



(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C. Nagar, K.Vellakulam – 625 701 (Near **VIRUDHUNAGAR**).

B.E. CIVIL ENGINEERING

(Regulation 2020 - Autonomous)

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI (V TO VI Semester)

Vision

To make the Department of Civil Engineering, unique of its kind to promote education and research in the various fields of construction industry.

Mission

To impart highly innovative and technical knowledge in the field of Civil Engineering to the urban and rural student folks through "Total Quality Education".

Program Education Objectives:

Educational objectives of the course Bachelor of Civil Engineering programme can be divided into

1. **Program Specific Academic Excellence:** Graduates of the program will be creative, able to apply scientific knowledge and computer aided design tools for technical problems in the field of Civil Engineering.
2. **Professional Attitude:** Graduates of the program will be a professional Civil Engineer and/or will pursue higher education in various domains of Civil Engineering by taking competitive examinations.
3. **Core Competence:** Graduates of the program will passionately perform as a competent team member, team leader and/or entrepreneur in the development of a sustainable environment.

PROGRAM OUTCOMES:

After going through the four years of study, the Civil Engineering graduates will have the ability to

PO No.	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

1. **Future ready graduates:** Graduating students will be able to deal complex problems in the field of Civil Engineering to achieve design solutions with modern technological approach and application software.

2. **Socially Aware graduates:** Graduating students will be able to understand the professional Civil Engineering practice and apply contextual knowledge with the appropriate consideration of the society and environment.

SEMESTER V

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	CE1501	Design of Reinforced Cement Concrete Elements	PC	3	3	0	0	3
2.	CE1502	Foundation Engineering	PC	3	3	0	0	3
3.	CE1503	Structural Analysis I	PC	3	3	0	0	3
4.	CE1504	Water Supply Engineering	PC	3	3	0	0	3
5.	CE1505	Concrete and Highway Engineering (Theory cum Lab)	PC	5	3	0	2	4
6.		Open Elective*	OE	3	3	0	0	3
7.		Online Course**	OL	NPTEL/SWAYAM				
8.		Audit Course	AC	3	3	0	0	0
PRACTICALS								
9.	CE1511	Hydraulic Engineering Laboratory	PC	4	0	0	4	2
10.	CE1521	Survey Camp	EEC	0	0	0	0	2
11.	HS1521	Professional Communication	EEC	2	0	0	2	1
TOTAL				29	21	0	8	24

SEMESTER VI

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	CE1601	Design of Steel Structural Elements	PC	3	3	0	0	3
2.	CE1602	Structural Analysis II	PC	3	3	0	0	3
3.	CE1603	Wastewater Engineering	PC	3	3	0	0	3
4.		Professional Elective I	PE	3	3	0	0	3
5.		Professional Elective II	PE	3	3	0	0	3
6.		Online Course**	OL	NPTEL/SWAYAM				3
PRACTICALS								
7.	CE1611	Computer Aided Design and Drafting Laboratory	PC	4	0	0	4	2
8.	CE1612	Water and Waste Water Analysis Laboratory	PC	4	0	0	4	2
TOTAL				23	15	0	8	22

**Students can take online courses in any of the three semesters (5th, 6th, and 7th) for a total of 6 credits, and grades will be awarded in the consolidated mark statement accordingly.

**PROFESSIONAL ELECTIVE
SEMESTER VI
ELECTIVE -I**

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CE1631	Environmental Impact Assessment	PE	3	3	0	0	3
2.	CE1632	Construction Planning and Scheduling	PE	3	3	0	0	3
3.	CE1633	Remote Sensing Techniques and GIS	PE	3	3	0	0	3
4.	CE1634	Industrial Safety	PE	3	3	0	0	3
5.	CE1635	Maintenance, Repair and rehabilitation of structures	PE	3	3	0	0	3
6.	CE1636	Railways, Airport , Docks and Harbour Engineering	PE	3	3	0	0	3

ELECTIVE –II

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CE1637	Air Pollution and Control Engineering	PE	3	3	0	0	3
2.	CE1638	Housing Planning and Management	PE	3	3	0	0	3
3.	CE1639	Hydrology	PE	3	3	0	0	3
4.	CE1640	Municipal Solid Waste Management	PE	3	3	0	0	3
5.	CE1641	Soil Dynamics	PE	3	3	0	0	3
6.	CE1642	Urban Planning and Development	PE	3	3	0	0	3

OPEN ELECTIVE (offered to other departments)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	OCE151	Air Pollution and Control Engineering	OE	3	3	0	0	3
2	OCE152	Environment and Agriculture	OE	3	3	0	0	3
3	OCE153	Geographic Information System	OE	3	3	0	0	3

CE1501 DESIGN OF REINFORCED CEMENT CONCRETE ELEMENTS

L	T	P	C
3	0	0	3

Course Objectives:

- To introduce the different types of philosophies related to design of basic structural elements such as slab, beam, column and footing which form part of any structural system with reference to Indian standard code of practice

UNIT I INTRODUCTION

9

Objective of structural design-Steps in RCC Structural Design Process- Type of Loads on Structures and Load combinations- Code of practices and Specifications - Concept of Working Stress Method, Ultimate Load Design and Limit State Design Methods for RCC -Properties of Concrete and Reinforcing Steel - Analysis and Design of Singly reinforced Rectangular beams by working stress method - Limit State philosophy as detailed in IS code - Advantages of Limit State Method over other methods - Analysis and design of singly and doubly reinforced rectangular beams by Limit State Method - Introduction to computer aided RC design (Demo only) – Preparation of spreadsheet for design of singly reinforced beam for moment (demo).

UNIT II DESIGN OF BEAMS

9

Analysis and design of Flanged beams for – Use of design aids for Flexure - Behaviour of RC members in Shear, Bond and Anchorage - Design requirements as per current code - Behaviour of rectangular RC beams in shear and torsion - Design of RC members for combined Bending, Shear and Torsion.

UNIT III DESIGN OF SLABS AND STAIRCASE

9

Analysis and design of cantilever, one way simply supported and continuous slabs and supporting beams-Two way slab- Design of simply supported and continuous slabs using IS code coefficients- Types of Staircases – Design of dog-legged Staircase.

UNIT IV DESIGN OF COLUMNS

9

Types of columns -Axially Loaded columns – Design of short Rectangular Square and circular columns -Design of Slender columns- Design for Uniaxial and Biaxial bending using Column Curves

UNIT V DESIGN OF FOOTINGS

9

Concepts of Proportioning footings and foundations based on soil properties-Design of wall footing – Design of axially and eccentrically loaded Square, Rectangular pad and sloped footings - Design of Combined Rectangular footing for two columns only.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of course the students will be able to

- CO1 Summarize the various design philosophies involved in the design of RC elements and design beams by working stress method & Limit state method.
- CO2 Solve flanged beams problems and identify the shear, torsion, bond with anchorage forces required in beams.
- CO3 Solve the problems in design of structural members like slabs and staircase by adopting limit state method.
- CO4 Solve the problems in design of columns based on the geometry and forces and choose the relevant design technique.
- CO5 Solve the problems in design of footing based on the geometry and forces and choose the relevant design technique.

TEXT BOOKS:

1. Varghese, P.C., 2002, *Limit State Design of Reinforced Concrete*, Prentice Hall of India, Pvt. Ltd., New Delhi.
2. Gambhir. M.L., 2006, *Fundamentals of Reinforced Concrete Design*, Prentice Hall of India Private Limited, New Delhi.
3. Subramanian,N.,2013, *Design of Reinforced Concrete Structures*,Oxford University Press, New Delhi.
4. Krishnaraju.N 2015, *Design of Reinforced Concrete Structures*, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
5. Ramachandra, 2018, *Limit state Design of Concrete Structures*, Standard Book House, New Delhi

REFERENCES:

1. Jain, A.K., 1998, *Limit State Design of RC Structures*, Nemchand Publications, Roorkee.
2. Sinha, S.N., 2002, *Reinforced Concrete Design*, Tata McGraw Hill Publishing Company Ltd., New Delhi,
3. UnnikrishnaPillai, S., DevdasMenon., 2009, *Reinforced Concrete Design*, Tata McGraw Hill Publishing Company Ltd.
4. Punmia. B.C., Ashok Kumar Jain, Arun Kumar Jain, 2007, *Limit State Design of Reinforced Concrete*, Laxmi Publication Pvt. Ltd., New Delhi.
5. Bandyopadhyay. J.N. , 2008, *Design of Concrete Structures*, Prentice Hall of India Pvt. Ltd., New Delhi.
6. *IS456:2000, Code of practice for Plain and Reinforced Concrete*, Bureau of Indian Standards, New Delhi
7. *SP16, IS456:1978 Design Aids for Reinforced Concrete to Bureau of Indian Standards*, New Delhi
8. Shah V L Karve S R.,2013, *Limit State Theory and Design of Reinforced Concrete*, Structures Publications, Pune

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1501 - Design of Reinforced Cement Concrete Elements

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	L	L	L	-	M	H	M	L	L	M	-	L	L
CO2	H	M	L	L	-	H	H	H	M	M	H	-	L	L
CO3	H	M	L	L	-	H	H	H	M	M	H	-	L	L
CO4	H	M	L	L	-	H	H	H	M	M	H	-	L	L
CO5	H	M	L	L	-	H	H	H	M	M	H	-	L	L

H - High; M - Medium; L - Low

CE1502

FOUNDATION ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

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

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

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

UNIT II SHALLOW FOUNDATION 9

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 test) - 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 thickness for rigid behaviour - Applications - Compensated foundation - 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 - Cohesive - expansive - non expansive - Cohesionless soils - Codal provisions.

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's Graphical method - Pressure on the wall due to line load - Stability analysis of retaining walls - Codal provisions.

TOTAL: 45 PERIODS**TEXTBOOKS:**

1. Murthy, V.N.S., 2014 *Text book of Soil Mechanics and Foundation Engineering*, CBS Publishers Distribution Ltd., New Delhi..
2. Arora, K.R., 2017(Reprint) *Soil Mechanics and Foundation Engineering*, Standard Publishers and Distributors, New Delhi, 7th Edition.
3. Punmia, B.C., 16th Edition 2017 *Soil Mechanics and Foundations*, Laxmi Publications Pvt. Ltd. New Delhi.

REFERENCES:

1. Braja M Das, 2014, *Principles of Foundation Engineering* (Eighth edition), Cengage Learning.
2. Kaniraj, S.R. 2014, *Design aids in Soil Mechanics and Foundation Engineering*, Tata McGraw Hill publishing company Ltd., New Delhi.
3. Joseph E bowles, 5th Edition, 28th August 2015, *Foundation Analysis and design*, McGraw Hill Education,.
4. IS Code 6403 : 1981 (Reaffirmed 1997) - Bearing capacity of shallow foundation||, Bureau of Indian Standards, New Delhi.
5. IS Code 8009 (Part 1):1976 (Reaffirmed 1998) - Shallow foundations subjected to symmetrical static vertical loads||, Bureau of Indian Standards, New Delhi.
6. IS Code 8009 (Part 2):1980 (Reaffirmed 1995) - Deep foundations subjected to

- symmetrical static vertical loading||, Bureau of Indian Standards, NewDelhi.
7. IS Code 2911 (Part 1): 1979 (Reaffirmed 1997) – Concrete Piles|| Bureau of Indian Standards, NewDelhi.
 8. IS Code 2911 (Part 2): 1979 (Reaffirmed 1997) – Timber Piles||, Bureau of Indian Standards, NewDelhi.
 9. IS Code 2911 (Part 3) : 1979 (Reaffirmed 1997) – Under Reamed Piles||, Bureau of Indian Standards, NewDelhi.
 10. IS Code 2911 (Part 4) : 1979 (Reaffirmed 1997) – Load Test on Piles||, Bureau of Indian Standards, NewDelhi.
 11. IS Code 1904: 1986 (Reaffirmed 1995) – Design and Construction of Foundations in Soils||, Bureau of Indian Standards, NewDelhi.
 12. IS Code 2131: 1981 (Reaffirmed 1997) – Method for Standard Penetration test for Soils||, Bureau of Indian Standards, NewDelhi.
 13. IS Code 2132: 1986 (Reaffirmed 1997) – Code of Practice for thin - walled tube sampling for soils||, Bureau of Indian Standards, NewDelhi.
 14. IS Code 1892 (1979): Code of Practice for subsurface Investigation for Foundations. Bureau of Indian Standards, NewDelhi.
 15. IS Code 14458 (Part 1) : 1998 – Retaining Wall for Hill Area – Guidelines, Selection of Type of Wall|| , Bureau of Indian Standards, NewDelhi.
 16. IS Code 14458 (Part 2) : 1998 – Retaining Wall for Hill Area - Guidelines, Design of Retaining/Breast Walls|| , Bureau of Indian Standards, NewDelhi.
 17. IS Code 14458 (Part 3) : 1998 – Retaining Wall for Hill Area – Guidelines, Construction Of Dry Stone Walls|| , Bureau of Indian Standards, NewDelhi.

COURSE OUTCOMES

Upon successful completion of course the students will be able to

- CO1 Outline the appropriate site investigation techniques and suitable foundations.
- CO2 Demonstrate settlement and shear failure of shallow foundation.
- CO3 Choose safe dimensions for shallow footings.
- CO4 Summarize load carrying capacity and settlement of single and pile groups.
- CO5 Plan stability analysis of retaining walls

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES CE1502 – FOUNDATION ENGINEERING

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	M	L	M	L	M	M	M	-	-	-	-	M	M
CO2	M	M	M	M	M	M	M	M	-	-	-	-	M	M
CO3	M	M	M	L	L	M	M	M	-	-	-	-	M	M
CO4	H	H	M	M	L	M	H	H	-	-	-	-	H	H
CO5	M	M	M	M	M	M	M	M	-	-	-	-	M	M

H - High; M - Medium; L - Low

CE1503 STRUCTURAL ANALYSIS I

L	T	P	C
3	0	0	3

Course Objectives:

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

UNIT I STRAIN ENERGY METHOD 9

Determination of Static and Kinematic Indeterminacies – Analysis of continuous beams, plane frames and indeterminate plane trusses by strain energy method (up to two degree of redundancy).

UNIT II SLOPE DEFLECTION METHOD 9

Slope deflection equations - Equilibrium conditions - Analysis of continuous beams and rigid frames – Rigid frames with inclined members - Support settlements- symmetric frames with symmetric and skew-symmetric loadings. Comparison of analysis results with software (demo only).

UNIT III MOMENT DISTRIBUTION METHOD 9

Stiffness and carry over factors - Distribution and carryover of moments - Analysis of continuous Beams- Plane rigid frames with and without sway - Support settlement - symmetric frames with symmetric and skew-symmetric loadings.

UNIT IV FLEXIBILITY METHOD 9

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

UNIT V STIFFNESSMETHOD 9

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

TOTAL: 45 PERIODS**COURSE OUTCOMES**

Upon successful completion of course the students will be able to

- CO1 Analyze continuous beams, pin-jointed indeterminate plane frames and rigid plane frames by strain energy method
- CO2 Analyse the continuous beams and rigid frames by slope deflection method.
- CO3 Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.

- CO4 Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.
- CO5 Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

TEXTBOOKS:

1. Bhavikatti, S.S, Structural Analysis, Vol. 1, & 2, Vikas Publishing House Pvt. Ltd., New Delhi-4, 2014.
2. Bhavikatti, S.S, Matrix Method of Structural Analysis, I. K. International Publishing House Pvt. Ltd., New Delhi-4, 2014.
3. Vazrani. V.N And Ratwani, M.M, Analysis of Structures, Vol. II, Khanna Publishers, 2015.
4. Pandit G.S. and Gupta S.P., Structural Analysis - A Matrix Approach, Tata McGraw Hill Publishing Company Ltd., 2006

REFERENCES:

1. Punmia. B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2004.
2. William Weaver, Jrand James M. Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, Delhi, 1995
3. Hibbeler, R.C., Structural Analysis, VII Edition, Prentice Hall, 2012.
4. Reddy. C.S, Basic Structural Analysis, Tata McGraw Hill Publishing Company, 2005.
5. Rajasekaran. S, & G. Sankarasubramanian., Computational Structural Mechanics, PHI Learning Pvt. Ltd, 2015
6. Negi L.S. and Jangid R.S., Structural Analysis, Tata McGraw Hill Publishing Co. Ltd. 2004.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1503 – STRUCTURAL ANALYSIS I

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	H	H	H	H	H	-	-	-	-	-	-	L	M	M
CO2	H	H	H	H	H	-	-	-	-	-	-	L	M	M
CO3	H	H	H	H	H	-	-	-	-	-	-	L	M	M
CO4	H	H	H	H	H	-	-	-	-	-	-	L	M	M
CO5	H	H	H	H	H	-	-	-	-	-	-	L	M	M

H - High; M - Medium; L - Low

CE1504 WATER SUPPLY ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives:

- To equip the students with the principles and design of water treatment units and distribution system.

UNIT I SOURCES OF WATER**9**

Public water supply system - Planning, Objectives, Design period, Population forecasting; Water demand - Sources of water and their characteristics, Surface and Groundwater - Impounding Reservoir - Development and selection of source - Source Water quality - Characterization - Significance - Drinking Water quality standards.

UNIT II CONVEYANCE FROM THE SOURCE**9**

Water supply - intake structures - Functions; Pipes and conduits for water - Pipe materials - Hydraulics of flow in pipes - Transmission main design - Laying, jointing and testing of pipes - appurtenances - Types and capacity of pumps - Selection of pumps and pipe materials.

UNIT III WATER TREATMENT**9**

Objectives - Unit operations and processes - Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation - Clarifloccuator-Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - Residue Management -Construction, Operation and Maintenance aspects.

UNIT IV ADVANCED WATER TREATMENT**9**

Water softening - Desalination- R.O. Plant - demineralization - Adsorption - Ion exchange- Membrane Systems - RO Reject Management - Iron and Manganese removal - Defluoridation - Construction and Operation & Maintenance aspects - Recent advances - MBR process.

UNIT V WATER DISTRIBUTION AND SUPPLY**9**

Requirements of water distribution - Components - Selection of pipe material - Service reservoirs- Functions - Network design - Economics - Analysis of distribution networks -Computer applications - Appurtenances - Leak detection. Principles of design of water supply in buildings - House service connection - Fixtures and fittings, systems of plumbing and types of plumbing.

TOTAL: 45 PERIODS**COURSE OUTCOMES**

Upon successful completion of course the students will be able to

CO 1: Understand the structure of drinking water supply systems, including water transport, treatment and distribution

CO 2: Understand about principles of various unit operations and processes in water treatment

CO 3: Design the various functional units in water treatment

CO 4: Understand the water quality criteria and standards, and their relation to public health

CO 5: Design and evaluate water supply project alternatives on basis of chosen criteria.

TEXT BOOKS:

- 1.Garg, S.K. 2010, *Environmental Engineering*, Vol.I Khanna Publishers, New Delhi.
- 2.Modi, P.N., 2010, *Water Supply Engineering*, Vol.I Standard Book House, New Delhi.
- 3.Punmia, B.C., Ashok Jain and Arun Jain, 2014, *Water Supply Engineering*, Laxmi Publications (P) Ltd., New Delhi.

REFERENCES:

1. *Manual on Water Supply and Treatment*, 1999, CPHEEO, Ministry of Urban Development, Government of India, New Delhi.
2. Syed R. Qasim and Edward M. Motley Guang Zhu, 2009, *Water Works Engineering Planning, Design and Operation*, Prentice Hall of India Learning Private Limited, New Delhi, 2009.
3. Unnikrishna Pillai, S., Devdas Menon.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES**CE1504 – WATER SUPPLY ENGINEERING**

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	H	L	-	-	-	M	H	L	-	-	-	-	H	H
CO2	H	-	-	-	-	M	H	L	-	-	-	-	H	H
CO3	H	-	-	-	-	M	H	L	-	-	-	-	H	H
CO4	H	H	H	H	-	M	H	L	-	-	-	-	H	H
CO5	H	H	H	H	-	M	H	L	-	-	-	-	H	H

H - High; M - Medium; L - Low

CE1505 CONCRETE AND HIGHWAY ENGINEERING (THEORY CUM LABORATORY)

L	T	P	C
3	0	2	4

OBJECTIVE:

- To give an overview about the highway engineering with respect to, planning, design, construction and maintenance of highways as per IRC standards, specifications and methods.
- To learn the principles and procedures of testing Concrete and Highway materials and to get hands on experience by conducting the tests and evolving inferences.

UNIT I HIGHWAY PLANNING AND ALIGNMENT**9+6**

Significance of highway planning - Modal limitations towards sustainability - History of road development in India - factors influencing highway alignment - Soil suitability analysis - Road ecology - Engineering surveys for alignment, objectives, conventional and modern methods - Classification of highways - Locations and functions - Typical cross sections of Urban and Rural roads

2. Flexure test
3. Modulus of Elasticity

PART B

TEST ON AGGREGATES

1. Specific Gravity
2. Los Angeles Abrasion Test
3. Water Absorption of Aggregates

TEST ON BITUMEN

1. Specific Gravity of Bitumen
2. Penetration Test
3. Viscosity Test
4. Softening Point Test
5. Ductility Test

TESTS ON BITUMINOUS MIXES

1. Stripping Test
2. Determination of Binder Content
3. Marshall Stability and Flow Values

DEMONSTRATION OF ANY ONE FIELD TESTING EQUIPMENT LIKE SKID RESISTANCE TESTER/ BENKELMAN BEAM ETC

COURSE OUTCOMES

Upon successful completion of course the students will be able to

- CO1 Outline the principles of highway planning and alignment
- CO2 Explain the various geometric elements of Highways
- CO3 Make use of codes of practice for the design of flexible pavements
- CO4 Explain the design of rigid pavements and test on concrete
- CO5 Understand the concepts of test on highway materials, pavement evaluation and maintenance methods

TEXTBOOKS:

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A., 2014, *Highway Engineering*, Nemchand Publishers.
2. Subramanian K.P., 2010, *Highways, Railways, Airport and Harbour Engineering*, Scitech Publications (India), Chennai.
3. Kadiyali.L.R., 2013, *Principles and Practice of Highway Engineering*, Khanna Technical Publications, 8th edition Delhi.
4. Shetty,M.S., 2003 , *Concrete Technology*, S.Chand and Company Ltd, New Delhi.

5. Bhavikatti.S.S., 2015 ,*Concrete Technology*, I.K.International Publishing House Pvt. Ltd., New Delhi.

REFERENCES:

1. Yang H. Huang., 2012, *Pavement Analysis and Design*, Pearson Education Inc, Ninth Impression, South Asia.
2. Ian D. Walsh., 2011, *ICE manual of highway design and management*, ICE Publishers, 1st Edition, USA.
3. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski., 2011, *Principles of Highway Engineering and Traffic Analysis*, Wiley India Pvt. Ltd., New Delhi.
4. Garber and Hoel., 2010, *Principles of Traffic and Highway Engineering*, CENGAGE Learning, New Delhi.
5. O'Flaherty.C.A., 2006, *Highways*, Butterworth - Heinemann, Oxford.
6. Gambhir, M.L., 2007 ,*Concrete Technology*, 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi.
7. IS10262-2009., 1998, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi,.
8. IRC-37-2012,The Indian roads Congress, Guidelines for the Design of Flexible Pavements, New Delhi
9. IRC 58-2012. The Indian Road Congress, Guideline for the Design of Rigid Pavements for Highways, New Delhi
10. Highway Materials and Pavement Testing, 2009, Nem Chand and Bros., Roorkee, Revised Fifth Edition,
11. Methods for testing tar and bituminous materials, IS 1201-1978 to IS 1220-1978, Bureau of Indian Standards
12. Methods of test for aggregates, IS 2386 - 1978, Bureau of Indian Standards
13. Mix Design Methods Asphalt Institute Manual Series No. 2, Sixth Edition, 1997, Lexington, KY, USA.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1505 – CONCRETE AND HIGHWAY ENGINEERING (THEORY CUM LABORATORY)

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	M	L	M	M	M	M	M	-	-	-	-	M	M
CO2	H	M	M	L	L	M	H	H	-	-	-	-	H	H
CO3	H	M	L	M	L	L	H	H	-	-	-	-	H	H
CO4	M	M	H	-	M	M	L	-	M	L	-	-	-	L
CO5	M	M	M	L	L	L	L	L	-	-	-	-	H	M

H - High; M - Medium; L - Low

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- At the end of the semester, the student shall be able to verify the principles studied in theory by performing the experiments in lab.

LIST OF EXPERIMENTS**A. Flow Measurement**

1. Calibration of Rotameter
2. Calibration of Venturimeter / Orificemeter
3. Bernoulli's Experiment
4. Calibration of V notch

B. Losses in Pipes

5. Determination of friction factor in pipes
6. Determination of minor losses

C. Pumps

7. Characteristics of Centrifugal pumps
8. Characteristics of Gear pump
9. Characteristics of Submersible pump
10. Characteristics of Reciprocating pump

D. Turbines

11. Characteristics of Pelton wheel turbine
12. Characteristics of Francis turbine/Kaplan turbine

E. Determination of Metacentric height

13. Determination of Metacentric height of floating bodies

TOTAL: 60 PERIODS**COURSE OUTCOMES:**

Upon successful completion of course the students will be able to

- CO1 Experiment with techniques used to measure the flow of fluids
- CO2 Identify the various frictional losses in pipe flow
- CO3 Apply the concept to develop characteristics types of pumps

CO4 Apply the concept to develop characteristics types of turbines

CO5 Make use of the technique to determine meta centric height

REFERENCES:

1. Sarbjit Singh.2009,*Experiments in Fluid Mechanics*, Prentice Hall of India Pvt. Ltd, Learning Private Limited, Delhi.
2. 2004,*Hydraulic Laboratory Manual*, Centre for Water Resources, Anna University.
3. Modi P.N. & Seth S.M.2000, *Hydraulics and Fluid Mechanics*, Standard Book House, New Delhi.
- 4.Subramanya K.2001,*Flow in open channels*, Tata McGraw Hill Publishing.Company.

LIST OF EQUIPMENTS

1. One set up of Rotameter
2. One set up of Venturimeter/Orifice meter
3. One Bernoulli's Experiment set up
4. One set up of Centrifugal Pump
5. One set up of Gear Pump
6. One set up of Submersible pump
7. One set up of Reciprocating Pump
8. One set up of Pelton Wheel turbine
9. One set up of Francis turbines/one set of kaplon turbine
10. One set up of equipment for determination of Metacentric height of floating bodies
11. One set up for determination of friction factor in pipes
12. One set up for determination of minor losses.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1511 – HYDRAULIC ENGINEERING LABORATORY

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	M	-	-	-	M	L	M	M	-	-	-	-	L
CO2	M	H	-	-	-	H	L	M	M	-	-	-	-	L
CO3	M	M	-	-	-	M	M	M	M	-	-	-	-	M
CO4	M	H	--	-	-	M	M	M	M	-	-	-	-	M
CO5	M	M	-	-	-	L	L	M	L	-	-	-	-	L

H - High; M - Medium; L - Low

L	T	P	C
0	0	0	2

The objective of the survey camp is to enable the students to get practical training in the field work. Groups of not more than six members in a group will carry out each exercise in survey camp. The camp must involve work on a large area of not less than 40 acres outside the campus (Survey camp should not be conducted inside the campus). At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

Two weeks Survey Camp will be conducted during summer vacation in the following activities:

1. Traverse - using Total station
2. Contouring
 - (i). Radial tachometric contouring - Radial Line at Every 45 Degree and Length not less than 60 Meter on each Radial Line
 - (ii). Block Level/ By squares of size at least 100 Meter x 100 Meter at least 20 Meter interval
 - (III). L.S & C.S - Road and canal alignment for a Length of not less than 1 Kilo Meter at least L.S at Every 30M and C.S at every 90 M
3. Offset of Buildings and Plotting the Location
4. Sun observation to determine azimuth (guidelines to be given to the students)
5. Use of GPS to determine latitude and longitude and locate the survey camp location
6. Traversing using GPS
7. Curve setting by deflection angle
8. Introduction to geo informatics (Study)

Apart from above students may be given survey exercises in other area also based on site condition to give good exposure on survey.

COURSE OUTCOMES

Upon successful completion of course the students will be able to

CO 1 Examine the area of the field by using the principles of triangulation

CO 2 Examine the area of the field by using the principles of trilateration

CO 3 Take part in astronomical survey and calculate azimuth

CO 4 Construct a contour plan by the application of leveling

CO 5 Make use of advanced surveying equipment's like total station, GPS etc

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1521 – SURVEY CAMP

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	H	M	M	M	M	H	M	M	M	M	M	H	H	H
CO2	H	M	M	M	M	H	M	M	M	M	M	H	H	H
CO3	M	M	M	M	M	H	M	M	M	M	M	H	H	H
CO4	H	M	M	M	M	H	M	M	M	M	M	H	H	H
CO5	H	M	M	M	M	H	M	M	L	M	L	H	M	M

H - High; M - Medium; L - Low

HS1521 PROFESSIONAL COMMUNICATION

L	T	P	C
0	0	2	1

Course Objectives:

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I SOFT SKILLS

6

Introduction to Soft Skills- Hard skills & soft skills - employability and career Skills– Grooming as a professional with values–Time Management–General awareness of Current Affairs - Error Spotting.

UNIT II EFFECTIVE PRESENTATIONS

6

Self-Introduction-organizing the material - Introducing oneself to the audience - introducing the topic - answering questions with clarity and appropriate phrases - individual presentation practice– presenting the visuals effectively – 5 minute presentations

UNIT III GROUP DISCUSSION

6

Introduction to Group Discussion– Participating in group discussions - understanding group dynamics - brainstorming the topic -- questioning and clarifying -GD strategies- activities to improve GD skills

UNIT IV INTERVIEW ETIQUETTE**6**

Interview etiquette - dress code - body language - attending job interviews- telephone/skype interview -one to one interview &panel interview - FAQs related to job interviews

UNIT V CAREER PLAN**6**

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

TOTAL: 30 PERIODS**COURSE OUTCOMES**

Upon successful completion of course the students will be able to

- CO1 Apply hard and soft skills to enhance their employability
- CO2 Utilize adequate presentation skills to present a PPT
- CO3 Demonstrate the proper usage of grammar in GD
- CO4 Make use of the acquired skills while attending interviews
- CO5 Develop adequate Soft Skills required for the workplace

REFERENCES:

1. Butterfield, 2015 *Jeff Soft Skills for Everyone*. Cengage Learning: New Delhi.
2. E. Suresh Kumar et al., 2015 *Communication for Professional Success*. Orient Blackswan: Hyderabad
3. *Interact English Lab Manual for Undergraduate Students*,.Orient BalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma, 2014, *Professional Communication*. Oxford University Press: Oxford.
5. S. Hariharan et al. 2010, *Soft Skills*. MJP Publishers: Chennai.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES**HS1521 – PROFESSIONAL COMMUNICATION**

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	-	-	-	-	M	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	M	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	M	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	M	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	M	-	-	-	-

H - High; M - Medium; L - Low

L	T	P	C
3	0	0	3

Course Objectives:

- To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections. Design of structural systems such as roof trusses, gantry girders as per provisions of current code (IS 800 - 2007) of practice for working stress and Limit state Method.

UNIT I INTRODUCTION AND ALLOWABLE STRESS DESIGN**9**

Structural steel types – Mechanical Properties of structural steel- Indian structural steel products-Steps involved in the Design Process -Steel Structural systems and their Elements- -Type of Loads on Structures and Load combinations- Code of practices, Loading standards and Specifications - Concept of Allowable Stress Method, and Limit State Design Methods for Steel structures-Relative advantages and Limitations-Strengths and Serviceability Limit states.

Allowable stresses as per IS 800 section 11 -Concepts of Allowable stress design for bending and Shear -Check for Elastic deflection-Calculation of moment carrying capacity -Design of Laterally supported Solid Hot Rolled section beams-Allowable stress design of Angle Tension and Compression Members and estimation of axial load carrying capacity. Cold formed steel concept and pre Engineering building concepts

UNIT II CONNECTIONS IN STEEL STRUCTURES**9**

Type of Fasteners- Bolts Pins and welds- Types of simple bolted and welded connections Relative advantages and Limitations-Modes of failure-the concept of Shear lag-efficiency of joints- Axially loaded bolted connections for Plates and Angle Members using bearing type bolts -Prying forces and Hanger connection- Design of Slip critical connections with High strength Friction Grip bolts.- Design of joints for combined shear and Tension- Eccentrically Loaded Bolted Bracket Connections- Welds-symbols and specifications- Effective area of welds-Fillet and butt Welded connections-Axially Loaded connections for Plate and angle truss members and Eccentrically Loaded bracket connections..

UNIT III TENSION MEMBERS**9**

Tension Members - Types of Tension members and sections -Behaviour of Tension Members-modes of failure-Slenderness ratio- Net area – Net effective sections for Plates ,Angles and Tee in tension -Concepts of Shear Lag- Design of plate and angle tension members-design of built up tension Members-Connections in tension members - Use of lug angles - Design of tension splice.

UNIT IV COMPRESSION MEMBERS**9**

Types of compression members and sections-Behaviour and types of failures-Short and slender columns- Current code provisions for compression members- Effective Length, Slenderness ratio -Column formula and column curves- Design of single

section and compound Angles-Axially Loaded solid section Columns- Design of Built up Laced and Battened type columns – Design of column bases – Plate and Gusseted bases for Axially loaded columns- Splices for columns.

UNIT V DESIGN OF FLEXURAL MEMBERS

9

Types of steel Beam sections- Behaviour of Beams in flexure- Codal Provisions – Classification of cross sections- Flexural Strength and Lateral stability of Beams -Shear Strength-Web Buckling, Crippling and deflection of Beams- Design of laterally supported Beams- Design of solid rolled section Beams- Design of Plated beams with cover plates - Design Strength of Laterally unsupported Beams – Design of laterally unsupported rolled section Beams- Purlin in Roof Trusses-Design of Channel and I section Purlins.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of course the students will be able to

- CO1 Understand the concepts of various design philosophies of steel structural elements by allowable stress method.
- CO2 Solve the problems in design of common bolted and welded connections for steel structures.
- CO3 Solve the problems in design tension members and understand the effect of shear lag.
- CO4 Solve the problems in design of axially loaded columns and column base connections.
- CO5 Solve the problems in design of laterally restrained and unrestrained steel beams.

TEXT BOOKS:

1. Subramanian.N, 2013, *Design of Steel Structures*, Oxford University Press, New Delhi.
2. Gambhir. M.L., 2013, *Fundamentals of Structural Steel Design*, McGraw Hill Education India Pvt. Ltd.
3. Duggal. S.K , 2005, *Limit State Design of Steel Structures*, Tata McGraw Hill Publishing Company

REFERENCES:

1. Narayanan.R.et.al. ,2002, *Teaching Resource on Structural Steel Design*, INSDAG, Ministry of Steel Publications
2. Sai Ram. K.S., 2015, *Design of Steel Structures*, Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2nd Edition, www.pearsoned.co.in/kssairam
3. Shiyekar. M.R. , 2013, *Limit State Design in Structural Steel*, Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd Edition
4. Bhavikatti.S.S, 2009, *Design of Steel Structures*, By Limit State Method as per IS:800- 2007, IK International Publishing House Pvt. Ltd.
5. Shah.V.L. and Veena Gore, 2009, *Limit State Design of Steel Structures*, IS 800-2007, Structures Publications.
6. *IS800 :2007*, 2007, *General Construction in Steel - Code of Practice, (Third Revision)*, Bureau of Indian Standards, New Delhi,
7. *SP 6(1) Hand book on structural Steel Sections*

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1601 DESIGN OF STEEL STRUCTURAL ELEMENTS

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	L	L	L	-	M	H	M	L	L	M	-	L	L
CO2	M	M	L	L	-	H	H	H	M	M	H	-	L	L
CO3	H	M	L	L	-	H	H	H	M	M	H	-	L	L
CO4	H	M	L	L	-	H	H	H	M	M	H	-	L	L
CO5	H	M	L	L	-	H	H	H	M	M	H	-	L	L

H - High; M - Medium; L - Low

CE 1602

STRUCTURAL ANALYSIS II

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the method of drawing influence lines and its uses in various applications like beams and plane trusses.
- To analyse the arches, suspension bridges and space trusses
- Also to learn Plastic analysis of beams and rigid frames

UNIT I INFLUENCE LINES FOR DETERMINATE BEAMS 9

Influence lines for reactions in statically determinate beams - Influence lines for shear force and bending moment - Calculation of critical stress resultants due to concentrated and distributed moving loads - absolute maximum bending moment - influence lines for member forces in pin jointed plane frames.

UNIT II INFLUENCE LINES FOR INDETERMINATE BEAMS 9

Muller Breslau's principle- Influence line for Shearing force, Bending Moment and support reaction components of propped cantilever, continuous beams (Redundancy restricted to one), and fixed beams.

UNIT III ARCHES 9

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

UNIT IV CABLES AND SUSPENSION BRIDGES 9

Equilibrium of cable - length of cable - anchorage of suspension cables - stiffening girders - cables with three hinged stiffening girders - Influence lines for three hinged stiffening girders.

UNITV PLASTIC ANALYSIS**9**

Plastic theory - Statically indeterminate structures - Plastic moment of resistance - Plastic modulus - Shape factor - Load factor - Plastic hinge and mechanism - collapse load - Static and kinematic methods - Upper and lower bound theorems - Plastic analysis of indeterminate beams and frames.

TOTAL:45 PERIODS**OUTCOMES:**

Upon successful completion of course the students will be able to

CO 1 Outline influence lines for statically determinate structures

CO 2 Summarize influence lines for statically indeterminate beams.

CO 3 Illustrate bending moment and shear force diagrams for various types of arches.

CO 4 Solve suspension bridges with stiffened girders.

CO 5 Illustrate plastic analysis for beams and frames.

TEXTBOOKS:

1. Bhavikatti,S.S, , 2014,*Structural Analysis*,Vol.1 & 2, Vikas Publishing House Pvt.Ltd., NewDelhi-4.
2. Punmia.B.C,2004 Ashok Kumar Jain and Arun Kumar Jain, *Theory of structures*, Laxmi, Publications..
3. Vazrani.V.N And Ratwani,M.M, 2015*Analysis of Structures*, Vol.II, Khanna Publishers.

REFERENCES:

1. Negi.L.S and Jangid R.S.,2004,*Structural Analysis*, Tata McGraw-Hill Publishers,.
2. Reddy C.S.,2002,*Basic Structural Analysis*, Tata McGraw Hill Publishing Co.Ltd..
3. Gambhir.M.L., 2011,*Fundamentals of Structural Mechanics and Analysis*, PHIL earning Pvt. Ltd.,.
4. PrakashRao D.S.,1996,*Structural Analysis*, Universities Press.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES**CE 1602****-****STRUCTURAL ANALYSIS II**

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	H	H	H	H	H	-	-	-	-	-	-	L	M	M
CO2	H	H	H	H	H	-	-	-	-	-	-	L	M	M
CO3	H	H	H	H	H	-	-	-	-	-	-	L	M	M
CO4	H	H	H	H	H	-	-	-	-	-	-	L	M	M
CO5	H	H	H	H	H	-	-	-	-	-	-	L	M	M

H - High; M - Medium; L - Low

L	T	P	C
3	0	0	3

Course Objectives:

- The objectives of this course is to help students develop the ability to apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants.

UNIT I PLANNING AND DESIGN OF SEWERAGE SYSTEM 9

Characteristics and composition of sewage - population equivalent -Sanitary sewage flow estimation - Sewer materials - Hydraulics of flow in sanitary sewers - Sewer design - Storm drainage-Storm runoff estimation - sewer appurtenances - corrosion in sewers - prevention and control - sewage pumping-drainage in buildings-plumbing systems for drainage - Rain Water ting.

UNIT II PRIMARY TREATMENT OF SEWAGE 9

Objectives - Unit Operations and Processes - Selection of treatment processes -- Onsite sanitation - Septic tank- Grey water harvesting - Primary treatment - Principles, functions and design of sewage treatment units - screens - grit chamber-primary sedimentation tanks - Construction, Operation and Maintenance aspects.

UNIT III SECONDARY TREATMENT OF SEWAGE 9

Objectives - Selection of Treatment Methods - Principles, Functions, - Activated Sludge Process and Extended aeration systems -Trickling filters- Sequencing Batch Reactor(SBR) - Membrane Bioreactor - UASB - Waste Stabilization Ponds - - Other treatment methods -Reclamation and Reuse of sewage - Advanced Treatment Technologies Concept and Case studies - Ozonation, Electro coagulation, Fenton, Photo Fenton.

UNIT IV DISPOSAL OF SEWAGE 9

Standards for- Disposal - Methods - dilution - Mass balance principle - Self-purification of river- Oxygen sag curve - deoxygenation and reaeration - Streeter-Phelps model - Land disposal - Sewage farming - sodium hazards - Soil dispersion system.

UNIT V SLUDGE TREATMENT AND DISPOSAL 9

Objectives - Sludge characterization - Thickening - Design of gravity thickener- Sludge digestion- Standard rate and High-rate digester design- Biogas recovery - Sludge Conditioning and Dewatering - Sludge drying beds- ultimate residue disposal - recent advances.

TOTAL:45 PERIODS

COURSE OUTCOMES

Upon successful completion of course the students will be able to

CO 1 Apply the concept of sewage Collection, Conveyance along with the components like appurtenances, pumps & plumbing systems for Building.

CO 2 Solve the various Primary wastewater treatment units.

CO 3 Solve the Secondary and Advanced wastewater treatment units.

CO 4 Illustrate the disposal methods and standards for sewage.

CO 5 Outline treatments and disposal methods for sludge.

TEXT BOOKS:

1.Garg, S.K.,2015, *Environmental Engineering* Vol. II, Khanna Publishers, New Delhi.

2.Duggal K.N.,2014, *Elements of Environmental Engineering* S.Chand and Co. Ltd., New Delhi.

3.Punmia, B.C., Jain, A.K., and Jain.A.K.,2010,*Environmental Engineering*, Vol.II, Laxmi Publications.

REFERENCES:

1.*Manual on Sewerage and Sewage Treatment Systems*, 2013, Part A,B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi,

2.Metcalf and Eddy, 2010, *Wastewater Engineering*, Treatment and Reuse, TataMc.Graw-Hill Company, New Delhi.

3.Syed R. Qasim, 2010,*Wastewater Treatment Plants*, CRC Press, WashingtonD.C.

4.Gray N.F, 2006, *Water Technology*, Elsevier India Pvt. Ltd., New Delhi.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1603

WASTE WATER ENGINEERING

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	L	-	-	-	M	3	L	-	-	-	-	L	M
CO2	H	M	L	L	-	H	M	L	-	-	L	-	M	H
CO3	H	M	L	L	-	H	M	L	-	-	L	-	M	H
CO4	H	M	L	L	-	H	M	L	-	-	L	-	M	H
CO5	M	L	-	-	-	M	H	L	-	-	-	-	L	M

H - High; M - Medium; L - Low

CE1611

COMPUTER AIDED DESIGN AND DRAFTING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To acquire hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice.

LIST OF EXPERIMENTS:

1. Design and drawing of RCC cantilever and counter fort type retaining walls with reinforcement details.
2. Design of solid slab and RCC Tee beam bridges for IRC loading and reinforcement details.
3. Design and drafting of circular and rectangular RCC water tanks.(Elevated or underground in any one type to be adopted)
4. Design of Detailed Drawings of steel water tank(any 2 simple cross - section)
5. Analysis and Design of simple portal frame and truss using any open source analysis software.

TOTAL: 60 PERIODS

COURSE OUT COMES:

At the end of the course the student acquires hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice.

TEXT BOOKS:

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

REFERENCES:

1. Krishnamurthy, D.,2010, *Structural Design & Drawing – Vol. II and III*, CBS Publishers,.
2. Shah V L and Veena Gore,2009 *Limit State Design of Steel Structures*|| IS800-2007, Structures Publications.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of Equipment	Quantity
1.	Models of Structures	1 each
2.	Computers Pentium IV	30 Nos
3.	Analysis and Design Software - Minimum 5 use License	1 No

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1611 – COMPUTER AIDED DESIGN AND DRAFTING LABORATORY

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	H	M	M	L	-	M	-	L	L	-	-	L	M	M
CO2	H	M	M	L	-	M	-	L	L	-	-	L	M	M
CO3	H	M	M	L	-	M	-	L	L	-	-	L	M	M
CO4	H	M	M	L	-	M	-	L	L	-	-	L	M	M
CO5	H	M	M	L	-	M	-	L	L	-	-	L	M	M

H - High; M - Medium; L - Low

CE1612 WATER AND WASTE WATER ANALYSIS LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To analyse the physical, chemical and biological characteristics of water and wastewater
- To quantify the dosage requirement for coagulation process
- To study the growth of micro-organism and its quantification
- To quantify the sludge

Course Content:

1. Physical, Chemical and biological characteristics of water and wastewater
2. Jar test
3. Chlorine demand and residual test
4. Growth of micro-organism

COURSE OUTCOME:

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

- Quantify the pollutant concentration in water and wastewater
- Suggest the type of treatment required and amount of dosage required for the treatment
- Examine the conditions for the growth of micro-organisms

TOTAL: 60 PERIODS

List of Experiments:

1. Determination of pH, Turbidity and conductivity
2. Determination of Hardness
3. Determination of Alkalinity and Acidity
4. Determination of Chlorides
5. Determination of Phosphates and Sulphates
6. Determination of iron and fluoride
7. Determination of Optimum Coagulant dosage
8. Determination of residual chlorine and available chlorine in bleaching powder
9. Determination of Oil, and Grease

10. Determination of suspended, settleable, volatile and fixed solids
11. Determination Dissolved Oxygen and BOD for the given sample
12. Determination of COD for given sample
13. Determination of SVI of Biological sludge and microscopic examination
14. Determination of MPN index of given water sample
15. Reverse Osmosis process Unit. (Demo only)
16. Biological Wastewater Treatment (Demo only)

Course Outcome:

On successful completion of this course, the students will be able

- CO1 inspect the physical parameters of wastewater
- CO2 examine the coagulation and flocculation process
- CO3 test the organic materials in wastewater
- CO4 examine the inorganic ions in wastewater
- CO5 examine the Bacteriological characteristics of wastewater

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1612 – WATER AND WASTE WATER ANALYSIS LAB

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	H	H	M	-	-	M	H	-	H	-	-	-	-	M
CO2	H	H	M	-	-	M	H	-	H	-	-	-	-	M
CO3	H	H	M	-	-	M	H	-	H	-	-	-	-	M
CO4	H	H	M	-	-	M	H	-	H	-	-	-	-	M
CO5	H	H	M	-	-	M	H	-	H	-	-	-	-	M

H - High; M - Medium; L - Low

GE 1771

PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

(Common to all Branches of B.E / B.Tech Programmes)

OBJECTIVES:

- To give a basic idea about the need of management principles in all kinds of organization
- To understand the managerial functions like planning, organizing, staffing, Directing and controlling
- To gain some knowledge about different structures of organization
- To understand the role played by leader in different levels, and to understand the qualities, skills required for the leader while leading a team globally.
- To gain some knowledge about international management.

UNITI INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management - Nature, Scope and Functions of Management - Evolution of Management - Contributions of FW Taylor (14 principles of

Management), Henri Fayol, Elton Mayo, Roethlisberger, H.A.Simon and P.F Drucker- Management theories - Science or Art - Manager Vs Entrepreneur- types of managers, managerial roles and skills - Evolution of Management - Scientific, human relations , system and contingency approaches -Current trends and issues in Management.

UNITII PLANNING

9

Nature and purpose of planning – Planning process – Types of planning – Objectives - Setting objectives - Policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.

UNITIII ORGANISING

9

Nature and purpose - Formal and informal organization - Organization chart - Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority -Centralization and decentralization – Job Design - Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNITIV DIRECTING

9

Directing meaning-importance-principles of directing - Motivation - Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership - types and theories of leadership- Communication - Process of communication, types of communication and its uses – Barrier in communication - Effective Communication - Communication and IT.

UNITV CONTROLLING

9

System and process of controlling – Budgetary and non - Budgetary control techniques - Use of computers and IT in Management control - Productivity problems and management – Inventory Management – PERT, CPM – Application - Control and performance - Direct and preventive control.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the students will be able to

- CO1: Explain the trends and challenges of management in global scenario, the different types of organization and its effectiveness.
- CO2: Utilize the strategies and policies which are involved in planning, Steps involved in the process of planning and use it for decision.
- CO3: Identify the structure, purpose, selection and recruitment process in organizations.
- CO4: Explain the various motivational theories and processes of management including its functions.
- CO5: Compare and contrast the various control techniques.

TEXT BOOKS:

1. Harold Koontz and Heinz Weihrich –Essentials of Management, Tata McGraw Hill, 1998.
2. Stephen P. Robbins and Mary Coulter, –Management, Prentice Hall (India)Pvt.

Ltd., 10th Edition, 2009.

REFERENCES:

1. Robert Kreitner and Mamata Mohapatra, "Management", Biztantra, 2008.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, "Fundamentals of Management", Pearson Education, 7th Edition, 2011.
3. Tripathy PC and Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

GE1771 – PRINCIPLES OF MANAGEMENT

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	M	H	M	M	M	M	L	L	M
CO2	-	-	-	-	-	H	H	H	H	H	H	M	L	M
CO3	-	-	-	-	-	H	H	H	H	H	H	M	L	M
CO4	-	-	-	-	-	M	H	M	M	M	M	L	L	M
CO5	-	-	-	-	-	M	H	M	M	M	M	L	L	M

H - High; M - Medium; L - Low

CE1631 ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on Environmental management and Environmental Impact Assessment.

UNIT I INTRODUCTION

8

Impact of development projects – Sustainable development- Need for Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) - EIA capability and limitations – Legal provisions on EIA-Stages of EIA, Types of EIA - OSHA Standards, EIA 2020 Standards

UNIT II METHODOLOGIES

9

Methods of EIA - Check lists - Matrices - Networks - Cost-benefit analysis - Analysis of alternatives

UNIT III PREDICTION AND ASSESSMENT

9

Assessment of Impact on land, water, air, social & cultural activities and on flora & fauna- Mathematical models- Public participation

UNIT IV ENVIRONMENTAL MANAGEMENT PLAN**9**

Plan for mitigation of adverse impact on environment – Options for mitigation of impact on water, air, land and on flora & fauna - Addressing the issues related to the Project Affected People. Post project monitoring 71

UNIT V CASE STUDIES**10**

EIA for infrastructure projects - Dams - Highways - Multi-storey Buildings - Water Supply and Drainage Projects - Waste water treatment plants.

TOTAL: 45 PERIODS**OUTCOMES:**

The students completing the course will have ability to

CO1 Carry out scoping and screening of developmental projects for environmental and social assessments

CO2 Explain different methodologies for environmental impact prediction and assessment

CO3 Plan environmental impact assessments

CO4 Plan environmental management plans

CO5 Evaluate environmental impact assessment reports

TEXTBOOKS:

1. Canter, R.L. 1996, "Environmental Impact Assessment", McGraw Hill Inc., New Delhi. 2. Shukla, S.K. and Srivastava, P.R., 1992 "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi.

REFERENCES: 1. John G. Rau and David C Hooten 1990 "Environmental Impact Analysis Handbook", McGraw Hill Book Company.

2. Vol. I, II & III. The World Bank, Washington, D.C.1991. "Environmental Assessment Source book",

3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I & III", Blackwell Science, 1999

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES**CE1631 – ENVIRONMENTAL IMPACT ASSESSMENT**

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	H	M	H	M	H	H	H	L	M	M	L	H	L	H
CO2	H	H	H	H	H	H	M	L	M	M	L	M	M	M
CO3	H	M	H	M	M	H	M	L	L	M	L	M	M	M
CO4	H	M	H	H	H	H	H	L	M	L	L	M	L	H
CO5	H	M	H	H	H	H	H	-	M	L	L	M	L	L

H - High; M - Medium; L - Low

CE1632 CONSTRUCTION PLANNING AND SCHEDULING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To make the students to learn about planning of construction projects, scheduling procedures and techniques, cost and quality control projects and use of project information as decision making tool.

UNIT I CONSTRUCTION PLANNING 6

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

UNIT II SCHEDULING PROCEDURES AND TECHNIQUES 12

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 precedences -Use of Advanced Scheduling Techniques-Scheduling with uncertain durations- Crashing and time/cost tradeoffs - Improving the Scheduling process – Introduction to application software. Resource balancing and allocation – EVM.

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. Cost benefit ratio.

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 - Industrial Psychology.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of course the students will be able to

CO1: Outline the concept of construction planning and scheduling.

CO2: Apply the knowledge of scheduling activities of the project using different network diagrams such as CPM, PERT etc.,

CO3: Illustrate financial accounting system and to apply cost control mechanism to projects.

CO4: Infer quality and safety concerns in construction.

CO5: Outline the use data base management system to predict project information.

TEXTBOOKS:

1. Chitkara, K.K. 2009 *Construction Project Management Planning*, Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi,
2. Srinath, L.S. 2001, *Pert and CPM Principles and Applications*, Affiliated East West Press.

REFERENCES:

1. Chris Hendrickson and Tung Au, 2000 *Project Management for Construction Fundamentals Concepts for Owners*, Engineers, Architects and Builders, Prentice Hall, Pittsburgh.
2. Moder, J., Phillips, C. and Davis E, 1985 *Project Management with CPM*, PERT and Precedence Diagramming, Van Nostrand Reinhold Co., 3rd Edition.
3. Willis, E.M., 1986, *Scheduling Construction projects*, John Wiley and Sons.
4. Halpin, D.W., 1985, *Financial and Cost Concepts for Construction Management*, John Wiley and Sons, New York.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1632 – CONSTRUCTION PLANNING AND SCHEDULING

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	L	L	-	-	L	M	L	L	-	M	-	M	M
CO2	H	M	L	L	-	M	M	L	L	L	H	-	L	H
CO3	M	M	L	L	-	M	M	M	L	L	M	-	L	M
CO4	H	L	L	-	-	M	M	L	L	L	M	-	M	M
CO5	M	L	L	-	-	M	M	L	L	L	M	-	M	M

H - High; M - Medium; L - Low

CE1633 REMOTE SENSING TECHNIQUES AND GIS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the students to the basic concepts and principles of various components of remote sensing and its application in Civil Engineering
- To provide an exposure to GIS and its practical applications in civil engineering.

UNIT I EMR AND ITS INTERACTION WITH ATMOSPHERE & 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 - Airborne and spaceborne TIR and microwave sensors.

UNIT III IMAGE INTERPRETATION, ANALYSIS AND APPLICATION 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. Civil Engineering applications: highway and railway alignments, site selection for dams, town and regional planning

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 - Application of QGIS - 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 - Modeling in GIS Highway alignment studies - Land Information System.

TOTAL: 45 PERIODS

OUTCOMES:

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

- CO1 Understand the interaction of electromagnetic radiation with atmosphere and earth material
- CO2 Acquire knowledge about satellite orbits and remote sensors
- CO3 Gain knowledge about the concepts of interpretation of satellite imagery and civil engineering applications
- CO4 Understand the fundamentals of maps, their characteristics and GIS, its Components
- CO5 Apply various analysis tools for modeling applications

TEXTBOOKS:

1. Lillesand, T.M., Kiefer, R.W. and JW, C., 2004. *Remote Sensing and Image Interpretation*, New York: JohnWiley and Sons.
2. Anji Reddy, M., 2001. *Textbook of remote sensing and geographical information systems*, S. Publications, Hyderabad

REFERENCES:

1. Lo CP and AKW Yeung., 2002. *Concepts and Techniques of Geographic Information Systems*, Prentice-Hall of India Pvt. Ltd., New Delhi
2. Burrough, P.A., McDonnell, R., McDonnell, R.A. and Lloyd, C.D., 2015. *Principles of geographical information systems*.Oxford university press.
3. Ian, H., 2010. *An introduction to geographical information systems*, Pearson Education India.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1633 – REMOTE SENSING TECHNIQUES AND GIS

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	H	H	-	-	M	L	-	-	-	-	-	M	L	L
CO2	H	H	-	-	M	L	-	-	-	-	-	M	L	L
CO3	H	H	-	-	M	M	-	-	-	-	-	M	H	H
CO4	H	H	-	-	M	M	-	-	-	-	-	M	M	M
CO5	H	H	-	-	H	M	-	-	-	-	-	M	H	H

H - High; M - Medium; L - Low

L	T	P	C
3	0	0	3

Course Objectives:

- To study and understand the various safety concepts and requirements applied to construction projects.
- To study the construction accidents, safety programmes, contractual obligations, and design for safety.

UNIT I CONSTRUCTION ACCIDENTS 9

Accidents and their Causes - Human Factors in Construction Safety - Costs of Construction Injuries - Occupational and Safety Hazard Assessment - Legal Implications.

UNIT II SAFETY PROGRAMMES 9

Problem Areas in Construction Safety - Elements of an Effective Safety Programme - Job-Site Safety Assessment - Safety Meetings - Safety Incentives.

UNIT III CONTRACTUAL OBLIGATIONS 9

Safety in Construction Contracts - Substance Abuse - Safety Record Keeping.

UNIT IV DESIGNING FOR SAFETY MATERIALS 9

Safety Culture - Safe Workers - Safety and First Line Supervisors - Safety and Middle Managers - Top Management Practices, Company Activities and Safety - Safety Personnel - Sub contractual Obligation - Project Coordination and Safety Procedures - Workers Compensation.

UNIT V OWNERS' AND DESIGNERS' OUTLOOK 9

Owner's responsibility for safety - Owner preparedness - Role of designer in ensuring safety - Safety clause in design document.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of course the students will be able to

- CO1 Identify the causes of accidents and understand legal consequences.
- CO2 Identify problem Areas in construction and understand about safety. programmes like safety assessment, safety meeting, safety incentives.
- CO3 Outline the concept of contractual obligation regarding safety.
- CO4 Build some knowledge about designing for safety.
- CO5 Outline the concept of role of owners and designers in ensuring safety.

REFERENCES:

1. Jimmy W. Hinze, 1997, *Construction Safety*, Prentice Hall Inc.,.
2. Richard J. Coble, Jimmie Hinze and Theo C Haupt, 2001, *Construction Safety and Health Management*, Prentice Hall Inc.
3. 2001, *TamilNadu Factory Act*, Department of Inspectorate of factories, Tamil Nadu. Health Management, Prentice Hall Inc.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES**CE1634 – INDUSTRIAL SAFETY**

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	L	-	-	-	M	-	H	L	-	-	-	L	H
CO2	L	L	-	-	-	M	-	M	-	-	-	L	L	L
CO3	-	L	-	-	-	-	-	-	-	-	-	L	-	L
CO4	-	L	-	-	-	L	-	H	H	-	L	L	-	L
CO5	-	-	L	-	-	L	-	L	-	-	-	L	-	-

H - High; M - Medium; L - Low

CE1635 MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To acquire the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

UNIT I MAINTENANCE AND REPAIR STRATIGES**9**

Maintenance, Repair and Rehabilitation - Facets of Maintenance - Importance of Maintenance - Various aspects of Inspection - Assessment procedure for evaluating a damaged structure - causes of deterioration.

UNIT II STRENGTH AND DURABILITY OF CONCRETE**9**

Quality assurance for concrete - Strength, Durability, of concrete - Cracks, different types, causes - Effects due to climate, temperature, Sustained elevated, Corrosion - Effects of cover thickness.

UNIT III DIAGNOSIS OF DISTRESS

9

General causes and effects of failures of concrete structures and diagnosis of distress. NDT.

UNIT IV TECHNIQUES FOR REPAIR AND PROTECTION METHODS

9

Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.

UNIT V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES

9

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage and earthquake - Demolition techniques - Engineered demolition methods - Case studies on Ferro cement Jacketing/ Fibre reinforced concrete/for strengthening of RC structure.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of course the students will be able to

- CO1 Know the importance of inspection and maintenance.
- CO2 Study the Impacts of cracks, corrosion and climate on structures.
- CO3 Study the diagnosis of distress
- CO4 Understand the materials and techniques needed for repairs.
- CO5 Know the failures of the structures and demolition techniques.

TEXT BOOKS:

1. Shetty.M.S. *Jain A K., 2019, Concrete Technology - Theory and Practice*, S.Chand and Company, Eighth Edition.
2. B.Vidivelli, 2009, *Rehabilitation of Concrete Structures*, Standard Publishes Distribution. 1st edition.

REFERENCES:

1. Hand book on Seismic Retrofit of Buildings, 2008 CPWD and Indian Buildings Congress, Narosa Publishers.
2. Hand Book on *Repair and Rehabilitation of RCC Buildings* - 2002, Director General works CPWD, Govt of India, New Delhi.
3. P.C.Varghese, 2014, *Maintenance Repair and Rehabilitation & Minor works of building*, Prentice Hall India Pvt Ltd.
4. R. Dodge Woodson, 2012, *Concrete Structures, Protection, Repair and Rehabilitation*, Butterworth-Heinemann, Elsevier, New Delhi.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1635 – MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	L	M	-	-	-	H	L	L	M	L	M	M	M
CO2	M	H	M	-	-	L	M	M	L	M	M	L	M	M
CO3	M	M	M	H	M	M	M	M	L	M	-	L	L	M
CO4	M	M	M	L	-	M	M	L	L	-	M	L	L	M
CO5	H	H	M	M	M	M	L	M	L	M	-	L	L	M

H - High; M - Medium; L - Low

CE1636 RAILWAYS, AIRPORTS, DOCKS AND HARBOUR ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the students about Railways planning, design, construction and maintenance and planning design principles of airport and harbour

UNIT I RAILWAY PLANNING AND CONSTRUCTION

10

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

UNIT II RAILWAY CONSTRUCTION AND MAINTENANCE

8

Earthwork – Stabilization of track on poor soil - Track drainage – Calculation of Materials required for track laying - Construction and maintenance of tracks - Railway Station and yards and passenger amenities-Signalling

UNIT III AIRPORT PLANNING

7

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

UNIT IV AIRPORT DESIGN

10

Runway Design: Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design - Elements of Taxiway Design - Airport Zones - Passenger Facilities and Services - Runway and Taxiway Markings.

UNIT V HARBOUR ENGINEERING

10

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

TOTAL: 45 PERIODS

OUTCOMES:

Students who successfully complete this course will be able to:

CO1 Understand the methods of route alignment and design elements in Railway Planning and Constructions

CO2 Understand the Construction techniques and Maintenance of Track laying and Railway stations

CO3 Gain an insight on the planning and site selection of Airport Planning and design

CO4 Analyze and design the elements for orientation of runways and passenger facility systems

CO5 Understand the various features in Harbours and Ports, their construction, coastal protection works and coastal Regulations to be adopted

TEXTBOOKS:

1. Subramanian K.P.,2010. *Highways, Railways, Airport and Harbour Engineering*, V Scitech Publications (India), Chennai,
2. SaxenaSubhash, C.andSatyapalArora., 1998. *A Course in Railway Engineering*, DhanapatRai and Sons, Delhi
3. Khanna.S.K. Arora.M.G and Jain.S.S.,1994. *Airport Planning and Design*, Nemachand and Bros, Roorkee

REFERENCES:

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

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1636 – RAILWAYS, AIRPORTS, DOCKS AND HARBOUR ENGINEERING

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	H	M	M	L	L	L	L	L	-	-	-	-	H	M
CO2	H	L	L	L	L	L	M	L	-	-	-	-	H	M
CO3	H	M	L	L	M	L	M	M	-	-	-	-	H	M
CO4	H	L	M	M	M	L	M	L	-	-	-	-	H	M
CO5	H	L	L	L	L	L	M	M	-	-	-	-	H	M

H - High; M - Medium; L - Low

CE1637 AIR POLLUTION AND CONTROL ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.

UNIT I INTRODUCTION

7

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution - Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards.

UNIT II METEOROLOGY

6

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS

11

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle - Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS

11

Factors affecting Selection of Control Equipment - Working principle - absorption, Adsorption, condensation, Incineration, Bio filters - Process control and Monitoring.

UNIT V INDOOR AIR QUALITY MANAGEMENT

10

Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness- Sources and Effects of Noise Pollution - Measurement - Standards - Control and Preventive measures.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students completing the course will have

CO1 : Classify the air pollutants, their effects and to know about the ambient air quality and emission standards.

CO2 : Characterize the plume behaviour and dispersions.

CO3 : Select the methods of air pollution control for particulate contaminants.

CO4 : Select the methods of air pollution control for gaseous pollutants.

CO5 : Assess the indoor air quality and to know about the noise pollution, source, effect, control and preventive measures.

TEXTBOOKS:

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, 2004, *Air Pollution Control Engineering*, Tokyo, springer science + science media LLC.
2. Noel de Nevers, 2017, *Air Pollution Control Engineering*, Waveland press, Inc.
3. Anjaneyulu. Y, 2002, *Air Pollution and Control Technologies*, Allied Publishers (P) Ltd., India.

REFERENCES:

1. David H.F. Liu, Bela G. Liptak, 2000, *Air Pollution*, Lweis Publishers.
2. Arthur C. Stern, 2006, *Air Pollution (Vol.I – Vol.VIII)*, Academic Press.
3. Wayne T. Davis, 2000, *Air Pollution Engineering Manual*, John Wiley & Sons, Inc.
4. M.N Rao and HVN Rao, 2007, *Air Pollution*, Tata Mcgraw Hill Publishing Company limited.
5. C.S.Rao, 2006, *Environmental Pollution Control Engineering*, New Age International(P) Limited Publishers.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES**CE1637 – AIR POLLUTION AND CONTROL ENGINEERING**

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	L	L	L	L	-	M	H	-	-	-	-	-	L	M
CO2	L	M	L	-	L	M	H	-	-	L	-	L	M	M
CO3	L	L	H	L	M	H	H	-	-	L	M	L	H	H
CO4	L	M	M	M	L	M	M	-	-	-	M	M	M	M
CO5	L	-	L	-	L	M	M	-	-	-	-	-	L	L

H - High; M - Medium; L - Low

L	T	P	C
3	0	0	3

Course Objectives:

- The objective of the course is to train the students to have a comprehensive knowledge of planning, design, evaluation, construction and financing of housing projects. The course focuses on cost effective construction materials and methods. Emphasis is given on the principles of sustainable housing policies and programmes.

UNIT I INTRODUCTION TO HOUSING**10**

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

UNIT II HOUSING PROGRAMMES**10**

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

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS**9**

Formulation of Housing Projects – Land Use and Soil suitability analysis -Building Byelaws and Rules and Development Control Regulations - Site Analysis, Layout Design, Design of Housing Units (Design Problems) – Housing Project Formulation, case studies.

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS 8

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

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL**8**

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

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of course the students will be able to

CO1 : Outline national housing policies and basic infrastructure consideration

CO2 : Explain about various housing programs, town planning and role of Non-Government Organisations in slum housing

CO3 : Make use of building bye laws to prepare layout design and housing project formulation

CO4 : Classify the construction techniques and cost effective environment friendly materials.

CO5 : Explain about cash flow analysis and pricing of housing units.

TEXT BOOKS:

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

REFERENCES:

1. Wiley- Blackwell, 2012. *Neufert Architects*, Data, 4th Edition, Blackwell Publishing Ltd
2. Donald Watson and Michael J.Crosbie, 2011. *Time Saver Standards for Architectural Design*, 8th Edition, Tata McGraw Hill Edition
3. Walter Martin Hosack, 2010, *Land Development Calculations*, McGraw Hill 2nd Edition, USA 2010
4. *Development Control Rules for Chennai Metropolitan Area*, 2004. CMA, Chennai,
5. UNCHS, 1994. *National Experiences with Shelter Delivery for the Poorest Groups*, UNCHS Habitat, Nairobi,
6. Government of India,1994. *National Housing Policy*

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1638 – HOUSING PLANNING AND MANAGEMENT

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	L	-	-	-	-	M	M	-	-	-	-	-	-	-
CO2	L	-	-	-	-	M	M	-	-	-	-	-	-	-
CO3	L	-	-	-	-	M	M	-	-	-	-	-	-	M
CO4	L	-	-	-	-	M	M	-	-	-	-	-	-	M
CO5	L	-	-	-	-	M	M	-	-	-	-	-	-	M

H - High; M - Medium; L - Low

TEXTBOOKS:

1. Subramanya, K., 2013. Engineering Hydrology, 4e. Tata McGraw-Hill Education.
2. Raghunath, H.M., 2000. *Ground Water Hydrology*, Wiley Eastern Ltd.
3. Jayarami Reddy. P., 2008. *Hydrology*, Tata McGraw Hill.
4. Madan Mohan das and Mimi Das Saikia., 2013. *Hydrology*, Prentice Hall of India.

REFERENCES:

1. Chow, V.T. and Maidment D.R. , 2000. *Hydrology for Engineers*, McGraw-Hill Inc., Ltd.
2. Singh, V.P., 2000. *Hydrology*, McGraw Hill Inc., Ltd.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES**CE1639 – HYDROLOGY**

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	H	H	M	-	-	-	-	-	-	-	-	M	-	L
CO2	H	H	M	-	-	-	-	-	-	-	-	M	-	L
CO3	H	H	L	-	-	-	-	-	-	-	-	M	-	M
CO4	H	H	H	-	-	H	-	-	-	-	-	M	-	M
CO5	H	H	M	-	-	-	-	-	-	-	-	M	-	L

H - High; M - Medium; L - Low

CE1640 MUNICIPAL SOLID WASTE MANAGEMENT

L	T	P	C
3	0	0	3

Course Objectives:

To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

UNIT I SOURCES AND CHARACTERISTICS**9**

Sources and types of municipal solid wastes- Public health and environmental impacts of improper disposal of solid wastes- sampling and characterization of wastes - factors affecting waste generation rate and characteristics - Elements of integrated solid waste management – Requirements and salient features of Solid waste management rules (2016) -- Role of public and NGO"s- Public Private participation – Elements of Municipal Solid Waste Management Plan.

UNIT II SOURCE REDUCTION , WASTE STORAGE AND RECYCLING**8**

Waste Management Hierarchy - Reduction, Reuse and Recycling - source reduction of waste - On-site storage methods - Effect of storage, materials used for containers - segregation of solid wastes - Public health and economic aspects of open storage - case studies under Indian conditions – Recycling of Plastics and

Construction/Demolition wastes.

UNIT III COLLECTION AND TRANSFER OF WASTES

8

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

UNIT IV PROCESSING OF WASTES

12

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

UNIT V WASTE DISPOSAL

8

Land disposal of solid waste- Sanitary landfills - site selection, design and operation of sanitary landfills - Landfill liners - Management of leachate and landfill gas- Landfill bioreactor - Dumpsite Rehabilitation

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of course the students will be able to

- CO1 Understand the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.
- CO 2 Characterize, reduce, reuse and recycling of waste.
- CO3 Plan and design systems for storage, collection, transport, processing and disposal of municipal solid waste. . .
- CO4 Get the knowledge on the issues on solid waste management from an integrated and holistic perspective, as well as in the local and international context.
- CO5 Design and operation of sanitary landfill.

TEXTBOOKS:

1. William A. Worrell, P. AarneVesilind., 2012, *Solid Waste Engineering*, Cengage Learning.
2. John Pitchel., 2014, *Waste Management Practices-Municipal, Hazardous and industrial*, CRC Press, Taylor and Francis, New York.

REFERENCES:

1. CPHEEO., 2014, *Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation*, Government of India, New Delhi.
- 2 George Tchobanoglous and FrankKreith., 2002, *Handbook of Solid waste management*, McGraw Hill, New York.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1640 – MUNICIPAL SOLID WASTE MANAGEMENT

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	H	L	-	-	-	M	H	L	-	L	-	-	L	H
CO2	H	L	-	-	-	M	H	L	-	L	-	-	L	H
CO3	H	L	-	-	-	M	H	L	-	L	-	-	L	H
CO4	H	H	H	H	-	M	H	L	-	-	-	-	L	H
CO5	H	H	H	H	-	M	H	L	-	-	-	-	L	H

H - High; M - Medium; L - Low

CE1641 SOIL DYNAMICS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the basics of soil dynamics - dynamic behaviour of soils - effects of dynamic loads and the various design methods.

UNIT I THEORY OF VIBRATION

9

Introduction - Nature dynamic loads - Vibrations of single degree freedom system - Free vibrations of spring - mass systems - Forced vibrations - Viscous damping - Transmissibility - Principles of vibration measuring instruments - Effect of Transient and Pulsating loads.

UNIT II WAVE PROPAGATION

9

Elastic waves in rods of infinite length - Longitudinal and Torsional - Effect of end conditions - Longitudinal and torsional vibrations of rods of finite length - Wave Propagation in infinite, homogeneous isotropic and elastic medium - Wave propagation in elastic half space - Typical values of compress wave and shear wave velocity - Wave propagation due to Machine foundation - Surface wave - Typical values - Particle movements and velocity.

UNIT III DYNAMIC PROPERTIES OF SOILS

9

Dynamic stress - Strain characteristics - Principles of measuring dynamic properties - Laboratory Techniques - Field tests - Factors affecting dynamic properties - Typical values - Dynamic bearing capacity - Dynamic earth pressure.

UNIT IV FOUNDATION FOR DIFFERENT TYPES OF MACHINES

9

Types of machines and foundation - General requirements - Modes of vibration of a rigid foundation - Method of analysis - Linear elastic weightless spring method - Elastic half space method - Analog Method - Design of block foundation - Special

consideration for rotary, Impact type of machines - Codal Provisions.

UNIT V INFLUENCE OF VIBRATION AND REMEDIATION

9

Mechanism of Liquefaction - Influencing factors - Evaluation of Liquefaction potential based on SPT-Force Isolation - Motion Isolation - Use of spring and damping materials – Vibration control of existing machine foundation - Screening of vibration - Open trenches - Pile Barriers - Salient construction aspects of machine Foundations.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Understand the theory and measurement of vibration.

CO2 : Understand the concept of wave propagation in infinite medium and due to machine foundation.

CO3 : Get knowledge on dynamic properties of soils and laboratory and field testing.

CO4 : Design of foundation for different types of machines

CO5 : Understand liquefaction, motion isolation and vibration control.

TEXT BOOKS:

1. Swamisaran, 2016 , *Soil Dynamics and Machine Foundations*||, Galgotia Publications Pvt.Ltd. New Delhi-110002, 3rd Edition.
2. KameswaraRao., 2003, *Dynamics Soil Tests and Applications*||, Wheeler Publishing, New Delhi.
3. P. Srinivasulu, and C.V. Vaidyanathan, 2007, *Handbook of Machine Foundations*||, Tata McGraw-Hill.

REFERENCES:

1. KamaswaraRao., 1998, *Vibration Analysis and Foundation Dynamics*, Wheeler Publishing, New Delhi.
2. IS Code of Practice for Design and Construction of Machine Foundations, McGrew Hill, 1996.
3. Moore, P.J., 2005, *Analysis and Design of Foundation for Vibration*, Oxford and IBH.
4. Steven L. Kramer, 1996 *Geotechnical Earthquake Engineering*, Prentice Hall.
5. IS Code 5249: 1992 (Reaffirmed 2006) *Determination of Dynamic Properties of Soil – Method of Test*|| Bureau of Indian Standards, New Delhi.
6. IS Code 2974: (Part 1) 1982 (Reaffirmed 2008) *Code of Practice for Design and Construction of Machine Foundations - Foundation for Reciprocating Type Machines*|| Bureau of Indian Standards, New Delhi.
7. IS Code 2974: (Part 2) 1980 (Reaffirmed 2008) *Code of Practice for Design and Construction of Machine Foundations - Foundations for Impact Type Machines (Hammer Foundations)*|| Bureau of Indian Standards, New Delhi.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1641 – SOIL DYNAMICS

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	L	M	-	-	-	H	L	L	M	L	M	M	M
CO2	M	H	M	-	-	L	M	M	L	M	M	L	M	M
CO3	H	H	H	H	M	M	M	M	L	M	-	L	L	M
CO4	H	M	M	L	-	L	L	L	L	-	M	L	L	M
CO5	H	H	H	M	M	M	L	M	L	M	-	L	L	M

H - High; M - Medium; L - Low

CE1642 URBAN PLANNING AND DEVELOPMENT

L	T	P	C
3	0	0	3

Course Objectives:

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

UNIT I BASIC ISSUES

8

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

UNIT II PLANNING PROCESS

8

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

UNIT III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION 10

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

UNIT IV PLANNING AND DESIGN OF URBAN DEVELOPMENT PROJECTS 9

Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects, case studies

UNIT V LEGISLATION, DEVELOPMENT AND MANAGEMENT 10
OF URBAN SYSTEM

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

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of course the students will be able to

CO1 : Outline the concept of basic issues in urban planning

CO2 : Develop the skills necessary to formulate plans for urban and rural development

CO3 : Build some knowledge about plan and analysis socio economic aspects of urban and rural planning

CO4 : Apply the knowledge of design of urban development projects.

CO5 : Illustrate legalization, standards and regulation of urban planning

TEXT BOOKS:

1. Goel, S.L., 2002. *Urban Development and Management*, Deep and Deep publications, New Delhi
2. George Chadwick., 1978. *A Systems view of planning*, Pergamon press, Oxford
3. Singh V.B., 2001. *Revitalised Urban Administration in India*, Kalpaz publication, Delhi
4. Edwin S.Mills and Charles M.Becker., 1986.*Studies in Urban development*, A World Bank publication

REFERENCES:

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

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

CE1642 – URBAN PLANNING AND DEVELOPMENT

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	H	-	-	-	M	M	M	H	-	H	-	-	-	L
CO2	H	H	H	H	M	-	-	-	H	-	-	-	-	L
CO3	H	L	M	-	-	M		H	-	M	-	H	-	M
CO4	-	L	M	H	-	M	-	H	H	-	H	H	-	M
CO5		-	-	-	-		L	H	H	H	-	-	-	M

H - High; M - Medium; L - Low

OCE151 AIR POLLUTION AND CONTROL ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives:

- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends

UNIT I INTRODUCTION

7

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution - Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards.

UNIT II METEOROLOGY

6

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS

11

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle - Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS

11

Factors affecting Selection of Control Equipment - Working principle - absorption, Adsorption, condensation, Incineration, Bio filters - Process control and Monitoring

UNIT V INDOOR AIR QUALITY MANAGEMENT

10

Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness- Sources and Effects of Noise Pollution - Measurement - Standards - Control and Preventive measures.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of course the students will be able to

CO1 : Classify the air pollutants, their effects and to know about the ambient air quality and emission standards.

CO2 : Characterize the plume behaviour and dispersions.

CO3 : Select the methods of air pollution control for particulate contaminants.

CO4 : Select the methods of air pollution control for gaseous pollutants.

CO5 : Assess the indoor air quality and to know about the noise pollution, source, effect, control and preventive measures.

TEXT BOOKS:

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, 2004, *Air Pollution Control Engineering*, Tokyo, springer science + science media LLC.
2. Noel de Nevers, 2017, *Air Pollution Control Engineering*, Waveland press, Inc.
3. Anjaneyulu. Y, 2002, *Air Pollution and Control Technologies*, Allied Publishers (P) Ltd., India.

REFERENCES:

1. David H.F. Liu, Bela G. Liptak, , 2000, *Air Pollution*, Lweis Publishers.
2. Arthur C. Stern, 2006, *Air Pollution (Vol.I – Vol.VIII)*, Academic Press.
3. Wayne T.Davis, 2000, *Air Pollution Engineering Manual*, John Wiley & Sons, Inc.
4. M.N Rao and HVN Rao,,2007, *Air Pollution*, Tata Mcgraw Hill Publishing Company limited.
5. C.S.Rao, 2006, *Environmental Pollution Control Engineering*, New Age International(P) Limited Publishers.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

OCE151 AIR POLLUTION AND CONTROL ENGINEERING

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	L	L	L	L		M	H	-	-	-			L	M
CO2	L	M	L		L	M	H	-	-	L		L	M	M
CO3	L	L	H	L	M	H	H	-	-	L	M	L	H	H
CO4	L	M	M	M	L	M	M	-	-		M	M	M	M
CO5	L		L		L	M	M	-	-	-	-	-	L	L

H - High; M - Medium; L - Low

L	T	P	C
3	0	0	3

OBJECTIVE:

- To emphasize on the importance of environment and agriculture on changing global scenario and the emerging issues connected to it.

UNIT I ENVIRONMENTAL CONCERNS 8

Environmental basis for agriculture and food - Land use and landscape changes - Water quality issues - Changing social structure and economic focus - Globalization and its impacts - Agro ecosystems.

UNIT II ENVIRONMENTAL IMPACTS 9

Irrigation development and watersheds - mechanized agriculture and soil cover impacts - Erosion and problems of deposition in irrigation systems - Agricultural drainage and downstream impacts - Agriculture versus urban impacts.

UNIT III CLIMATE CHANGE 8

Global warming and changing environment - Ecosystem changes - Changing blue-green-grey water cycles - Water scarcity and water shortages - Desertification.

UNIT IV ECOLOGICAL DIVERSITY AND AGRICULTURE 10

Ecological diversity, wild life and agriculture - GM crops and their impacts on the environment - Insects and agriculture - Pollination crisis - Ecological farming principles - Forest fragmentation and agriculture - Agricultural biotechnology concerns.

UNIT V EMERGING ISSUES 10

Global environmental governance - alternate culture systems - Mega farms and vertical farms - Virtual water trade and its impacts on local environment - Agricultural environment policies and its impacts - Sustainable agriculture.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of course the students will be able to

- CO1 : Appreciate the role of environment in the current practice of agriculture and impacts of globalization.
- CO2 : Acquire knowledge about the environmental impacts in irrigation.
- CO3: Understand the context of climate change.
- CO4: Get knowledge on Ecological diversity, wild life and agriculture.
- CO5: Understand the context of emerging global issues and sustainable agriculture.

TEXTBOOKS:

- M.Lakshmi Narasaiah, 2006, *Environment and Agriculture*, Discovery Pub. House.
- Arvind Kumar, 2005, *Environment and Agriculture*, ABH Publications, New Delhi.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

OCE152

ENVIRONMENT AND AGRICULTURE

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	L	M	-	-	M	H	L	L	-	-	M	M	M
CO2	M	M	M	-	-	L	M	M	L	-	-	L	M	M
CO3	M	L	M	L	-	M	M	M	L	-	-	L	L	M
CO4	H	M	M	L	-	L	L	L	L	-	-	L	L	M
CO5	H	H	H	M	M	M	L	M	L	-	-	L	L	M

H - High; M - Medium; L - Low

OCE153

GEOGRAPHIC INFORMATION SYSTEM

OBJECTIVE:

L	T	P	C
3	0	0	3

- To introduce the students to the basic concepts and principles of various components of Geographic information system. To provide an exposure to GIS and its practical applications.

UNIT I FUNDAMENTALS OF GIS

9

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems - Definitions - History of GIS - Components of a GIS - Hardware, Software, Data, People, Methods - Proprietary and open source Software - Types of data - Spatial, Attribute data- types of attributes - scales/ levels of measurements.

UNIT II SPATIAL DATA MODELS

9

Database Structures - Relational, Object Oriented - Entities - ER diagram - data models - conceptual, logical and physical models - spatial data models - Raster Data Structures - Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models.

UNIT III DATA INPUT AND TOPOLOGY

9

Scanner - Raster Data Input - Raster Data File Formats - Georeferencing - Vector Data Input -Digitiser - Datum Projection and reprojection -Coordinate Transformation - Topology - Adjacency, connectivity and containment - Topological Consistency - Non topological file formats - Attribute Data linking - Linking External Databases - GPS Data Integration

UNIT IV DATA QUALITY AND STANDARDS

9

Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage - Metadata - GIS Standards - Interoperability - OGC - Spatial Data Infrastructure

UNIT V DATA MANAGEMENT AND OUTPUT

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: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of course the students will be able to

- CO1 Outline the principles of GIS
- CO2 Classify the types of data models
- CO3 Illustrate the data input formats and Topology details
- CO4 Describe the data quality standards
- CO5 Understand the data management concepts and data output

TEXT BOOKS:

1. Kang - Tsung Chang, 2011, *Introduction to Geographic Information Systems*, McGraw Hill Publishing, 2nd Edition,.
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, 2007, *An Introduction Geographical Information Systems*, Pearson Education, 2nd Edition.
3. Lillesand, T.M., Kiefer, R.W. and J.W. Chipman. 2004, *Remote Sensing and Image Interpretation*. V Edn. John Willey and Sons (Asia) Pvt. Ltd., New Delhi.
4. Lo. C.P. and A.K.W. Yeung, 2002, *Concepts and Techniques of Geographic Information Systems*, Prentice-Hall of India Pvt. Ltd., New Delhi.
5. Peter A. Burrough, Rachael A. McDonnell, 2000, *Principles of GIS*, Oxford University Press.

REFERENCES:

1. Lo.C.P., Albert K.W. Yeung, 2006, *Concepts and Techniques of Geographic Information Systems*, Prentice-Hall India Publishers.
2. Ian Heywood., 2000, *An Introduction to GIS*, Pearson Education Asia.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES**OCE153 GEOGRAPHIC INFORMATION SYSTEM**

Course Outcomes	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	M	L	-	-	-	-	M	-	-	-	L	M	M	L
CO2	M	L	M	-	M	M	-	-	-	-	-	M	M	M
CO3	M	L	-	-	-	M	L	-	-	-	-	-	-	L
CO4	M	M	-	-	-	M	-	-	-	-	-	H	M	M
CO5	M	M	-	-	-	M	M	-	-	-	-	M	H	M

H - High; M - Medium; L - Low