PAAVAI ENGINEERING COLLEGE (AUTONOMOUS)
B.E. – CIVIL ENGINEERING
REGULATIONS 2016
(CHOICE BASED CREDIT SYSTEM)
CURRICULUM
SEMESTER V

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	CE16501	Design of Reinforced Concrete Elements	3	0	0	3
2	PC	CE16502	Highway Engineering	3	0	0	3
3	PC	CE16503	Structural Analysis – I	3	0	0	3
4	PC	CE16504	Water Supply Engineering	3	0	0	3
5	PC	CE16505	Soil Mechanics	3	0	0	3
6	PE	CE1615*	Programme Elective – I	3	0	0	3
Practical							
7	PC	CE16506	Highway Engineering Laboratory	0	0	4	2
8	PC	CE16507	Soil Mechanics Laboratory	0	0	4	2
9	EE	EN16501	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	CE16601	Design of Steel Structures	3	0	0	3
2	PC	CE16602	Structural Analysis – II	3	0	0	3
3	PC	CE16603	Design of Reinforced Concrete and Brick Masonry Structures	3	0	0	3
4	PC	CE16604	Waste Water Engineering	3	0	0	3
5	PC	CE16605	Foundation Engineering	3	0	0	3
6	OE	*******	Open Elective – I	3	0	0	3
Practical							
7	EE	CE16606	Computer Aided Design and Drafting Laboratory	0	0	2	1
8	PC	CE16607	Environmental Engineering Laboratory	0	0	4	2
9	EE	CE16608	Survey Camp	0	0	2	1
10	EE	EN16601	Career Development Laboratory – II	0	0	2	1
			Total	**18**	**0**	**10**	**23**

LIST OF PROGRAMME ELECTIVES

PROGRAMME ELECTIVE I

S. No	Category	Course Code	Course Title	L	T	P	C
1	PE	CE16151	Hydrology and Water Resources Engineering	3	0	0	3
2	PE	CE16152	Total Station and GPS Surveying	3	0	0	3
3	PE	CE16153	Construction Planning and Scheduling	3	0	0	3
4	PE	CE16154	Air pollution and Control Engineering	3	0	0	3
5	PE	CE16155	Coastal Engineering	3	0	0	3

LIST OF OPEN ELECTIVES

OPEN ELECTIVE I

S. No	Category	Course Code	Course Title	L	T	P	C
1	OE	CE16901	Building Services	3	0	0	3
2	OE	CE16902	Contract Laws and Regulations	3	0	0	3
3	OE	CE16903	Architecture	3	0	0	3
4	OE	CE16904	Smart Structures and Smart Materials	3	0	0	3
5	OE	CE16905	Remote Sensing Techniques and GIS	3	0	0	3

SEMESTER V

CE16501 DESIGN OF REINFORCED CONCRETE ELEMENTS 3 0 0 3

COURSE OBJECTIVE

To enable the students to

- develop an understanding on the basic concepts in the behaviour and design of reinforced concrete systems and elements using limit state method.
- present the design principles of RC members for shear, bond, and torsion.
- announce the concepts in the design of RC column design
- get the knowledge in the concept of RC footings.
- develop an understanding on the basic concepts in the behaviour and design of staircase.

Prerequisite: Nil

UNIT I INTRODUCTION AND DESIGN OF FLEXURAL MEMBERS 9

Stages in Structural Design – Design philosophies – Introduction to working stress method, ultimate load Design (Principles only) – Limit state method – Comparison – General principles of design – Design of beams and slabs – Procedure for the analysis of section by strain compatibility method.

UNIT II DESIGN FOR BOND, ANCHORAGE, SHEAR & TORSION 9

Design of flanged beams – Behaviour of RC members in bond and Anchorage – Curtailment of reinforcement – Behavior of RC beams in shear and torsion – Design of RC members for combined bending, shear and torsion.

UNIT III DESIGN OF COLUMNS 9

Columns – Assumptions – Effective length – Classification – Design guidelines – Axially loaded short columns with lateral ties and helical reinforcement – Columns – Uniaxial bending – Biaxial bending.

UNIT IV DESIGN OF FOOTING 9

Foundations – Classification – Design guidelines – Codal provisions – Design of wall footing – Design of axially and eccentrically loaded square, rectangular and circular footing – Design of combined footing – Standard method of detailing the RC footing.

UNIT V DESIGN OF STAIRCASE 9

Types of stairs – Design of ordinary stairs, dog–legged stairs, Open newel stairs and stairs with stringer beams – Standard method of detailing of staircase.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- design flexural members using limit state method under different loading and end conditions.
- enterprise flexural members of any cross–sectional shape for shear, bond and torsion
- plan RC columns of any cross section with different end conditions
- select and design RC footing of different cross section under various site conditions.
- choose and design various types of staircase as per the site/building requirements

TEXT BOOKS

1. Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw–Hill Publishing Company Ltd., New Delhi 2009.
2. Krishna Raju, N., "Design of Reinforced Concrete Structures", CBS Publishers & Distributors, New Delhi,2003.

REFERENCES

1. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., New Delhi 2010
2. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw–Hill Publishing Company Ltd., New Delhi 2014.
3. Subramanian, N., "Design of Reinforced Concrete Structures", Oxford University Press, New Delhi, 2013.
4. IS 456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000.
5. SP16, IS456:1978 "Design Aids for Reinforced Concrete to Bureau of Indian Standards, New Delhi, 1999.

WEB LINKS

1. http://nptel.ac.in/video.php?subjectId=105105105

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	2	3	2	2	-	-	-	-	-	-	-	2	1	2
CO2	2	2	2	2	-	-	-	-	-	-	-	2	1	2
CO3	2	3	2	2	-	-	-	-	-	-	-	2	1	2
CO4	2	2	2	2	-	-	-	-	-	-	-	2	1	2
CO5	2	3	2	2	-	-	-	-	-	-	-	2	1	2

CE16502 HIGHWAY ENGINEERING 3 0 0 3

COURSE OBJECTIVE

To enable the students to

- gain knowledge on planning of roadways.
- illustrate proficiency in the geometric design of various highway elements.
- gain knowledge on planning and design of flexible and rigid pavements.
- illustrate exposure of materials used for highways and construction procedures.
- gain knowledge on highway projects under public–private sector participation.

Prerequisite: Nil

UNIT I HIGHWAY PLANNING AND ALIGNMENT 9

History of road development in India – Classification of highways – Institutions for Highway planning, design and construction at different levels – Factors influencing in highway alignment; Road ecology; Engineering surveys for alignment, objectives, conventional and modern methods.

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 9

Typical cross sections of Urban and Rural roads — Cross sectional elements – Horizontal curves, super elevation, transition curves, widening of curves – Sight distances – Vertical curves, gradients, hairpin bends – Lateral and vertical clearance at underpasses – IRC standards – Road sign and safety.

UNIT III DESIGN OF FLEXIBLE AND RIGID PAVEMENTS 9

Design principles – Pavement components and their role – Design practice for flexible and rigid pavements (IRC methods only).

UNIT IV HIGHWAY CONSTRUCTION AND MAINTENANCE 9

Highway construction materials, properties, testing methods – Construction practice including modern materials and methods of concrete and flexible pavements, Highway drainage – Special considerations for hilly roads; Evaluation and Maintenance of pavements.

UNIT V HIGHWAY ECONOMICS AND FINANCE 9

Introduction, Highway User Benefits, Highway Costs, Vehicle Operation Costs, Economic analysis, Highway projects under public – Private sector participation, Bidding process, Highway finance.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- plan and align the highway components.
- execute geometric design of various highway components.
- prepare the design of flexible and rigid pavements.
- apply knowledge of construction procedure of various roads.
- perceive the economic analysis of highways.

TEXT BOOKS

1. Veeraragavan.A, Khanna.K and Justo.C.E.G. "Highway Engineering", Nem Chand & Bros Publishers, 2014.
2. Subramanian.K.P., "Highways, Railways, Airport and Harbour Engineering", Sci tech Publications(India), Chennai, 2010.

REFERENCES

1. Kadiyali.L.R., "Principles and Practice of Highway Engineering", Khanna Technical Publications,Delhi, 1997.
2. Subhash C Saxena, "Textbook of Highway and Traffic Engineering", CBS Publishers, 2014.
3. Partha Chakroborty and Animesh Das, "Principles of Transportation Engineering", PHI Learning Pvt. Ltd., 2005
4. Indian Road Congress(IRC), Guidelines and Special Publications on Planning and design of Highways
5. IRC Standards (IRC 37 – 2001 & IRC 58 –1998)

WEB LINKS

1. http://nptel.ac.in/downloads/105101087/
2. http://transportationengineering2012onwards.blogspot.in/2014/04/highway–economics–and–finance–part–1.html
3. https://www.dot.state.mn.us/planning/program/benefitcost.html

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	2	-	-	-	-	-	1	-	-	-	-	-	1	2
CO2	2	2	3	-	-	-	1	-	-	-	-	2	1	3
CO3	2	2	3	-	-	-	1	1	1	-	2	3	1	3
CO4	2	-	-	-	2	2	1	1	-	-	2	3	1	3
CO5	1	-	-	-	2	2	1	1	1	-	2	3	1	2

CE16503 STRUCTURAL ANALYSIS – I 3 0 0 3

COURSE OBJECTIVE

To enable the students to

- gain knowledge on computing slopes and deflections using energy methods.
- gain knowledge on influence lines for statically determinate and indeterminate structures
- analyse and solve arched structures.
- analyse the indeterminate structures for internal forces by slope deflection method.
- analyse the indeterminate structures for internal forces by moment distribution method.

Prerequisite: Nil

UNIT I DEFLECTION OF DETERMINATE STRUCTURES 9

Principles of virtual work for deflections – Deflections of beams, pin-jointed plane frames and rigid plane frames – Deflection of trusses.

UNIT II MOVING LOADS AND INFLUENCE LINES 9

(Determinate & Indeterminate Structures with Redundancy Restricted To One)

Influence lines for reactions in statically determinate structures – Influence lines for members forces in pin–jointed frames – Influence lines for shear force and bending moment in beam sections – Calculation of critical stress resultants due to concentrated and distributed moving loads – Muller Breslau's principle – Influence lines for continuous beams and single storey rigid frames – Indirect model analysis for influence lines of indeterminate structures

UNIT III ARCHES 9

Arches as structural forms – Examples of arch structures – Types of arches – Eddy's theorem – Analysis of three hinged, two hinged and fixed arches, parabolic and circular arches – Settlement and temperature effects

UNIT IV SLOPE DEFLECTION METHOD 9

Analysis of continuous beams (with and without support yielding) and rigid frames (with and without sway) – Symmetry and antisymmetry – Support displacements.

UNIT V MOMENT DISTRIBUTION METHOD 9

Distribution and carryover of moments – Stiffness and carry over factors – Analysis of continuous beams – Plane rigid frames with and without sway.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- determine the slopes and deflections of beams and frames.
- draw influence lines for statically determinate and indeterminate structures.
- analyse and solve arched and cable profiled structures.
- analyse the indeterminate structures by exact analysis.
- analyse the indeterminate structures by iterative procedure.

TEXT BOOKS

1. Bhavikatti,S.S, "Structural Analysis, Vol.1", Vikas Publishing House Pvt. Ltd., New Delhi–4, 2010.
2. Bhavikatti,S.S, "Structural Analysis, Vol.2", Vikas Publishing House Pvt. Ltd., New Delhi–4, 2013
3. Vaidyanathan, R. and Perumal. P., "Comprehensive structural Analysis – Vol. I & II", Laxmi Publications, New Delhi, 2003

REFERENCES

1. Punmia B.C., "Theory of Structures (SMTS) Vol II" Laxmi Publishing Pvt ltd, New Delhi, 2004.
2. L.S. Negi& R.S. Jangid, "Structural Analysis", Tata McGraw–Hill Publications, New Delhi, Sixth Edition, 2003..
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 Education Pvt. Ltd., New Delhi, 2013.

WEB LINKS

1. http://www.ce.memphis.edu/3121/notes/notes.html
2. http://elearning.vtu.ac.in/CV42.html

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	2	3	2	1	-	-	-	-	-	-	-	2	1	2
CO2	2	3	2	2	-	-	-	-	-	-	-	2	1	2
CO3	2	3	2	2	-	-	-	-	-	-	-	2	1	2
CO4	2	3	2	2	-	-	-	-	-	-	-	2	1	2
CO5	1	3	2	2	-	-	-	-	-	-	-	2	1	2

CE16504 WATER SUPPLY ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart the knowledge on sources, effect and control of water pollution.
- know the principles of dispersion characteristics of pollution in water.
- impose the knowledge in the control of water pollution.
- know the concepts behind the water pollution management.
- deliver the sources, effect and control of water pollution.

Prerequisite: Nil

UNITI PLANNING FOR WATER SUPPLY SYSTEM 9

Public water supply system – Planning – Objectives – Design period; Population forecasting-Water demand; Sources of water and their characteristics – Surface and Groundwater – Impounding Reservoir Well hydraulics – Development and selection of source – Water quality – Characterization and standards – Impact of climate change.

UNIT II CONVEYANCE SYSTEM 9

Water supply – Intake structures – Functions and drawings ; Pipes and conduits for water – Pipe materials; Hydraulics of flow in pipes –Transmission main design; Laying, jointing and testing of pipes – Drawings Appurtenances ;Types and capacity of pumps – Selection of pumps and pipe materials.

UNIT III WATER TREATMENT 9

Objectives – Unit operations and processes – Principles, functions, design and drawing of Chemical feeding, Flash mixers, flocculator, sedimentation tanks and sand filters – Disinfection ; Residue management; Construction and Operation & Maintenance aspects of Water Treatment Plants.

UNIT IV ADVANCED WATER TREATMENT 9

Principles and functions of Aeration – Iron and manganese removal; De–fluoridation and demineralization ; Water softening ; Desalination – Membrane Systems ; Recent advances.

UNIT V WATER DISTRIBUTION AND SUPPLY TO BUILDINGS 9

Requirements of water distribution – Components – Service reservoirs ;Functions and drawings Network design – Economics – Computer applications – Analysis of distribution networks Appurtenances – Operation and maintenance; Leak detection, Methods. Principles of design of water supply in buildings; House service connection – Fixtures and fittings; Systems of plumbing and drawings of types of plumbing.

TOTAL PERIODS 45

COARSE OUTCOMES

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

- analyze the structure of drinking water supply systems, including water transport, treatment and distribution.
- understand the water quality criteria and standards, and their relation to public health.
- design and evaluate water supply project alternatives on basis of chosen selection criteria.
- aware on the water pollution management ideas.
- aware with the sources, effects and control of water pollution.

TEXT BOOKS

1. Garg, S.K., "Environmental Engineering", Vol. 1 Khanna Publishers, New Delhi, 2009.
2. Punmia, B.C., Ashok K Jain and Arun K Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2010.

REFERENCES

1. Government of India, "Manual on Water Supply and Treatment", CPHEEO, Ministry of Urban Development, New Delhi, 2003
2. Syed R. Qasim and Edward M. Motley Guang Zhu, "Water Works Engineering Planning, Design and Operation", Prentice Hall of India Private Limited, New Delhi, 2006.
3. Garg, S.K., "Environmental Engineering Vol. I", Khanna Publishers, New Delhi,2009.
4. Modi, P.N. "Water Supply Engineering", Vol. I Standard Book House, New Delhi, 2005.

WEB LINKS

1. http://nptel.ac.in/courses/103107084/
2. http://nptel.ac.in/courses/105106119/

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	2	-	-	-	-	2	3	1	-	-	-	1	1	-
CO2	2	1	1	1	-	2	3	1	-	-	-	1	1	1
CO3	2	1	1	1	-	2	3	1	-	-	-	1	1	1
CO4	2	-	-	-	-	2	3	1	-	-	-	1	1	-
CO5	2	1	1	1	1	2	3	1	-	-	-	1	1	1

CE16505 SOIL MECHANICS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- describe the soil properties.
- discuss about the seepage analysis and flow nets.
- 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

Nature of soil – Phase relationships – Soil description and classification for engineering purposes, their significance – Index properties of soils – BIS Classification system – Soil compaction – Theory, comparison of laboratory and field compaction methods – Factors influencing compaction behaviour of soils.

UNIT II SOIL WATER AND WATER FLOW 9

Soil water – Static pressure in water – Effective stress concepts in soils – Capillary stress – Permeability measurement in the laboratory – Factors influencing permeability of soils – Seepage – Introduction to flow nets – Simple problems.

UNIT III STRESS DISTRIBUTION AND SETTLEMENT 9

Stress distribution – Soil media – Boussinesq theory – 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 – Factors influencing compression behaviour of soils.

UNIT IV SHEAR STRENGTH 9

Shear strength of cohesive and cohesionless 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

Slope failure mechanisms – Types – Infinite slopes – Finite slopes – Total stress analysis for saturated clay – Swedish Circle method – Friction circle method – Use of stability number – Slope protection measures.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- list the soil properties.
- confess about the seepage analysis and static pressure in water.
- determine the components of settlements and behavior of soils.
- perceive the concept of shear strength and its measurements.
- analyze the total stress for slope failure mechanism.

TEXT BOOKS

1. Punmia B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 2018
2. Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 2006

REFERENCES

1. Craig. R.F., "Soil Mechanics". E & FN Spon, London and New York, 2007
2. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", Wiley Eastern Ltd, New Delhi (India), 2000.
3. Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", 2nd Edition, Pearson Education,2013

WEBLINKS

1. nptel.ac.in/courses/105103097/
2. https://www.slideshare.net/vlmvv2/soil–mechanicsfullcoursenotesandlectures

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	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO2	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO3	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO4	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO5	2	2	2	1	1	-	-	-	-	-	-	1	1	2

CE16506 HIGHWAY ENGINEERING LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to,

- gain knowledge on various tests of coarse aggregate.
- explain about various workability tests on fresh concrete.
- find out the strength parameters of hardened concrete.
- have a hand–on practice, with reference to various tests on bitumen.

Prerequisite: Concrete Technology

LIST OF EXPERIMENTS

I TESTS ON FRESH CONCRETE 12

1. Slump cone test
2. Flow table
3. Compaction factor
4. Vee bee test

II TESTS ON HARDENED CONCRETE 12

1. Compressive strength – Cube & Cylinder
2. Flexure test
3. Modulus of Elasticity

III TESTS ON BITUMEN 12

1. Penetration
2. Softening Point
3. Ductility
4. Viscosity
5. Elastic Recovery

IV TESTS ON AGGREGATES 12

1. Soundness
2. Proportioning of Aggregates
3. Water Absorption
4. Fineness modulus of aggregate
5. Impact strength
6. Crushing strength

V TESTS ON BITUMINOUS MIXES (DEMONSTRATION ONLY) 12

1. Determination of Binder Content
2. Marshall Stability and Flow values
3. Specific Gravity
4. Density

TOTAL PERIODS 60

COURSE OUTCOMES

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

- assess the quality of coarse aggregate used in concrete.
- do various workability tests on fresh concrete.
- analyze the strength characteristics of the given concrete.
- apply sufficient idea of practice and procedure of using bitumen in road works.

REFERENCES

1. Shetty, M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003
2. Santhakumar, A.R; "Concrete Technology", Oxford University Press, New Delhi, 2007

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	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO2	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO3	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO4	2	-	-	-	1	-	-	-	-	-	-	1	1	1

CE16507 SOIL MECHANICS LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- gain knowledge on classification of soil based on index properties.
- estimate optimum moisture content and maximum dry density.
- estimate the shear strength of soil and compressibility of soil.
- acquire knowledge about the CBR..

Prerequisite: Soil Mechanics

LIST OF EXPERIMENTS

1. Specific gravity of soil
2. Grain size distribution – Sieve analysis
3. Liquid limit and Plastic limit tests
4. Shrinkage limit
5. Field density test
6. Determination of moisture – density relationship using standard proctor compaction test.
7. Permeability determination (constant head and falling head methods)
8. Direct shear test in cohesionless soil
9. Unconfined compression test in cohesive soil
10. Laboratory vane shear test in cohesive soil
11. California Bearing Ratio test
12. Triaxial Compression test (Demonstration only)
13. Consolidation test (Demonstration only)

TOTAL PERIODS 60

COURSE OUTCOMES

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

- classify soil based on its properties.
- assess the optimum moisture content required in the field.
- check stability of slopes by knowing shear strength and compressibility characteristics of soil.
- analyze the characteristics of soil.

REFERENCES

1. "Soil Engineering Laboratory Instruction Manual", Published by the Engineering College Co–operative Society, Chennai, Anna university, Chennai, 2010.
2. Head, K.H, "Manual of Soil Laboratory Testing (Vol–1 to 3)", John Wiley & Sons, Chichester, 1998.
3. Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1990.

WEBLINKS

1. https://www.ltu.edu/engineering/civil/labs/tab.geotechnical.asp

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	2	2	2	1	1	-	-	-	-	-	-	2	1	1
CO2	2	2	2	1	1	-	-	-	-	-	-	2	1	1
CO3	2	2	2	1	1	-	-	-	-	-	-	2	1	1
CO4	2	2	2	1	1	-	-	-	-	-	-	2	1	1

EN16501 CAREER DEVELOPMENT LABORATORY – I 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- understand their capabilities and enhance their grooming and showcasing his/her capabilities to a prospective employer
- provide an opportunity for the students to become acquainted with corporate opportunities relevant to their academic learning
- articulate their thoughts on a given topic – in English and also to make decent write ups in English on any given topic
- practice and score well in Aptitude tests conducted by corporate / prospective employers

Prerequisite: Nil

UNIT I BASICS – SELF ANALYSIS

Introduction – Self Explorations: Who Am I, Personal Attributes, Self Confidence and Self Esteem – Communication Skills : Introduction to communication, Flow of communication, Listening, Barriers of communications, How to overcome the barriers of communications – Leadership Qualities : Skills for a good Leader, Leadership styles, SWOT Analysis, – Time Management: Time is a resource, Identify Time wasters, Time Management Styles, Techniques for better time management – Group Dynamics/ Team Building : Importance of group in organizations, Team Building, Interaction with the team, How to build the good team.

UNIT II PERSONALITY DEVELOPMENT

Motivation: Introduction, Relevance and types of motivation, Analysis of motivation – Attitude: Factors, Influencing Attitude, Challenges and lessons from attitude – Creativity: Out of box thinking, Lateral thinking – Goal Setting: Wish list; Blue print for success; Short, long, life time goals.

UNIT III QUANTITATIVE APTITUDE – I

Number System – LCM & HCF – Square root & Cube root – Percentage – Time speed & Distance.

UNIT IV QUANTITATIVE APTITUDE – II

Trains – Boats & Streams – Average – Ages – Area.

UNIT V LOGICAL AND VERBAL REASONING

Series Completion: Number Series, Letter series, Symbol Series – Blood Relation – Coding and decoding – Logical Sequence – Analogy – Character Puzzles – Classification – Data sufficiency.

TOTAL PERIODS 30

COURSE OUTCOMES

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

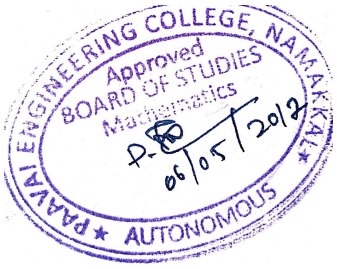
- demonstrate aptitude and reasoning skills
- enhance verbal and written ability
- improve his/her grooming and presentation skills
- interact effectively on any recent event / happenings / current affairs.

REFERENCES

1. Agarwal, R.S. "A modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi, 2003
2. AbhijitGuha, "Quantitative Aptitude", Tata–Mcgraw Hill, 2010
3. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications, 2011
4. Johnson, D.W. Reaching out – Interpersonal Effectiveness and self–actualization. Boston: Allyn And Bacon, 2014
5. Agarwal, R.S. "Objective General English", S.Chand & Co, 2007
6. Infosys Campus Connect Program – Students' guide for soft skills.

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



SEMESTER VI

CE16601 DESIGN OF STEEL STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- describe limit state design concepts and the design of bolted and riveted joints.
- gain knowledge on design of tension members.
- acquire knowledge about design of compression member.
- gain knowledge about design of beams.
- acquire knowledge on designing the components of roof trusses

Prerequisite: Nil

UNIT I INTRODUCTION 9

Properties of steel – Structural steel sections – Limit state design concepts – Loads on Structures; Connections using bolting and welding – Design of bolted and welded joints – Eccentric Connections – Efficiency of joints.

UNIT II TENSION MEMBER 9

Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag.

UNIT III COMPRESSION MEMBER 9

Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of lacing and battening type columns – Design of column bases – Gusseted base.

UNIT IV BEAMS 9

Design of laterally supported and unsupported beams – Built up beams – Beams subjected to Uniaxial and biaxial Bending – Design of plate girders – Intermediate and bearing stiffeners – Flange and web splices.

UNIT V ROOF TRUSSES AND INDUSTRIAL STRUCTURES 9

Roof trusses – Roof and side coverings – Design loads, design of purlin and elements of truss – Design of gantry girder.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply knowledge of limit state design concepts and joints.
- design tension members.
- design compression members.
- apply knowledge on design of beams.
- design components of steel trusses such as Purlins and gantry girders.

TEXT BOOKS

1. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800–2007, International Publishing House Pvt. Ltd., 2009
2. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013

REFERENCES

1. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2010
2. Dayaratnam, P., "Design of Steel Structures", Second edition, S. Chand & Company, 2004.
3. Shah.V.L. and Veena Gore, "Limit State Design of Steel Structures", IS 800–2007 StructuresPublications, 2009.
4. Ramachandra, S. and Virendra Gehlot, "Design of Steel Structures – Vol. I & II", Standard Publication, NewDelhi, 2007
5. IS800 :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 thanEarthquake) For Buildings and Structures.
7. Steel Tables

WEB LINKS

1. https://engineering.purdue.edu/~ahvarma/CE%20470/
2. http://www.learnerstv.com/Free–engineering–Video–lectures–ltv323–Page1.html
3. http://peer.berkeley.edu/~yang/courses/ce248/CE248_LN_Floor_vibrations.pdf

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	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO2	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO3	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO4	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO5	2	2	2	1	1	-	-	-	-	-	-	1	1	2

CE16602 STRUCTURAL ANALYSIS – II 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- analyse statically indeterminate structures by imposing boundary conditions on flexibility matrix.
- formulate the element stiffness matrix and assemble the structure stiffness matrix for solving indeterminate problems.
- understand the basics of finite element method and its application to structural analysis.
- introduce the importance of plastic analysis to calculate the collapse loads for beams and frames
- analyse a cable structures and stiffening girders.

Prerequisite: Structural Analysis I

UNIT I FLEXIBILITY METHOD 9

Equilibrium and compatibility – Determinate vs Indeterminate structures – Indeterminacy – Primary structure – Compatibility conditions – Formation of flexibility matrix for beams and frames – Analysis of indeterminate pin–jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).

UNIT II STIFFNESS METHOD 9

Element and global stiffness matrices – Analysis of continuous beams – Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of pin-jointed plane frames and rigid frames (with redundancy restricted to two)

UNIT III FINITE ELEMENT METHOD 9

Introduction – Element shapes, nodes, nodal unknowns and coordinate systems – Shape functions – Discretisation of a structure – Assembling stiffness equation – Displacement functions – Truss element – Beam element – Plane stress and plane strain – Triangular elements

UNIT IV PLASTIC ANALYSIS OF STRUCTURES 9

Introduction to plastic analysis – Statically indeterminate axial problems – Beams in pure bending – Plastic moment of resistance, Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems

UNIT V CABLE STRUCTURES AND SUSPENSION BRIDGE AND BEAMS CURVED IN PLAN 9

Suspension cables – Suspension bridges with two and three hinged stiffening girders – Beams curved in plan.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyse statically indeterminate structures by imposing boundary conditions on flexibility matrix.
- form the element stiffness matrices and assemble the global stiffness matrix for solving indeterminate problems.
- apply the concept of finite element method to structural analysis.
- employ plastic analysis to calculate the collapse loads for beams and frames.
- determine the member forces in suspension bridges and space truss

TEXT BOOKS

1. Bhavikatti,S.S, "Structural Analysis, Vol.1", Vikas Publishing House Pvt. Ltd., New Delhi–4, 2010.
2. Bhavikatti,S.S, "Structural Analysis, Vol.2", Vikas Publishing House Pvt. Ltd., New Delhi–4, 2013
3. Vaidyanathan, R. and Perumal, P., "Comprehensive structural Analysis – Vol. I & II", Laxmi Publications, New Delhi, 2003

REFERENCES

1. Punmia,B.C., Ashok Kumar and Arun Kumar Jain, " Theory of Structures", Laxmi Publications, 2004.
2. Ghali.A, Nebille,A.M. and Brown,T.G. "Structural Analysis" A unified classical and Matrix approach" – 5th edition. Spon Press, London and New York, 2003.
3. L.S. Negi & R.S. Jangid, "Structural Analysis", Tata McGraw–Hill Publications, New Delhi, 2003.
4. Coates R.C, Coutie M.G. and Kong F.K., "Structural Analysis", ELBS and Nelson, 1990
5. Gambhir, M.L., "Fundamentals of Structural Mechanics and Analysis"., PHI Learning Pvt. Ltd., New Delhi, 2011.
6. William Weaver Jr & James M. Gere, "Matrix Analysis of Framed Structures", CBS Publishers and Distributors, delhi, 2004.
7. Vazrani.V.N And Ratwani,M.M, Analysis of Structures, Vol. II, Khanna Publisers,2015.

WEB LINKS

1. http://www.ce.memphis.edu/3121/notes/notes.html.
2. http://elearning.vtu.ac.in/CV42.html

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	2	3	1	2	1	-	-	-	-	-	-	1	1	2
CO2	2	3	2	2	1	-	-	-	-	-	-	1	1	2
CO3	2	3	2	2	1	-	-	-	-	-	-	1	1	2
CO4	2	3	2	2	1	-	-	-	-	-	-	1	1	2
CO5	2	2	2	2	1	-	-	-	-	-	-	1	1	2

CE16603 DESIGN OF REINFORCED CONCRETE AND BRICK MASONRY STRUCTURES **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- familiarize the various steps involved in the design of retaining walls
- understand the design concept of water tank
- acquire knowledge in design of staircases, slabs, foundation and bridge
- learn concept of yield line theory
- gain the knowledge about brick masonry.

Prerequisite: Design of Reinforced Concrete Elements

UNIT I RETAINING WALLS **9**

Design of Cantilever and Counterfort Retaining walls.

UNITII WATER TANKS **9**

Design of rectangular and circular water tanks both below and above ground level – Design of circular slab.

UNIT III SELECTED TOPICS **9**

Design of staircases (ordinary and doglegged) – Design of flat slabs – Principles of design of box culvert and road bridges

UNIT IV YIELD LINE THEORY **9**

Assumptions – Characteristics of yield line – Determination of collapse load / Plastic moment – Application of virtual work method – Square, rectangular and circular slabs – Design problems

UNIT V BRICK MASONRY **9**

Introduction – Classification of walls – Lateral supports and stability – Effective height of wall and columns – Effective length of walls – Design loads – Load dispersion – Permissible stresses – Design of axially and eccentrically loaded brick walls.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply knowledge about the design of retaining walls
- acquire knowledge about the design the water tank
- familiarize on the design of staircases, slabs, foundation and bridge
- confess concept of yield line theory
- apply the knowledge about brick masonry

TEXT BOOKS

1. Gambhir.M.L., "Design of Reinforced Concrete Structures", Prentice Hall of India Private Limited, 2012.
2. Dayaratnam, P., "Brick and Reinforced Brick Structures", Oxford & IBH Publishing House, 2017

REFERENCES

1. Punmia B.C, Ashok Kumar Jain, Arun K.Jain, "R.C.C. Designs Reinforced Concrete Structures", Laxmi Publications Pvt. Ltd., New Delhi, 2006.
2. Varghese.P.C., "Advanced Reinforced Concrete Design", Prentice Hall of India Pvt. Ltd., New Delhi, 2012.
3. Subramanian. N., "Design of Reinforced Concrete Structures", Oxford University, New Delhi, 2013.
4. IS456:2000, "Code of practice for Plain and Reinforced Concrete", Bureau of Indian Standards, New Delhi, 2007
5. SP16, IS456:1978 "Design Aids for Reinforced Concrete" to Bureau of Indian Standards, New Delhi, 1999.
6. IS1905:1987, "Code of Practice for Structural use of Unreinforced Masonry Bureau of Indian Standards", New Delhi, 2002

WEB LINKS

1. http://nptel.ac.in/courses/105105105/
2. http://nptel.ac.in/courses/10102088/27

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	1	2	3	1	1	-	-	-	-	-	-	2	1	2
CO2	2	2	3	1	1	-	-	-	-	-	-	2	1	2
CO3	1	2	3	1	1	-	-	-	-	-	-	2	1	2
CO4	2	2	3	1	1	-	-	-	-	-	-	2	1	2
CO5	2	2	3	1	1	-	-	-	-	-	-	2	1	2

CE16604 WASTE WATER ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- illustrate the principles of wastewater supply, treatment and distribution.
- distinguish the concept of transport of wastewater
- 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 FOR SEWERAGE SYSTEMS 9

Sources of wastewater generation – Effects ; Estimation of sanitary sewage flow ; Estimation of storm runoff ; Factors affecting Characteristics and composition of sewage and their significance ; Effluent standards – Legislation requirements.

UNIT II SEWER DESIGN 9

Sewerage – Hydraulics of flow in sewers – Objectives – Design period ; Design of sanitary and storm sewers – Small bore systems ; Computer applications ; Laying, joining & testing of sewers – Appurtenances ; Pumps – selection of pumps and pipe Drainage ; Plumbing System for Buildings – One pipe and two pipe systems.

UNIT III PRIMARY TREATMENT OF SEWAGE 9

Objective – Selection of treatment processes; Principles, Functions, Design and Drawing of Units – Onsite sanitation – Septic tank with dispersion – Grey water harvesting ; Primary treatment – Principles, functions design and drawing of screen, grit chambers and primary sedimentation tanks – Construction, operation and Maintenance aspects.

UNIT IV SECONDARY TREATMENT OF SEWAGE 9

Objective – Selection of Treatment Methods ; Principles, Functions, Design and Drawing of Units – Activated Sludge Process and Trickling filter ; Oxidation ditches; UASB; Waste Stabilization Ponds ; Reclamation and Reuse of sewage; Sewage recycle in residential complex ; Recent Advances in Sewage Treatment – Construction and Operation & Maintenance of Sewage Treatment Plants.

UNIT V DISPOSAL OF SEWAGE AND SLUDGE MANAGEMENT 9

Stand Standards for Disposal – Methods – Dilution – Self–purification of surface water bodies – Oxygen sag curve ; Land disposal ; Sludge characterization – Thickening – Sludge digestion – Biogas recovery – Sludge Conditioning and Dewatering – Disposal – Advances in Sludge Treatment and disposal.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- observe various wastewater resources of India and Tamil Nadu.
- apply the knowledge about the sewer design.
- have an elaborate knowledge about selection of wastewater 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., "Environmental Engineering" Vol. II, Khanna Publishers, New Delhi, 2007.
2. Punmia, B.C., Jain, A.K., and Jain. A., "Environmental Engineering, Vol.II", Lakshmi Publications, Newsletter, 2005

REFERENCES

1. Mark J. Hammer, Mark J. Hammer Jr, "Water and Waste Water Technology", Prentice hall of India 2008
2. "Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
3. Metcalf & Eddy, "Wastewater Engineering – Treatment and Reuse", Tata McGraw Hill Company, New Delhi, 2005.

WEB LINKS

1. http://nptel.ac.in/courses/105106119/
2. http://nptel.ac.in/courses/105104102/

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	2	-	-	-	1	1	3	1	-	-	-	1	1	-
CO2	2	1	1	-	1	1	3	1	-	-	-	1	1	1
CO3	2	1	1	-	1	1	3	1	-	-	-	1	1	1
CO4	2	1	1	-	1	1	3	1	-	-	-	1	1	1
CO5	2	-	-	-	1	1	3	1	-	-	-	1	1	-

CE16605 FOUNDATION ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- gain knowledge about the geotechnical site investigation.
- understand the types of foundation and design principles
- gain knowledge of footings and special foundation
- discuss different types of pile foundation and its capacity
- study various earth pressure theories

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

UNIT IV PILE FOUNDATION 9

Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity 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

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- conduct sub surface investigation and select foundation based on soil condition
- calculate bearing capacity of soil and settlement
- confess contact pressure distribution below the footing
- describe the types of piles and their load carrying capacity
- check the stability of retaining wall

TEXT BOOKS

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd, New Delhi 2015
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi 2011.

REFERENCES

1. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt.Ltd., New Delhi, 2018.
2. GopalRanjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New age Ltd. InternationalPublisher New Delhi (India) 2006
3. Das, B.M. "Principles of Foundation Engineering" (Eigth edition), Thompson Asia Pvt. Ltd., Singapore, 2013.
4. Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 2002.
5. Venkatramaiah, C., "Geotechnical Engineering", New Age International Publishers, New Delhi, 2007 (Reprint)
6. IS Code 6403: 1981 (Reaffirmed 1997) "Bearing capacity of shallow foundation", Bureau of Indian Standards, New Delhi.
7. IS Code 1892 (1979): Code of Practice for subsurface Investigation for Foundations. Bureau of Indian Standards, New Delhi.

WEB LINKS

1. http://www.cdeep.iitb.ac.in/nptel/Civil%20Engineering/Foundation_Engineering/TOC–M1.htm
2. http://elearning.vtu.ac.in/06CV64.html

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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CO2	2	1	1	1	-	-	-	-	-	-	-	2	1	1
CO3	2	1	1	1	-	-	-	-	-	-	-	2	1	1
CO4	2	1	1	1	-	-	-	-	-	-	-	2	1	1
CO5	2	1	1	1	-	-	-	-	-	-	-	2	1	1

CE16606 COMPUTER AIDED DESIGN AND DRAFTING LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- design manually the retaining wall, water tank
- operate with software proficiency
- list the various IRC loadings and the concept of prestressing
- explain the design of plate girder and truss girder for various loading conditions

Design and Drafting of the following Structures

(Manual Design and Drafting by Software)

1. RCC Cantilever Retaining wall
2. RCC Counter fort Retaining wall
3. RCC Underground Water tank
4. RCC Overhead Circular and Rectangular Water Tanks
5. RCC slab culvert
6. Rectangular Steel Tank
7. Welded Plate Girders
8. Truss
9. Ductile Detailing of RC members

TOTAL PERIODS 30

COURSE OUTCOMES

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

- apply knowledge for the design and detailing of different types of retaining walls and will be able to apply the theoretical concepts in the real–world construction
- perceive the importance of measuring systems and the measuring instruments involved in drafting and related fields
- design and draw the detailing of various types of water tanks (RC and steel) along with the staging and foundation
- plot the drawing using scaling techniques as per industry requirements

TEXT BOOKS

1. N.Krishnaraju, “Design of Reinforced Concrete Structures”–CBS Publishers, 2016
2. Dr.Ramchandra and Virendra Gehlot “Design of Steel Structures”–Scientific Publishers , 2011

REFERENCES

1. B.C., Punmia, Ashok Kumar Jain & Arun Kumar Jain, "Comprehensive Design of Steel Structures", Laxmi Publications Pvt. Ltd., 2003
2. Krishnamurthy, D., "Structural Design & Drawing – Vol. II and III", CBS Publishers, 2010.
3. Shah V L and Veena Gore, "Limit State Design of Steel Structures" IS800–2007, Structures Publications, 2009.

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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	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
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CO2	1	2	3	-	2	-	-	-	-	-	-	1	1	2
CO3	1	2	3	-	2	-	-	-	-	-	-	1	1	2
CO4	1	2	3	-	2	-	-	-	-	-	-	1	1	2

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CE16607 ENVIRONMENTAL ENGINEERING LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- impart the principles of sampling and preservation of water and wastewater.
- convey the principles of testing of water and wastewater
- provide analyzing methods for water and wastewater
- acquire knowledge about importance of bacteria in wastewater

Prerequisite: Water supply Engineering & Waste Water Engineering

LIST OF EXPERIMENTS

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

TOTAL PERIODS 60

COURSE OUTCOMES

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

- acquire the sampling and preservation methods of water and wastewater
- test the water and wastewater and their different characteristics as per standards
- do the different water and wastewater analysis as per standards
- know about importance of bacteria in wastewater

REFERENCES

1. Garg, S.K., “Environmental Engineering Vol. I & II”, Khanna Publishers, New Delhi, 2010
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														
Cos	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	2	3	-	-	-	-	1	1	1
CO2	2	-	-	-	-	2	3	-	-	-	-	1	1	1
CO3	2	-	-	-	-	2	3	-	-	-	-	1	1	1
CO4	2	-	-	-	-	2	3	-	-	-	-	1	1	1

CE16608 SURVEY CAMP (2 Weeks – During V Semester) **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- gain knowledge on survey field techniques and to learn the various methods of surveying to solve the real–world problems.
- Know the basic concepts of advanced equipment.
- Apply to solve the description to engineering and surveying activities.
- Learn the various methods of surveying to solve the real world problems.

Prerequisite: Surveying I & Surveying II

SYLLABUS

Two weeks survey camp will be conducted during winter vacation to expose on field surveying such as

1. Triangulation
2. Vertical control by spirit leveling
3. Contouring

TOTAL PERIODS 30

COURSE OUTCOMES

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

- attain practical knowledge on handling survey instruments.
- Determine L.S and C.S by using advances equipment.
- Understand the surveying techniques infield.
- Prepare contour map for given area.

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	1	2	1	3	-	-	-	-	-	-	3	1	2
CO2	3	1	2	1	3	-	-	-	-	-	-	3	1	2
CO3	3	1	2	1	3	-	-	-	-	-	-	3	1	2
CO4	3	1	2	1	3	-	-	-	-	-	-	3	1	2

EN16601 CAREER DEVELOPMENT LABORATORY – II 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- understand their capabilities and enhance their grooming and showcasing his/her capabilities to a prospective employer
- provide opportunity for the students to become acquainted with corporate opportunities relevant to their academic learning
- articulate their thoughts on a given topic – in English and also to make decent write ups in English on any given topic
- practice and score well in Aptitude tests conducted by corporate / prospective employers

Prerequisite: Nil

UNIT I CORPORATE READINESS

Business communication – Email, Paragraph, Letter Writing Skills – Public speaking skills: Rules of Public speaking skills; Extempore, JAM – Inter and intra personal skills: Introduction; Need for Inter and Intra personal skills in organizations – Stress management: Causes of stress and its impact, how to manage and distress, Circle of control, stress busters – Emotional Intelligence: What is emotional Intelligence, Why Emotional Intelligence Matters, Managing Emotions,

UNIT II INTERVIEW SKILLS

Interview Basics: General Selection process, Grooming, Dress code, Supporting Documents to carry – Resume Building: Impact of Powerful CV, Do's and don'ts in CV – Group Discussion: Introduction to GD, Important of Listening and Speaking skills, Do's and Don't in GD – Face to face interview / Hire me: Rules for face to face interview, body language, Self–Introduction – Psychometric Assessment: Importance of Psychometric assessment, Why psychometric assessment

UNIT III QUANTITATIVE APTITUDE – I

Simplification – Time and work – Pipes and cisterns – Ratio and Proportion – Partnership

UNIT IV QUANTITATIVE APTITUDE – II

Simple interest and Compound interest – Profit and loss – Permutation and combination Probability – Calendar

UNIT V LOGICAL AND VERBAL REASONING

Seating arrangement – Direction – Arithmetic reasoning – Syllogisms – Making Judgments – Statements and conclusions – Matching definition – Cause and effect

TOTAL PERIODS 30

COURSE OUTCOMES

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

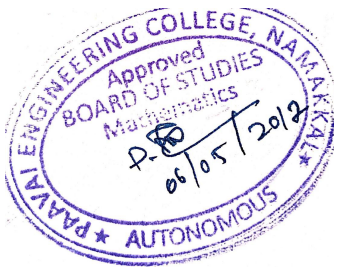
- demonstrate aptitude and reasoning skills
- enhance verbal and written ability
- improve his/her grooming and presentation skills
- interact effectively on any recent event / happenings / current affairs.

REFERENCES

1. Agarwal, R.S. "A modern approach to Verbal & Non-Verbal Reasoning", S. Chand & Co Ltd, New Delhi, 2003
2. Abhijit Guha, "Quantitative Aptitude", Tata-Mcgraw Hill, 2010
3. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications, 2011
4. Johnson, D.W. Reaching out – Interpersonal Effectiveness and self-actualization. Boston: Allyn And Bacon, 2014
5. Agarwal, R.S. "Objective General English", S.Chand & Co, 2007
6. Infosys Campus Connect Program – students' guide for soft skills.
7. Mitra barun.K, "Personality Development & Soft skills", Oxford University.

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



LIST OF PROGRAMME ELECTIVES

PROGRAMME ELECTIVE I

CE16151 HYDROLOGY AND WATER RESOURCES ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- have good understanding of all the components of the hydrological cycle
- gain knowledge about the estimation of runoff
- realize the importance of flood control and mitigation measures
- study reservoir and its classification
- understand the dynamics of ground water flow and their implication

Prerequisite: Nil

UNIT I PRECIPITATION AND ABSTRACTIONS 10

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

UNIT II RUNOFF 8

Watershed- catchment and basin – Catchment characteristics ; Factors affecting runoff – Runoff estimation using empirical ; Strange's table and SCS methods ; Stage discharge relationships flow measurements ; Hydrograph – Unit Hydrograph – IUH.

UNIT III FLOOD AND DROUGHT 9

Natural Disasters – Flood Estimation – Frequency analysis – Flood control ; Definitions of droughts – Meteorological, hydrological and agricultural droughts – IMD method – NDVI analysis – Drought Prone Area Programme (DPAP).

UNIT IV RESERVOIRS 8

Classification of reservoirs- General principles of design, site selection, spillways, elevation – Area – Capacity – storage estimation, sedimentation – Life of reservoirs – Rule curve.

UNIT V GROUNDWATER AND MANAGEMENT 10

Origin – Classification and types – Properties of aquifers – Governing equations – Steady and unsteady flow – Artificial recharge – RWH in rural and urban areas – Seawater intrusion.

TOTAL PERIODS 45

COURSE OUTCOMES:

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

- estimate the mean areal precipitation and their significance in design of various hydraulic structures.
- calculate the runoff and measurements of flow
- estimate the flood by various methods and concept of flood routing.
- confess about the various classification of reservoirs
- perceive the dynamics of ground water flow and their estimation

TEXT BOOKS

1. Subramanya .K. "Engineering Hydrology" – Tata McGraw Hill, 4th Edition, 2017
2. Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 3rd Edition, 2016.

REFERENCES

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007
2. VenTe Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 2010.
3. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 2004

WEB LINKS

1. http://nptel.ac.in/downloads/105101002/.
2. http://nptel.ac.in/courses/105101002/8
3. http://nptel.ac.in/courses/105107129/.
4. https://www.ipcc.ch/ipccreports/tar/wg2/pdf/wg2TARchap4.pdf.

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	2	1	1	1	-	2	3	-	-	-	-	1	1	1
CO2	2	-	-	-	-	2	3	-	-	-	-	1	1	-
CO3	2	-	-	-	2	2	3	-	-	-	-	1	1	-
CO4	2	-	-	-	-	2	3	-	-	-	-	1	1	-
CO5	2	-	-	-	-	2	3	-	-	-	-	1	1	-

CE16152 TOTAL STATION AND GPS SURVEYING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the working of total station equipment and solve the surveying problems
- understand the concepts of electromagnetic waves and impact of RI
- 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: Surveying II

UNIT I FUNDAMENTALS OF TOTAL STATION AND GPS 9

Methods of Measuring Distance – Basic Principles of Total Station – Historical Development – Classifications – Applications and comparison with conventional surveying ; 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

UNIT II ELECTROMAGNETIC WAVES 9

Classification – Applications of Electromagnetic waves – Propagation properties – Wave propagation at lower and higher frequencies – Refractive index (RI) – Factors affecting RI – Computation of group for light and near infrared waves at standard and ambient conditions – Computation of RI for microwaves at ambient condition – Reference refractive index – Real time application of first velocity correction. Measurement of atmospheric parameters – Mean refractive index – Second velocity correction – Total atmospheric correction – Use of temperature – Pressure transducers.

UNIT 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 – Modern positioning systems – Traversing and Trilateration.

UNIT IV SATELLITE SYSTEM 9

GPS – 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.

UNIT V GPS DATA PROCESSING 9

GPS observables – Code and carrier phase observation – Linear combination and derived observables – Concept of parameter estimation – Downloading the data – Data processing – Software modules – Solutions of cycle slips, ambiguities, RINEX format. Concepts of rapid, static methods with GPS – Semi Kinematic and pure Kinematic methods – Basic constellation of satellite geometry & accuracy measures – Applications – Long baseline processing – Use of different software's available in the market.

TOTAL PERIODS 45

COURSE OUTCOMES:

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

- attain knowledge on working of modern surveying equipment such as total station and GPS.
- perceive the concepts of electromagnetic waves and impact of RI
- confess the 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, N madhu, "Advanced Surveying, Total Station GPS and Remote Sensing" Pearson education, 2007.

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, 2003.
3. Alfred Leick, "GPS satellite surveying", John Wiley & Sons Inc., 3rd Edition, 2004.

WEB LINKS

1. nptel.ac.in/courses/105104100/lectureA_3/A_3_3_TS.htm
2. nptel.ac.in/courses/Webcourse–contents/IIT–KANPUR/.../ui/Course_homeA_3.htm

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	2	1	2	1	2	-	-	-	-	-	-	2	2	1
CO2	2	1	2	1	3	-	-	-	-	-	-	2	2	1
CO3	2	1	2	1	3	-	-	-	-	-	-	2	2	1
CO4	2	1	2	1	3	-	-	-	-	-	-	2	2	1
CO5	2	1	2	1	2	-	-	-	-	-	-	2	2	1

CE16153 CONSTRUCTION PLANNING AND SCHEDULING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study the necessity of the planning in the diverse construction projects.
- know the appropriate techniques used for scheduling the resources.
- have exposure on various costs, control methods and departmental procedure for accounting.
- study the quality control and monitoring techniques and the necessity of training to personnel.
- provide awareness about management information system and usage of data base in the project accountings.

Prerequisite: Nil

UNIT I CONSTRUCTION PLANNING 9

Basic concepts in the development of construction plans – Choice of Technology and Construction method – Defining Work Tasks – Definition – Precedence relationships among activities – Estimating Activity Durations – Estimating Resource Requirements for work activities – Coding systems.

UNIT II SCHEDULING PROCEDURES AND TECHNIQUES 9

Relevance of construction schedules – Bar charts – The critical path method – Calculations for critical path scheduling – Activity float and schedules – Presenting project schedules – Critical path scheduling for Activity – on–node and with leads, Lags and Windows – Calculations for scheduling with leads, lags and windows – Resource oriented scheduling – Scheduling with resource constraints and precedencies – Use of Advanced Scheduling Techniques – Scheduling with uncertain durations – Crashing and time/cost tradeoffs – Improving the Scheduling process – Introduction to application software.

UNIT III COST CONTROL MONITORING AND ACCOUNTING 9

The cost control problem – The project Budget – Forecasting for Activity cost control – Financial accounting systems and cost accounts – Control of project cash flows – Schedule control – Schedule and Budget updates – Relating cost and schedule information.

UNIT IV QUALITY CONTROL AND SAFETY DURING CONSTRUCTION 9

Quality and safety Concerns in Construction – Organizing for Quality and Safety – Work and Material Specifications – Total Quality control – Quality control by statistical methods – Statistical Quality control with Sampling by Attributes – Statistical Quality control by Sampling and Variables – Safety.

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 course, the students will be able to

- confess the requirement of planning techniques exercised in the construction projects.
- choose 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.
- experience 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

WEB LINKS

1. http://nptel.ac.in/courses/Webcourse–contents/IIT–%20Guwahati /cpm/index.html

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	2	-	-	-	1	-	-	-	1	-	2	1	1	1
CO2	2	-	-	-	1	-	-	-	1	-	2	1	1	1
CO3	2	-	-	-	1	-	-	-	1	-	2	1	1	1
CO4	2	-	-	-	1	-	-	-	1	-	2	1	1	1
CO5	2	-	-	-	1	-	-	-	1	-	2	1	1	1

CE16154 AIR POLLUTION AND CONTROL ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart the knowledge on sources, effect and control of air pollution.
- know the principles of dispersion characteristics of pollution in atmosphere.
- impose the knowledge on the control of air pollution.
- know the concepts behind the air pollution management.
- deliver the sources, effect and control of noise pollution.

Prerequisite: Nil

UNIT I SOURCES AND EFFECTS OF AIR POLLUTANTS 9

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation and animals – Global warming – Ozone layer depletion, sampling – Basic principles – Source and ambient sampling – Analysis of pollutants.

UNIT II DISPERSION OF POLLUTANTS 9

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.

UNIT III AIR POLLUTION CONTROL 9

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment – Gaseous pollutants control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries.

UNIT IV AIR QUALITY MANAGEMENT 9

Air quality standards – Air quality monitoring – Preventive measures – Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental impact assessment on air quality.

UNIT V NOISE POLLUTION 9

Sources of noise pollution – Effects – Assessment – Standards – Control methods – Prevention measures.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- classify the sources and effects of air pollution.
- realize the dispersion characteristics and modeling of air pollution.
- get an exposure to know about air pollution control methods.
- apply on the air pollution management ideas.
- aware with the sources, effects and control of noise pollution.

TEXT BOOKS

1. Rao M.N. and Rao H.V.N., "Air Pollution" McGraw Hill Education, New Delhi, 2013.
2. Rao, C.S. "Environmental Pollution Control Engineering", New Age international, 2018.
3. Mahajan SP, "Air Pollution Control" TERI Press, New Delhi, 2009.

REFERENCES

1. Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2011.
2. Garg, S.K., "Environmental Engineering Vol. II", Khanna Publishers, New Delhi.
3. Mahajan, S.P., "Pollution Control in Process Industries", Tata McGraw–Hill, New Delhi, 2010.
4. Heumann.W.L., "Industrial Air Pollution Control Systems", McGraw Hill, New York, 1997

WEB LINKS

1. http://www.tutorialspoint.com/air pollution
2. http://nptel.ac.in/courses/105104099/

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	2	-	-	-	1	2	3	-	-	-	-	1	1	1
CO2	2	-	-	-	1	2	3	-	-	-	-	1	1	1
CO3	2	-	-	-	1	2	3	-	-	-	-	1	1	1
CO4	2	-	-	-	1	2	3	-	-	-	-	1	1	1
CO5	2	-	-	-	1	2	3	-	-	-	-	1	1	1

CE16155 COASTAL ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know about the basic concept of coastal area
- provide exposure on types of waves and their characteristics
- gain knowledge in wave transformation
- give exposure to coastal structures and shore protection
- identify about the modeling of coastal areas

Prerequisite: Nil

UNIT I INTRODUCTION TO COASTAL ENGINEERING 9

Introduction – Wind and waves – Sea and Swell – Introduction to small amplitude wave theory – Use of wave tables – Mechanics of water waves – Linear (Airy) wave theory – Wave measurement.

UNIT II WAVE PROPERTIES AND ANALYSIS 9

Introduction to non–linear waves and their properties – Waves in shallow waters – Wave Refraction, diffraction and shoaling – Hind casting of waves – Short term wave analysis – Wave spectra and its utilities – Long term wave analysis – Statistical analysis of ground wave data.

UNIT III TYPES AND WAVE TRANSFORMATION 9

Tide analysis and prediction, storm surge, seiches and seasonal fluctuations – Long term water level fluctuations – Wave shoaling; wave refraction; wave breaking; wave diffraction.

UNIT IV COASTAL STRUCTURES AND SHORE PROTECTION 9

Risk analysis – Design wave – Break waters – Shore protection – Groins, seal walls, offshore break water sand artificial nourishment.

UNIT V MODELING IN COASTAL ENGINEERING 9

Physical modeling in Coastal Engineering – Limitations and advantages – Role of physical modeling in coastal engineering – Numerical modeling – Modeling aspects – Limitations.

TOTAL PERIODS 45

COURSE OUTCOMES:

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

- calculate the wave transformations
- comprehend the characteristics of the waves
- analyse and predict the wave transformations
- appreciate the multi–faceted nature of coastal problems and the techniques of coastal engineering analysis
- perceive the different role in modelling of coastal areas

TEXT BOOKS

1. Kamphuis, J.W., "Introduction to coastal engineering and management", 2000
2. Dean, R.G. and Dalrymple, R.A., "Water wave mechanics for Engineers and Scientists", Prentice–Hall, Inc., Englewood Cliffs, New Jersey, 1994.

REFERENCES

1. Mani, J. S. "Coastal Hydrodynamics". PHI Learning Pvt. Ltd., 2012.
2. Coastal Engineering Manual, Vol. I–VI, Coastal Engineering Research Centre, Dept. of the Army, US Army Corps of Engineers, Washington DC, 2006.
3. Ippen, A.T., "Estuary and Coastline Hydrodynamics", McGraw–Hill Book Company, Inc., New York, 1978.
4. Sorenson, R.M., "Basic Coastal Engineering", A Wiley–Inter Science Publication, New York, 1978.

WEB LINKS

1. nptel.ac.in/courses/114106032/
2. https://www.nap.edu/read/11764/chapter/5
3. nptel.ac.in/courses/114106032/

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	2	-	-	-	-	2	2	-	-	-	-	1	1	1
CO2	2	-	-	-	-	2	2	-	-	-	-	1	1	1
CO3	2	-	-	-	-	2	2	-	-	-	-	1	1	1
CO4	2	-	-	-	-	2	2	-	-	-	-	1	1	1
CO5	2	-	-	-	-	2	2	-	-	-	-	1	1	1

LIST OF OPEN ELECTIVES

OPEN ELECTIVE I

CE16901 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

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 – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans 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 PRINCIPLES AND APPLICATIONS 9

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – Saturation temperature – Super heated vapour – Subcooled 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

UNIT V PLUMBING AND DRAINAGE 9

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 the course, students will be able to

- perceive about the system of electrical work in building
- obtain the knowledge on various illumination and lighting process in building.
- confess 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 Chaddert 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.

WEB LINKS

1. nptel.ac.in/courses/107106009/Downloads/LECTURE7.ppt
2. https://nptel.ac.in/courses/112105129/pdf/R&AC%20Lecture%2036.pdf
3. https://www.youtube.com/watch?v=1Hl1TXJUjmg
4. https://www.cibse.org/getmedia/56352fa8–370c–4943–9638–77920939fe3b/The–control–of–air–pressure–within–tall–building–drainage–SoPHE–ppt–Compatibility–Mode.pdf.aspx.

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	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	2	-	-	-	2	-	-	-	-	-	-	1	1	1
CO3	2	-	-	-	2	-	-	-	-	-	-	1	1	1
CO4	2	-	-	-	2	-	-	-	-	-	-	1	1	1
CO5	2	-	-	-	2	-	-	-	-	-	-	1	1	1

CE16902 CONTRACT LAWS AND REGULATIONS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study various elements in the contract document.
- review different concepts of tender making process as per contract law.
- get an information on arbitration procedure during disputes.
- study the various taxes related to construction business and statutory recommendations.
- know the complexity of labour laws along with legislation in the construction industries.

Prerequisite: Nil

UNIT I CONSTRUCTION CONTRACTS 9

Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts.

UNIT II TENDERS 9

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Preparation of Tender schedules – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamil Nadu Transparency in Tenders Act 1998 Rules 2000.

UNIT III ARBITRATION 9

Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award.

UNIT IV LEGAL REQUIREMENTS 9

Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations.

UNIT V LABOUR REGULATIONS 9

Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen's Compensation Act – Indian Factory Act 1948 – Tamil Nadu Factory Act 1950 – Child Labour Act 1986 Amended in 2016 – Other Labour Laws.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- prepare contract document for various government & non–governmental works.
- make tender as per the current rates along with guidelines from sources.
- perceive the factors of arbitration during the time of court proceedings.
- exercise correctly the procedure during sell; buy their land & property oriented with various tax provisions.
- adopt and follow the various acts and laws related to labour in the field.

TEXT BOOKS

1. Jimmie Hinze, "Construction Contracts", McGraw Hill, New Delhi 2013.
2. Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India", M.M. TripathiPrivate Ltd., Bombay, 2000

REFERENCES

1. Patil. B.S, "Civil Engineering Contracts and Estimates", Universities Press (India) Private Limited, 2015.
2. Joseph T. Bockrath, "Contracts and the Legal Environment for Engineers and Architects", McGraw Hill, 2010.
3. Oxley Rand Posicit, "Management Techniques applied to the Construction Industry", GrandPublications, Noida,2009

WEB LINKS

1. http://nptel.ac.in/courses/105103093/11

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	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO3	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO4	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO5	2	-	-	-	-	-	-	-	-	-	-	1	1	1

CE16903 ARCHITECTURE 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart knowledge on the fundamentals of visual perception and principles
- get exposure about architectural principles in the design of buildings
- impart knowledge in the national traditions and the local regional heritage in architecture, landscape design including the vernacular tradition.
- provide the basic principles and appropriate application and performance of building envelope materials and assemblies
- demonstrate competency in the technical, practical skills of landscape architecture and their role in investigating complex and innovative ideas.

Prerequisite: Nil

UNIT I INTRODUCTION 9

Definition – Architecture – Classification – Influencing factors – Region, culture, climate, topography, building materials, economic and technology – Historic structure – Prominent world architecture – Anthropometrics – Human scale – Space requirements in architecture.

UNITII ELEMENTS OF ARCHITECTURE 9

Elements – Mass and space visual emotional effects of geometric forms and their derivatives – Sphere, cube, pyramid, cylinder, and cone – Aesthetic qualities of architecture- proportion, scale, balance, symmetry, rhythm and axis – Contrast in form – Harmony.

UNIT III ORIENTATION AND PLANNING OF BUILDINGS 9

General – Factors affecting orientation – Sun – Wind – Rain – Orientation criteria for Indian conditions – Planning – specifications and standards – Planning of buildings – Green building – Carbon rating – Case studies.

UNIT IV INTERIOR DESIGN 9

General – Decorative materials – Cement bonded boards, water proof cement – Paint – Industrial glazing and roofing – Masonry – Plaster and dry wall – Wall surface materials – Effect of color – Home furnishing – Preparation of interior design plans – Case studies.

UNIT V LANDSCAPE DESIGN 9

Principles – Site planning – Design – Styles – Elements and materials – Plant characteristics and design – Landscape planning – Case studies

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply the fundamentals of visual perception in two and three–dimensional design
- perceive the architectural principles in the design of buildings and interior spaces
- make plan for the buildings by considering our Indian climatic conditions.
- choose the various building material as per the interior design aspects.
- perform landscape architecture according to the environmental conditions.

TEXT BOOKS

1. Francis D.K.Ching, "Architecture: Form, Space and Order", John Wiley & Sons, Inc. 2007.
2. Mohmohan, MuthuShoba G, "Principles of Architecture" Oxford University Press, New Delhi, 2009.

REFERENCES

1. Arvind Krishnan "Climate Responsive Architecture: A Design Handbook for Energy Efficient Buildings", McGraw Hill Education, New Delhi, 2013
2. Simon Unwin, "Analysing Architecture", Routledge, London, 2003

WEB LINKS

1. http://ocw.mit.edu/courses/architecture/

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	2	1	3	1	2	-	-	-	-	-	-	1	1	2
CO2	2	1	3	1	2	-	-	-	-	-	-	1	1	2
CO3	2	1	3	1	2	-	-	-	-	-	-	1	1	2
CO4	2	1	3	1	2	-	-	-	-	-	-	1	1	2
CO5	2	1	3	1	2	-	-	-	-	-	-	1	1	2

CE16904 SMART STRUCTURES AND SMART MATERIALS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- familiarize the basics in smart structures and smart materials
- understand the measuring techniques
- acquire knowledge on sensors
- learn concept of actuators
- gain the knowledge about signal processing and control systems.

Prerequisite: Nil

UNIT I INTRODUCTION 9

Introduction to Smart Materials and Structures – Instrumented structures functions and response – Sensing systems – Self-diagnosis – Signal processing consideration – Actuation systems and effectors.

UNITII MEASURING TECHNIQUES 9

Strain Measuring Techniques using Electrical strain gauges, Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

UNIT III SENSORS 9

Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers – The LVDT – Fiber optic Techniques – Chemical and Bio–Chemical sensing in structural Assessment – Absorptive chemical sensors – Spectroscopes – Fiber Optic Chemical Sensing Systems and Distributed measurement.

UNIT IV ACTUATORS 9

Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magneto structure Material – Shape Memory Alloys – Electro orheological Fluids – Electromagnetic actuation – Role of actuators and Actuator Materials.

UNIT V SIGNAL PROCESSING AND CONTROL SYSTEMS 9

Data Acquisition and Processing – Signal Processing and Control for Smart Structures – Sensors as Geometrical Processors – Signal Processing – Linear and Non – Linear Control System.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply knowledge about the smart materials and structures
- attain knowledge about the measuring techniques
- manage various types of sensors
- confess concept of actuators
- apply the knowledge about signal processing and control systems.

TEXT BOOKS

1. Brain Culshaw – "Smart Structure and Materials" Artech House – Borton. London 2003.
2. Gandhi, M.V and Thompson, B.S., "Smart Materials and Structures", Chapman and Hall, 2006.

REFERENCES

1. L. S. Srinath – "Experimental Stress Analysis" – Tata McGraw–Hill, 1998.
2. J. W. Dally & W. F. Riley – "Experimental Stress Analysis" – Tata McGraw–Hill, 1998.

WEB LINKS

1. https://www.electronics–tutorials.ws/blog/wheatstone–bridge.html
2. https://www.smart–material.com/ActuatorSensor.html

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	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO2	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO3	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO4	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO5	2	-	-	-	1	-	-	-	-	-	-	1	1	1

CE16905 REMOTE SENSING TECHNIQUES AND GIS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the concept of remote sensing and its components.
- list the types of platforms and various sensors used in GIS.
- analyze the GIS data and create digital elevation model.
- describe the various types of map projections and software used in GIS.
- know about the land information system and various data model.

Prerequisite: Nil

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

Definition of remote sensing and its components – Electromagnetic spectrum – Wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan – Boltzman and Wein's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – Spectral signature concepts – Typical spectral reflective characteristics of water, vegetation and soil.

UNIT II PLATFORMS AND SENSORS 9

Types of platforms – Orbit types, Sun–synchronous and Geosynchronous ; Passive and Active sensors – Resolution concept – Pay load description of important Earth Resources and Meteorological satellites – Air borne and space borne TIR and microwave sensors.

UNIT III IMAGE INTERPRETATION AND ANALYSIS 9

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

UNIT IV GEOGRAPHIC INFORMATION SYSTEM 9

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

UNIT V DATA ENTRY, STORAGE AND ANALYSIS 9

Data models – Vector and raster data – Data compression – Data input by digitization and scanning – Attribute data analysis – Integrated data analysis Modelling in GIS Highway alignment studies – Land Information System.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- attain the fundamental knowledge in the concept of remote sensing and its components.
- evaluate the various platforms and sensors in GIS.
- create the digital image using various image enhancement techniques.
- use the software's in GIS for map analysis.
- create the various data models and to understand the land information systems.

TEXT BOOKS

1. Lillesand, T.M., Kiefer, R.W. and J.W.Chipman. "Remote Sensing and Image Interpretation" V Edn. John Willey and Sons (Asia) Pvt. Ltd., New Delhi 2007.
2. Anji Reddy, M. "Textbook of Remote Sensing and Geographical Information Systems" BS Publications, 2006.

REFERENCES

1. Lo. C.P. and A.K.W.Yeung "Concepts and Techniques of Geographic Information Systems" Prentice–Hall of India Pvt. Ltd., New Delhi. 2011
2. Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, "Principles of Geographical Information Systems" Third Edition, Oxford University Press, 2000.
3. Ian Heywood, Sarah Cornelius, Steve Carver "An Introduction to Geographical Information Systems (4th Edition)" Pearson Education Asia, 2000.

WEB LINKS

1. nptel.ac.in/courses/105108077/
2. nptel.ac.in/courses/105108077/module1/lecture1.pdf

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	2	-	-	-	2	1	1	-	-	-	-	1	1	1
CO2	2	-	-	-	2	1	1	-	-	-	-	1	1	1
CO3	2	-	-	-	2	1	1	-	-	-	-	1	1	1
CO4	2	-	-	-	2	1	1	-	-	-	-	1	1	1
CO5	2	-	-	-	3	1	1	-	-	-	-	1	1	1