspension cables; Stiffening girders - cables with three hinged stiffening girders; Influence lines for three hinged stiffening girders.

UNIT V APPROXIMATE ANALYSIS OF FRAMES 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- draw influence lines for statically determinate structures.
- understand Muller Breslau principle and draw the influence lines for statically indeterminate beams.
- analyze three hinged, two hinged and fixed arches
- analyze the suspension bridges with stiffening girders
- analyze rigid frames by approximate methods for gravity and horizontal loads

TEXT BOOKS

1. Bhavikatti. S.S, "Structural Analysis, Vol.1 & Vol.2", Vikas Publishing House Pvt. Ltd., New Delhi-4, 2014.
2. Vaidyanathan, R. and Perumal. P., "Comprehensive structural Analysis – Vol.II", Laxmi Publications, 4th edition, New Delhi, 2016

REFERENCES

1. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi, Publications, 2004.
2. L.S. Negi & R.S. Jangid, "Structural Analysis", Tata McGraw-Hill Publications, New Delhi, Sixth Edition, 2004.
3. Gambhir, M.L., "Fundamentals of Structural Mechanics and Analysis", PHI Learning Pvt. Ltd., New Delhi, 2011.
4. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co. Ltd., Third Edition, 2010.
5. Vazrani.V.N and Ratwani.M.M, Analysis of Structures, Vol. II, Khanna Publishers, 2015.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong, 2-Medium, 1-Weak														
Cos	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	2	-	2	2	2	-	-	-	2	3	2
CO2	3	2	-	2	-	2	2	2	-	-	-	2	3	2
CO3	3	2	-	2	-	2	2	2	-	-	-	2	3	2
CO4	3	2	-	2	-	2	2	2	-	-	-	2	3	2
CO5	3	2	-	2	-	2	2	2	-	-	-	2	3	2



COURSE OBJECTIVES

To enable the students to,

- plan and execute a detail site investigation programme
- select geotechnical design parameters and type of foundations
- design of different type of footings and special foundations
- discuss different types of pile foundation and its capacity
- get knowledge of various earth pressure theories and design of retaining walls

Prerequisite: Soil Mechanics

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

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

UNIT II SHALLOW FOUNDATION 9

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

UNIT III FOOTINGS AND RAFTS 9

Types - Isolated footing, Combined footing, Mat foundation - Contact pressure and settlement distribution, Proportioning of foundations for conventional rigid behavior, Minimum depth for rigid behavior, Applications; Floating foundation, Special foundations - Seismic force consideration.

UNIT IV PILE FOUNDATION 9

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

UNIT V RETAINING WALLS 9

Introduction to Retaining walls; Plastic equilibrium in soils - Active and passive states, Rankine's theory - Cohesion less and cohesive soil; Coulomb's wedge theory - Condition for critical failure plane; Earth pressure on retaining walls of simple configurations; Culmann Graphical method; Pressure on the wall due to line load; Stability analysis of retaining walls; Reinforced Earth wall.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- plan and execute a detailed site investigation and prepare report.
- design shallow foundations, its component as per the needs and specifications.
- confess contact pressure distribution below the footing.
- describe the type of piles and their load carrying capacity.
- check the stability of retaining walls.

TEXT BOOKS

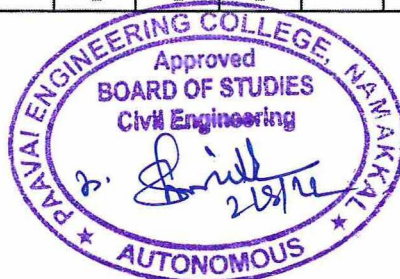
1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributers Ltd., New Delhi, 2015.
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi 2011.(7th reprint, 2019)

REFERENCES

1. Joseph.E.Bowls, "Foundation Analysis and Design", 5th Edition, McGraw Hill Companies, New Delhi, 2001.
2. Dr.Swami Saran, "Analysis and Design of Substructures-Limit State Design", 2nd Edition, Oxford and IBH Publishing Company Pvt Ltd., New Delhi, 2013.
3. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt.Ltd., New Delhi, 2018.
4. Venkatramaiah, C, "Geotechnical Engineering", New Age International Publishers, New Delhi, 2007 (Reprint)
5. IS Code 6403: 1981 (Reaffirmed 1997) "Bearing capacity of shallow foundation", Bureau of Indian Standards, New Delhi.
6. IS Code 1892 (1979): Code of Practice for subsurface Investigation for Foundations. Bureau of Indian Standards, New Delhi.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong, 2-Medium, 1-Weak														
Cos	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO2	3	2	-	2	-	2	2	2	-	-	-	3	3	2
CO3	3	3	-	2	-	2	2	2	-	-	-	3	3	2
CO4	2	3	-	2	-	2	2	2	-	-	-	3	3	2
CO5	3	3	-	2	-	2	2	2	-	-	-	3	3	2



COURSE OBJECTIVES

To enable the students to,

- understand the basics of railway planning and railway geometrics.
- gain knowledge on railway construction and maintenance.
- develop skills in airport planning.
- provide proficiency in the design of airports.
- gain knowledge in components of docks and harbours.

Prerequisite: Nil

UNIT I RAILWAY PLANNING 9

Elements of permanent way - Rails, Sleepers, Ballast, rail fixtures and fastenings; Selection of gauges - Track Stress - Coning of wheels - Creep in rails - defects in rails; Route alignment surveys - Conventional and Modern methods; Geometric design of railway - Gradient, Super elevation, Widening of gauge on curves, Level Crossings.

UNIT II RAILWAY CONSTRUCTION AND MAINTENANCE 9

Earthwork - Stabilization of track on poor soil; Tunneling Methods, drainage and ventilation; Calculation of Materials required for track laying; Construction and maintenance of tracks; Signaling; interlocking and track circuiting; Railway Station and yards and passenger amenities; Metro rails and MRTS.

UNIT III AIRPORT PLANNING 9

Air transport characteristics - Airport classification; Airport planning - objectives, components, layout characteristics, socio-economic characteristics of the Catchment area; Airport site selection - Orientation of Runways and correction factors as ICAO stipulations, typical Airport Layouts, Parking and Circulation area.

UNIT IV AIRPORT DESIGN 9

Runway Design - Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design, Configuration and Pavement Design Principles; Elements of Taxiway Design; Airport Zone - Passenger Facilities and Services, Runway and Taxiway Markings.

UNIT V HARBOUR ENGINEERING 9

Definition of Basic Terms - Harbour, Port, Satellite Port, Docks, Waves and Tides; Planning and Design of Harbours - Requirements, Classification, Location and Design Principles; Harbour Layout and Terminal Facilities; Coastal Structures - Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage; Inland Water Transport - Wave action on Coastal Structures and Coastal Protection Works, Environmental concern of Port Operations, Coastal Regulation Zone, 2011.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyze the concepts and elements in planning, design and construction of railways.
- determine appropriate methods for construction and maintenance of railway tracks and other infrastructures.
- expose the concepts and elements in planning and selection of site for airport.
- design the runway length and evaluate the orientation of runways.
- understand the terminologies, infrastructures in Harbour Engineering and Coastal regulations.

TEXT BOOKS:

1. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering, Scitech Publications (India), Chennai, 2010.
2. C.Venkatramaiah., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels., Universities Press (India) Private Limited, Hyderabad, 2016.

REFERENCES:

1. Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand and Bros,Roorkee, 2012.
2. Rangwala S.C & K.S. "Railway Engineering", Charotar Publications, 2017.
3. Subhash C. Saxena , Airport Engineering Planning and Design, Dhanapat Rai and Sons, Delhi,2020.
4. Satish chandra & MM Agarwal., "Railway Engineering", Oxford University Press, Second Edition, 2013.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong, 2-Medium, 1-Weak														
Cos	Programme Outcomes (POs)												PSO1	PSO2
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		
CO1	3	3	-	-	-	2	3	2	-	-	-	2	2	2
CO2	3	-	-	-	-	2	3	2	-	-	-	2	2	2
CO3	3	-	-	-	-	2	3	2	-	-	-	2	2	2
CO4	3	3	-	-	-	2	3	2	-	-	-	2	2	2
CO5	3	-	-	-	-	2	3	2	-	-	-	2	2	2



COURSE OBJECTIVES

To enable the students to,

- describe limit state design concepts and the design of bolted and welded joints.
- gain knowledge on design of tension and compression members.
- gain knowledge about design of beams.
- impart knowledge on the design of industrial structure components
- acquire knowledge about plastic design of analysis

Prerequisite: Nil

UNIT I INTRODUCTION TO STRUCTURAL STEEL AND DESIGN OF CONNECTIONS 9

General - Types of Steel, Properties of structural steel, I.S. rolled sections; Concept of Limit State Design; Design of Simple and eccentric Bolted and welded connections, efficiency of joint; Prying action; Introduction to HSFG bolts

UNIT II TENSION AND COMPRESSION MEMBERS 9

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

UNIT III BEAMS 9

Beams - Types of steel beams, Modes of failure, Design of laterally supported and unsupported beam; Rolled beam- built-up beams, Design for strength and serviceability, web yielding, web crippling, bearing stiffeners; Welded plate girder - Components, Stiffener, Analysis and design using IS 800-2007 of welded plate girder.

UNIT IV INDUSTRIAL STRUCTURES 9

Roof truss - Types, Components, Design of roof trusses, loads on trusses; Purlin design using angle and channel sections; Design of joints and end bearings; Design of gantry girder; Introduction to pre-engineered buildings

UNIT V PLASTIC ANALYSIS AND DESIGN 9

Introduction to plastic analysis - Theorems of plastic Analysis, Design of continuous beams and portal frames using plastic design approach.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- calculate the strength of connections and design the bolted and welded connections
- design tension and compression members and beams as per codal provisions
- calculate the strength of beams and plate girders

- identify and compute the design loads on Industrial structures, and gantry girder
- calculate ultimate load of steel beams and portal frames using plastic analysis

TEXT BOOKS

1. S.S.Bhavikatti, Design of Steel Structures, IK publications, New Delhi, Third Edition 2017.
2. N. Subramanian, Design of Steel Structures, Oxford University Press, New Delhi, 2016

REFERENCES

1. S. K. Duggal, Limit State Design of Steel Structures, Tata , Mc Graw Hill Education Pvt Ltd, New Delhi, 2014.
2. Dayaratnam, P., “Design of Steel Structures”, Second edition, S. Chand & Company, 2008.
3. Gambhir M.L, “Fundamentals of Structural Steel Design”, McGraw Hill Education India Pvt. Ltd, 2013
4. Ramachandra, S. and Virendra Gehlot, “Design of Steel Structures – Vol. I & II”, Standard Publication, New Delhi, 2011
5. IS 800 :2007, General Construction in Steel – Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007
6. IS 875: (Part 2 and 3) 1987 (Reaffirmed 1997), Code of practice for design loads (Other than Earthquake) For Buildings and Structures

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong, 2-Medium, 1-Weak														
Cos	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	2	-	2	2	2	-	-	-	2	2	3
CO2	3	3	3	2	-	2	2	2	-	-	-	2	2	3
CO3	3	3	3	2	-	2	2	2	-	-	-	2	2	3
CO4	3	3	3	2	-	2	2	2	-	-	-	2	2	3
CO5	3	3	3	2	-	2	2	2	-	-	-	2	2	3



COURSE OBJECTIVES

To enable the students to,

- gain knowledge on planning of buildings.
- operate with software proficiency.
- know the various IRC loadings and the concept of prestressing
- learn the various loading conditions.

Prerequisite: Design of Reinforced Cement Concrete Structures

Drafting of the following Structures by Software

1. Principles of planning and orientation
2. Buildings with load bearing walls and Framed Structures (Plan, section, elevation)
3. Industrial buildings – North light roof truss
4. Reinforcement details of RCC structural elements (slab, beam and column)
5. Reinforcement details of footings (Isolated, stepped, combined footing)
6. Reinforcement details of RCC water tanks (circular, rectangular)
7. Reinforcement details of retaining walls (cantilever, counterfort)
8. Steel structures (beam column connection, beam to beam connection, steel water tank with hemispherical bottom)

TOTAL PERIODS 60

COURSE OUTCOMES

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

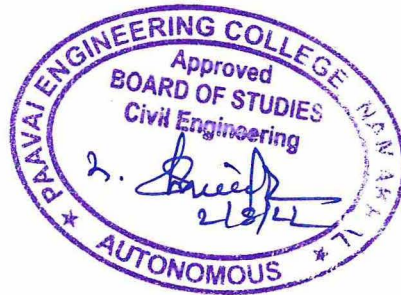
- draft the plan, elevation and sectional view of the buildings
- draft the plan, elevation and sectional view of Industrial structures.
- draw the structural detailing of RCC elements.
- draw the structural detailing of RCC water tanks, footings and retaining walls.

REFERENCES

1. Krishna Raju.N., "Structural Design and Drawing", 3rd Edition, Universities Press Publisher, 2009
2. SP 34: 1987, "Handbook on Concrete Reinforcement and Detailing"
3. Ramamrutham.S, "Design of Reinforced Concrete Structures", Dhanapat Rai Publishing Company, 2016

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	2	-	2	2	2	3	2	-	2	2	3
CO2	3	3	3	2	-	2	2	2	3	2	-	2	2	3
CO3	3	3	3	2	-	2	2	2	3	2	-	2	2	3
CO4	3	3	3	2	-	2	2	2	3	2	-	2	2	3



COURSE OBJECTIVES

To enable the students to,

- gain knowledge on survey field techniques.
- apply tools of the description to engineering and surveying activities.
- learn the various methods of surveying to solve the real world problems.
- understand the setting out work and different computation process.

Prerequisite: Plane and geodetic Surveying

Experiments

Two weeks survey camp carried out over a large area for area measurements, leveling and angular measurements. At the end of the camp, each student will independently complete the office work for the survey works done in the field. The camp record shall include all original field observations, calculation and plots. The students will be evaluated through a viva-voce examination by a team of Internal staff.

Principles of planning and orientation

- Topographical survey
- Contour surveying, L.S/C.S for road works
- Building survey (column marking)
- Total station surveying to plot a boundary

TOTAL PERIODS 30

COURSE OUTCOMES

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

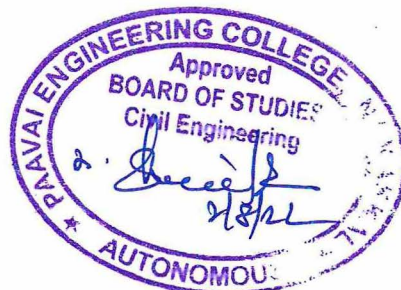
- implement perform survey as per the field condition
- understand the surveying techniques in field
- prepare contour map for given area
- prepare topographical survey and mark the building

REFERENCES

1. Punmia.B.C, "Surveying" Vols. I and II, Laxmi Publications, 2006.
2. Kanetkar.T.P, "Surveying and Levelling" Vols. I and II, United Book Corporation, Pune, 2008.
3. K.R. Arora, Surveying Vol I & II, Standard Book house, Twelfth Edition. 2013

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong, 2-Medium, 1-Weak														
Cos	Programme Outcomes (POs)													
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CO1	3	3	-	-	3	2	2	2	3	2	-	2	3	2
CO2	3	3	-	-	3	2	2	2	3	2	-	2	3	2
CO3	3	3	-	-	3	2	2	2	3	2	-	2	3	2
CO4	3	3	-	-	3	2	2	2	3	2	-	2	3	2



COURSE OBJECTIVES

To enable students to,

- draft resume and enhance their skills to manage stress to survive in corporate world.
- excel in interview skills.
- solve the quantitative aptitude problems and improve their problem-solving skills.
- improve their reasoning skills to get placed in reputed companies.

UNIT I RESUME WRITINGS 6

Resume Writing Skills: Curriculum Vitae and Resume – Things to do while writing a Resume – Mistakes and Pitfalls to Avoid- Cover Letter: General Guidelines – The Content - Stress Management – Dressing Etiquette

Activities: Corporate Resume Building Session I – JAM Session: Level III – Role Play Session (Individual): Level III - Company Profile Analysis Session III – Personality Profile Analysis Session III

UNIT II INTERVIEW SKILLS 6

Interview Skills: Introduction – Before the Interview – During the Interview – After the Interview – Types of Interview

Activities: Presentation Session: Level II- Group Discussion Session: Level III, Mock Interview Practice Session, Corporate Resume Building Session II

UNIT III QUANTITATIVE APTITUDE 6

Permutation and Combination – Probability: Dice, Colours, Coin, Cards ; Partnership – Ages – Calendars

UNIT IV LOGICAL REASONING -I 6

Making Judgments – Matching Definitions – Cause and Effect

UNIT V LOGICAL REASONING II 6

Directions – Syllogism – Analogy – Statements and Arguments

TOTAL PERIODS 30

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- write resume and enhance their etiquettes.
- demonstrate the interpersonal skills in group discussions.
- compute problems based on quantitative aptitude.
- reveal their logical and verbal reasoning by scoring the expected percentage to get placed in reputed companies.

TEXTBOOKS

1. Agarwal, R.S. "A Modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi 2015.
2. Agarwal, R.S. "Objective General English", S.Chand & Co 2016.

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude ", Tata-Mcgraw Hill 2015.
2. Word Power Made Easy By Norman Lewis ,Wr.Goyal Publications 2016.
3. Johnson, D.W. Reaching out – Interpersonal Effectiveness and self actualization. Boston: Allyn and Bacon 2019.
4. Infosys Campus Connect Program – students' guide for soft skills 2015.

CO PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
CO's	Programme Outcomes (PO's)												PSO1	PSO2
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		
CO1	3	2	2	3	3	1	-	-	-	-	-	-	3	2
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CO3	3	2	2	-	-	1	-	-	-	-	2	-	2	3
CO4	2	3	3	2	1	3	3	1	-	1	2	-	2	3



LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE-I

CE20151

CONCRETE TECHNOLOGY

3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- acquire a sound technical knowledge on the constituents of concrete.
- impart basic knowledge on the admixtures in concrete.
- gain knowledge on the properties of concrete and quality assessment.
- know about the uses of modern concrete.
- understand the concepts of mix proportioning and durability.

Prerequisite: Construction Materials, Techniques and Practices

UNIT I CONSTITUENTS OF CONCRETE 9

Cement - ASTM classification of Cement, Manufacturing, Types of cement, Chemical composition and physical properties, Hydration, Testing, IS Specifications; Aggregates - Classification, Types of aggregates, Physical and Mechanical properties, Tests, Importance of grading, Interfacial transition zone, M-Sand; Water - Quality of water for use in concrete, Use of sea water and its effects in concrete.

UNIT II ADMIXTURES AND MIX PROPORTIONS 9

Admixtures - Functions, Classification, Types, Effects of admixture on concrete properties, Mineral Admixtures, Chemical Admixtures, Compatibility of concrete chemicals, IS Specifications. Principles of mix proportioning - Factors influencing mix design, Different methods of mix design, IS method and ACI method.

UNIT III WORKABILITY, MECHANICAL PROPERTIES AND NDT 9

Workability - Tests for workability of concrete; Segregation and bleeding, Creep, shrinkage and temperature effects of concrete; Determination of strength Properties of hardened concrete, Gain of strength with age, Stress and strain characteristics of concrete; Rebound hammer - Ultrasonic pulse velocity test.

UNIT IV DURABILITY 9

Durability of concrete - Chemical attack - Chloride attack, Sulphate attack; Electrical Resistivity; Permeability; Corrosion of steel in concrete, Causes, effects and remedial measures.

UNIT V SPECIAL CONCRETE 9

Special concretes - Lightweight concrete, High density concrete, High performance concrete, Foam concrete, Self compacting concrete, Vacuum concrete, High strength concrete, Bacterial concrete, Fiber reinforced concrete, Ferrocement, Ready mix concrete, SIFCON, Shotcrete, Polymer concrete, Geopolymer concrete, Pumped concrete, Roller compacted concrete.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- determine the properties of various constituents present in concrete.
- utilize various admixtures and the effect of admixtures on properties of concrete.
- summarize the properties of fresh and hardened concrete.
- apply the special concretes and their applications.
- compute the design mix for various grades of concrete as per IS and ACI standards with durability requirement.

TEXT BOOKS

1. Shetty.M.S., "Concrete Technology", S.Chand and Co., Ltd., New Delhi.
2. Dr.Job Thomas, "Concrete Technology", Cengage Learning India, 2015.

REFERENCES

1. Santhakumar.A.R., "Concrete Technology", Oxford University Press, New Delhi, 2018.
2. Gambhir.M.L., "Concrete Technology", Tata Mc Graw Hill Publishing Co., Ltd., New Delhi, 2013.
3. Neville, A.M. and Brooks, J.J, "Concrete Technology" ELBS 2010.
4. IS10262-2019 Indian standard concrete mix design.
5. ACI 211, Standard Practice for selecting proportions for concrete.

CO PO MAPPING:

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CO3	2	-	-	-	2	2	3	2	-	-	-	2	3	2
CO4	3	-	-	-	2	2	3	2	-	-	-	2	3	2
CO5	3	-	-	-	2	2	3	2	-	-	-	2	3	2



COURSE OBJECTIVES

To enable the students to,

- gain knowledge in planning and construction pavements
- impart knowledge in design of flexible pavements
- impart knowledge in design of rigid pavements
- gain knowledge in pavement construction and maintenance as per IRC guidelines
- understand the stabilization of pavements

Prerequisite: Nil

UNIT I PAVEMENT TYPES AND STRESS DISTRIBUTION 9

Introduction - Pavement as layered structure, pavement types rigid and flexible; Resilient modulus - stress and deflections in pavements under repeated loading.

UNIT II DESIGN OF FLEXIBLE PAVEMENTS 9

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

UNIT III DESIGN OF RIGID PAVEMENTS 9

Cement concrete pavements - factors influencing Cement concrete pavements; Modified Westergaard approach; Design procedure as per IRC guidelines; Concrete roads and their scope in India.

UNIT IV PAVEMENT CONSTRUCTION, EVALUATION AND MAINTENANCE 9

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

UNIT V STABILIZATION OF PAVEMENTS 9

Stabilization with special reference to highway pavements - Choice of stabilizers, Testing and field control; Stabilization for rural roads in India; Use of Geosynthetics in roads.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- explain concepts and standards adopted in Planning, Design and construction of Pavements.
- apply the knowledge of science and engineering fundamentals in designing flexible pavement.
- apply the standards adopted in designing rigid pavement.

- select appropriate methods for construction and evaluation of Pavements
- address the problem statement in construction of pavement and to impart knowledge in stabilization techniques

TEXT BOOKS

1. Khanna, S.K. and Justo C.E.G. and Veeraragavan, A, "Highway Engineering", New Chand and Brothers, Revised 10th Edition, 2014.
2. R.Srinivasa Kumar., "Pavement Engineering" Universities Press (India) Private Limited, Hyderabad, 2013.

REFERENCES

1. Rajib B.Mallick and Tahar El-Korchi, "Pavement Engineering Principles and Practice:, CRC Press, 2018
2. Kadiyali.L.R, "Principles and Practice of Highway Engineering", Khanna tech Publications, New Delhi, 2005.
3. Yoder, R.J. and Witchak M.W. "Principles of Pavement Design", John Wiley 2000.
4. Prithvi Singh Kandhal," Bituminous Road Construction in India", PHI Learning Private Limited, New Delhi, 2016.
5. Guidelines for the Design of Flexible Pavements,IRC-37-2012,The Indian roads Congress, New Delhi.
6. Guideline for the Design of Rigid Pavements for Highways, IRC 58-2002, The Indian Road Congress, New Delhi.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
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CO1	3	-	-	-	-	2	2	2	-	-	-	2	2	3
CO2	3	-	3	-	-	2	2	2	-	-	-	2	2	3
CO3	3	-	3	-	-	2	2	2	-	-	-	2	2	3
CO4	3	-	-	-	-	2	2	2	-	-	-	2	2	3
CO5	3	-	-	-	-	2	2	2	-	-	-	2	2	3



COURSE OBJECTIVES

To enable the students to,

- understand the green building requirements for sustainable construction
- know about the various green building assessments
- impart knowledge on the sustainable construction strategies
- understand the building hydrologic systems
- obtain knowledge in green buildings commissioning

Prerequisite: Nil

UNIT I SUSTAINABLE CONSTRUCTION AND GREEN BUILDING REQUIREMENTS 9

Ethics and sustainability - Increased CO₂ trade, Sustainable construction, Major environmental and resource concerns ; Green building movement and obstacles ; Green building requirements, Perceived use of green building.

UNIT II GREEN BUILDING PROCESS AND ASSESSMENT 9

Life Cycle Impacts of Materials and Product-Conventional versus green building delivery systems, Execution of green building process - Integrated design process, Ecological design - Merits and demerits, Historical perspective; LEED building assessment standard - LEED certification process; International building assessment standards - Building rating system in India and its future; Case study of a green building.

UNIT III SUSTAINABLE LANDSCAPING AND ENERGY 9

Land and landscape approaches for green buildings - sustainable landscapes; Landscaping water efficiency Storm water management - Heat island mitigation, Building energy issues, Building energy design strategies, Building envelope, Active mechanical systems, Innovative energy optimization strategies; Smart buildings and energy management systems, Case study on smart buildings and energy management studies.

UNIT IV BUILDING HYDROLOGIC SYSTEM AND MATERIAL LOOPS 9

High performance building water supply strategy - High performance building wastewater strategy; Green building materials issues and priorities - LCA of building materials and products, Emerging construction materials and products, Construction and demolition waste management; Design for deconstruction and disassembly - Closing material loops in practice, Case study on LCA of buildings.

UNIT V GREEN BUILDING IMPLEMENTATION 9

Site protection planning - Health and safety planning, Reducing the footprint of construction operations, Essentials of building commissioning, Costs and benefits of building commissioning; The economics of green buildings - Quantifying green building costs, Future directions in green buildings, Case study for high performance green buildings.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- identify the requirements of green buildings
- explain the green building design process and assessment
- examine suitable sustainable landscaping and energy strategies for green building.
- expose suitable sustainable hydrologic landscaping and energy strategies for green building.
- illustrate green building commissioning and implementation

TEXT BOOKS

1. Charles. J. Kibert, Sustainable Construction: Green Building Design and Delivery, John Wiley & Sons, Inc., New Jersey, 2008
2. M. Bauer, P. Mosle and M. Schwarz, Green Building: Guidebook for Sustainable Architecture, Springer - Verlag Berlin Heidelberg, 2010

REFERENCES

1. Jerry Yudelson, Marketing Green Building Services: Strategies for success, Elsevier, 2008
2. Jerry Yudelson, Marketing Green Buildings: Guide for Engineering, Construction and Architecture, The Fairmont Press Inc., 2006
3. Angela. M. Dean, Green by Design: Creating a Home for Sustainable Living, Gibbs Smith Publication, 2003

CO PO MAPPING:

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CO3	3	-	-	-	2	2	2	2	-	-	-	2	2	3
CO4	3	-	-	-	2	2	2	2	-	-	-	2	2	3
CO5	3	-	-	-	2	2	2	2	-	-	-	2	2	3



COURSE OBJECTIVES

To enable the students to,

- understand the concepts, components and source of remote sensing
- explain the EMR interaction with atmosphere
- gain knowledge about different types of remote sensing platforms and sensors
- explain the concept of satellite image interpretation
- understand the applications of remote sensing in Civil Engineering

Prerequisite: Nil

UNIT I REMOTE SENSING AND ELECTROMAGNETIC RADIATION 9

Definition – components of RS, History of Remote Sensing, Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic Spectrum, Radiation principles - Wave theory, Planck's law, Wien's Displacement Law, Stefan's Boltzmann law, Kirchoff's law - Radiation sources: active & passive - Radiation Quantities.

UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL 9

Standard atmospheric profile – main atmospheric regions and its characteristics, interaction of radiation with atmosphere, Scattering, absorption and refraction; Atmospheric windows – Energy balance equation, Specular and diffuse reflectors, Spectral reflectance & emittance, Spectroradiometer, Spectral Signature concepts, Typical spectral reflectance curves for vegetation, soil and water, solid surface scattering in microwave region.

UNIT III ORBITS AND PLATFORMS 9

Motions of planets and satellites – Newton's law of gravitation , Gravitational field and potential, Escape velocity; Kepler's law of planetary motion - Orbit elements and types, Orbital perturbations and maneuvers ;Types of remote sensing platforms - Ground based, Airborne platforms and Space borne platforms; Classification of satellites – Sun synchronous and Geosynchronous satellites – Lgrange Orbit.

UNIT IV SENSING TECHNIQUES 9

Classification of remote sensors – Resolution concept : spatial, spectral, radiometric and temporal resolutions, Scanners - Along and across track scanners; Optical-infrared sensors – Thermal sensors , microwave sensors, Calibration of sensors, High Resolution Sensors, LIDAR , UAV, Orbital and sensor characteristics of live Indian earth observation satellites

UNIT V DATA INTERPRETATION AND CIVIL ENGINEERING APPLICATIONS 9

Photographic and digital products – Types, levels and open source satellite data products, selection and procurement of data, Visual interpretation - basic elements and interpretation key, Digital interpretation - Concepts of Image rectification, Image enhancement and Image classification; Civil Engineering applications: highway and railway alignments, site selection for dams, town and regional planning

TOTAL PERIODS 45**COURSE OUTCOMES**

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

- understand the concepts and laws related to remote sensing
- understand the interaction of electromagnetic radiation with atmosphere and earth material
- acquire knowledge about satellite orbits and different types of satellites
- understand the different types of remote sensors
- gain knowledge about the concepts of interpretation of satellite imagery and Civil engineering applications

TEXT BOOKS

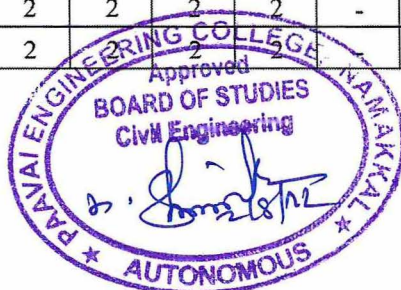
1. Thomas M.Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York, 2009
2. George Joseph and C Jeganathan, Fundamentals of Remote Sensing, Universities Press (India) Private limited, Hyderabad, 2018

REFERENCES

1. Janza, F.Z., Blue H.M. and Johnson, J.E. Manual of Remote Sensing. Vol.I, American Society of Photogrametry, Virginia, USA, 2002.
2. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 1995
3. Paul Curran P.J. Principles of Remote Sensing. Longman, RLBS, 2003.
4. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, 2011

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CO4	3	-	-	-	2	2	2	2	-	-	-	2	2	3
CO5	3	-	-	-	2	2	2	2	-	-	-	2	2	3



UNIT V ORGANIZATION AND USE OF PROJECT INFORMATION

9

Types of project information - Accuracy and Use of Information, Computerized organization and use of Information, Organizing information in databases, Relational model of Data bases, Other Conceptual Models of Databases; Centralized Database Management systems - Databases and application programs, Information transfer and Flow.

TOTAL PERIODS 45**COURSE OUTCOMES**

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

- expose the requirement of planning techniques exercised in the construction projects..
- examine suitable scheduling technique for the particular project.
- get exposure in the modern cost account systems and control techniques adopted in the construction projects.
- make use of advanced management tools for quality control and monitoring techniques towards speedy and guaranteed projects.
- explain how to use the data base for complex large projects.

TEXT BOOKS

1. Dr.S.Seetharaman, "Construction Planning and Scheduling", Revised edition, Anuradha Publication, Chennai 2014.
2. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 1998

REFERENCES

1. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
2. Srinath,L.S., "Pert and CPM Principles and Applications ", Third edition, Affiliated East West Press, 2001

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CO5	3	3	-	-	2	2	2	2	-	-	2	2	2	3



COURSE OBJECTIVES

To enable the students to,

- understand the working of total station equipment and concepts of electromagnetic waves
- understand the impact of Refraction index and concept of atmospheric correction
- impart the knowledge on the total station principles and its applications
- impart the knowledge of GPS and its applications.
- impart the knowledge of the advantages of electronic surveying over conventional surveying methods

Prerequisite: Plane and Geodetic Surveying

UNIT I FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES 9

Methods of Measuring Distance; Total station - Historical Development, Basic Principles, Classifications, applications and comparison with conventional surveying; Electromagnetic waves - Classification, applications, Propagation properties, wave propagation at lower and higher frequencies

UNIT II DISTANCE AND ATMOSPHERIC CORRECTION 9

Refractive index (RI) - factors affecting RI, Computation of group for light and near infrared waves at standard and ambient conditions, Computation of RI for microwaves at ambient condition, Reference refractive index- Real time application of first velocity correction; Measurement of atmospheric parameters - Mean refractive index, Second velocity correction, Total atmospheric correction, Use of temperature and pressure transducers.

UNIT III ELECTRO OPTICAL AND MICRO WAVE SYSTEM 9

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

UNIT IV GPS SATELLITE SYSTEM 9

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

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- attain knowledge on working of modern surveying equipment such as total station and GPS.
- perceive the impacts of RI and its corrections on atmosphere
- attain knowledge on total station and its applications
- evaluate the concepts of GPS and its different methods and its applications
- perceive the advantages of electronic surveying over conventional surveying methods

TEXT BOOKS

1. Rueger, J.M. "Electronic Distance Measurement", Springer-Verlag, Berlin, 2007.
2. Satheesh Gopi, Sathishkumar.R, Madhu.N, "Advanced Surveying, Total Station GPS and Remote Sensing" Pearson education, 2nd edition 2017.

REFERENCES

1. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993.
2. GuochengXu, "GPS Theory, Algorithms and Applications", Springer – Verlag, Berlin, 3rd edition 2016.
3. Alfred Leick, "GPS satellite surveying", John Wiley & Sons Inc., 4th Edition, 2015.
4. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.

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CO4	3	-	-	-	2	2	2	2	-	-	-	2	2	3
CO5	3	-	-	-	2	2	2	2	-	-	-	2	2	3



COURSE OBJECTIVES

To enable the students to,

- study the substructure construction techniques like box jacking, sheet piling etc.
- understand the concepts of different tall structure construction techniques.
- know recent and advancement in construction techniques and methods in concreting
- study the elements and construction techniques of special structures
- impart the knowledge of strengthening techniques for different construction

Prerequisite: Nil

UNIT I SUB STRUCTURE CONSTRUCTION 9

A frame techniques - Box Jacking, pipe jacking; diaphragm walls types and methods; Piling techniques - driving well and caisson; sheet piles - construction procedures and applications; cofferdam - methods, cable anchoring; laying operations for built up offshore system - shoring for deep cutting ; Well points - dewatering and stand by plant equipment for underground open excavation, Trenchless Technology.

UNIT II TALL STRUCTURE CONSTRUCTION 9

Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections launching techniques; Slip form techniques suspended form work - erection techniques of tall structures, large span structures, launching techniques for heavy decks - in situ prestressing in high rise structures, aerial transporting handling erecting lightweight components on tall structures

UNIT III LARGE SPAN STRUCTURE CONSTRUCTION 9

Types of bridges and loading standards - Bow string bridges, cable stayed bridges; Construction aspects and inspection and maintenance of bridges; Launching and pushing of box decks; Construction sequence and methods in domes and prestressed domes - various construction techniques of domes, methods, merits and demerits and space decks support structure for heavy equipment and conveyor and machinery in heavy industries.

UNIT IV SPECIAL STRUCTURE CONSTRUCTION 9

Erection of lattice towers and rigging of transmission line structures - construction procedures of cooling towers, silos, chimney, sky scrapers; Advanced construction techniques in offshore construction practice - Vacuum dewatering of concrete flooring, white topping - methods and application, erection of articulated structures; floating structures - methods.

UNIT V COMMON STRENGTHENING TECHNIQUES 9

Mud Jacking grout through slab foundation - micro piling for strengthening floor and shallow profile pipeline laying, protecting sheet piles, screw anchors; Sub grade water proofing - under pinning , crack stabilizing techniques , advanced techniques; Explosives and its classification; Sequence in demolition and dismantling.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- know the working principle of different sub structure construction techniques.
- explain erection and launching methods of tall structures.
- choose the construction techniques for large span structures.
- demonstrate the different techniques involved in special structure construction.
- explain common strengthening techniques and its application.

TEXT BOOKS

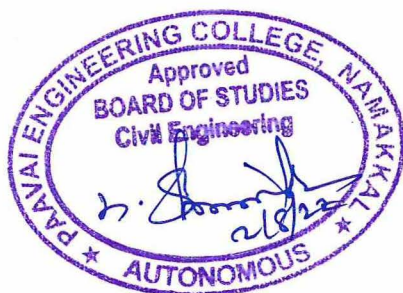
1. Roy Chudley, Roger Geeno , "Advanced Construction Technology" Latest Edition, 2005.
2. Sankar .S.K. And Saraswati .S, Construction Technology, Oxford University Press, New Delhi, 2008.

REFERENCES

1. Patrick Powers .J, "Construction Dewatering: New Methods And Applications", John Wiley & Sons, 2002.
2. Peurifoy. R.L., Ledbette. W.B., Construction Planning, Equipment and Methods, McGraw Hill Co., 2000.
3. Gahlot .P.S & Sanjay Sharma , "Building repair and maintenance management" , CBS Publications.2006.

CO PO MAPPING:

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CO4	3	-	-	-	3	2	2	2	-	-	-	2	2	2
CO5	3	-	-	-	3	2	2	2	-	-	-	2	2	2



COURSE OBJECTIVES

To enable the students to,

- impart the knowledge impacts of developmental projects on environment.
- understand the different methods of impact prediction
- make a plan for environmental assessment and management
- understand the concepts of economic valuation of environmental impacts
- prepare the environmental impact assessment reports

Prerequisite: Nil

UNIT I INTRODUCTION 9

Impacts of Development on Environment - Sustainable Development and Environmental Impact Assessment (EIA) - Objectives, Historical development, EIA Types EIA in project cycle, EIA Notification and Legal Framework in India, Selection & Registration Criteria for EIA Consultants Stakeholders and their Role in EIA.

UNIT II ENVIRONMENTAL ASSESSMENT 9

Screening and Scoping in EIA - Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna; Matrices - Networks Checklist Methods, Mathematical models for Impact prediction, Analysis of alternatives

UNIT III ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna; Environmental Monitoring Plan - EIA Report Preparation, Review of EIA Reports, Environmental Clearance, Post Project Audit

UNIT IV SOCIO ECONOMIC ASSESSMENT 9

Baseline monitoring of Socio economic environment - Identification of Project Affected Personal, Rehabilitation and Resettlement Plan, Economic valuation of Environmental impacts , Cost benefit Analysis, Public Consultation

UNIT V CASE STUDIES 9

EIA case studies pertaining to Infrastructure Projects; Real Estate Development - Roads and Bridges; Mass Rapid Transport Systems; Ports and Harbor; Airports; Dams and Irrigation projects; Waste Processing and Disposal facilities Mining Projects.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- carry out scoping and screening of developmental projects for environmental and social assessments
- explain different methodologies for environmental impact prediction and assessment
- plan environmental impact assessments and environmental management plans
- asses socioeconomic investigation of the environment in a project
- knowledge to prepare environmental impact assessment reports

TEXT BOOKS

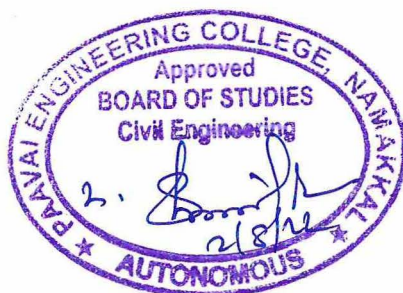
1. Canter, R.L (1995). Environmental impact Assessment, 2nd Edition, McGraw Hill Inc., New Delhi.
2. Peter Morris, Riki Therivel (2009), "Methods of Environmental Impact Assessment", Routledge Publisher

REFERENCES

1. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu. (1997), "Environmental Impact Assessment for Developing Countries in Asia", Volume 1 –Overview, Asian Development Bank
2. Becker H. A., Frank Vanclay (2003), The International handbook of social impact assessment: conceptual and methodological advances, Edward Elgar Publishing
3. Barry Sadler and Mary McCabe (2002), "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme.
4. Judith Petts, Handbook of Environmental Impact Assessment Vol. I and II, Blackwell Science, New York, 1998.
5. Ministry of Environment and Forests (2010), EIA Notification and Sectoral Guides, Government of India, New Delhi.

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LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE – III

CE20351

STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING

3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- gain knowledge of science and engineering fundamentals of structural dynamics.
- evaluate natural frequencies and modes for multi degree of freedom system.
- understand the concepts of earthquake phenomenon.
- explain the effects of earthquake on different types of structure.
- know about the earthquake forces on building and make a design and detailing.

Prerequisite: Nil

UNIT I SINGLE DEGREE OF FREEDOM SYSTEM 9

Definition of degree of freedom - Idealization of structure as Single Degree of Freedom (SDOF) system, Formulation of equation of motion for various SDOF system, D'Alemberts Principles, Effect of damping; Free and forced vibration of damped and undamped structures; Response to harmonic forces and periodic loading.

UNIT II MULTI DEGREE OF FREEDOM SYSTEM 9

Formulation of equation of motion for multi degree of freedom (MDOF) system - Evaluation of natural frequencies and modes, Eigen values and Eigen vectors; Orthogonality and normality principles; Response to free and forced vibration of undamped and damped MDOF systems - Modal superposition methods.

UNIT III INTRODUCTION TO EARTHQUAKE ENGINEERING 9

Elements of Engineering Seismology - Definitions, Introduction to Seismic hazard, Earthquake phenomenon - Seismo tectonics, Seismic Instrumentation, Characteristics of Strong Earthquake motion; Estimation of Earthquake Parameters - Soil Structure Interaction.

UNIT IV EARTHQUAKE EFFECTS ON STRUCTURES 9

Effect of earthquake on different types of structures - Behaviour of RCC, Steel and prestressed Concrete Structures under earthquake loading; Pinching Effect - Bouchinger Effects; Liquefaction of soil - Response Spectra, Causes of damage; Lessons learnt from past earthquakes.

UNIT V CONCEPTS OF EARTHQUAKE RESISTANT DESIGN 9

Planning considerations and Architectural concepts - Evaluation of Earthquake forces, Lateral load analysis, Guidelines for Earthquake resistant design; Earthquake resistant design of masonry and RCC buildings - Design considerations, Guidelines, Design and detailing.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply the knowledge of science and engineering fundamentals to idealize and formulate the equations of motion for SDOF system.
- develop the equations of motion for MDOF system and to evaluate the natural frequencies and mode shapes.
- explain the elements of engineering seismology, characteristics of earthquake and seismic instrumentation.
- identify the various causes and effects of earthquakes on structures due to past earthquakes.
- analyze the structures subjected to dynamic loading and to design for seismic loading as per codal provisions.

TEXT BOOKS

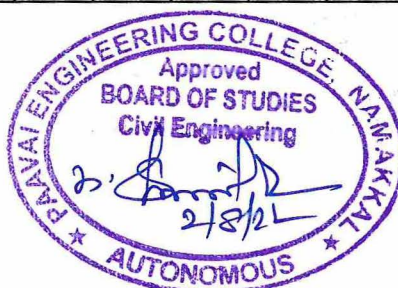
1. Mario Paz, "Structural Dynamics – Theory and Computations", Fifth Edition 2nd printing, CBS publishers, 2006.
2. Agarwal.P and Shrikhande.M. "Earthquake Resistant Design of Structures", Prentice Hall of India Pvt. Ltd. 2011.

REFERENCES

1. Clough.R.W, and Penzien.J, "Dynamics of Structures", Second Edition, McGraw Hill International Edition, 1995.
2. Minoru Wakabayashi, "Design of Earthquake Resistant Buildings", Mc Graw – Hill Book Company, 1986.
3. Anil K Chopra, "Dynamics of structures – Theory and applications to Earthquake Engineering", Prentice Hall Inc., 2007.
4. Moorthy.C.V.R., "Earthquake Tips", NICEE, IIT Kanpur, 2002.

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CO2	3	-	-	2	-	2	2	2	-	-	-	-	3	2
CO3	3	-	-	2	-	2	2	2	-	-	-	-	3	2
CO4	3	-	-	2	-	2	2	2	-	-	-	-	3	2
CO5	3	-	-	2	-	2	2	2	-	-	-	-	3	2



COURSE OBJECTIVES

To enable the students to,

- understand the properties of modern construction materials used in construction.
- explain manufacturing and applications of different metals.
- gain knowledge about different types of composite materials used in construction.
- obtain the concepts of admixtures and construction chemicals.
- know the difference between smart and intelligent materials.

Prerequisite: Nil

UNIT I SPECIAL CONCRETES 9

Concretes - Behaviour of concretes, Properties and Advantages of High Strength and High Performance Concrete; Properties and Applications of Fibre Reinforced Concrete; Self-compacting concrete; Alternate Materials to concrete on high performance and high Strength concrete.

UNIT II METALS 9

Types of Steels - Manufacturing process of steel, Advantages of new alloy steels, Properties and advantages of aluminium and its products, Types of Coatings and Coatings to reinforcement, Applications of Coatings

UNIT III COMPOSITES 9

Types of Plastics - Properties and Manufacturing process, Advantages of Reinforced polymers; Types of FRP, FRP on different structural elements, Applications of FRP.

UNIT IV OTHER MATERIALS 9

Introduction - Types and properties of Water Proofing Compounds , Types of Non-weathering Materials and its uses; Types of Flooring and Facade Materials and its application, concrete admixtures and construction chemicals

UNIT V SMART AND INTELLIGENT MATERIALS 9

Types and Differences between Smart and Intelligent Materials – Special features; Case studies showing the applications of smart and Intelligent Materials.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- acquire knowledge on special concretes
- explain the manufacturing process of different metals.
- gain knowledge on polymer and fibre reinforced concrete.
- summarize the uses of different admixtures in construction
- explain the difference between smart and intelligent materials.

TEXT BOOKS

1. Building Materials, P.C. Varghese, Prentice-Hall India, 2nd Edition, 2015.
2. Ganapathy, C., Modern Construction Materials, Eswar Press, 2015.

REFERENCES

1. Shetty M.S, Concrete Technology: Theory and Practice, S.Chand& Company Ltd., 2005
2. Santhakumar.A.R., Concrete Technology, Oxford University press, New Delhi, 2005.
3. Materials Science and Engineering: An introduction, W.D. Callister, John Wiley, 1994.
4. Materials Science and Engineering, V. Raghavan, Prentice Hall, 1990.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong, 2-Medium, 1-Weak														
Cos	Programme Outcomes (POs)												PSO1	PSO2
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		
CO1	3	-	2	-	3	2	3	2	-	-	-	3	2	2
CO2	3	-	2	-	3	2	3	2	-	-	-	3	2	2
CO3	3	-	2	-	3	2	3	2	-	-	-	3	2	2
CO4	3	-	2	-	3	2	3	2	-	-	-	3	2	2
CO5	3	-	2	-	3	2	3	2	-	-	-	3	2	2



COURSE OBJECTIVES

To enable the students to,

- understand the source, types and characterization of municipal solid wastes.
- know the storage methods and the processing of solid wastes
- learn the methods of collection and transfer stations with option under Indian condition.
- gain knowledge on the processing techniques equipment used for processing.
- understand the disposal methods of solid waste and discuss leachate collection and treatment

Prerequisite: Nil

UNIT I SOURCES AND CHARACTERISTICS 9

Sources and types of municipal solid wastes - waste generation rates, factors affecting generation, characteristics, methods of sampling and characterization; Effects of improper disposal of solid wastes - Public health and environmental effects; Elements of solid waste management - Social and financial aspects, Public awareness; Role of NGO's, Public Private participation.

UNIT II ON-SITE STORAGE AND PROCESSING 9

On-site storage methods - Effect of storage, materials used for containers, segregation of solid wastes, Public health and environmental aspects of open storage; Waste segregation and storage - case studies under Indian conditions; Source reduction of waste - Reduction, Reuse and Recycling of plastic waste; Construction and Demolishing waste.

UNIT III COLLECTION AND TRANSFER 9

Methods of Residential and commercial waste collection - Collection vehicles, Manpower; Collection routes - Analysis of collection systems; Transfer stations - Selection of location, operation and maintenance; options under Indian conditions - Field problems-solving.

UNIT IV OFF-SITE PROCESSING 9

Objectives of waste processing - Physical Processing techniques and Equipment; Resource recovery from solid waste composting and biomethanation; Thermal processing options - case studies under Indian conditions.

UNIT V DISPOSAL 9

Land disposal of solid waste; Sanitary landfills - site selection, design and operation of sanitary landfills, Landfill liners - Management of leachate and landfill gas, Landfill bioreactor; Dump site capping; Bio mining.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the nature and characteristics of municipal solid wastes
- apply knowledge about the regulatory requirements regarding municipal solid waste management
- identify the waste minimization techniques.
- evaluate the design systems for storage, collection, transport, and processing.
- implement the knowledge about the disposal of municipal solid waste.

TEXT BOOKS

1. Cherry P M, "Solid and Hazardous Waste Management", CBS publishers and distributors Pvt Ltd, 2018
2. Rao M.N, Razia Sultana, Sri Harsha Kota, "Solid and hazardous Waste management–Science and Engineering, Butterworth-Heinemann, 2016

REFERENCES

1. CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization", Government of India, New Delhi, 2014.
2. Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal, 2001.
3. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management, Mc-Graw Hill India, First edition, 2015.
4. William A. Worrell, P. Aarne Vesilind, Christian Ludwig, Solid Waste Engineering-A Global Perspective, 3rd Edition, Cengage Learning, 2017.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong, 2-Medium, 1-Weak														
Cos	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	2	2	2	-	-	-	2	2	2
CO2	3	-	-	-	-	2	2	2	-	-	-	2	2	2
CO3	3	-	-	-	-	2	2	2	-	-	-	2	2	2
CO4	3	-	-	-	-	2	2	2	-	-	-	2	2	2
CO5	3	-	-	-	-	2	2	2	-	-	-	2	2	2



COURSE OBJECTIVES

To enable the students to,

- know an overview of Road user characteristics and vehicle performance.
- gain knowledge in traffic regulation, management and traffic surveys
- gain knowledge in traffic regulations and control
- study about road safety measures environmental hazards.
- study about various traffic management systems

Prerequisite: Nil

UNIT I TRAFFIC CHARACTERISTICS 9

Road Characteristics - Classification, Functions and standards; Road user characteristics - PIEV theory, Vehicle, Performance characteristics, Fundamentals of Traffic Flow; Urban Traffic problems in India; Integrated planning of town, country, regional and all urban infrastructure - Towards Sustainable approach

UNIT II TRAFFIC SURVEYS 9

Traffic Surveys - Speed, journey time and delay surveys, Vehicle Volume Survey - Methods and interpretation, Origin Destination Survey - Methods and presentation, Parking Survey - Methods, interpretation and presentation; Statistical applications in traffic studies and traffic forecasting, level of service, Concept, application and significance.

UNIT III TRAFFIC ENGINEERING REGULATION AND CONTROL 9

Capacity of Rotary intersection and Design - Capacity of signalized intersections; Traffic signals, warrants, type - Design and coordination; Intersection channelization - Grade separation; Traffic signs and road markings.

UNIT IV TRAFFIC SAFETY AND ENVIRONMENT 9

Road accidents - Causes, effect, prevention, and cost; street lighting; Traffic and environment hazards - Air and Noise Pollution, causes, health effects and abatement measures; Promotion and integration of public transportation; Promotion of non-motorized transport.

UNIT V TRAFFIC MANAGEMENT 9

Area Traffic Management System - One way street system, exclusive traffic lanes, tidal flow operation, staggering of work hours and road pricing; Non road pricing options - Parking charges, Public transport, Subsidies, Vehicle License fees, Road Building, Permit system, Physical Traffic Management Transport System Management (TSM) and Transport Demand Management (TDM); Introduction to Intelligent Transportation Systems (ITS) - ITS Applications in Traffic Management.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the principles and standards adopted in Planning and Design of Traffic system.
- apply the knowledge of engineering fundamentals in conducting traffic surveys
- design various types of control and regulatory measures to meet an efficient traffic network
- select appropriate methods to ensure the safety of the road users
- understand various traffic management measures and ITS applications

TEXT BOOKS

1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2014.
2. Khanna .K and Justo C.E.G. and Veeraragavan, A Highway Engineering, Nem Chand Bros., Roorkee, Revised 10th Edition, 2014.

REFERENCES

1. Srinivasa Kumar, "Introduction to Traffic Engineering", Universities Press, 2018
2. Wohl and Martin, "Traffic System Analysis for Engineering and Planners", McGraw Hill, 2007
3. Subhash Saxena, "A Course in Traffic Engineering and Design", Dhanpat Rai & Sons, 2010.
4. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong, 2-Medium, 1-Weak														
Cos	Programme Outcomes (POs)												PSO1	PSO2
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		
CO1	3	-	-	-	-	2	3	2	-	-	-	-	2	2
CO2	3	2	2	-	-	2	3	2	-	-	-	-	2	2
CO3	3	-	-	-	-	2	3	2	-	-	-	-	2	2
CO4	3	-	-	-	-	2	3	2	-	-	-	-	2	2
CO5	3	-	-	-	-	2	3	2	-	-	-	-	2	2



OPEN ELECTIVE I

CE20901

BUILDING SERVICES

3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- know about the system of electrical work in building
- acquire the knowledge on various illumination and lighting process in building.
- learn the principles of electrical and air conditioning facilities.
- study the fire safety installation in various types of building.
- enhance the knowledge on water supply and drainage system in building.

Prerequisite: Nil

UNIT I ELECTRICAL SYSTEMS IN BUILDINGS 9

Ohms and Kirchoff's laws of Basics of electricity, Single / Three phase supply, Protective devices in electrical installations, Earthing for safety, Types of earthing - ISI specifications, Types of wires, wiring systems and their choice, Planning electrical wiring for building, Main and distribution boards - Transformers and switch gears, Layout of substations

UNIT II PRINCIPLES OF ILLUMINATION AND DESIGN 9

Visual tasks, Factors affecting visual tasks, Modern theory of light and colour, Synthesis of light, Additive and subtractive synthesis of colour, Luminous flux, Candela, Solid angle illumination, utilization factor, Depreciation factor, MSCP, MHCP, Lamps of illumination, Classification of lighting, Artificial light sources, Spectral energy distribution, Luminous efficiency, Colour temperature, Colour rendering; Design of modern lighting - Lighting for stores, offices, schools, hospitals and house lighting, Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT III REFRIGERATION AND AIR CONDITIONING 9

Thermodynamics, Heat, Temperature, measurement transfer, Change of state, Sensible heat - Latent heat of fusion, evaporation, sublimation, Saturation temperature, Super-heated vapour, Sub cooled liquid; Pressure temperature relationship for liquids - Refrigerants, Vapour compression cycle, Compressors, Evaporators, Refrigerant control devices, Electric motors, Starters, Air handling units, Cooling towers, Window type and packaged air conditioners; Chilled water plant - Fan coil systems, Water piping, Cooling load - Air conditioning systems for different types of buildings, Protection against fire to be caused by A.C. Systems.

UNIT IV FIRE SAFETY INSTALLATION 9

Causes of fire in buildings, Safety regulations, NBC, Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems; Special features required for physically handicapped and elderly in building types; Heat and smoke detectors - Fire alarm system; snorkel ladder, Fire lighting pump and water storage, Dry and wet risers, Automatic sprinklers.

Plumbing fixtures and fixture fittings, Water conserving fittings, over flows, Strainers and connectors, Prohibited fixtures, Special fixtures - Installation of water closet, Urinals, Flushing devices, Floor drains, Shower stall, Bath tub, Bidets; Minimum plumbing facilities; Rain water harvesting systems - necessity, construction, different types.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- explain about the system of electrical work in building
- obtain the knowledge on various illumination and lighting process in building.
- Know about the principles of electrical and air conditioning facilities.
- apply the fire safety installation in various types of building.
- gather the knowledge on water supply and drainage system in building.

TEXT BOOKS

1. David .V Chadderton on “Building Service Engineering”, Routledge Taylor and Francise group, London and Network 2013.
2. E.R.Ambrose, “Heat pumps and Electric Heating”, John and wiley and Sons, Inc., New York, 2011.

REFERENCES

1. William H.Severns and Julian R.Fellows, “Air–conditioning and Refrigeration”, John Wiley and Sons, London, 2007.
2. Handbook for Building Services in fred hall and roger greeno, 2013
3. National Building Code 2016.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong, 2-Medium, 1-Weak														
Cos	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	2	3	3	2	-	-	-	2	2	2
CO2	3	-	-	-	2	3	3	2	-	-	-	2	2	2
CO3	3	-	-	-	2	3	3	2	-	-	-	2	2	2
CO4	3	-	-	-	2	3	3	2	-	-	-	2	2	2
CO5	3	-	-	-	2	3	3	2	-	-	-	2	2	2



COURSE OBJECTIVES

To enable the students to,

- gain knowledge on housing planning
- apply the knowledge of design, evaluation.
- understand the construction and financing of housing projects.
- learn cost of effective construction materials and methods
- know the sustainable housing policies and programmes

Prerequisite: Nil

UNIT I INTRODUCTION TO HOUSING 9

Definition of Basic Terms - House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy; Principle of Sustainable Housing - Integrated approach on arriving holding capacity and density norms; All basic infrastructure consideration; Institutions for Housing at National, State and Local levels.

UNIT II HOUSING PROGRAMMES 9

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods - Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing; Slum Housing Programmes, Slum improvement, Slum redevelopment and Relocation; Use of GIS and MIS in Slum Housing Projects; Role of Public housing agencies and Private sector in supply, quality, infrastructure and pricing; Role of Non - Government Organizations in slum housing.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS 9

Formulation of Housing Projects - Land Use and Soil suitability analysis; Building Byelaws and Rules; Development Control Regulations - RERA, site Analysis, Layout Design, Design of Housing Units (Design Problems), feasibility study, Housing Project Formulation.

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS 9

New Constructions Techniques - Cost Effective Modern Materials and methods of Construction; Green building concept; Building Centers - Concept, Functions and Performance Evaluation - optimum floor space index.

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL 9

Evaluation of Housing Projects for sustainable principles - Housing Finance, Cost Recovery; Cash Flow analysis, Subsidy and Cross Subsidy; Public Private Partnership Projects; Viability Gap Funding - Pricing of Housing Units (Problems).

TOTAL PERIODS 45

COURSE OUTCOMES

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

- identify and suggest the types of various houses and sustainability
- understand the types of various housing programmes in India
- classify the comprehensive knowledge of planning and designing in housing.
- analyze the cost effective materials and techniques used in housing construction
- understand the appropriate evaluation and financing of housing projects

TEXT BOOKS

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. Meera Mehta and Dinesh Mehta, "Metropolitan Housing Markets", Sage Publications Pvt Ltd., New Delhi, 2004.
2. Francis Cherunilam and Odeyar D Heggade, "Housing in India", Himalaya Publishing House, Bombay, 2008.
3. Wiley-Blackwell, "Neufert Architects" Data, 4th Edition, Blackwell Publishing Ltd, 2012
4. Donald Watson and Michael J. Crosbie, "Time Saver Standards for Architectural Design", 8th Edition, Tata McGraw Hill Edition, 2011
5. Walter Martin Hosack, "Land Development Calculations", McGraw Hill 2nd Edition, USA 2010
6. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2004.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong, 2-Medium, 1-Weak														
Cos	Programme Outcomes (POs)												PSO1	PSO2
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		
CO1	3	-	-	-	2	3	3	2	-	-	-	2	2	2
CO2	3	-	-	-	2	3	3	2	-	-	-	2	2	2
CO3	3	-	-	-	2	3	3	2	-	-	-	2	2	2
CO4	3	-	-	-	2	3	3	2	-	-	-	2	2	2
CO5	3	-	-	-	2	3	3	2	-	-	-	2	2	2

