SEMESTER VII

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE 41001: DESIGN OF ADVANCED RCC STRUCTURES

CREDITS:

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	2	3	1	CW	END SEM	SW	END SEM	200
					30	70	40	60	

Pre-requisite: The candidate must know the basics of structural designing and should be familiar with Indian standard codes.

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:
To provide an overview of the building planning and its interior and exterior design aspects by considering the standard regulations and bye-laws. This subject helps the student to build up their knowledge in the field of infrastructure development.

COURSE OUTCOMES (CO):
Students should be able to:

1. Design tanks resting on the ground and underground, including circular and rectangular tanks, using IS 3370 and other methods.
2. Design overhead tanks and their structural components, considering the effects of continuity.
3. Design silos, bunkers, and chimneys in reinforced concrete and steel.
4. Analyze and design flat slabs using direct and equivalent frame methods.
5. Design grid slabs using approximate and exact methods.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	3	3	-	-	-	3
CO2	3	3	3	-	-	-	3	3	-	-	-	3
CO3	3	3	3	-	-	-	3	3	-	-	-	3
CO4	3	3	3	-	-	-	3	3	-	-	-	3
CO5	3	3	3	-	-	-	3	3	-	-	-	3
Target	3	3	3	-	-	-	3	3	-	-	-	3

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Theory:

Unit - 1

Tanks Resting on Ground and Underground: Classification of tanks. Design of Circular Cylindrical tanks with walls flexible at base and fixed at base. Rectangular Tanks with different Boundary Conditions using IS 3370 Tables, approximate method Carpenter's method and Raisonor's. Tank Resting on Ground, Underground and Over Head Tanks.

Unit - 2

Overhead Tanks: Overhead Circular and Rectangular Tanks. Intze Tank Membrane Analysis and design of Staging, Columns, Braces and Raft Foundations. Introduction to the effect of continuity in tank elements.

Unit - 3

Silos and Bunkers: Principles of Design of Bunkers, Silos, Chimneys in RCC and Steel.

Unit - 4

Flat Slab: Definition, types, Behaviour, Direct design method, Equivalent Frame Method.

Unit - 5

Grid Slab: types of R.C.C Grids, Behaviour, Design by approximate and exact methods.

Practical:

COURSE OUTCOMES (CO):
Students should be able to:

1. Design and produce detailed drawings for various water storage structures, including circular and rectangular tanks with different base conditions.
2. Develop proficiency in creating technical drawings and designs for specialized structures such as Intze tanks, bunkers, silos, and advanced slab systems.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	3	3	-	-	-	3
CO2	3	3	3	-	-	-	3	3	-	-	-	3
Target	3	3	3	-	-	-	3	3	-	-	-	3

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

List of experiments:

Preparation of drawing and design of following structures:

(1) Circular water tank flexible at base resting on ground.
(2) Circular water tank fixed at the base resting on ground.
(3) Rectangular water tank fixed at the base resting on ground.
(4) Rectangular underground water tank.
(5) Intze Water tank.
(6) R.C.C Bunker.
(7) Silo.
(8) Flat Slab.
(9) Grid Slab.

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

Semester-end:

Theory examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

Books & References Recommended:

1. Dayaratnam P., RCC Design by Limit State,Oxford &Ibh-Pubs CompAny-New Delhi Edition 4th
2. Sinha S.N., R.C.C. Design, Tata McGraw-Hill Education New Delhi Edition 3rd 2014
3. Syal & Goyal, Design of Reinforcement Concrete, S. Chand & Company New Delhi Edition 3 rd 2013
4. Vazirani & Ratwani, Design of R.C. Structures, Khanna Publishers New Delhi Edition 16th
5. Punmia B.C., R.C.C. Designs, Laxmi Publication New Delhi Edition 10th 2015.

Reference Books

1. Chandra R., Design of Steel Structures Vol. I.,Scientific Publishers Jodhpur (2012)
2. Krishna Raju N., R.C.C. Design,CBS Publisher New Delhi Edition 2nd
3. Park and Paulay, Design of R.C.C. Structures, Wiley publication New York 1975.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE41006: DESIGN OF HYDRAULIC STRUCTURES

CREDITS:

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
4	-	2	3	1	CW	END SEM	SW	END SEM	200
					30	70	40	60	

Pre-requisite: The candidate must know about different types of irrigation schemes & should know about the different types of hydraulic structure required to conceive an irrigation scheme starting from source to the agricultural fields.

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:
Develop comprehensive skills in designing, analyzing, and selecting appropriate hydraulic structures, including dams, energy dissipaters, spillways, gates, and cross drainage systems, with emphasis on stability, seepage analysis, and site suitability.

COURSE OUTCOMES (CO):
Students should be able to:

1. Analyze different types of hydraulic structures based on materials and the functions of each with the given site conditions.
2. Apply the theories of stability analysis of dam structures to ensure a safe and serviceable design for execution
3. Apply the theories of design of structures on pervious foundations and design the structures for safety and serviceability
4. Develop design aspects of canal regulation structures suitable for different conditions of materials, site conditions and hydraulic aspects of flow
5. Produce detailed drawings in executable form of the designed structures.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	-	-	-	3
CO2	3	2	2	3	-	-	-	3	-	-	-	3
CO3	3	2	3	3	-	-	-	3	-	-	-	3
CO4	3	3	3	3	-	-	-	3	-	-	-	3
CO5	3	-	2	-	-	-	-	3	-	-	-	3
Target	3	2	2.4	1.8	-	-	-	2.4	-	-	-	3

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Theory:

Unit - 1

Introduction : Introduction to different types of Structures used in Irrigation Schemes, their functions and necessity, viz. Gravity Dam, Earthen Dams, Arch Dams, Buttress Dams, Weirs, Barrages, Spillways, Head & Cross Regulators, Falls, C.D. Works, Outlets, Canals, etc.

Gravity Dams : Forces Acting and their determination, I.S. Load Combinations Modes of failure, Stability Analysis, Elementary Profile, Practical Profile, Design of High Gravity Dams.

Unit - 2

Earthen Dams: Suitability Of Foundation, Selection of Construction Materials, Design Criteria, Seepage Control and Foundation Treatment.

Unit - 3

Spillways: Types And their Suitability, Detailed Design of Ogee Spillway and Syphon Spillway, Design Considerations of Side Channels, Shafts and Chute Spillways.

Energy Dissipation Devices: Hydraulic Jump as Energy Dissipator, Design of Stilling Basins, Introduction to Bucket Type Dissipators.

Unit - 4

Structures on Pervious Foundations: Bligh's Creep Theory, Lane's Weighted Creep Theory, Khosla's Theory of Independent Variables, Jump Profiles, Determination of Uplift Pressures under Surface and Sub-surface Flows.

Weirs and Barrages: Detailed Design of Vertical Drop Weir and Barrage including Design of Floor for Surface and Sub-surface Flows.

Unit - 5

Canal Regulation Structures: Detailed Design of Falls, C.D. Works, Head and Cross Regulators, Channel Transitions.

Practical:

COURSE OUTCOMES (CO):
Students should be able to:

1. Apply digital tools to design water channels using Kennedy's and Lacey's theories.
2. Analyze and design gravity dams and earthen dams using spreadsheet software.
3. Develop skills in designing hydraulic structures including vertical drop weirs and barrages.
4. Calculate reservoir capacity and flood hydrographs using various methods.
5. Generate and manipulate unit hydrographs using different techniques including Snyder's method and S-curve technique.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	2	-	-	3	-	-	-	3
CO2	3	2	3	-	3	-	-	3	-	-	-	3
CO3	3	3	3	3	2	-	-	3	-	-	-	3
CO4	3	3	-	3	2	-	-	-	-	-	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	3
Target	3	2	1.8	1.2	1.8	-	-	1.8	-	-	-	3

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

List of experiments:

(1) Design of channel based on kennedy’s theory on M.S. Excel.
(2) Design of channel based on Lacey’s theory on M.S. Excel.
(3) Design of gravity dam:
  (a) Stability criteria on M.S. Excel.
  (b) Load calculation on M.S. Excel.
(4) Design of earthern dam on M.S. Excel.
(5) Design of vertical drop weir on M.S. Excel.
(6) Design of barrage on M.S. Excel.
(7) Design to determine reservoir capacity for given data.
(8) Determine ordinate of flood hydrograph by ordinate of unit hydrograph.
(9) Determination of synthetic unit hydrograph by snyder’s method. (10)Determination of unit hydrograph of some specific duration from given unithydrograph.
  (a) By method of superposition.
  (b) By method of S-curve technique

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

Semester-end:

Theory examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

Books & References Recommended:

1. Varshney R.S., Theory and Design of Irrigation Structures Vol. II.,Nem Chand &Brothers-Roorkee, 3rd Edition, 2015
2. Punmia B.C. &Pande, B.B. Lal, Irrigation Engg, Laxmi Publication 13th Edition, 2009.
3. Garg S.K., Irrigation Engg. & Hydraulic Structures, Khpub. Publication 5th Edition, 2010.

Reference Books

1. Sharma H.D., Concrete Dam, Central Board of Irrigation and Power., Indian Edition,2008
2. Varshney R.S, Concrete Dams,Oxford& IBH Pub. Co. 2nd Edition,2010
3. Varshney R.S., Hydro Power Structures, Nem Chand & Brothers-Roorkee, 5thEdition, 2009

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE: 41007: GEOTECHNICAL ENGINEERING – II

CREDITS:

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	2	3	1	CW	END SEM	SW	END SEM	200
					30	70	40	60	

Pre-requisite: Geotechnical engineering-I

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:
Develop proficiency in analyzing earth structures, evaluating soil strength and bearing capacity, designing foundations, and conducting soil investigations for civil engineering projects.

COURSE OUTCOMES (CO):
Students should be able to:

1. Analyse earth retaining structures in various types of soil medium.
2. Estimate appropriate soil strength parameters with respect to the drainage conditions
3. Analyze the bearing capacity of soil by IS code methods.
4. Evaluate solutions for shallow and deep foundations for various structures.
5. Discuss the importance of soil investigation for any civil engineering construction.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	-	-	-	-	-	-	-	-	3
CO3	3	3	-	2	-	-	-	3	-	-	-	3
CO4	3	3	-	-	-	-	-	-	-	-	-	3
CO5	3	-	-	-	-	-	3	-	-	-	-	3
Target	3	3	-	0.4	-	-	0.6	0.6	-	-	-	3

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:
Theory:

Unit - 1

Introduction to earth pressure: Active, Passive and earth pressure at rest. Rankines and coulombs theory of earth pressure. Graphical method of determination of earth pressure.

Unit - 2

Shear Strength of Soil, Mohr Columbs Theory, Mohr's Stress Circles, Different types of Shear Test namely, Direct Shear Test, Unconfined Compression Test, Tri Axial Compression Test & Vane Shear Test. Stability of slopes –different methods of stability analysis

Unit - 3

Introduction to bearing capacity and different related terms. Different modes of soil failure. Derivation of Terzaghi's equation of bearing capacity. Effect of eccentricity of load and change in water table. I.S. code method for determination of bearing capacity.
Introduction to settlement analysis. Different time fitting methods and time settlement curves

Unit - 4

Shallow and deep foundation: Requirement of satisfactory foundation. Different types of shallow and deep foundations and their suitability.
Pile foundation: Different types of piles. Group action and negative skin friction, load carrying capacity of pile using different formulae. Pile load test.
Well Foundation: Introduction and different types of well foundation.

Unit - 5

Introduction to geotechnical investigation. Various methods of soil exploration. SPT, DCPT, Plate load test. Introduction to Rock Mechanics, core Recovery, Rock Quality designation, joint, fracture R.M.R, Unconfined compression strength, point load index.

Practical:

COURSE OUTCOMES (CO):
Students should be able to:

1. Conduct laboratory tests to determine soil strength parameters and interpret the results for engineering applications.
2. Perform field tests and sampling techniques to assess soil properties and site conditions for geotechnical investigations.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	3	-	-	-	-	2	2	-	2
CO2	3	3	-	3	-	-	2	-	2	2	-	2
Target	3	3	-	3	-	-	1	-	2	2	-	2

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

List of Experiments:

1. Determination of CBR of soil under (a) unsoaked condition (b) soaked condition.
2. Determination of swelling pressure of soil.
3. Determination of shear parameters of soil by Direct shear test.
4. Determination unconfined compressive strength and shear parameters of soil.
5. Determination of shear strength of soil by vane shear test.
6. determination of shear parameters of soil by triaxial compaction test in :

a. Unconsolidated undrained conditions i.e. UU test.
b. Consolidated undrained conditions i.e. CU test.
c. Consolidated drained conditions i.e. CD test.

7. Determination of parameters of consolidation-by-consolidation test.
8. Determination of undisturbed sampling.
9. Determination of standard penetration test.
10. Determination of dynamic cone penetration test.
11. Determination of plate load and pile load and pile load test.

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of calculations & drawing sheets, internal submission and Viva Voice examination by internal examiner

Semester-end:

Theory examination of 3 Hours duration and Practical Viva Voice Examination by external examiner

Books & References Recommended:

1. Punmia B.C., A., Soil Mechanics and Foundation, Saurabh & Co. (P) Ltd... Madras, 2017 (16thedition)
2. Bowles J.E.., Foundation Analysis & Design, McGraw-Hill Publishing Co., 2012 (5thedition)
3. Gopal Ranjan & Rao, Basic & Applied Soil Mechanics, New Age International. 2016 (3rdedition)
4. Alam Singh, Modern Geotechnical Engineering, CBS Publisher. 2012 (3rdedition)
5. S.K. Garg, Geotechnical Engineering, Phi Learning Pvt. Ltd-New Delhi. 2016 (10)

ELECTIVE III

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE 41281: ADVANCED ANALYSIS OF STRUCTURES

CREDITS:

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

Pre-requisite: Structure Analysis I

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:
1. To know the concepts of flexibility and stiffness methods for structural analysis
2. To study the truss, beam and multi storey frames subjected to gravity loads and lateral loads
3. To know Tension coefficient method for analysis of pin jointed structural frames
4. To know the basics of finite element modelling of structures.

COURSE OUTCOMES (CO):
Students should be able to:

1. Apply matrix flexibility method to analyze structural systems.
2. Analyze structures using flexibility method, considering various factors.
3. Implement matrix stiffness method for structural evaluation.
4. Apply stiffness method to complex structural problems.
5. Utilize tension coefficient method and introduce finite element method.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	3	-	-	-	-	-	-	-	3
CO3	3	3	-	3	-	-	-	-	-	-	-	3
CO4	3	3	-	3	-	-	-	-	-	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	-	3
Target	3	2.4	-	1.8	-	-	-	-	-	-	-	3

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Theory:

Unit - 1

MATRIX METHOD (FLEXIBILITY METHOD): Force methods. Basic concepts, evaluation of flexibility coefficients, flexibility transformations. Analysis of a single member of different types. Transformation of single member.

Unit - 2

Applications to plane and space structures with pin joints and rigid joints. Energy approach in flexibility method., Effect of support displacements and transformation.

Unit - 3

MATRIX METHOD (STIFFNESS METHOD): Displacement methods, Basic concepts, Evaluation of stiffness coefficients, Direct stiffness method. Energy approach in stiffness method. Code No. approach for global stiffness matrix. Effect of support displacement and temperature.

Unit - 4

Symmetrical & antisymmetric problems. Stiffness of plane & space frames. Solution of problems. Comparison of force and displacement methods of solution.

Unit - 5

SPACE FRAME: Tension coefficient method for analysis of pin jointed structural frames. Applications and different types of space truss.Introduction to "Finite element method"

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required,

Semester-end:

Theory examination of 3 Hours duration

Books & References Recommended:

1. Basic Structural Analysis by C.S.Reddy – (TMH Publisher)
2. Matrix Analysis of Framed Structures by William Wearer Jr. & James M.Gere (CBS Publisher

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE41283: ADVANCED GEOLOGY & ROCK MECHANICS

CREDITS:

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

Pre-requisite: Geology

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:
Develop comprehensive skills in subsurface exploration, rock mechanics, and geological engineering applications for effective analysis and utilization of rock in civil engineering projects.

COURSE OUTCOMES (CO):
Students should be able to:

1. Apply subsurface exploratory methods and geophysical techniques.
2. Analyze rock properties' influence on groundwater and conduct surveys.
3. Evaluate rocks as construction materials for various civil engineering applications.
4. Classify tunnels, assess stability factors, and investigate landslide prevention.
5. Analyze rock mechanical properties and perform relevant laboratory tests.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	3	-	2	-	-	-	-	-	2
CO2	3	-	-	3	-	2	-	-	-	-	-	2
CO3	3	-	-	3	-	2	-	-	-	-	-	2
CO4	3	-	-	3	-	2	-	-	-	-	-	2
CO5	3	-	-	3	-	2	-	-	-	-	-	2
Target	3	-	-	1.8	-	-	-	-	-	-	-	2

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Theory:

Unit - 1

Preliminary And Exploration Work: Subsurface Exploratory Work, Test borings, test drillings and collection of core samples, geophysical exploration, seismic methods, gravity methods, magnetic methods, electrical methods.

Unit - 2

Ground Water: Influence Of Nature Of Rocks, porosity, permeability and influence of geological structures, springs artesian water, movement of ground water, ground water surveys, fluctuation of water table.

Unit - 3

Engineering Geology: Rocks As Construction Material, EngineeringProportions of Rocks

Unit - 4

Tunnels: Classification, Terminology, Ground supports, influence of rocks stratification on tunnel lining, water and moisture in tunnels, geological survey prior to tunneling.

Land Slides: Causes, Types and Prevention. Geological Investigation for Bridge Foundation, Dams, Reservoir and Buildings.

Unit - 5

Rock Mechanics: Rock Classification, Engineering Classification of intact rocks, rock quality designation, mechanical properties of rocks, tensile, compressive, shear strength, hardness, brittle failure of rock, stress deformation characteristics of rock masses, deformation modules and elastic constants laboratory tests on rock spacing, point load index test, high pressure permeability

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required,

Semester-end:

Theory examination of 3 Hours duration

Books & References Recommended:

1. Legget E., Geology for Civil Engineers.
2. William Todd, Ground Water Geology.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE41285: TRANSPORTATION PLANNING

CREDITS:

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

Pre-requisite: Transportation Engineering (CE 31004).

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:

1. Understanding the system approaches of planning
2. Understanding the transportation demand of an individual and a city
3. Applying the statistical techniques for transportation system analysis
4. Analyzing the alternatives solutions of transportation problems
5. Applying the economic impacts of transportation planning

COURSE OUTCOMES (CO):
Students should be able to:

1. Demonstrate knowledge of transportation planning and its processes.
2. Analyze travel demand and trip generation-distribution patterns.
3. Evaluate modal choices for urban transportation systems.
4. Apply trip assignment techniques for various routes within a zone.
5. Implement economic principles in transportation facility design and management.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	2	-	-	-	-	-	-	-	-	2
CO3	3	-	-	-	-	-	-	-	-	-	-	2
CO4	3	-	-	-	-	-	-	-	-	-	-	2
CO5	3	-	-	-	-	2	-	-	-	-	-	2
Target	3	-	0.4	-	-	0.4	-	-	-	-	-	2

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Theory:

Unit - 1

Transportation Planning System –Urban transportation planning concepts-systems approach to the planning process. Urban travel and transportation systems characteristics. Transport behaviour of individuals and households, Transportation planning surveys. Transport related land use models.

Unit - 2

Trip Generation –Trip generation modelling-variables; influencing trip generation, Regression analysis and category analysis.

Unit - 3

Trip Distribution –Trip distribution modelling-- factors governing trip distribution, growth--factor methods and gravity models, calibration of gravity models.

Unit - 4

Modal Split and Route Assignment –Modal split modelling-factors influencing mode choice, discrete choice models, Route assignment- traffic assignment techniques.

Unit - 5

Transportation Economics and Urban Freight Transportation –Economic and financial evaluation techniques, selection of project. Introduction to urban freight transportation and urban mass transportation and urban mass transportation systems, urban structure, urban goods transport.

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required,

Semester-end:

Theory examination of 3 Hours duration

Books & References Recommended:

1. Kadialy L.R.," Traffic Engg. and Transport Planning", 8thedition, Khanna Publishers, 2011.
2. Partha chakrobarty & Animesh Das "Principles of Transportation Engineering"
3. Subhash C Saxena "textbook of Highway and traffic engineering" CBS publishers and distributions pvt. Ltd.
4. Paul H. Wright and Norman J. Ashford, "Transportation Egg. Planning and Design",4thedition, 1998.
5. O. Flaherty C.A., "Traffic Engineering and Transport Planning", 2006."
6. C. Jotin Khisty & B. Kent Lall "Transportation Engineering An Introduction"

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE : PLANNING AND MANAGEMENT OF WATER RESOURCES

CREDITS:

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

Pre-requisite: Water resources

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:

1. To understand the various factors and importance of water resources planning and system.
2. Application of different types of models in water resources system.
3. Use of optimization methods and economic considerations in the system and application of modelling in the river basin planning

COURSE OUTCOMES (CO):
Students should be able to:

1. To explain the complex interaction and integration of different components of water resources systems related to natural processes, economics, and environmental values.
2. To identify and assess risks and estimate reliability of predictions.
3. To apply modelling techniques and simulation or optimization for the outcomes.
4. To develop the ability to create, defining and select best solution from a suitable set of efficient alternatives solutions to water resources related engineering problems.
5. To evaluate economic consideration for water resources systems.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	3	-	-	-	-	-	-	-	2
CO3	3	-	-	3	3	-	-	-	-	-	-	2
CO4	3	-	-	3	-	-	-	-	-	-	-	2
CO5	3	-	-	-	-	-	-	-	-	-	-	2
Target	3	-	-	1.8	0.6	-	-	-	-	-	-	2

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Theory:

Unit - 1

Introduction and Basic Concepts- Introduction, issues and factors in water resources planning, why plan and why manage, systems components, Planning Scales and Sustainability, Planning and Management,

Unit - 2

Water Resource Systems Modelling: Its Role in Planning and Management, Modelling of Water Resources Systems, Challenges in Water Resources Systems Modelling, Developments in Modelling, Modelling Methods for Evaluating Alternatives, Plan Formulation and Selection, Simulation or Optimization, Model Development, Issues of Scale

Unit - 3

Optimization Methods, Non-linear Optimization Models and Solution Procedures, Dynamic Programming, Linear Programming, Fuzzy Optimization, Data-Based Models, meta-heuristic models for optimization

Unit - 4

Economic considerations in water resources systems, Comparing Time Streams of Economic Benefits and Costs, Interest Rates, Discount factors, Equivalent Present Value, Equivalent Annual Value, amortization, comparison of alternate plans, economic analysis, Market demands and supply, aggregation of demands, Conditions of project optimality, benefit cost analysis,

Unit - 5

Multi objective planning and management, non-inferior solutions, plan formulation, plan selection, concepts in Probability, Statistics and Stochastic Modelling, Modelling Uncertainty,introduction to River Basin Planning Models

Practicals:

List of experiments:

1. Study of WEAP software using example.
2. FORTRAN programming for Linear programming in reservoirs.

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required,

Semester-end:

Theory examination of 3 Hours duration

Books & References Recommended:

1. Water Resources Systems Planning and Management, An Introduction to Methods, Models and Applications, Daniel P. Loucks and Eelco van Beek with contributions from Jery R. Stedinger, Jozef P.M. Dijkman, Monique T. Villars, Studies and Reports in Hydrology UNESCO
2. Water Resources Systems, Modelling Techniques and Analysis, S. Vedula and P.P. Mujumdar, Tata Mcgraw-Hill, New Delhi

ELECTIVE IV

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE41312: BRIDGE ENGINEERING

CREDITS:

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

Pre-requisite: Strength of Material, Structural Mechanics, Structural Analysis and design.

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:

At the end of the course students should be able to design & detail, sub and super structures of different types of RCC and steel bridges, selection of appropriate bridge structures and design it for given site conditions.

COURSE OUTCOMES (CO):
Students should be able to:

1. Apply IRC specifications for bridge planning, analysis, and design, including site selection and investigation.
2. Compare highway and railway bridges across various construction materials.
3. Design concrete and composite bridges, selecting appropriate bearings and expansion joints.
4. Analyze and design bridge substructures including piers, abutments, and foundations.
5. Evaluate bridge construction techniques, maintenance, and design steel bridges for railway loads.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	3	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	3	-	-	3	-	-	-	-	-	3
CO4	3	3	3	-	-	3	-	-	-	-	-	3
CO5	3	3	3	-	-	3	-	-	-	-	-	3
Target	3	1.8	2.4	-	-	2.4	-	-	-	-	-	3

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Theory:

Unit - 1

Investigation and site selection, Hydraulic factors, Alignment, traffic aspects, Type of bridges; IRC Loading, General design consideration.

Unit - 2

Highway and railway bridges in masonry, Reinforced concrete, pre-stressed concrete and steel bridges.

Unit - 3

Design of RC Slab bridge, Girder bridge, Bearings and expansion joints for RCC structures, Plate girder and composite bridges.

Unit - 4

Types of bridge piers, Abutments and foundations, Design of solid pier, Abutment and well & pile foundation.

Unit - 5

Construction techniques and maintenance of bridges, (OR steel bridges subjected to railway loading, Truss bridges, Girder bridges, Design of rocker and roller bearing).

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required,

Semester-end:

Theory examination of 3 Hours duration

Books & References Recommended:

1. D. Johnson Victor, Essentials of Bridge Engineering.
2. Aswani M.G., Vazirani V.N., Ratwani M.M., Design of Concrete Bridges. 3.Ratwani M.M., Steel Structures Vol. III.

Reference Books

1. Ponnuswamy S., Bridge Engineering.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE: ADVANCE CONSTRUCTION PLANNING AND MANAGEMENT

CREDITS:

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

Pre-requisite: Strength of Material, Structural Mechanics, Structural Analysis and design.

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:

1. Introduce the basic concepts and principles of construction, planning and management.
2. Explain the importance of resource management in enhancing the project output.
3. Study about Indian contract act, contract procedure and its documentation.
4. Learn the basic concept of financial management and estimation of project.
5. Gain the knowledge of organization's working procedures and organizational developments and group decision making.

COURSE OUTCOMES (CO):
Students should be able to:

1. Discuss and explain the planning and management principles in construction projects.
2. Demonstrate the techniques of resource management for optimizing the time & cost of project.
3. Develop the contract documentation and explain different acts related to contracts and arbitration.
4. Generate the estimation for different construction projects and evaluate budget for various construction projects.
5. Develop the organization's working procedures and group decision making ability.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	3	-	-	-	-	3	2
CO2	3	2	-	-	-	-	-	-	-	-	3	2
CO3	3	-	3	-	-	3	-	-	-	-	-	2
CO4	3	2	-	-	-	3	-	-	-	-	-	2
CO5	3	-	3	-	-	3	-	-	3	3	-	2
Target	3	0.8	1.2	-	-	2.4	-	-	0.6	0.6	1.2	2

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Theory:

Unit - 1

SITE PLANNING:

Introduction of site planning, Preparation and interpretation of plans, site clearance, site organization.

Unit - 2

MATERIAL PLANNING & MANAGEMENT:

Material/Labour cost, importance of economy in material cost, estimating material quantity, procedure for obtaining quotation and ordering, seasonal variation in prices-seasonal availability of some material. Construction Equipment and Management.

Unit - 3

CONSTRUCTION CONTRACT & THEIR MANAGEMENT:

Indian contract act, contract procedure and documents, important contract clauses arbitration act.

Unit - 4

CONSTRUCTION ACCOUNTING:

Nature and role of accounting books, final accounts, accounting policies, cost measurement and estimation in construction projects.

Unit - 5

CONSTRUCTION FINANCE MANAGEMENT:

Scope of financial management, working capital management, capital investment decision, role and scope of management accounting, budgeting control system.

Construction personal Management: personal administration, labour legislation, industrial relations.

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required,

Semester-end:

Theory examination of 3 Hours duration

Books & References Recommended (Main Textbooks):

1. PERT & CPM, by Srinath.
2. Estimating and costing by G.S. Birdie.
3. Construction management and account by Harpal Singh.
4. Construction Planning and Equipment by C. L. Purifoy.
5. Chitkara, K.K., "Construction Project Management: Planning, Scheduling and Controlling", Tata McGraw-Hill Education, 2nd Edition, 2014.

Reference Books:

1. Mubarak, S., "Construction Project Scheduling and Control", Wiley, 3rd Edition, 2015.
2. Harris, F., and McCaffer, R., "Modern Construction Management", Wiley-Blackwell, 8th Edition, 2021.
3. Gould, F.E., and Joyce, N.E., "Construction Project Management", Pearson, 4th Edition, 2014.
4. Oberlender, G.D., "Project Management for Engineering and Construction", McGraw-Hill Education, 3rd Edition, 2014.
5. Halpin, D.W., and Senior, B.A., "Construction Management", Wiley, 5th Edition, 2017.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE41313 PRESTRESSED CONCRETE DESIGN

CREDITS:

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

Pre-requisite:
1. Strength of Materials
2. Structural Mechanics
3. Structural Analysis
4. Design of RCC Structures

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:

1. To showcase the principles, materials, methods and systems of prestressing.
2. To describe the different types of losses and deflection of prestressed members.
3. To demonstrate the design of prestressed concrete beams for flexural, shear and tension.
4. To outline the concepts of prestress concrete sections.
5. To discuss the principles, procedures and current code requirements in the design of prestressed concrete members.

COURSE OUTCOMES (CO):
Students should be able to:

1. Explain key principles and concepts of prestressing.
2. Compare pre-tensioning and post-tensioning methods, considering prestress losses.
3. Design prestressed members for flexural strength.
4. Analyze prestressed members for shear, torsion, deflection, and crack width.
5. Apply prestressed concrete concepts to analyze and design various structural elements.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	3	-	-	-	-	3	-	-	-	3
CO4	3	3	-	-	-	-	-	-	-	-	-	3
CO5	3	3	3	-	-	-	-	3	-	-	-	3
Target	3	1.2	1.2	-	-	-	-	1.2	-	-	-	3

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Theory:

Unit - 1

Introduction and Principles of Prestressing. Different Methods of Prestressing and Post tensioning. Prestressed Concrete Materials, Need for High Strength Concrete and High Tensile Strength Steel, Creep and Shrinkage of Concrete Relaxation of Steel, Losses of Prestress, Friction and Anchorage of Steel.

Unit - 2

Flexural Strength of Prestressed Concrete Section, Analysis of Prestress, Resultant stress at a Section, Line of Thrust, Load Balancing, Cracking Moments.

Unit - 3

Shear strength and Torsional strength of Prestressed Concrete Section, Principle stresses and Principle Shear Stresses, Ultimate Shear Resistance. Stress pattern in Anchorage Zones, Transmission Length, End Zone Reinforcement and Stress Distribution in End Block.

Unit - 4

Design of Members for Flexure, Working Load and Limit State Methods, IS Recommendation, rectangular and I-section. Working out of sections for Concrete and Prestressing Forces of Steels, Application to Design of Slabs and Continuous Beams and Bridge Girders, Design for Concordant Cable Tendon Profiles.

Unit - 5

Design of Tension and Compression Members, Design of combined Bending and Compression, Different approaches for Design, Application design of Transmission

Poles, Roof Truss Members, Purlins, Railway Sleepers. Circular prestressing for Tanks, Principles and Derivation of Formula, Composite Construction of Prestressed and In-situ Concrete. Analysis of Stresses. Design for Flexure and Shear.

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required,

Semester-end:

Theory examination of 3 Hours duration

Books & References Recommended:

1. Krishna Raju. N., Pre-stressed Concrete - Problems and Solutions, CBS Publishers and Distributors, Pvt. Ltd., New Delhi, 2014.
2. Lin T.Y., Design of Prestressed Concrete Structures.
3. Dayaratnam P., Prestressed Concrete Structures.

References

1. Praveen Nagarajan, Advanced Concrete Design, Person, 2013.
2. P. Dayaratnam, Prestressed Concrete Structures, Oxford & IBH-Pubs Company, Delhi, 5th Edition, 2009.
3. IS: 1343: Indian Standard code of practice for Prestressed concrete, BIS, New Delhi.
4. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.
5. Graduate I.I., Prestressed Concrete
6. Evans R.J. and Benett E.W., Prestressed Concrete.
7. Hillick S.K. and Rangaswamy R.N., The Mechanics of Prestressed Concrete Design.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE: SYSTEM APPLICATION TO WATER RESOURCES CREDITS

CREDITS:

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

Pre-requisite: Nil

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:

The student will be able to understand the deterministic optimization techniques such as Linear Programming, Dynamic Programming, and Optimization using Calculus. Learning Stochastic Optimization techniques such as Stochastic Dynamic Programming, Chance Constrained Liner Programming will help them in reservoir sizing, planning and operation.

COURSE OUTCOMES (CO):
Students should be able to:

1. Identify components of water resources planning and systems.
2. Analyze reservoir sizing, planning, operation, and water management techniques.
3. Apply deterministic optimization methods to water resource problems.
4. Utilize stochastic optimization techniques in water resource management.
5. Solve reservoir optimization and flood control problems using dynamic programming.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	-	-	-	-	-	-	-	-	3
CO3	3	-	-	3	-	-	-	-	-	-	-	3
CO4	3	-	-	3	-	-	-	-	-	-	-	3
CO5	3	-	-	3	-	-	-	-	-	-	-	3
Target	3	0.6	-	1.8	-	-	-	-	-	-	-	3

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:
Theory:

Unit - 1

INTRODUCTION: Introduction to Water Resources Planning, Concept of a system, Terminology and Definition of Terms, Need of Systems Analysis to Water Resources Problems, Systems Approach, Characteristics of Systems Analysis Applications.

Unit - 2

PROBLEMS IN WATER RESOURCES ENGINEERING: Development Problems, Design Problems, Operational Problems, recapitulation, Statistical Applications, Stochastic Processes and Water Storage, Storage Control Problems.

Unit - 3

MATHEMATICAL PROGRMMING TECHNIQUES: Review of Various Mathematical Programming techniques viz. Method of Lagrangian Multipliers, Linear Programming, Dynamic Programming, Integer Programming, Goal Programming, Simulation and Search Methods.

Unit - 4

RESERVOIR PLANNING AND ANALYSIS: Reservoir Capacity Determination, Mass Diagram Analysis, Sequent Peak Analysis, Optimization Analysis, Capacity Expansion Problem using Integer Programming and Dynamic Programming Models.

Unit - 5

DETERMINISTIC RESERVOIR MODELLING: Reservoir Operation Problems, Deterministic D.P. Models, Reservoir Storage Yield Models, Flood Control Problem,

List of experiments:

1. FORTRAN programming for Sequent peak analysis.

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required,

Semester-end:

Theory examination of 3 Hours duration

Books & References Recommended:

1. Planning & Analysis of Water Resources Systems by Loucks, Stedinger & Haith.
2. Stochastic Water Resources Technology by N.T. Kottegoda.
3. Water Resources Systems by Vedula & Majumdar.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE41311: TRAFFIC ENGINEERING

CREDITS:

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

Pre-requisite: Traffic Engineering

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:

1. To learn the fundamentals of traffic engineering and to implement them for developing a computer-based system for fast and efficient design for various traffic parameters.
2. To solve problems related to traffic in the existing and new highway areas.
3. To analyze the various traffic studies and its applications

COURSE OUTCOMES (CO):
Students should be able to:

1. Analyze driver characteristics and conduct traffic studies.
2. Apply traffic flow relationships to heterogeneous and homogeneous flows.
3. Evaluate highway capacity, LOS, and design traffic control systems.
4. Implement traffic safety measures and mitigate accident-prone areas.
5. Develop traffic management strategies and propose roadway improvements.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	-	-	-	-	-	-	-	-	2
CO3	3	2	2	3	-	-	-	3	-	-	-	2
CO4	3	-	-	3	-	3	-	2	-	-	-	2
CO5	3	-	3	3	-	-	-	-	-	-	2	2
Target	3	1	1	1.8	-	0.6	-	1	-	-	0.4	2

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Theory:

Unit - 1

Traffic characteristics: Driver, road user characteristics - reaction time psychological and physiological characteristics, vehicle characteristics and kinematics.

Traffic studies: Traffic volume studies, spot speed studies, travel time and delay studies, origin, and destination studies.

Unit - 2

Traffic flow characteristics: Heterogeneous and homogeneous traffic flows, volume, density and speed relationships, fundamental relation of traffic flow.

Traffic parameter: Speeds and volume, computation of AADT, design hourly volume, headway characteristics and distributions.

Unit - 3

Capacity and Level-of-Service: Capacity of highway lane, types of capacity, factors affecting capacity, characteristics of uninterrupted traffic, capacity and los of uninterrupted facilities, characteristics of interrupted traffic.

Traffic characteristics at unsignalized and signalized intersections: Capacity and LOS of signalized intersections, Rotary Design, actuated signal control, signal coordination.

Unit - 4

Traffic controls and safety: Traffic regulations- motor vehicle act, traffic signs and markings, accidents- data collection, causes and prevention, black spots identification.

Parking studies: Need for Parking Studies, Off-Street and On-Street Parking; Types of Parking Surveys.

Unit - 5

Traffic management: Local traffic management methods, temporary management methods - one way and two-way street, closing side streets; permanent management methods - exclusive bus lanes. Traffic improvement methodology - surveys and analysis of existing traffic, relation between traffic and roadway characteristics.

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required,

Semester-end:

Theory examination of 3 Hours duration

Books & References Recommended:

1. Kadialy L.R.," Traffic Engg. and Transport Planning", 8th edition, Khanna Publishers,2011.
2. Partha chakrobarty & Animesh Das "Principles of Transportation Engineering"
3. Subhash C Saxena "textbook of Highway and traffic engineering" CBS publishers and distributions pvt. Ltd.
4. Paul H. Wright and Norman J. Ashford, "Transportation Egg. Planning and Design",4th edition, 1998.
5. O. Flaherty C.A., "Traffic Engineering and Transport Planning", 2006.
6. C. Jotin Khisty & B. Kent Lall "Transportation Engineering an Introduction"

References Recommended:

1. IRC 102-1988 "Traffic studies for planning bypass around towns"1988"
2. IRC 108-1980 "Traffic prediction of rural highways"
3. IRC 108-1996 "Guidelines for traffic prediction on rural highways

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE ADVANCED FLUID MECHANICS

CREDITS:

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

Pre-requisite: Traffic Engineering

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:

Develop a comprehensive understanding of advanced fluid mechanics concepts, including boundary layer theory, open channel flow, unsteady flow, fluid machinery, and their applications in hydraulic engineering and pump design.

COURSE OUTCOMES (CO):
Students should be able to:

1. Analyze boundary layer behavior, flow separation, and drag forces in various fluid flow scenarios.
2. Apply gradually varied flow concepts and compute water surface profiles in open channels.
3. Evaluate unsteady flow phenomena and perform hydraulic routing and discharge measurements.
4. Analyze the principles of jet impingement and assess the performance of various hydraulic turbines.
5. Evaluate the working principles and performance characteristics of centrifugal and reciprocating pumps.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	2
CO2	3	3	-	-	-	-	-	-	-	-	-	2
CO3	3	2	-	2	-	-	-	-	-	-	-	2
CO4	3	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	-	2	-	-	-	-	-	-	-	2
Target	3	2.8	-	0.8	-	-	-	-	-	-	-	2

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:
Theory:

Unit - 1

Revision of the concepts in fluid mechanics. Boundary Layer: Boundary layer concept- laminar and turbulent boundary layer growth over a flat plate, Von-Karman momentum integral equation- Separation and control of boundary layer and wake formation. displacement and momentum thickness - development of flow in circular pipes - Drag and lift in flat plates, cylinders and spheres - Drag coefficients - Boundary layer control.

Unit - 2

Open Channel Flow: Non-Uniform steady flow-equations for gradually varied flow-Direct Step method, Type of GVF profiles, Computation of GVF profiles. Rapidly varied flow- Hydraulic jump- Location of hydraulic jump- flow under sluices-Water surface profiles. Specific force, Computation of energy loss.

Unit - 3

Unsteady Flow: Celerity of a gravity wave, Monoclonal rising wave, Positive and negative surges, St. Venant's equations, Method of characteristics, Hydraulic routing. discharge measurement in open channel flow - All types of notches and weirs, venturiflume - critical depth meter - basic principles.

Unit - 4

Principles of impingement of jets - Impact of jet on a stationary vertical plate, stationary inclined plate, stationary curved plate, hinged plate, moving vertical and inclined plates, moving curved plate and on series of moving flat and curved vanes fixed on the periphery of circular rim. Turbines - classification- impulse turbines - Pelton wheel - Reaction turbines - Francis and Kaplan Turbines - draft tubes - Governing of a Francis turbine - Performance of turbines - specific speed and their significance.

Unit - 5

Centrifugal pump - description and working - Head, discharge and efficiency of a centrifugal pump - pressure rise in the pump - minimum starting speed of a pump - cavitation - priming - multistage pumps - characteristic curves. Reciprocating pump - Description and working - types - discharge and slip - power required to drive the pump - Indicator diagram - Air vessel - work done against friction with and without air vessels.

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required,

Semester-end:

Theory examination of 3 Hours duration

Books & References Recommended:

1. Chow V.T. Open Channel Hydraulics, Blackburn Press , 2009.
2. Franck M White, Fluid Mechanics, Tata McGraw Hill Publications 2011.
3. Robert W. Fox Ogukuo H. Orutcgardm Alan T. Mc Donald, Introduction to Fluid Mechanics, Student Edition 7th Wiley India Edition, 2011.
4. Subramnaya, K., Flow In Open Channel, Tata McGraw Hill Publications, New Delhi, 2008.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE41315: INDUSTRIAL WASTEWATER MANAGEMENT

CREDITS:

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	T	P	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	CW	END SEM	SW	END SEM	100
					30	70	-	-	

Pre-requisite: Nil

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:

The objective of this course is to get on broader understanding on various aspects of industrial wastewater treatment (starting from its generation to processing with options for treatment, reuse and recycle, transport and disposal) practiced in different industries.

COURSE OUTCOMES (CO):
Students should be able to:

1. Determine the characteristics, sources and terms related to industrial wastewater treatment and have a better understanding of the effects and disposal of industrial waste on sewers.
2. Perform auditing with case examples and discuss waste minimization methods and guidelines for environmental management system.
3. Test various characteristics of industrial wastewater via. different instruments, software's and their applications.
4. Characterize different types of industrial waste and determine the appropriate treatment methods for them.
5. Explain various aspects of common effluent treatment plant, their treatment and disposal.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	-	-	2	2	-	-	3	2	2
CO3	3	-	-	2	3	-	-	-	-	-	-	2
CO4	3	-	-	2	-	-	-	-	-	-	-	2
CO5	3	-	-	2	-	-	-	-	-	-	-	2
Target	3	-	-	1.2	0.6	0.4	0.4	-	-	0.6	0.4	2

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Theory:

Unit - 1

Solid liquid and gaseous effluents of industries, Public Health, Economic and Aesthetic Consideration, River Standards and Effluents Standards, Effect of industrial waste on Sewers and Sewage treatment plants, Disposal of waste in water bodies, Zero liquid discharge, Role of National Green Tribunal in relation to industrial waste water management.

Unit - 2

Environmental Audit & its objectives, methodology and present scenario in India, Environmental management Systems Guidelines and case examples, Location of industries, method of reduction of wastes, Volume reduction, Waste strength reduction, Neutralization, Equalization and proportioning. Segregation or intermixing of wastes. Reuse and recovery of by-products.

Unit - 3

Characterization testing of industrial wastewater, Instrumentation for measurement and control of pH, turbidity and other parameters, Potentiometric analysis of wastewater, SCADA-its contest and applications, Real time monitoring of industries.

Unit - 4

Characteristics and Treatment of waste originating from major typical industries such as : a) Textile manufacture, dyeing and finishing wastes (Cotton, Woolen, Silk, Rayon, and Nylon b) Sugar c) Paper &Pulp Mills d) Milk e) Radio-active wastes f) Tanneries, other industries.

Unit - 5

Various aspects of a Common Effluent Treatment Plant, Planning and Site Selection Procedure, Maintenance and Operation of Plant, removal of toxic substances, Disposal of sludge, gases and residues, real time monitoring of industries.

Assessment:

Continuous: Two midterm tests in a semester and a makeup test if required,

Semester-end:

Theory examination of 3 Hours duration

Books & References Recommended:

1. Nemerow N.L., “Theories and practices of Industrial waste treatment”, Addison Wesley publishing company California Sydney & London.
2. Arceivala, S. J. and Asolekar, S. R. "Wastewater Treatment for Pollution Control and Reuse "Tata McGraw Hill Pvt. Ltd., New Delhi.,3rd edition 2007.
3. Sawyer, C N., McCarty, P. L., Parkin, G. F. "Chemistry for Environmental Engineering and science" Tata McGraw Hill Pvt. Ltd., New Delhi., 5th edition 2003.

References Recommended:

1. Dhameja, S. K. "Environmental Engineering and Management" S. K. Kataria & Sons, New Delhi., 2nd edition 2004
2. Patwardhan, A.D. Industrial Wastewater Treatment "PHI Learning Pvt. Ltd., New Delhi.,2nd edition2009Mapping of CO with PO and PSO:

ELECTIVE V

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE41674 (CE41684): ADVANCED TRANSPORATION ENGINEERING

Credits:

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu.	T	P	Tu.	THEORY		PRACTICA L		TOTAL MARKS
4	-	-	3	-	-	CW	END SEM	SW	END SEM	100
						30	70	-	-	

Pre-requisite: Transportation Engineering.

COURSE OBJECTIVES: Course objective is to make aware the students about behaviour of different modes of transportations as well as transport economics. In this subject detailed study of transportation demand analysis, urban public transport system and construction equipment used in pavement construction is given. This subject provides a base for the students in the transportation engineering field.

COURSE OUTCOMES (CO): The students will be able to**:**

1. Evaluate the economic aspects of highway projects, including cost components and parameters.
2. Develop and apply transportation demand models to predict and analyze travel behavior and demand.
3. Analyze traffic and transportation problems in urban areas, and classify various transportation modes and their characteristics.
4. Analyze various urban public transportation systems, including BRTS, bus lanes, and rail systems, in the context of their advantages and limitations.
5. Select the different construction equipment for pavement construction, considering factors like selection, cost, and output.

Mapping of CO with PO

COs\POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	0	1	0	0	0	0	1	1
CO2	3	3	1	2	3	2	0	0	0	0	0	0
CO3	1	2	3	1	0	2	2	0	0	0	1	0

CO4	1	1	3	1	0	2	2	2	0	0	3	1
CO5	3	1	1	1	0	1	0	0	0	0	0	0
Target	2.2	2	2	1.2	0.6	1.6	0.8	0.4	0	0	1	0.4

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:

Theory:

Unit – 1 Transport Economics

Introduction, Indian Roads and its present scenarios, some parameters used in economic analysis, cost components in transportation systems, economic evaluation of highway projects.

Unit - 2 Transportation Demand Analysis

Travel behaviour, travel demand modelling, trip generation models, trip distribution models, mode choice models, trip assignment models.

Unit – 3 Modes of Transportation Traffic and Transport Problems of a city, Mass transport system, Modes of transportation & characteristics, public transport system, public private transport system, Advantages and disadvantages of public transport system. Role of transportation in mass transportation.

Unit – 4 Urban Public Transport System

BRTS, Bus Lane system, Advantages and limitations in Indian Scenario, Rail System, Types of rail system, advantages and disadvantages of rail system.

Unit – 5 Construction Equipment

Used in Pavement Construction Factor affecting selection of equipment, investment and operating cost, output of various equipment's, brief study of equipment's required for various jobs such as earthwork, dredging, conveyance, concreting, hoisting, pile driving, compaction and grouting.

Continuous: Two midterm tests in a semester and a makeup test if required.
Semester-end: Theory examination of 3 Hours duration.

Books & References Recommended (Main Textbooks):

1. Adolf D. May, Traffic Flow Fundamentals, Prentice Hall, 1990.
2. C. Jotin Khisty, B. Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 3rd Edition, 2003.
3. Chakroborty Partha, Das Animesh, Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 1st Edition, 2009.
4. L.R. Kadiyali, Traffic Engineering and Transportation Planning, Khanna Publishers, 2011.
5. Roger P. Roess, Elena S. Prassas and William R. McShane, Traffic Engineering, Prentice Hall, 4th Edition, 2010.

Reference Books:

1. TRB Highway Capacity Manual, Transportation Research Board, Washington, D.C., 2010.
2. Khanna & Justo, Highway Engineering.
3. Kadiyali L.R., Principle and Practice of Highway Engineering.
4. Martin Wohl and Brian V. Martin, Traffic System Analysis.
5. Hutchinson B.G., Principles of Urban Transportation System Planning, McGraw-Hill Publishing.
6. Saxena, Traffic Planning and Design.
7. Bruton M.J., Introduction to Transportation Planning.
8. Papacostas, C.S. and Prevedouros, P.D., Transportation Engineering and Planning, Prentice Hall, 3rd Edition, 2001.
9. Garber, N.J. and Hoel, L.A., Traffic and Highway Engineering, Cengage Learning, 5th Edition, 2014.
10. Wright, P.H. and Dixon, K., Highway Engineering, Wiley, 7th Edition, 2004.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE 41678 (CE41608): DESIGN OF R.C.C. & PRESTRESSED BRIDGE

CREDITS:

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu.	T	P	Tu.	THEORY		PRACTICAL		TOTAL MARKS
4	-	-	3	-	-	CW	END SEM	SW	END SEM	100
						30	70	-	-	

PRE-REQUISITE: Design of R.C.C. Structures.

COURSE OBJECTIVE

At the end of the course students should be able to aware of the design procedures involved while designing various reinforced cement concrete structures. Along with this the students will be given basic concepts and understanding of prestressed bridges.

COURSE OUTCOME

Students should be able to:

1. Identify standard specifications of road bridges, define various specifications of IRCfor planning, analysis & design of bridges in general design consideration.
2. Define various Types of Bridges, Design of Solid slab and girder Slab Bridges &design of girders and slabs as per Courbon's Theory and Pigeaud Theory.
3. Analyze and design of balanced cantilever bridges, design of cantilever section,suspended span and articulations.
4. Analyze and design of bridge piers, abutments & bearings, define introduction of continuous and arch bridges.

Analyse and design of prestressed concrete bridges, And define pre & post tensioning,cable zone

equation, initial & final stress condition, shear.

Mapping of CO with PO

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	0	3	0	0	0	0	0	0
CO2	3	2	3	2	0	2	0	0	0	0	0	0
CO3	3	3	3	2	0	2	0	0	0	0	0	0
CO4	3	3	3	3	0	2	0	0	0	0	0	0
CO5	3	3	3	3	0	2	0	0	0	0	0	0

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS: THEORY

Unit-1 Standard specifications and code of practice for general requirements of road bridges. Design loads for bridges. IRC loading standards. Traction Forces and Temperature Effect. General Design requirements. Economic Span of Bridge.

Unit-2 Various Types of Bridges, Design of Solid slab and girder Slab Bridges, Courbon's Theory and Pigeaud Theory for design of girders and slabs.

Unit-3 Design of Balanced Cantilever bridges, Design of Cantilever section. Suspended Span and Articulations.

Unit-4 Design of Supporting structures for Piers and Abutments, Solid and hollow piers. Single Cellular and Multi Cellular piers. Design of Bearings. Introduction of continuous and arch bridges.

Unit-5 Prestressed concrete bridges, pre & post tensioning, cable zone equation, initial & final stress condition, Shear.

ASSESSMENT

Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of design calculations & drawing sheets, internal submission and Viva Voce examination by internal examiner
Semester-end: Theory examination of 3 Hours duration and Practical Viva Voce Examinationby external

examiner.

PRACTICALS*:*

List of experiments:

1. Sheet 1 on types of bridge.
2. Sheet 2 on types of loading.
3. Sheet 3 on design of slab culvert.
4. Sheet 4 on T-girder bridge.
5. Sheet 5 on piers and abutments.

Book & References Recommended :

Text Books

1. N. Krishna Raju Design Of Bridges Oxford IBH Publications.
2. D. Johnson Victor, Essentials of Bridge Engineering, Oxford IBH Publications.
3. Aswani M.G., Vazirani V.N. Ratwani. M. M., Design Of Concrete Bridges, KhannaPublishers, Delhi.

Reference Books

1. Ponnuswamy S. Bndge Engineering.Tata McGraw -Hill Education.
2. B.R. Phatak Bridge Engineering.
3. Baidar Bakht, Leslie G. Jaeger Bridge Analysis Simplified. McGraw-Hill.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE_____: AIR QUALITY MANAGEMENT

CREDITS:

HOURS PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICALS		TOTAL MARKS
4	-	-	3	-	-	CW	ENDSEM	SW	END SEM	100
						30	70	-	-	

Pre-requisites: environmental science

COURSE OBJECTIVES
This Course has three components i.e., sources of air pollution, pathways (air pollutants transformation and transport) and receptors. Students would get an insight into the dispersion of air pollution in the atmosphere. This life cycle of air pollution will enable the student to first identify the pollutants and their sources and then the transport mechanisms of the pollutants followed by the affected population and there control mechanisms.

COURSE OUTCOME:

The students should be able:
1. To analyze various perspectives of air pollution, sources, classification.
2. To understand the effects, air quality monitoring and indices, control technologies.
3. To develop the concept of carbon credit and its applications, and to measure the effects of Photochemical Smog.
4. To understand the meteorological terms related to the environment/atmosphere.
5. To identify and understand the control devices for air pollution control and monitoring.

Mapping of CO with PO

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	0	2	0	3	0	0	0	0	0	0

CO2	3	3	2	2	0	3	0	0	0	0	0	0
CO3	3	2	2	2	0	2	0	0	0	0	0	0
CO4	3	2	0	1	0	2	0	0	0	0	0	0
CO5	3	3	2	2	0	3	0	0	0	0	0	0

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

Theory:

Unit – 1
FUNDAMENTALS OF AIR POLLUTION: Definition, Sources of Air Pollution, Primaryand Secondary Air Pollutants, Micro and Macro Air Pollution, Air Pollution episodes, Air Quality and Emission Standards.

Unit - 2
EFFECTS OF AIR POLLUTION: Effects of air pollution on human beings, flora and fauna, and materials. Economic effects of Air Pollution, Sampling of Particulates and Gases such asSPM, RPM (PMand PM2.5), SOX, NOX, CO etc. and Monitoring. Air Pollution Survey andIndices.

Unit -3
PHOTOCHEMICAL AIR POLLUTION: Introduction, Theory of Formation of Photochemical Smog, Measurement and Effects of Photochemical Smog, Carbon Credit - Its Concept and Applications, Carbon Foot Print.

Unit-4
METEOROLOGY: Introduction, Solar radiation, Wind Circulation, Lapse rate, StabilityConditions, Wind Velocity profile, Maximum mixing depth, wind rose, Turbulence, General Characteristics of stack Plumes, Heat Island effect, Global circulation of pollutants.

Unit-5
ENGINEERING CONTROL OF AIR POLLUTION: Particulate control devices such as Gravity Settling chamber, Cyclone separators, Wet collectors (Scrubbers), Fabric filters and electrostatic precipitators, Gaseous control methods such as adsorption, absorption, condensation, combustion and automotive emission control.

List of Experiments:

It shall include study of relevant Is codes/Standards. Submission of technical report based oncase studies/case examples. Poster preparation and presentation based on relevant topics.

Books & References Recommended:

1. Peavy H. S., Rowe D. R. and Tchobanoglous, G. (2013) "Environmental Engineering" TataMc Graw Hill Education Pvt. Ltd., New Delhi., 1st edition.

2. Rao, C. S. (2006) "Environmental Pollution & Control Engineering" New AgeInternational Pvt. Ltd., New Delhi., 2nd edition.

3. Wark, K. and Warner, C. F. (1998) "Air Pollution-/ts origin and Control" Addison WesleyLongman, California., 3edition.

4. Rao, M. N. and Rao, H. V. N. (2009) "Air Pollution" Tata McGraw Hill Education Pvt.Ltd., New Delhi., 32nd reprint.

5. Trivedy, R. K. and Goel, P. K. (2005) "An Introduction to Air Pollution" BS Publications.,New Delhi., 2nd edition.

6. Davis, M. L. and Cornwell, D. A. (2013) "Introduction to Environmental Engineering"Tata Mc Graw Hill Pvt. Ltd., New Delhi, 5th edition.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE- 41677(CE-41604) : ADVANCED HYDROLOGIC ANALYSIS
CREDITS:

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu.	T	P	Tu.	THEORY		PRACTICAL		TOTAL MARKS
4	-	-	3	-	-	CW	END SEM	SW	END SEM	100
						30	70	-	-	

Pre-requisite:

The candidate must know about the rainfall runoff process, aspects of preliminary hydrologicanalysis.

COURSE OBJECTIVES:

The student will be able to analyse the hydrological modelling process especially in the context of design flood estimation. The student should also understand the flood flow modelling in longer river channels and develop proper flood protection measuresfor the rivers. Understand the rainfall runoff relation modelling will help them to predict the flows in various conditions of climatic factors and land cover land use.This will make him/her capable of planning for any kind of change in climaticcondition of the catchment area .The student will gain an insight of the ground water processes.

COURSE OUTCOMES:

Course Outcomes: At the end of the course, student will be able to:

1. Summarize the hydrological modelling process especially in the context of designflood estimation.
2. Apply the flood flow modelling equations in longer river channels.
3. Evaluate the rainfall runoff modelling to predict the flows in various conditions ofclimatic factors and land cover land use.
4. Understand the basic concepts of watershed modelling philosophy.
5. Analyse the ground water processes and its flow phenomena.

Mapping of CO with PO

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	0	1	0	0	0	0	0	0
CO2	3	3	3	3	0	1	0	0	0	0	0	0
CO3	3	3	3	3	0	2	0	0	0	0	0	0
CO4	3	2	2	2	0	1	0	0	0	0	0	0
CO5	3	3	2	3	0	1	0	0	0	0	0	0

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS :

Theory:

Unit-1:

Revision of studies in Hydrological Cycle its components, Study of Hydrological Losses such as Interception, Infiltration and Evaporation. Design Storm estimation, Standard Project Storm and flood, Probable Maximum Precipitation and Flood, empirical methods of design flood estimation, critical storm sequence and unit hydrograph method of design flood estimation. Flood Frequency Analysis, Risk and reliability analysis for hydraulic structures

Unit 2

Concepts of flood Routing, hydrologic and hydraulic routing, Muskingum Method, Saint-Venant's Equations- Reynolds's Transport Theorem, Continuity Equation, momentum Equation, Energy Equation. Muskingum Cunge Method Linear and Kinematic Wave Model, Overland Flow Models, Dynamic Wave Routing, Floodmanagement and control, Flood Routing through Reservoirs, flood protection and control measures

Unit-3:

Introduction to Stochastic Models in Hydrology, Concept of co-variance and correlation, dependant and independent data series, Markov Process, Markov Chain, Time series modelling, trend and periodicity, AR, ARMA, ARIMA models, applications of time series models, Thomas Fierring Model

Unit-4:

Watershed Concepts, Philosophy of Mathematical Models of Watershed Hydrology. Hydrologic Simulation Models-Steps in Watershed Modelling, A study of major Hydrologic Models, Climate Change Impacts and Models, Climate Change Impact on Hydrologic Cycle,

Effects on Water Resource Systems, Climate Change Simulation, climate change scenarios and downscaling

Unit-5:

ADVANCED WELL HYDRAULICS: steady/ unsteady, uniform/ radial flow to a well in a confined/ unconfined /leaky aquifer, well flow near aquifer boundaries/ for special conditions, partially penetrating/horizontal wells & multiple well systems, well completion/ development/ protection/ rehabilitation/ testing for yield

Books & References Recommended:

1. Engineering Hydrology by Subramanya
2. Applied Hydrology by Chow, Maidment and Mays
3. Hydrology and Hydroclimatology: Principles and Applications, M. Karamouz, S. Nazif, O. M. Falahi, CRC Press

These three books were specifically listed in the original document. To expand on this list and provide additional resources, we could consider adding the following references:

Additional Reference Books:

4. Handbook of Applied Hydrology, Second Edition by Vijay P. Singh
5. Statistical Methods in Hydrology by Charles T. Haan
6. Engineering Hydrology: Principles and Practices by Victor Miguel Ponce
7. Flood Hydrology and Watershed Management by Vijay P. Singh and Donald K. Frevert
8. Groundwater Hydrology by David Keith Todd and Larry W. Mays
9. Hydrologic Analysis and Design by Richard H. McCuen

ELECTIVE VI

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)

CE 41774 ADVANCED FLUID MECHANICS

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu.	T	P	Tu.	THEORY		PRACTICAL		TOTAL MARKS
						CW	END SEM	SW	END SEM	
4	-	-	3	-	-	30	70	-	-	100

Pre-requisite: Fluid Mechanics

Mapping of CO with PO

COURSE OBJECTIVES:

1. To develop a comprehensive understanding of advanced fluid mechanics concepts
2. To study boundary layer theory and its applications
3. To analyze open channel flow and unsteady flow phenomena
4. To understand the principles of jet impingement and hydraulic turbines
5. To evaluate the performance characteristics of centrifugal and reciprocating pumps

COURSE OUTCOMES (CO):

Students should be able to:

1. Analyze boundary layer behavior, flow separation, and drag forces in various fluid flow scenarios.
2. Apply gradually varied flow concepts and compute water surface profiles in open channels.
3. Evaluate unsteady flow phenomena and perform hydraulic routing and discharge measurements.
4. Analyze the principles of jet impingement and assess the performance of various hydraulic turbines.
5. Evaluate the working principles and performance characteristics of centrifugal and reciprocating pumps.

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	0	1	0	0	0	0	0
CO2	3	3	3	2	1	0	1	0	0	0	0	0
CO3	3	3	2	3	2	0	1	0	0	0	0	0
CO4	3	3	2	2	1	0	0	0	0	0	0	0

CO5	3	3	2	2	1	0	0	0	0	0	0

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

Unit 1

Revision of the concepts in fluid mechanics. Boundary Layer: Boundary layer concept- laminar and turbulent boundary layer growth over a flat plate, Von-Karman momentum integral equation- Separation and control of boundary layer and wake formation. displacement and momentum thickness - development of flow in circular pipes - Drag and liftin flat plates, cylinders and spheres - Drag coefficients - Boundary layer control.

Unit 2

Open Channel Flow: Non-Uniform steady flow-equations for gradually varied flow- Direct Step method, Type of GVF profiles, Computation of GVF profiles. Rapidly varied flow- Hydraulic jump- Location of hydraulic jump- flow under sluices-Water surface profiles. Specific force, Computation of energy loss.

Unit 3

Unsteady Flow: Celerity of a gravity wave, Monoclonal rising wave, Positive and negative surges, St. Venant's equations, Method of characteristics, Hydraulic routing. discharge measurement in open channel flow - All types of notches and weirs, venturiflume - critical depth meter - basic principles.

Unit 4

Principles of impingement of jets - Impact of jet on a stationary vertical plate, stationary inclined plate, stationary curved plate, hinged plate, moving vertical and inclined plates, moving curved plate and on series of moving flat and curved vanes fixed on the periphery of circular rim. Turbines - classification- impulse turbines - Pelton wheel - Reaction turbines - Francis and Kaplan Turbines - draft tubes - Governing of a Francis turbine - Performance of turbines - specific speed and their significance.

Unit 5

Centrifugal pump - description and working - Head, discharge and efficiency of a centrifugal pump - pressure rise in the pump - minimum starting speed of a pump - cavitation - priming - multistage pumps - characteristic curves. Reciprocating pump - Description and working - types - discharge and slip - power required to drive the pump - Indicator diagram - Air vessel
- work done against friction with and without air vessels.Books

Books & References Recommended (Main Textbooks):

1. Chow V.T., Open Channel Hydraulics, Blackburn Press, 2009.
2. Franck M White, Fluid Mechanics, Tata McGraw Hill Publications, 2011.
3. Robert W. Fox, Philip J. Pritchard, Alan T. McDonald, Introduction to Fluid Mechanics, Wiley India Edition, 9th Edition, 2015.
4. Subramnaya, K., Flow In Open Channel, Tata McGraw Hill Publications, New Delhi, 2008.

Reference Books:

1. Bruce R. Munson, Donald F. Young, Theodore H. Okiishi, Fundamentals of Fluid Mechanics, Wiley India, 7th Edition, 2013.
2. Yunus A. Cengel, John M. Cimbala, Fluid Mechanics: Fundamentals and Applications, McGraw Hill Education, 3rd Edition, 2013.
3. Jain, A.K., Fluid Mechanics: Including Hydraulic Machines, Khanna Publishers, 2016.
4. Streeter, V.L., Wylie, E.B., and Bedford, K.W., Fluid Mechanics, McGraw Hill Education, 9th Edition, 2010.
5. Rouse H., Elementary Mechanics of Fluids, Dover Publications, 1990.

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CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)

CE_____: STRUCTURAL DYNAMICS

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu.	T	P	Tu.	THEORY		PRACTICAL		TOTAL MARKS
4	-	-	3	-	-	CW	END SEM	SW	END SEM	100
						30	70	-	-	

Pre-requisite: Strength of Materials, Structural Analysis

COURSE OBJECTIVES:

1. To introduce the concepts of free and forced vibrations of dynamic systems
2. To study the physical significance of wave propagation theory and different modes of vibration
3. To analyze the dynamic response of single degree of freedom (SDOF) systems
4. To evaluate the dynamic response of multi-degree of freedom (MDOF) systems
5. To introduce continuous systems subjected to different types of dynamic loads

COURSE OUTCOMES (CO):

Students should be able to:

1. Calculate natural frequencies and draw mode shapes for harmonic vibration
2. Analyze the response of SDOF systems for general and random vibrations
3. Formulate and solve dynamic response problems for SDOF systems
4. Identify, formulate, and solve dynamic response problems for MDOF systems
5. Analyze continuous systems subjected to different types of dynamic loads

Mapping of CO with PO

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	1	0	0	0	0	0	0	0
CO2	3	3	3	3	2	0	0	0	0	0	0	0

CO3	3	3	3	3	2	0	0	0	0	0	0	0
CO4	3	3	3	3	2	0	0	0	0	0	0	0
CO5	3	3	3	3	2	0	0	0	0	0	0	0

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

Unit – 1

Single Degree of Freedom System: Free and forced vibrations, Linear Viscous Damper, Coulomb Damper: Response to harmonic excitation, rotating unbalance and support excitation. Vibration isolation and transmissibility. Single degree of freedom system as vibrometer and accelerometer. Response to periodic and arbitrary excitation.

Unit – 2

Duhamel's integral. Impulse response function. Laplace transform Fourier transform methods. Frequency response function. Phase-Plane Techniques. Critical speed of rotors. Energy methods, Rayleigh's method, Equivalent viscous damping.

Unit – 3

Two Degree of Freedom System. Matrix Formulation, Free Vibration, Beat phenomenon. Principle of damped and undamped vibration absorbers.

Unit – 4

Multi-Degree of Freedom Systems: Matrix formulation, stiffness and flexibility influence coefficients. Eigenvalue problem. Normal modes and their properties. Matrix iteration technique for eigen values, and eigen vectors. Free and forced vibration by modal analysis.

Unit – 5

Continuous System: Axial vibration of bar, torsional vibration of shafts, transverse vibration of strings and bending vibration beams. Forced vibration. Normal mode method. Lagrange's

equation. Approximate methods of Rayleigh-Ritz, Galerkin etc.

Books & References Recommended (Main Textbooks):

1. Anil K. Chopra, Dynamics of Structures: Theory and Applications to Earthquake Engineering, Pearson, 5th Edition, 2020.
2. R.W. Clough and J. Penzien, Dynamics of Structures, McGraw-Hill, 3rd Edition, 2003.
3. Mario Paz, Structural Dynamics: Theory and Computation, Springer, 6th Edition, 2012.
4. A. Ghali, A.M. Neville, and T.G. Brown, Structural Analysis: A Unified Classical and Matrix Approach, CRC Press, 7th Edition, 2016.

Reference Books:

1. Ray W. Clough and Joseph Penzien, Dynamics of Structures, Computers & Structures, Inc., 3rd Edition, 2003.
2. J.L. Humar, Dynamics of Structures, CRC Press, 3rd Edition, 2012.
3. Leonard Meirovitch, Fundamentals of Vibrations, Waveland Press, 2010.
4. S.S. Rao, Mechanical Vibrations, Pearson, 6th Edition, 2017.
5. D.J. Inman, Engineering Vibration, Pearson, 4th Edition, 2013.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE : FINITE ELEMENT METHOD

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu.	T	P	Tu.	THEORY		PRACTICAL		TOTAL MARKS
4	-	-	3	-	-	CW	END SEM	SW	END SEM	100
						30	70	-	-	

Pre-requisite: Strength of Materials, Structural Analysis

COURSE OBJECTIVES:

1. To introduce the concepts of free and forced vibrations of dynamic systems
2. To study the physical significance of wave propagation theory and different modes of vibration
3. To analyze the dynamic response of single degree of freedom (SDOF) systems
4. To evaluate the dynamic response of multi-degree of freedom (MDOF) systems
5. To introduce continuous systems subjected to different types of dynamic loads

COURSE OUTCOMES (CO):

Students should be able to:

1. Calculate natural frequencies and draw mode shapes for harmonic vibration
2. Analyze the response of SDOF systems for general and random vibrations
3. Formulate and solve dynamic response problems for SDOF systems
4. Identify, formulate, and solve dynamic response problems for MDOF systems
5. Analyze continuous systems subjected to different types of dynamic loads

Mapping of CO with PO

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	1	0	0	0	0	0	0	0
CO2	3	3	3	3	2	0	0	0	0	0	0	0
CO3	3	3	3	3	2	0	0	0	0	0	0	0
CO4	3	3	3	3	2	0	0	0	0	0	0	0
CO5	3	3	3	3	2	0	0	0	0	0	0	0
Target	3	3	2.8	3	1.8	0	0	0	0	0	0	0

Legends
0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

Unit 1 –Introduction to FEM, Mathematical modelling of Engineering problems, SolutionMethodologies, Approximate Method, Numerical Problems.
Unit 2 – Different Approaches in FEM & Interpolation function of one, two & threedimensional element.
Unit 3 – One Dimensional Finite Element Analysis – Linear Springs, Truss Element, BeamElement, Plane Frames & Grids

Unit 4 – Two & Three Dimensional Analysis – 2-D flow through porous media, 2-D stress Analysis, Isoparametric Formulation, Solution of Partial Differential Equation, Formulation based on Variational Principle, Axi-symmetric Solid, 8 – node Isoparametric element.
Unit 5 – Computer Implementation and further application of FEM – Use of Symmetry and Anti-symmetry condition in reducing a problem, Static condensation, Storage schemes for globalstructural stiffness matrix, Application of Boundary condition FEA of plates, Advance topics.

ASSESSMENT
Continuous: Two midterm tests in a semester and a makeup test if required, Evaluation of designcalculations & drawing sheets, internal submission and Viva Voce examination by internal examiner
Semester-end: Theory examination of 3 Hours duration and Practical Viva Voce Examination by external examiner.

LIST OF EXPERIMENTS –

1) Analysis of Single span beam.
2) Analysis of Multi span beam.
3) Analysis of truss.
4) Analysis of Single bay Single storey Plane frame.
5) Analysis of Multiple bay Multi storey Plane frame.
6) Analysis of 3-D frames.
7) Analysis of Plates.
8) Analysis of Shells.
9) Application of FEM in Fluid Flow, Thermal & Dynamics problem.

Books & References Recommended (Main Textbooks):

1. Y.M. Desai, T.I. Eldho & A. H. Shah, Finite Element Method, Pearson Publications.
2. Reddy, J. N., An Introduction to the Finite Element Method, 3rd Edition, McGraw-Hill.
3. Zienkiewicz, O.C. and Taylor, R.L., The Finite Element Method.
4. S. S. Rao, Finite Element Analysis
5. Bathe, K-J., Finite Element Procedures, Prentice Hall.

Reference Books:

1. Chandrupatla T. R. & Belegundu, A.D., Introduction to Finite Elements in Engineering, Prentice Hall.
2. R.D. Cook, D.S. Malkus, M.E. Plesha, and R.J. Witt, Concepts and Applications of Finite Element Analysis, Wiley, 4th Edition, 2001.
3. C.S. Krishnamoorthy, Finite Element Analysis: Theory and Programming, Tata McGraw-Hill Education, 2nd Edition, 1994.
4. S. Rajasekaran, Finite Element Analysis in Engineering Design, S. Chand Publishing, 2nd Edition, 2017.
5. S.S. Bhavikatti, Finite Element Analysis, New Age International Publishers, 2005.

CIVIL ENGINEERING AND APPLIED MECHANICS DEPARTMENT
B. E. IV Year (4YDC)
CE41711: MUNICIPAL SOLID WASTE MANAGEMENT

CREDITS:

HOURS PER WEEK			CREDITS			MAXIMUM MARKS				
L	T	P	T	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
3	-	2	3	1	-	CW	END SEM	SW	END SEM	200
						30	70	40	60	

PRE-REQUISITE:

1. Environmental Engineering

Syllabus with Course Outcomes (COs)

COURSE OBJECTIVES:
The objective of this course is to get on broader understandings on various aspects of solid waste management (starting from its generation to processing with options for reuse and recycle, transport, and disposal) practiced in different municipalities.

COURSE OUTCOMES (CO):
1. To determine the sources, composition, characteristics and learning of all terms related to general solid waste management including explanation of hierarchical structure in solid waste management and requirement for integrated solution.
2. To examine technical aspects of solid waste segregation, collection and transportation along with route optimization for a solid waste collection and transport system.
3. To analyze and design compost and incineration facilities.
4. To plan and design municipal sanitary landfills along with management of Leachate and landfill gas.
5. To identify appropriate technologies for recycle, recovery and reuse of municipal solid waste. Case studies and Solid waste legislation.

Mapping of CO with PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	0	0	0	0	3	3	0	0	0	0	0
CO2	3	0	0	0	0	2	0	0	0	0	0	0
CO3	3	0	0	0	0	2	2	0	0	0	0	0
CO4	3	0	0	0	0	2	0	0	0	0	0	0
CO5	3	0	3	0	0	0	3	0	0	0	0	0

Legends

0 - No Correlation 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

COURSE CONTENTS:
Theory:

Unit - 1

Fundamentals of municipal solid waste engineering: Solid waste generation, objectives of solid waste management, waste management and reduction, composition of municipal solid waste, characteristics of solid wastes, Integrated Solid Waste Management.

Unit - 2

Technical aspects: storage, collection and transportation of waste: Storage of waste, segregation of waste at source, collection of commingled wastes, collection of segregated waste, types of collection and hauling of vehicles, Equipments used for collection of waste, Transfer stations, Transportation of solid waste.

Unit - 3

Technical aspects: processing and treatment of municipal solid wastes: Biological Processing-Composting, principles of composting, types of composting-manual and mechanised, Indore and Bangalore methods of composting, factors affecting the composting process, control of composting process, mechanical composting, Vermiculture, Anaerobic conversion, Thermal Processing-Combustion and Incineration, Pyrolysis and Gasification, Pelletization, Other methods like Autoclaving, Hydroclaving etc.

Unit – 4

Solid waste disposal in municipal sanitary landfills: Landfill, Types of landfills, components of a landfill, decomposition of solid wastes in landfill, site selection and layout, Landfill operations, management and environmental monitoring of landfill site, Components and main elements in design of final cover, Leachate management.

Unit - 5

Recycle, recovery and reuse of solid wastes: Recyclable components, Biogas from municipal solid waste, Energy Recovery, Refused derived fuel, beneficial aspects of wastes, Utilization by Civil Engineers and Case studies, Solid Wastes Legislation.

Books & References Recommended (Main Textbooks):

1. "Municipal Solid Waste Management Manual", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2016.
2. Manual on "Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, First Edition, May 2000.
3. Khan Iqbal H. and Ahsan Naved, "Textbook of Solid Wastes Management", CBS Publishers and Distributors Pvt. Ltd., New Delhi, First Edition, 2003.

4. Bhide A.D., and Sundaresan B.B., "Solid Waste Management in Developing Countries", INSDOC, New Delhi, Second Edition, 1987.

Reference Books:

1. Vesilind P. Aarne, Worrell William A. and Reinhart Debra R., "Solid Waste Engineering", Cengage Learning India Pvt. Ltd., New Delhi, Third Indian Edition.
2. Peavy Howard S., Rowe Donald R. and Tchobanoglous George, "Environmental Engineering", McGraw Hill Education (India) Pvt. Ltd. New Delhi, First Edition 2013.
3. Tchobanoglous G., Theisen H., and Vigil S.A., "Integrated Solid Waste Management: Engineering Principles and Management Issues", McGraw-Hill, 1993.
4. Kreith F., "Handbook of Solid Waste Management", McGraw-Hill, 1994.
5. Chandrappa R., Das D.B., "Solid Waste Management: Principles and Practice", Springer, 2012