PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018

(AUTONOMOUS)

B.E. CIVIL ENGINEERING

REGULATION 2015

CURRICULUM

SEMESTER V

Course Code	Course Title	L	T	P	C
CE15501	Basic Structural Design II	3	0	0	3
CE15502	Structural Analysis I	3	0	0	3
CE15503	Highway Engineering	3	0	0	3
CE15504	Waste Water Engineering	3	0	0	3
CE15505	Soil Mechanics	3	0	0	3
CE1515*	Elective I	3	0	0	3
CE15506	Environmental Engineering Laboratory	0	0	2	1
CE15507	Soil Mechanics Laboratory	0	0	4	2
EN15501	Career Development Laboratory I	0	0	2	1

SEMESTER VI

Course Code	Course Title	L	T	P	C
CE15601	Railways, Airports and Harbour Engineering	3	0	0	3
CE15602	Structural Analysis II	3	0	0	3
CE15603	Design of Steel Structures	3	0	0	3
CE15604	Concrete Technology	3	0	0	3
CE15605	Foundation Engineering	3	0	0	3
*******	Elective II	3	0	0	3
CE15606	Environmental and Irrigation Engineering Drawing	0	0	4	2
CE15607	Concrete and Highway Laboratory	0	0	4	2
CE15608	Survey Camp	0	0	0	1
EN15601	Career Development Laboratory II	0	0	2	1

LIST OF ELECTIVES

ELECTIVE I

Course Code	Course Title	L	T	P	C
CE15151	Hydrology	3	0	0	3
CE15152	Electronic Surveying	3	0	0	3
CE15153	Construction Planning and Scheduling	3	0	0	3
CE15154	Air Pollution Management	3	0	0	3
CE15155	Ecological Engineering	3	0	0	3

ELECTIVE II

Course Code	Course Title	L	T	P	C
BA15151	Professional Ethics and Human Values	3	0	0	3
CE15251	Remote Sensing Techniques and Applications	3	0	0	3
CE15252	Irrigation Engineering	3	0	0	3
CE15253	Water Resource Engineering	3	0	0	3
CE15254	Management Of Irrigation System	3	0	0	3

SEMESTER V

CE15501 BASIC STRUCTURAL DESIGN II 3 0 0 3

COURSE OBJECTIVE

- To understand the basic concepts in the behavior and design of reinforced concrete systems and elements using working stress method.
- To gain knowledge about basic concepts and steps involved in the design of slabs in accordance with limit state method.
- To gain knowledge about basic concepts and steps involved in the design of beams in accordance with limit state method.
- To understand the concepts in the design of RC column.
- To gain knowledge about RC footing.

UNIT I REINFORCED CONCRETE MATERIALS 9

Materials: Stress strain curve for concrete - Standard concrete mixes for RCC works - types of reinforcements - plain and deformed bars - Stress strain curve for reinforcing steel; Design concepts- Design philosophy - Characteristic load and strength -permissible stresses - partial safety factors - limit state of collapse - limit state of serviceability - Durability limit state - deflection and cracking - modification factors - Basic design concepts - working stress and limit state methods.

UNIT II LIMIT STATE DESIGN OF SLABS 9

Behavior of one way & two-way slabs - Design of one-way slab - span/effective length ratio - Two-way slab - Design of simply supported and restrained slabs as per BIS code method - Stair case slabs - Distribution of loading and design; Continuous slabs and beams - Design using coefficients as per BIS code - critical sections for moments and shear.

UNIT III LIMIT STATE DESIGN OF BEAMS 9

Design of singly and doubly reinforced rectangular and flanged sections by limit state method with IS code specifications - Design for shear, torsion and development length.

UNIT IV LIMIT STATE DESIGN OF COLUMNS 9

Types of columns - design of columns with lateral ties or helical reinforcement - Reduction coefficient - column subjected to combined loading and bending - design based on cracked section - Exposure on interaction diagrams.

UNIT V LIMIT STATE OF FOOTING 9

Design of wall footing - strip foundation to wall axial load, eccentric load ; Design of isolated footing for axially loaded columns.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- know the basic principles of different design methods.
- design slab elements using limit state method under different loading and end conditions.
- design flexural member of any cross sectional shape for shear, bond and torsion.

- design RC columns of any cross section with different end conditions.
- select and design RC footing of different cross section under various site conditions.

TEXT BOOKS

1. Varghese P.C., "Limit State Design of reinforced concrete", Prentice hall of India Pvt. Ltd., 2004.
2. Krishna Raju, N., "Design of Reinforced Concrete Structures", CBS Publishers & Distributors, New Delhi,2016
3. Subramanian,N.,"Design of Reinforced Concrete Structures",Oxford University Press, New Delhi, 2013.

REFERENCES

1. Unnikrishna Pillai, S., DevdasMenon, "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., 2009
2. Dayaratnam P., "Design of reinforced concrete Structures", Oxford & IBH publishing Co.Pvt. Ltd., 2003.
3. Ashok K. Jain, "Reinforced Concrete – Limit state design" – Nem Chand & Bros., 2003.
4. Sinha.W.C and Roy.," Fundamentals of Reinforced concrete", Chand and Co., 2005.
5. IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000
6. 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.
2. http://nptel.ac.in/courses/105105104/pdf/m8l18.pdf
3. http://textofvideo.nptel.iitm.ac.in/105105105/lec14.pdf
4. http://nptel.ac.in/courses/105105104/pdf/m11l28.pdf.
4. http://nptel.ac.in/courses/105101083/download/lec18.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	-	-	-	-	-	-	-	-	2	3
CO2	2	2	2	1	-	-	-	-	-	-	-	-	2	3
CO3	2	3	2	1	-	-	-	-	-	-	-	-	2	3
CO4	2	2	2	1	-	-	-	-	-	-	-	-	2	3
CO5	2	2	2	1	-	-	-	-	-	-	-	-	2	3

CE15502 STRUCTURAL ANALYSIS I 3 0 0 3

COURSE OBJECTIVE

- To gain knowledge of computing slopes and deflections using energy methods.
- To gain knowledge of influence lines for statically determinate and indeterminate structures
- To analyse and solve arched and cable profiled structures.
- To analyse the indeterminate structures for internal forces by theorem of three moments and slope deflection method.
- To analyse the indeterminate structures for internal forces moment distribution method.

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 - Beggs deformeter.

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

At the end of this course, the 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 & Vol. 2, Vikas Publishing Pvt Ltd., New Delhi, 2008.

2. Vaidyanadhan, R and Perumal, P, “Comprehensive Structural Analysis – Vol. 1 & Vol.2”, Laxmi Publications, New Delhi, 2003.

REFERENCES

1. C.K. Wang, Analysis of Indeterminate Structures – Tata McGraw-Hill, 1992.
2. Punmia B.C., Theory of Structures (SMTS)Vol II Laxmi Publishing Pvt ltd, New Delhi, 2004.
3. L.S. Negi& R.S. Jangid, “Structural Analysis”, Tata McGraw-Hill Publications, New Delhi, Sixth Edition, 2003..
4. Gambhir. M.L., "Fundamentals of Structural Mechanics and Analysis", PHI Learning Pvt. Ltd., New Delhi, 2011.
5. 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
3. http://textofvideo.nptel.iitm.ac.in/105105105/lec14.pdf
4. http://nptel.ac.in/courses/105105104/pdf/m11l28.pdf.
5. http://nptel.ac.in/courses/105101083/download/lec18.pdf.

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CO1	2	3	2	1	-	-	-	-	-	-	-	-	3	2
CO2	2	3	2	1	-	-	-	-	-	-	-	-	3	2
CO3	2	3	2	1	-	-	-	-	-	-	-	-	3	2
CO4	2	3	2	1	-	-	-	-	-	-	-	-	3	2
CO5	2	3	2	1	-	-	-	-	-	-	-	-	3	2

CE15503 HIGHWAY ENGINEERING 3 0 0 3

COURSE OBJECTIVES

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

UNIT I HIGHWAY PLANNING AND ALIGNMENT 9

History of road development in India - Classification of highways - Institutions for Highway planning, designand construction at different levels - factors influencing 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 signs 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 materialsin concrete and flexible pavements (problem not included), 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

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

- planned design the highway components.
- execute geometric design of various highway components.
- prepare the design of flexible and rigid pavements.
- gain knowledge of construction procedures of various roads.
- explain 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, Scitech Publications (India), Chennai, 2010.

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

REFERENCES

1. Transportation Engineering & Planning, C.S. Papacostas, P.D. Prevedouros, Prentice Hall of India Pvt ltd, 2006.
2. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHILearning Pvt. Ltd., 2005.
3. R.Srinivasa Kumar., Textbook of Highway Engineering Universities Press (India) PrivateLimited, Hyderabad, 2011.
4. Nicholas Garber, Lester Hoel," Traffic and Highway Engineering" Cengage Learning.,4th edition, Stamford,USA.,2009.
5. Subhash C Saxena, Textbook of Highway and Traffic Engineering., CBS Publishers, 2014
6. C.Venkatramaiah., Transportation Engineering-Highway Engineering, Universities Press (India) Private Limited, Hyderabad, 2015

CODE BOOKS

1. Indian Road Congress (IRC), Guidelines and Special Publications on PlanningandDesign of Highways.
2. IRC Standards (IRC 37 - 2001 & IRC 58 -1998)

WEB LINKS

1. http://ascelibrary.org/toc/jtpedi/
2. www.CE.mtu.edu/~zyou/links/links-research.html

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Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	2	-	-	-	-	-	-	-	-	1	2
CO2	3	-	3	-	-	-	-	-	-	-	-	-	1	3
CO3	2	3	3	2	-	-	-	-	-	-	-	-	1	3
CO4	2	3	2	2	-	-	-	-	-	-	-	-	1	3
CO5	-	2	1	1	-	-	-	-	-	-	-	-	1	2

CE15504 WASTE WATER ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To make themselves conversant with the principles of wastewater supply, treatment and distribution.
- To distinguish the concept of transport of wastewater
- To estimate the load carrying capacity of the treatment.
- To gain knowledge about various advanced wastewater treatment.
- To identify disposal method of sewage and sludge.

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 - sewer appurtenances; Pumps - selection of pumps and pipe Drainage ; Plumbing System for Buildings - One pipe and two pipe system.

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 trench and Soak pit; 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 Unit; 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 and Maintenance of Sewage Treatment Plants.

UNIT V DISPOSAL OF SEWAGE AND SLUDGE MANAGEMENT 9

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 Dewa dewatering - disposal - Advances in Sludge Treatment and disposal.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- gain knowledge about various wastewater resources of India and Tamilnadu.
- gain knowledge of sewer design.
- acquire an elaborate knowledge of selection of wastewater treatment process.
- explore planning, design, operation and maintenance of STP.
- gain knowledge about proper disposal methods of sewage and sludge.

TEXT BOOKS

1. Garg. S. K., "Environmental Engineering", Vol I &Vol II, Khannah Publishers, New Delhi, 1994
2. Punmia, B.C., Jain, A.K., and Jain. A., "Environmental Engineering", Vol.II, Lakshmi Publications, News letter, 2005

REFERENCES

1. Manual on wastewater and treatment CPHEEC, Ministry of Urban Affairs and Employment, Govt. of India, New Delhi, 1990
2. Mark J. Hammer, Mark J. Hammer Jr, "Water and Waste Water Technology", Prentice hall of India 2008
3. Hussain. S. K., "Text Book of Water Supply and Sanitary Engineering", Oxford and IBH Publishing.

WEB LINKS

1. http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn0437pdf/ks043712.pdf

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Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	-	-	1	-	-	1	1	2	-	-	-	1	2
CO2	1	-	-	1	2	-	-	1	2	-	-	-	1	2
CO3	1	-	2	1	2	-	-	-	3	-	2	-	1	2
CO4	1	-	2	1	2	2	-	1	-	-	2	1	1	2
CO5	1	-	3	1	-	2	-	-	-	-	2	1	1	2

CE15505 SOIL MECHANICS 3 0 0 3

COURSE OBJECTIVES

- To gain knowledge of the engineering properties and compaction of soils
- To acquire knowledge about permeability of soil and Seepage
- To impart idea about stress distribution in soil media and consolidation of soil
- To familiarise themselves with the behaviour of soil under shear
- To gain knowledge of stability analysis of slopes

UNIT I SOIL CLASSIFICATION AND COMPACTON 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 behavior 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 and field pumping in pumping out tests - factors influencing permeability of soils; Seepage - introduction to flow nets - Simple problems. (sheet pile and Weir)

UNIT III STRESS DISTRIBUTION AND SETTLEMENT 9

Stress distribution - soil media - Boussinesq theory - use of Newmarks 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 shearstrength, 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 - Fellenious method - Friction circle method - Use of stability number - Slope protection measures.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- classify the soil based on engineering properties
- assess the permeability characteristics of soil and seepage
- find out the settlement of the structure
- assess the shear strength of various types of soil.
- analyze the stability of slopes using different methods.

TEXT BOOKS

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

2. Punmia P.C., "Soil Mechanics and Foundations", Laximi Publications Pvt. Ltd., New Delhi, Jan 2005.
3. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi 2011.

REFERENCES

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2006.
2. Coduto, D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of India Pvt.Ltd. New Delhi, 2010.
3. Das, B.M., "Principles of Geotechnical Engineering". Brooks / Coles / Thompson Learning Singapore, 8th Edition, 2013.
4. Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", 2nd Edition, Pearson Education, 2013
5. Palanikumar. M, "Soil Mechanics", Prentice Hall of India Pvt. Ltd, Leaning Private Limited, Delhi, 2013.
6. GopalRanjan and Rao, A.S.R., " Basic and Applied Soil Mechanics" , New age Ltd. International Publisher New Delhi (India) 2006
7. Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 1995

WEB LINKS

1. http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/soil_mech/index.htm
2. http://www.eng.fsu.edu/~tawfiq/soilmech/lecture.html
2. http://aboutcivil.org/soil-mechanics/soil-mechanics-1-high.pdf

CO PO MAPPING:

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	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	1	2	-	-	-	-	-	-	-	-	3	2
CO2	2	2	1	2	-	-	-	-	-	-	-	-	3	2
CO3	2	3	1	2	-	-	-	-	-	-	-	-	3	2
CO4	2	3	1	2	-	-	-	-	-	-	-	-	3	2
CO5	2	3	1	2	-	-	-	-	-	-	-	-	3	2

CE15506 ENVIRONMENTAL ENGINEERING LABORATORY 0 0 2 1

COURSE OBJECTIVES

- To impart the principles of sampling and preservation of water and wastewater.
- To provide the analyzing methods for water and wastewater.
- To estimate the load carrying capacity of the treatment.
- To convey the principles of testing of water and wastewater.

LIST OF EXPERIMENTS

1. Determination of
   i) pH, ii) turbidity
2. Determination of
   i) Hardness, ii) Electrical conductivity
3. Determination of Chlorides
4. Determination of Sulphate
5. Determination of Optimum Coagulant Dosage
6. Determination of available Ammonia Nitrogen
7. Determination of dissolved Oxygen
8. Determination of total, suspended and dissolved solids
9. Determination of Alkalinity
10. B.O.D. test
11. C.O.D. test
12. Determination of nutrients – Nitrogen and Phosphates (Demonstration only)

TOTAL PERIODS 30

COURSE OUTCOMES

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

- acquire the sampling and preservation methods of water and wastewater.
- the water and wastewater analysis.
- acquire an elaborate knowledge of selection of wastewater treatment process.
- test the water and wastewater.

REFERENCES

1. Standard methods for the examination of water and wastewater, APHA, 20th Edition, Washington, 1998
2. Garg, S.K., "Environmental Engineering Vol. I & II", Khanna Publishers, New Delhi
3. Modi, P.N., "Environmental Engineering Vol. I & II", Standard Book House, Delhi-6

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CO1	2	-	-	1	-	1	1	-	-	-	-	-	3	2
CO2	2	2	-	2	2	-	-	-	-	-	-	-	2	2
CO3	2	1	-	-	-	-	3	-	-	-	-	-	-	2
CO4	2	1	-	2	2	2	-	-	-	-	-	-	3	2

CE15507 **SOIL MECHANICS LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

- gain knowledge on classification of soil based on index properties.
- estimate optimum moisture content and maximum drydensity.
- 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 solids
2. Grain size distribution – Sieve analysis
3. Grain size distribution - Hydrometer analysis
4. Liquid limit and Plastic limit tests
5. Shrinkage limit
6. Field density test
7. Determination of moisture – density relationship using standard proctor compaction test.
8. Permeability determination (constant head and falling head methods)
9. Direct shear test in cohesion less soil
10. Unconfined compression test in cohesive soil
11. Laboratory vane shear test in cohesive soil
12. California Bearing Ratio Test

TOTAL PERIODS 60

COURSE OUTCOMES

At the end of this course, the 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.

WEB LINK

1. youtube.com/watch?v=hNNilkOKaw&list=PL9gC9b3b4pMvoQ4Sj8imonJgfDW2GxPTF

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CO1	1	2	1	3	-	-	-	-	-	-	-	-	2	1
CO2	1	2	1	3	-	-	-	-	-	-	-	-	2	1
CO3	1	2	1	3	-	-	-	-	-	-	-	-	2	1
CO4	1	2	1	3	-	-	-	-	-	-	-	-	2	1

EN15501 CAREER DEVELOPMENT LABORATORY I 0 0 2 1

COURSE OBJECTIVES

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

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UNIT I PERSONALITY DEVELOPMENT 1 6

Introduction - self explorations - character building - self esteem- self confidence- positive thinking leadership qualities- time management.

UNIT II PERSONALITY DEVELOPMENT 2 6

Grooming- role play - good etiquettes - extempore - writing skills: email, paragraph - team building- body language - non verbal communication

UNIT III QUANTITATIVE APTITUDE (QA) 1 6

Time , speed and distance - simple interest and compound interest - percentage - height and distance - timeand work - number systems -L.C.M and H.C.F - ratio proportion- area - directions.

UNIT IV LOGICAL REASONING (LR) 1 6

Analogies - letter and symbol series - number series - cause and effect - essential part - verbal reasoning.

UNIT V VERBAL REASONING (VR) 1 6

Blood relation - venn diagrams - analogy - character puzzles - logical sequence - classifiction -verification of truth - seating arrangement

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course, the 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 anyrecent event / happenings / current affairs.

REFERENCES

1. Agarwal, R.S." A Modern Approach to Verbal & Non Verbal reasoning", S.Chand & co ltd, New Delhi.
2. Abhijit guha, "Quantitative Aptitude ", Tata-Mcgraw hill.
3. word power made easy by norman lewis ,W.R.Goyal publications.
4. Johnson, D.W. reaching out – interpersonal effectiveness and self actualization.Boston: Allyn and Bacon.
5. Agarwal, R.S." objective general English",S.Chand & co
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	-	-	-	-	-	1	2	2	2	2	-	2	-	-
CO2	-	-	-	-	-	1	2	2	2	2	-	2	-	-
CO3	2	2	-	2	1	-	-	-	2	1	-	1	-	-
CO4	2	2	-	2	1	-	-	-	1	1	-	1	-	-

SEMESTER VI

CE15601 RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To gain knowledge of planning and design of railway tracks.
- To provide proficiency in the geometric design of railway tracks.
- To develop skills in planning and design of airports.
- To illustrate exposure to airport visual aids and traffic control devices.
- To gain knowledge of components of docks and harbours

UNIT I RAILWAY PLANNING AND DESIGN 9

Role of Indian railways in national development - Railways for urban transportation - LRT & MRTS - engineering surveys for track alignment -obligatory points - Conventional and modern methods - Remote Sensing, GIS & GPS, EDM and other equipment - Permanent way- components and their functions; Rails - types, fastenings, gauge, coning of wheels, creeps and kinks ; Sleepers-functions, materials, density ; Ballast- functions, materials - ballast less tracks.

UNIT II GEOMETRIC DESIGN OF RAILWAY TRACKS 9

Gradients and grade compensation, super elevation, widening of gauges in curves, transition curves, horizontal and vertical curves; Points and crossings- Turnouts- design, working principle - Track circuiting, signaling, interlocking - construction – maintenance- conventional, modern methods and materials; Soil suitability analysis- track drainage - Track modernization - Automated maintenance and upgrading, relaying of track - lay outs of railway stations and yards- rolling stock, tractive power, track resistance- Level crossings.

UNIT III AIRPORT PLANNING AND DESIGN 9

Role of air transport - Components of airports - Airport planning - air traffic potential, site selection, design of components - Cost estimates, evaluation and institutional arrangements; Runway - design, orientation, cross wind component, wind rose diagram - Geometric design and corrections for gradients - drainage - taxiway - geometric design elements, minimum separation distances, design speed - airport drainage.

UNIT IV AIRPORT VISUAL AIDS AND AIR TRAFFIC CONTROL 9

Airport zoning - clear zone, approach zone, buffer zone, turning zone, clearance over highways and railways - airport layouts - apron, terminal building, hangars, motor vehicle parking area and circulation pattern - Case studies of airport layouts- airport buildings - Primary functions, planning concept, passenger facilities - Visual aids - Runway and taxiway markings, wind direction indicators, runway and taxiway lightings - Air traffic control -basic actions and network - Helipads - Hangars- Service equipment.

UNIT V HARBOURS 9

Introduction - Harbours, ports and docks- components, factors influencing the site selection, wind, wave characteristics - Breakwater - Components and types- Tetrapods and other special blocks- Erosion - Tides - types of tides; Docks - types of docks- warehouses - Transit sheds, fenders- Quays and jetties - dolphins - containerization - mooring, types of mooring - goods transport - Container movement- Wave action on Coastal structures and Coastal protection works-Environmental concern of port operations-Coastal Regulation Zone,2011.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- planned design the railway track components.
- perform geometric design of railways track.
- do the design of runways, taxiways and apron.
- possess knowledge about airport visual aids and traffic control.
- familiarize themselves in the components of docks and harbours.

TEXT BOOKS

1. Rangwala, "Railway Engineering", Charotar Publishing House, 2013.
2. Rangwala, "Airport Engineering", Charotar Publishing House, 2013.
3. Rangwala, "Harbor Engineering", Charotar Publishing House, 2013.

REFERENCES

1. SaxenaSubhash C and SatyapalArora, "A Course in Railway Engineering", DhanpatRai and Sons, Delhi, 2003.
2. Mundrey J.S. "A course in Railway Track Engineering". Tata McGraw Hill, 2007.
3. Khanna S.K, Arora M.G and Jain S.S, "Airport Planning and Design", Nemchand and Brothers, Roorkee, 2012.
4. Dr.K.P.Subramanian,"A text book on Railways, Airports, Docks and Harbours", Scitech, Chennai, 2012.
5. Bindra S P, "A Course in Docks and Harbour Engineering", DhanpatRai and Sons, New Delhi, 2013.

WEB LINKS

1. www.fhwa.dot.gov/resourcecenter/teams/safety/courses.cfm
2. http://www.faa.gov/airports/central/aip/sponsor_guide/media/0500.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)**													
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CO1	2	-	2	-	-	-	-	-	-	-	-	-	2	3
CO2	2	-	2	-	-	-	-	-	-	-	-	-	2	3
CO3	2	3	2	1	-	-	-	-	-	-	-	-	2	3
CO4	2	3	-	1	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	-	-	-	-	-	-	-	2	2

CE15602 STRUCTURAL ANALYSIS II 3 0 0 3

COURSE OBJECTIVES

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

UNIT I MATRIX 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 MATRIX 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 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

At the end of this course, the 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., NewDelhi-4,2010.
2. Bhavikatti,S.S, Structural Analysis, Vol.2, Vikas Publishing House Pvt. Ltd., NewDelhi-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.
3. http://elearning.vtu.ac.in/CV42.html

CO PO MAPPING:

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CO1	2	3	2	1	-	-	-	-	-	-	-	-	3	2
CO2	2	3	2	1	-	-	-	-	-	-	-	-	3	2
CO3	2	3	2	1	-	-	-	-	-	-	-	-	3	2
CO4	2	3	2	1	-	-	-	-	-	-	-	-	3	2
CO5	2	3	2	1	-	-	-	-	-	-	-	-	3	2

CE15603 DESIGN OF STEEL STRUCTURES 3 0 0 3

COURSE OBJECTIVES

- To describe limit state design concepts and the design of bolted and riveted joints.
- To gain knowledge of design of tension members.
- To acquire knowledge about design of compression member.
- To gain knowledge about design of beams.
- To gain knowledge of design of industrial structures.

UNIT I INTRODUCTION 9

Properties of steel- Structural steel sections- Limit state design concepts- Loads on Structures- Connections using rivets, welding, bolting- 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

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

- gain knowledge of limit state design concepts and joints.
- design tension members.
- design compression members.
- gain knowledge of 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.
3. Ramachandra, S. and VirendraGehlot, “Design of Steel Structures – Vol. I & II”, Standard Publication, NewDelhi, 2007

REFERENCES

1. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2005
2. Dayaratnam, P., "Design of Steel Structures", Second edition, S. Chand & Company, 2003.
3. Shah.V.L. and Veena Gore, "Limit State Design of Steel Structures", IS 800–2007 Structures Publications, 2009.
4. Narayanan.R.et.al. "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002
5. IS800 :2007, General Construction In Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007
6. IS 875: (Part 3) 1987 (Reaffirmed 1997), Code of practice for design loads (Other than Earthquake) For Buildings and Structures.

WEB LINKS

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

CO PO MAPPING:

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CO1	2	2	3	1	-	1	-	-	-	-	-	-	2	3
CO2	2	2	3	1	-	1	-	-	-	-	-	-	2	3
CO3	2	2	3	1	-	1	-	-	-	-	-	-	2	3
CO4	2	2	3	1	-	1	-	-	-	-	-	-	2	3
CO5	2	2	3	1	-	1	-	-	-	-	-	-	2	3

CE15604 CONCRETE TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

- To tell the various compositions of concrete
- To understand the usage of admixtures
- To acquire knowledge about types of concrete
- To ensure the quality of concrete
- To know the modern concrete

UNIT I INGREDIENTS OF CONCRETE 9

Cement- chemical composition and physical properties and its uses - Tests on cement; Aggregates- General classification of aggregates, Mechanical and chemical properties of aggregate - bulking of sand, soundness of aggregates, alkali-aggregate reaction, thermal properties of aggregates - Grading of fine and coarse aggregates Gap graded aggregates - Artificial aggregates - Heavy weight, light weight and normal aggregates Samplingo aggregates - Tests on aggregates; Water- Quality of water - Permissible impurities - Suitability of sea water.

UNIT II CONCRETE ADMIXTURES 9

Admixtures; Accelerators - catalysts - retarders - corrosion inhibitors - air entraining agent - workability agent Information regarding commercially available admixtures; Plastizers - water repelling materials – pulverized flyash - pozzolanas - Use of silica fumes-Damp proof course material.

UNIT III PROPERTIES OF FRESH CONCRETE AND HARDENED CONCRETE 9

Properties of fresh concrete and hardened concrete -Workability of concrete - Test on fresh concrete –elastic segregation-bleeding – Test on hardened concrete-Strength of concrete in compression - Tension and flexure - properties of concrete - shrinkage of concrete - creep - thermal expansion - permeability - water tightness and crack control - Durability - thermal conductivity.

UNIT IV QUALITY CONTROL IN CONCRETE 9

General - Frequency of sampling - Test specimen - statistical analysis of test results - standard deviation - Coefficient of variation - characteristic strength - acceptance and rejection criteria - quality control in concrete.

UNIT V SPECIAL CONCRETING METHODS 9

Gap graded concrete - Light weight concrete- Heavy weight concrete - Prepacked concrete - Ready mixed concrete - vacuum concrete - concrete - fibre reinforced concrete - polymer Concrete - Geopolymer concrete-Self compacting concrete-Resin concretes - Ferro cement - High performance concrete - SIFCON- Vacuum Dewatering-Hot weather concreting and cold weather concreting.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- acquire and apply the fundamental knowledge of the fresh and hardened properties of concrete
- identify the functional role of raw materials and apply this knowledge to mix design philosophy.
- select the correct raw material components and mix design needed to formulate a concrete that meets prescribed specification requirements

- assessing the quality of concrete
- assess awareness of the utilization of special concretes

TEXT BOOKS

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

REFERENCES

1. Gupta.B.L.,Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2. Gambir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007

WEB LINK

1. http://nptel.ac.in/syllabus/syllabus.php?subjectId=105104030

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

CE15605 FOUNDATION ENGINEERING 3 0 0 3

COURSE OBJECTIVES

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

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 behavior - Minimum depth for rigid behavior - 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 - Cohesion less and cohesive soil - Coulomb's wedge theory - Condition for critical failure plane - Earth pressure on retaining walls of simple configurations - Culmann Graphical method - Pressure on the wall due to line load - Stability analysis of retaining walls

TOTAL PERIODS 45

COURSE OUTCOMES

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

- conduct sub surface investigation and select foundation based on soil condition
- calculate bearing capacity of soil and settlement
- know 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.
3. GopalRanjan and Rao, A.S.R., " Basic and Applied Soil Mechanics" , New age Ltd. International Publisher New Delhi (India) 2006

REFERENCES

1. Das, B.M. "Principles of Foundation Engineering" (Eigth edition), Thompson Asia Pvt. Ltd., Singapore, 2013.
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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
2. http://aboutcivil.org/soil-mechanics/soil-mechanics-1-high.pdf

CO PO MAPPING:

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CO1	2	1	1	3	-	-	-	-	-	-	-	-	3	2
CO2	2	1	1	3	-	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	2
CO4	1	3	2	2	-	-	-	-	-	-	-	-	3	2
CO5	1	3	2	2	-	-	-	-	-	-	-	-	3	2

CE15606 ENVIRONMENTAL AND IRRIGATION ENGINEERING DRAWING 0 0 4 2

COURSE OBJECTIVES

- Design and draw the coagulation and sedimentation tank in detail which showing the plan, elevationand sections.
- Design and draw the rapid sand filter in detail which showing the plan, elevationand sections.
- Design and draw the syphon aqueduct in detail which showing the plan, elevation andsections.
- Design and draw the canal drop, canal regulator in detail which showing the plan, elevation andsections.

LIST OF EXPERIMENTS

PART A : ENVIRONMENTAL ENGINEERING

1. Design and Drawing of coagulation and sedimentation tank.
2. Design and Drawing of rapid sand filter
3. Design and Drawing of screen chamber and grit chamber.
4. Design and Drawing of septic tank.
5. Design and Drawing of activated sludge process.
6. Design and Drawing of trickling filter.

PART B : IRRIGATION ENGINEERING

7. Design and Drawing of tank sluice with tower head.
8. Design and Drawing of tank surplus weir.
9. Design and Drawing of canal drop.
10. Design and Drawing of canal regulator cum foot path.
11. Design and Drawing of syphon aqueduct.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- design and draw coagulation and sedimentation tank structures.
- design and draw rapid sand.
- design and draw canal drop, canal regulator.
- design and draw syphon aqueduct.

REFERENCES

1. Mohanakrishnan. A, “A few Novel and Interesting Innovative Irrigation Structures: Conceived, Designed and Executed in the Plan Projects in Tamil Nadu”, Publ. No. 44 and Water Resources Development & Management Publ.No.43, IMTI Thuvakudy, Trichy, 2011.
2. Raghunath, H.M. “Irrigation Engineering”, Wiley India Pvt. Ltd., New Delhi, 2011.

3. Sharma R.K., “Irrigation Engineering and Hydraulic Structures”, Oxford and IBH Publishing Co., New Delhi, 2002.
4. SatyaNarayana Murthy Challa, “Water Resources Engineering: Principles and Practice”, New Age International Publishers, New Delhi, 2002.
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5. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 1999.

CO PO MAPPING:

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	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	-	-	2	3	-	-	-	-	2	1	2
CO2	2	1	2	-	-	2	3	-	-	-	-	2	1	2
CO3	2	1	2	-	-	2	3	-	-	-	-	2	1	2
CO4	2	1	2	-	-	2	3	-	-	-	-	2	1	2

CE15607 CONCRETE AND HIGHWAY LABORATORY 0 0 4 2

COURSE OBJECTIVES

- To gain knowledge of various tests of coarse aggregate.
- To explain about various workability tests on fresh concrete.
- To find out the strength parameters of hardened concrete.
- To gain knowledge about the quality of different bitumen mixes.

LIST OF EXPERIMENTS

I TESTS ON FRESH CONCRETE

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

II TESTS ON HARDENED CONCRETE

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

III TESTS ON BITUMEN

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

IV TESTS ON AGGREGATES

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)

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

TOTAL PERIODS 60

COURSE OUTCOMES

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

- assess the quality of coarse aggregate used in concrete.
- do various workability tests on fresh concrete.
- ensure the strength characteristics of the given concrete.
- check the existing quality of conventional bituminous roads and constituent materials with thehelp of the modern state of art equipment.

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

CE15608 **SURVEY CAMP (2 Weeks - During V Semester)** **0 0 0 1**

COURSE OBJECTIVES

To enable the students to

- gain knowledge on survey field techniques
- 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.

SYLLABUS

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

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

COURSE OUTCOMES

At the end of this course, the 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														
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CO1	-	2	1	-	3	-	1	1	-	-	-	-	3	-
CO2	-	2	1	-	3	-	-	1	-	-	-	-	3	-
CO3	-	2	1	-	3	-	-	2	-	-	-	-	3	-
CO4	-	2	1	1	2	-	-	1	-	-	-	-	3	-

EN15601 CAREER DEVELOPMENT LABORATORY II 0 0 2 1

COURSE OBJECTIVES

- To enhance career competency and employability skills
- To demonstrate effective leadership and interpersonal skills
- To improve professional capabilities through advanced study and researching current market strategy.
- To develop problem solving and decision making capabilities

UNIT I CORPORATE READINESS 6

Business Communication - Inter and Intra Personal skills - Business Etiquettes - Corporate ethics - Communication media Etiquette.

UNIT II INTERVIEW SKILLS 6

Resume building - Group discussions - Presentation skills - Entrepreneur skills - Psychometric assessment - Mock interview.

UNIT III QUANTITATIVE APTITUDE (QA) 2 6

Profit and Loss - Clock - Power and Square roots -Train - Boats and streams - Probability - Calendars - Permutations and Combinations - Partnership - Simplification - Pipes and Cisterns - Puzzles.

UNIT IV LOGICAL REASONING (LR) 2 6

Statements and Assumptions - Matching Definitions - Logical Games - Making judgments - Statements and conclusions - Verbal classifications.

UNIT V VERBAL REASONING (VR) 2 6

Syllogisms - Data sufficiency - Dice - Series completion - Character puzzles - cube and cuboids - Arithmetic Reasoning.

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course, the 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.
2. Abhijit guha, "quantitative aptitude for competitive examinations ", Tata Mcgraw hill
3. Word power made easy by norman lewis ,wr.goyal publications.
4. Johnson, d.w. (1997). Reaching out – interpersonal effectiveness and self Actualization -- Boston: Allyn and bacon.
5. Infosys Campus Connect Program – students' guide for soft skills.
6. Mitra ,barun.k, " Personalaity Development & Softskills " , Oxford University.

CO PO MAPPING

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CO1	-	-	-	-	-	1	2	2	2	2	-	2	-	-
CO2	-	-	-	-	-	1	2	2	2	2	-	2	-	-
CO3	2	2	-	2	1	-	-	-	2	1	-	1	-	-
CO4	2	2	-	2	1	-	-	-	1	1	-	1	-	-

ELECTIVE I

CE15151 HYDROLOGY 3 0 0 3

COURSE OBJECTIVE

- To understand the components of the hydrological cycle, the mechanics of rainfall, it's spatial and temporal measurement and their applications.
- To know the methods of estimating evaporation and infiltration losses.
- To acquire in-depth knowledge about various types of hydrographs and their applications.
- To realize the importance of flood control and mitigation measures.
- To understand the dynamics of ground water flow and their implications.

UNIT I PRECIPITATION 9

Hydrologic cycle - Types of precipitation - Form of precipitation - Measurement of Rainfall - Spatial measurement methods - Temporal measurement methods - Frequency analysis of point rainfall - Intensity, duration and frequency relationship - Probable maximum precipitation.

UNIT II ABSTRACTION FROM PRECIPITATION 9

Losses from precipitation - Evaporation process - Reservoir evaporation - Infiltration process - Infiltration capacity - Measurement of infiltration - Infiltration indices - Effective rainfall splines - Design of crankshafts - Design of rigid and flexible couplings.

UNIT III HYDROGRAPHS 9

Factors affecting Hydrograph - Base flow separation - Unit hydrograph - Derivation of unit hydrograph- S curve hydrograph -Unit hydrograph of different deviations - Synthetic Unit Hydrograph.

UNIT IV FLOODS AND FLOOD ROUTING 9

Flood frequency studies - Recurrence interval - Gumbel's method - Flood routing - Reservoir flood routing - Muskingum's Channel Routing - Flood control.

UNIT V GROUND WATER HYDROLOGY 9

Types of aquifers - Darcy's law - Dupuit's assumptions - Confined Aquifer - Unconfined Aquifer - Recuperation test - Transmissibility - Specific capacity - Pumping test - Steady flow analysis only.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the various components of hydrological cycle and their interactions.
- estimate the mean areal precipitation and their significance in design of various hydraulic structures.
- determine the magnitude of infiltration and evaporation and evapotranspiration by various empirical methods.
- estimate the concept of flood routing the impact of flood through various methods.
- understand the dynamics of groundwater flow and their estimation

TEXT BOOKS

1. Subramanya, K., "Engineering Hydrology", Tata McGraw-Hill Publishing Co., Ltd., 2000
2. Raghunath, H.M., "Hydrology", Wiley Eastern Ltd., 2000

REFERENCES

1. Chow, V.T. and Maidment, "Hydrology for Engineers", McGraw-Hill Inc., Ltd., 2000
2. Singh, V.P., "Hydrology", McGraw-Hill Inc., Ltd., 2000.
3. Patra K C, "Hydrology and Water Resources Engineering" Narosa Publishing House, New Delhi, 2002
4. JayaramiReddi P, "Text book of Hydrology", Laxmi Publications Pvt. Ltd., New Delhi, 1997

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														
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CO1	1	-	2	-	2	-	-	-	-	-	-	-	2	2
CO2	1	-	2	-	3	-	-	-	-	-	-	-	1	2
CO3	1	-	2	-	2	-	-	-	-	-	-	-	1	2
CO4	1	-	2	-	3	-	-	-	-	-	-	-	3	3
CO5	1	-	2	-	3	-	-	-	-	-	-	-	2	2

CE15152 ELECTRONIC SURVEYING 3 0 0 3

COURSE OBJECTIVES

- To gain knowledge about surveying instruments and advance instruments.
- To acquire knowledge of total station surveying.
- To understand the concept of GPS and its components
- To understand the concept of EDM
- To gain knowledge of the working principle of instruments and field use.

UNIT I FUNDAMENTALS 9

Methods of measuring distance- historical development- basic principles of EDM- classifications- applications andcomparison with conventional surveying.

UNIT II TOTAL STATION SURVEYING 9

Basic Principle – Classifications; 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 III GPS SURVEYING 9

Basic Concepts - Different segments - space, control and user segments - satellite configuration - signal structure- Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - Hand Held and Geodetic receivers -data processing - Traversing and triangulation.

UNIT IV ELECTROMAGNETIC DISTANCE MEASURING SYSTEM 9

Electro-optical system, measuring principle- working principle- sources of error- infrared EDM instruments- LaserEDM instruments and total station; Microwave system- measuring principle- working principle- sources of errormicro- wave EDM instruments - comparison with Electro-optical system- care and maintenance of EDMinstruments- Modern Positioning Systems EDM traversing- trilateration and base line measurement using EDM **UNIT V**

FIELD STUDIES 9

Study of different EDM instruments and Total Station EDM traversing- trilateration and base line measurement using EDM.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- gain knowledge about surveying instruments and advance instruments.
- familiarize them with the total station method.
- understand the concept of GPS and its components
- understand the concept of EDM
- illustrate the working principle of instruments and field use.

TEXT BOOKS

1. Punmia B.C., Surveying, Vols. I, II and III, Laxmi Publications, 1989
2. Dr.P.Purushothama Raj, "Surveying-II" Tata Mcgraw-Hill Publishing company Ltd. Newdelhi,2013.

REFERENCES

1. Burnside, C.D. Electromagnetic distance measurement Crosby Lock wood staples, U.K. 1971.
2. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 1990.
3. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983.
4. Soastamoinen, J.J. Surveyor's guide to electro-magnetic Distance Measurement, AdamHilger Ltd., 1967

WEB LINKS

1. http://navybmr.com/study%20material/14336a/14336A_ch4.pdf
2. https://theconstructor.org/surveying/modern-surveying-instruments-uses/16/

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

CE15153 CONSTRUCTION PLANNING AND SCHEDULING 3 0 0 3

COURSE OBJECTIVES

- To learn the necessity of planning in the diverse construction projects.
- To know the appropriate techniques used for scheduling the resources.
- To gain knowledge about various costs, control methods and departmental procedure for accounting.
- To examine the quality control and monitoring techniques and the necessity of training the personnel.
- To create awareness of management information system and usage of data base in the project accountings.

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

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

- understand the requirement of planning techniques exercised in the construction projects.
- select suitable scheduling technique for the particular project.
- gain knowledge of the modern cost account systems and control techniques adopted in the construction projects.

- use advanced management tools for quality control and monitoring techniques towards speedy and guaranteed projects.
- use the MIS and 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", Third edition , Tata McGraw-Hill Publishing Co., New Delhi, 2014.
3. Srinath,L.S., "Pert and CPM Principles and Applications ", Third edition,Affiliated East West Press, 2001

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1. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.
2. Edward .M.Willis.., "Scheduling Construction projects", John Wiley and Sons 1986. Digitized in 2008
3. Frederick Gould &Nancy Joyce, "Construction Project Management",Third edition, Pearson Prentice Hall,2013.

WEB LINKS

1. http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati /cpm/index.html
2. http://theconstructor.org/?s=construction+planning
3. https://books.google.co.in/books?isbn=1136827617

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

CE15154 AIR POLLUTION MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

- To impart the knowledge about sources, effect and control of air pollution.
- To identify the principles of dispersion characteristics of pollution in atmosphere.
- To gain knowledge of control of air pollution-n.
- To tell the concepts behind the air pollution management.
- To illustrate the sources, effect and control of noise pollution.

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, animals; Global warming-ozone layer depletion; Sampling and Analysis - Basic Principles of Sampling - Source and ambient sampling; Analysis of pollutants- Principles.

UNIT II DISPERSION OF POLLUTANTS 9

Elements of atmosphere - Meteorological factors - Wind roses - Lapse rate - Atmospheric stability andturbulence - 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 pollutant 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 and Air quality

UNIT V NOISE POLLUTION 9

Sources of noise pollution - Effects -Assessment of noise pollution- Standards of limits for noise pollution - various Control methods - Prevention activities

TOTAL PERIODS 45

COURSE OUTCOMES

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

- classify the sources and effects of air pollution.
- realize the dispersion characteristics and modeling of air pollution.
- gain knowledge of air pollution control methods
- familiarize themselves with air pollution management ideas.
- create awareness on sources, effects and control of noise pollution

TEXT BOOKS

1. Anjaneyulu, D., “Air Pollution and Control Technologies”, Allied Publishers, Mumbai, 2002.
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 2006.

REFERENCES

1. W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New Yark, 1997.
2. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw-Hill Publishing Company, New Delhi, 1991.
3. Peavy S.W., Rowe D.R. and Tchobanoglous G. Environmental Engineering, McGraw Hill, New Delhi, 1985.
4. Garg, S.K., "Environmental Engineering Vol. II", Khanna Publishers, New Delhi, 2008
5. RaoM.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 2001.

WEB LINKS

1. http://nptel.ac.in/corses/10510409

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

CE15155 ECOLOGICAL ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To understand the basic principles and concept of ecological Engineering.
- To study the functions of ecosystem and its types.
- To familiarize students with bio monitoring techniques, scope and applications of ecological principles for wastewater treatment and reuse.
- To create awareness of various effects of industrialization on ecology and ecological based waste purification methods.
- To understand various integrated ecological engineering systems.

UNIT I PRINCIPLES AND CONCEPTS 9

Aim - Scope and applications of Ecological Engineering - Eco technology and their relevance to human civilization - Development and evolution of ecosystems - principles and concepts pertaining species, populations and community

UNIT II ECOSYSTEM FUNCTIONS 9

Energy flow and nutrient cycling - Food chain and food webs - biological magnification, diversity and stability, immature and mature systems; Primary productivity -Biochemical cycling of nitrogen, phosphorous, sulphur and carbon dioxide; Habitat ecology - Terrestrial, fresh water, estuarine and marine habitats.

UNIT III ECOLOGICAL ENGINEERING METHODS 9

Bio monitoring and its role in evaluation of aquatic ecosystem; Rehabilitation of ecosystems through ecological principles - step cropping, bio-wind screens, Wetlands, ponds, Root Zone Treatment for Waste water, Aquaculture system, Reuse of treated wastewater through ecological systems.

UNIT IV ECOLOGICAL EFFECTS OF INDUSTRIALISATION 9

Ecological effects of exploration- production-extraction- processing- manufacture & transport.

UNIT V CASE STUDIES 9

Case studies of integrated ecological engineering systems.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply the basic principles and concept to preserve ecology.
- gain knowledge of scope and applications of ecological principles for waste water treatment and reuse.
- understand the social issues and ecological effects of industrialization.
- interpret the relationship among integrated ecological engineering systems.
- gain knowledge of ecological engineering systems.

TEXT BOOKS

1. Odum, E.P., “Fundamental of Ecology”, W.B.Sauders, 2002.
2. Kormondy, E.J., “Concepts of Ecology”, Prentice Hall, New Delhi, 1996

REFERENCES

1. Mitch, J.W. and Jorgensen, S.E., Ecological Engineering – An Introduction to Ecotechnology, John Wiley and Sons, 1996.
2. Colinvaux, P., Ecology, John Wiley and Sons, 1996.
3. Etnier, C &Guterstam, B., "Ecological Engineering for Wastewater Treatment", 2nd Edition, Lewis Publications, London, 1996.

WEB LINKS

1. https://www.researchgate.net/journal/0925-8574_Ecological_Engineering

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

ELECTIVE II

BA15151 PROFESSIONAL ETHICS AND HUMAN VALUES 3 0 0 3

COURSE OBJECTIVES

- To understand the basic human values of a professional.
- To discuss the significance of ethics in engineering and the theories related to it.
- To familiarize oneself with the role of engineers as responsible experimenters.
- To expose the students to their roles and responsibilities in assessing safety and reducing risks.
- To describe the global issues in ethics and role of engineers as manager and consultants.

UNIT I HUMAN VALUES 9

Morals, Values and Ethics - Integrity - Work Ethic - Service Learning - Civic Virtue - Respect for Others - Living Peacefully - caring - Sharing - Honesty - Courage - Valuing Time - Cooperation - Commitment - Empathy - Self-Confidence - Character - Spirituality.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas- moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlookon law - the challenger case study.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island and Chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT V GLOBAL ISSUES 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors - moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India, etc.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- describe the basic human values of a professional.
- understand the significance of ethics in engineering and the theories related to it.
- be familiar with the role of engineers as responsible experimenters.
- acquire knowledge about their roles and responsibilities in assessing safety and reducing risks.
- discuss the global issues in ethics and role of engineers as manager and consultants.

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics –Concepts and Cases",Thompson Learning, (2000).

REFERENCES

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003).
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers",Oxford University Press, (2001).
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective",Biztantra, New Delhi, (2004).
4. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003).

CO PO MAPPING:

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Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	2	-	3	2	2	1	2	-	-
CO2	-	-	-	-	-	2	-	3	2	2	1	2	-	-
CO3	-	-	-	-	-	2	-	3	2	2	1	2	-	-
CO4	-	-	-	-	-	2	-	3	2	2	1	2	-	-
CO5	-	-	-	-	-	2	-	3	2	2	1	2	-	-

CE15251 REMOTE SENSING TECHNIQUES AND APPLICATIONS 3 0 0 3

COURSE OBJECTIVES

- To impart the concepts of remote sensing techniques and their concepts.
- To gain knowledge of various applications of resource significance.
- To develop knowledge about various interpretation and analysis.
- To understand the definition and importance of GIS.
- To interpret the applications of data models.

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

Definition of remote sensing and its components - Electromagnetic spectrum - wave length 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 - Airborne and spaceborne 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 softwares - Data type - Spatial and nonspatial (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 - Modeling in GIS Highway alignment studies - Land Information System.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the principles of remote sensing techniques.
- identify the aid of remote sensing techniques
- analyse the image interpretation.
- analyse the RS and GIS data and interpret the data for modeling applications
- apply on data models and storage.

TEXT BOOKS

1. Lillesand,T.M., Kiefer, R.W. and J.W.Chipman. "Remote Sensing and Image Interpretation" 5th Edition., John Willey and Sons Asia Pvt. Ltd., New Delhi, 2004.
2. Anji Reddy, M. "Textbook of Remote Sensing and Geographical Information System"2nd edition. BS Publications, Hyderabad, 2001.

REFERENCES

1. Lo. C.P.andA.K.W.Yeung, "Concepts and Techniques of Geographic Information Systems",Prentice Hall of India Pvt. Ltd., New Delhi, 2002
2. Peter A.Burrough, Rachael A. McDonnell, " Principles of GIS", Oxford University Press, 2000
3. Ian Heywood "An Introduction to GIS", Pearson Education Asia, 2000

WEB LINKS

1. http://www.sciencedirect.com/science/article/pii0273117783901072
2. http://www.geol-amu.org/notes/b8-4-2.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	-	-	-	-	-	-	-	-	-	-	-	2	2
CO2	-	-	-	-	-	-	-	-	-	-	-	-	2	2
CO3	1	-	-	-	-	-	-	-	3	3	-	-	2	2
CO4	1	-	2	-	-	-	-	-	-	-	1	2	2	2
CO5	2	2	2	2	3	-	-	-	2	3	-	-	2	2

CE15252 IRRIGATION ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To understand the basic types of irrigation, irrigation standards.
- To study the crop water essentiality and uses.
- To study the design of various canal structures.
- To acquire knowledge of canal irrigation.
- To understand the various issues connected with irrigation and water management.

UNIT I IRRIGATION PRINCIPLES 9

Need for irrigation - Advantages and ill effects - Development of irrigation - National Water Policy - Tamil Nadu scenario - Physical properties of soil that influence soil moisture characteristics - Concept of soil water potential and its components; Gravitational and Osmotic pressures- Retention of water in soils - Concept of available water -Movement of water into and within the soils - Measurement of soil moisture content.

UNIT II CROP WATER REQUIREMENT 9

Necessity and importance- Crop and crop seasons in India -Duty, Delta, Base Period- Factors affecting Duty- Irrigation efficiencies- Consumptive use of water-Irrigation requirements of crops - Standards for irrigation water- Planning and Development of irrigation projects.

UNIT III DIVERSION AND IMPOUNDING STRUCTURES 9

Head works -Weirs and Barrages -Types of impounding structures - Factors affecting, location of dams -Forces on a dam -Design of Gravity dams; Earth dams, Arch dams - Spillways -Energy dissipaters.

UNIT IV CANAL IRRIGATION 9

Classification of canals- Alignment of canals - Design of irrigation canals- Regime theories - Canal Head works- Canal regulators - Canal drops - Cross drainage works - Canal Outlets, Escapes -Lining and maintenance of canals -Other methods of Irrigation: Surface, Subsurface - Merits and Demerits.

UNIT V IRRIGATION WATER MANAGEMENT 9

Modernization techniques - Rehabilitation - Command Area Development - Systems of rice intensification - Water delivery systems - Participatory Irrigation Management - Farmers organization and turn over - Water users' associations - Economic aspects of irrigation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- select suitable method of irrigation.
- assess the irrigation needs of crops.
- select and design suitable type of dam based on the requirement.
- design various types of canal structures.
- provide solutions to various issues related to irrigation and water management.

TEXT BOOKS

1. Punima B.C. &Pande B.B .Lal Irrigation and Water Power Engineering, Laxmi Publishing, New Delhi 2007
2. S.R.Sahasrabudhe, "Irrigation Engineering and Hydraulic Structures" S.K. Kataria& Sons, New Delhi, 2012

REFERENCES

1. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
2. Basak, N.N., "Irrigation Engineering", Tata McGraw-Hill Publishing Co, New Delhi, 2008.
3. Sharma R.K.. "Irrigation Engineering", S.Chand& Co. 2007.
4. Michael, A.M., "Irrigation Engineering", Vikas Publishers, New Delhi, 2008.

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1. http://enotesweekly.blogspot.com › 2011/11 › irrigation-engineering
2. http://npdp.stanford.edu ›principles of irrigation engineering
2. http://new1.dli.ernet.in › data1 › upload › insa › INSA 1

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

CE15253 WATER RESOURCES ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To study the various water resources of india and tamilnadu.
- To understand the statistical techniques in network design.
- To describe the necessity of estimation of water resources.
- To impart required knowledge about reservoir planning and management.
- To understand economic analysis including irrigation and irrigation management practices

UNITI GENERAL 9

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

UNIT II NETWORK DESIGN 9

Hydrologic measurements - Analysis of Hydrologic station network - Station network design - Statistical techniques in network design.

UNIT III WATER RESOURCE NEEDS 9

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

UNIT IV RESERVOIR PLANNING AND MANAGEMENT 9

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

UNIT V ECONOMIC ANALYSIS 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- gain knowledge of various water resources of India and Tamilnadu.
- get knowledge of the network design.
- develop knowledge of estimation of water resources.
- acquire skills in planning, design, operation and management of reservoir system.
- describe about economic analysis.

TEXT BOOKS

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

REFERENCES

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

WEB LINKS

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CO PO MAPPING:

Mapping of course objectives with Programme Outcome(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	-	1	-	-	-	-	-	-	-	-	2	3
CO2	1	2	-	1	-	-	-	-	-	-	-	-	2	3
CO3	2	2	-	1	-	-	-	-	-	-	-	-	2	3
CO4	2	2	3	1	-	-	-	-	-	-	-	-	2	3
CO5	2	2	-	1	-	-	-	-	-	-	-	-	2	2

CE15254 MANAGEMENT OF IRRIGATION SYSTEM 3 0 0 3

COURSE OBJECTIVES

- To create awareness of requirements of irrigation system.
- To understand of irrigation scheduling.
- To understand various issues connected with irrigation and water management.
- To study the various operations of canal structures.
- To understand the importance of involvement of stakeholders.

UNITI IRRIGATION SYSTEM REQUIREMENTS 9

Irrigation systems - supply and demand of water - cropping pattern - crop rotation - crop diversification - estimation of total and peak crop water requirements - effective and dependable rainfall - irrigation efficiencies.

UNIT II IRRIGATION SCHEDULING 9

Time of irrigation - Critical stages of water need of crops - Criteria for scheduling irrigation - Frequency and Interval of irrigation.

UNIT III MANAGEMENT 9

Structural and non-structural strategies in water use and management - Conjunctive use of surface and ground Waters - Quality of irrigation water.

UNIT IV OPERATION 9

Operational plans - Main canals, laterals and field channels - Water control and regulating structures - Performance indicators - Case study.

UNIT V INVOLVEMENT OF STAKE HOLDERS 9

Farmer's participation in system operation - water user's associations - farmer councils - changing paradigms on irrigation management - Participatory irrigation management with a case study.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- gain knowledge of the requirement of irrigation system.
- select suitable method of irrigation scheduling.
- create awareness about effective usage of irrigation water.
- gain knowledge of various regulating structures.
- gain knowledge about involvement of stakeholders.

TEXT BOOKS

1. Punmia B.C., et. al; Irrigation and water power Engineering, Laxmi Publications, 16th Edition, New Delhi, 2009
2. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23rd Revised Edition, New Delhi, 2009
3. Dilip Kumar Maiumdar, "Irrigation Water Management – Principles and Practice", Prentice Hall of India Pvt. Ltd., New Delhi, 2000.

REFERENCES

1. Asawa, G.L., "Irrigation Engineering", New Age International Publishers, New Delhi, 2000.
2. Hand Book on Irrigation System Operation Practices, Water Resources Management and Training Project, Technical report No. 33, CWC, New Delhi, 1990
3. Maloney, C. and Raju, K.V., "Managing Irrigation Together", Practice and Policy in India, Stage Publication, New Delhi, India, 1994.
4. Hand book on Irrigation Water Requirement, R.T. Gandhi, et. al., Water Management Division, Department of Agriculture, Ministry of Agriculture, New Delhi.

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2. https://pdfs.semanticscholar.org/a74f/b5cf58c7e6fbf545bf995b1cb84f10e201e1.pdf
3. http://nptel.ac.in/downloads/105105110/

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