Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE402	ENVIRONMENTAL ENGINEERING – II	3-0-0-3	2016

Prerequisites: CE405 Environmental Engineering- I

Course objectives:

- To understand the various sources and characteristics of wastewater
- To know the various treatment methods available for wastewater treatment

Syllabus : Wastewater, sources, characteristics, oxygen demand Design of sewers, Circular sewers, Partial flow and full flow conditions. Sewer appurtenances, Disposal of wastewater, Streeter Phelps equation, Oxygen sag curve, Treatment methods, Aerobic and anaerobic methods, Design of various treatment units-Screening, Grit chamber, Sedimentation tank, Activated Sludge process, Trickling filter, Rotating biological contactor, Septic tanks, Imhoff tanks, Oxidation ditches, Oxidation ponds, Upflow anaerobic sludge blanket reactors, Sludge digestion, Sludge drying bed.

Course Outcomes:

The students will

i. have an understanding of the various types of treatment methods for wastewater

ii. know the design aspects of various treatment units in a wastewater treatment plant.

Text Books

1. B.C Punmia , "Waste Water Engineering", Laxmi Publications Pvt. Ltd, 2012
2. Howard S Peavy, Donald R Rowe, George Tchobanoglous, Environmental Engineering, Mc Graw Hill Education, 1984
3. P N Modi, "Sewage Treatment & Disposal and Waste water Engineering", Standard Book House, NewDelhi, 2e, 2008.
4. S.K. Garg , "Sewage disposal and Air pollution Engineering", Khanna Publishers, 2008
5. G S Birdie, Water Supply and Engineering, Dhanpat Rai Publishing Company, 2014

References

1. G. L. Karia, R.A. Christian, Wastewater treatment: Concepts And Design Approach, PHI learning Pvt Ltd, 2013
2. J. Arceivala, Shyam R. Asolekar, Wastewater Treatment for Pollution Control and Reuse, McGrawhill Education, 2007
3. K N Duggal, Elements of Environmental Engineering, S Chand Publications, 2007
4. Mackenzie L Davis, Introduction to Environmental Engineering, McGraw Hill Education (India), 5e, 2012
5. Metcalf and Eddy, "Waste Water Engineering", Tata McGraw Hill publishing Co Ltd, 2003

COURSE PLAN

Module	Contents	Hours	Sem. Exam Marks %
I	Wastewater- Sources and flow rates, Domestic wastewater, Estimation of quantity of wastewater, Dry weather flow, storm water flow, Time of concentration Sewers, Design of circular sewers under full and partial flow	6	15

	conditions		
II	Sewer appurtenances-Man holes, Catch basin, flushing devices, Inverted siphon. Ventilation of sewers. Sewage, Sewerage, Systems of sewerage Sewage characteristics- Physical, chemical and biological parameters, Biological oxygen demand, first stage BOD, Chemical oxygen demand, Relative stability, Population equivalent.	7	15
FIRST INTERNAL EXAMINATION			
III	Waste water disposal systems- Self purification of streams, Dilution -Oxygen sag curve, Streeter Phelp's Equation, land treatment Treatment of sewage-Preliminary and Primary treatment -Theory and design of Screen, Grit chamber, Detritus chamber, Flow equalization tank and Sedimentation tank.	6	15
IV	Secondary treatment methods-Contact bed, Intermittent sand filter, Theory and design of Trickling filter, Activated sludge process, Trickling filter-High rate, standard. Rotating biological contactor	7	15
SECOND INTERNAL EXAMINATION			
V	Design of Septic tank and Imhoff tank, Principle and working of Oxidation ditch and oxidation ponds. Aerated lagoons, Design of upflow anaerobic sludge blanket reactors	8	20
VI	Sludge treatment and disposal-Methods of thickening, Sludge digestion- Anaerobic digestion, Design of sludge digestion tanks and Sludge drying beds, methods of sludge disposal	8	20
END SEMESTER EXAMINATION			

- **EXTERNAL EVALUATION:**

Maximum Marks :100 **Exam Duration: 3 Hrs**

QUESTION PAPER PATTERN (External Evaluation) :

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1.Each part should have at least one question from each module

2.Each question can have a maximum of 4 subdivisions (a,b,c,d)

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE404	CIVIL ENGINEERING PROJECT MANAGEMENT	3-0-0-3	2016

Prerequisite: HS300 Principles of Management

Course objectives:

- To impart knowledge on principles of planning and scheduling projects, with emphasis on construction.
- To understand the uses and suitability of various construction equipment,
- To study the legal and ethical issues related to construction projects
- To become familiar with TQM and similar concepts related to quality
- To impart knowledge in the principles of safe construction practices
- To understand the need of ethical considerations in construction.

Syllabus : Construction Planning and Scheduling, Construction disputes and settlement, Ethics in Construction, Construction safety, Principles of Materials management, Quality management practices, Construction procedures

Expected Outcomes:

The students will be able to:

i. Plan and schedule a construction project.
ii. Select an appropriate construction equipment for a specific job
iii. Familiarise the legal procedures in construction contracts
iv. Formulate suitable quality management plan for construction
v. Familiarise the safety practices and procedures.
vi. Apply principles of ethics in decision making.

Text Books:

1. Kumar Neeraj Jha, Construction Project Management, Pearson, Dorling Kindersley (India) pvt. Lt
2. L.S. Srinath – PERT and CPM –Principles and Applications, Affiliated East-West Press, 2001
3. Peurifoy and Schexnayder – Construction Planning, Equipment, and Methods, Tata McGraw Hill, 2010

Reference Books

1. B.C.Punmia & K K Khandelwal, Project Planning with CPM and PERT, Laxmi Publication, New Delhi, 2016
2. Charles D Fledderman, Engineering Ethics, Prentice Hall, 2012
3. F. Harris, Modern Construction and Ground Engineering Equipment and Methods, Prentice Hall, 1994
4. Gahlot and Dhir, Construction Planning and Management, New Age International, 1992
5. K KChitkara, Construction Project Management, McGraw Hill Education Pvt Ltd., 2000
6. Khanna, O.P., Industrial Engineering and Management., Dhanapat Rai Publications, 1980
7. National Building Code, BIS
8. P.P. Dharwadkar, Management in Construction Industry, Oxford and IBH
9. Shrivastava, Construction Planning and Management, Galgotia Publications, 2000

COURSE PLAN

Module	Contents	Hours	Sem. Exam Marks %

I	Unique features of construction projects ; Identification of components –Principles of preparing DPR- Construction planning and scheduling - I – Bar charts, Network Techniques, Use of CPM and PERT for planning – Drawing network diagrams – time estimates – slack – critical path-Examples	7	15
II	Crashing and time –cost trade off, Resource smoothing and resources levelling - Construction, equipment, material and labour schedules. Preparation of job layout. Codification of the planning system : Codification approach- Work package and activities identification code – Resource codes – Cost and Finance accounting codes – Technical document codes.	7	15
FIRST INTERNAL EXAMINATION			
III	Construction disputes and settlement : Types of disputes – Modes of settlement of disputes – Arbitration- Arbitrator - Advantages and disadvantages of arbitration – Arbitration Award. Construction cost and budget :Construction cost – Classification of construction cost – Unit rate costing of resources- Budget – Types of budget – Project Master budget.	6	15
IV	Concept of ethics – Professional ethics – ethical problems – provisions of a professional code – Role of professional bodies.Project management information system- Concept – Information system computerization – Acquiring a system – Problems in information system management - Benefits of computerized information system.	7	15
SECOND INTERNAL EXAMINATION			
V	Concept of materials management – inventory – inventory control – Economic order quantity- ABC analysis. Safety in construction – Safety measures in different stages of construction – implementation of safety programme.	7	20
VI	Construction procedures: different methods of construction – types of contract – Tenders – prequalification procedure - earnest money deposit – contract document – General and important conditions of contract - measurement and measurement book - Inspection and quality control - need, principles and stages. Basics of Total Quality Management	8	20
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN (End semester examination)

Maximum Marks :100 **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1.Each part should have at least one question from each module

2.Each question can have a maximum of 4 subdivisions (a, b, c, d)

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE462	TOWN AND COUNTRY PLANNING	3-0-0-3	2016

Prerequisite : Nil

Course Objective:

- To expose various levels of planning, the elements involved in urban and regional planning and their interrelationships
- To learn to draw up a town development plan.

Syllabus :

Goals and objectives of planning; Components of planning - regional planning for block, district, state, nation - Theories of urbanization - Study of Urban Forms - Urban Structure and its Characteristics - Spatial standards for various facility areas and utilities – zoning - Development of new towns - Urban Renewal - Town Development Plan - Techniques of Preparation of Base Maps.

Course Outcome:

The student will be able to

i. identify and develop the various components of planning at neighborhood, city, regional and national levels
ii. familiarize with spatial standards of facilities and prepare base maps for urban development.

Text Books:

1. Hutchinson B.G., Principles of Transportation Systems Planning, McGraw-Hill, 1974
2. Khadiyali L.R. Traffic Engineering and Transport planning, Khanna Tech Publishers, 1999
3. Oppenheim N., Applied Models in Urban and Regional Analysis, Prentice-Hall, 1980
4. Rangwala, Town planning , Charotar publishing house, 28e, 2015.

References:

1. Eisner S, Gallion A and Eisner S., The Urban Pattern, Wiley, 1993.
2. Hiraskar G K, Fundamentals of Town planning, Dhanpat Rai publications, 1993.
3. N.K Gandhi – Study of Town and Country planning in India – Indian Town and Country planning Association, 1973.
4. Wilson, A.G, Urban and Regional Models in Geography and Planning, John Wiley and Sons, 1974.

Module	Contents	Hours	Sem. Exam Marks %
I	Definitions and Rationales of Planning - Definitions of town and country planning; Goals and objectives of planning; Components of planning; Benefits of planning - urbanization, industrialization and urban development; push and pull factors; migration trends and impacts on urban and rural development - rural-urban fringes - city region - area of influence and dominance	6	15
II	Rural landscapes- regional planning: definition, need and importance, function, objective, concept of region, types of	6	15

	regions, delineation of regions - Types and contents of regional planning for block, district, state, nation, NCR, resource region, agro–climatic region, topographic region and sectoral planning, major regional problems and their solutions.		
FIRST INTERNAL EXAMINATION			
III	Theories of urbanization-Concentric Zone Theory; Sector Theory; Multiple Nuclei Theory; Land Use and Land Value Theory of William Alonso; City as an organism: a physical entity, social entity and political entity –- Study of Urban Forms such as Garden City, Precincts, Neighbourhoods, - MARS Plan, LeCorbusier Concept, Radburn Concept	**7**	**15**
IV	Urban Structure and its Characteristics - Functions of Transportation Network - concept of accessibility and mobility, Transit Oriented Development (TOD) - Spatial standards for residential, industrial, commercial and recreational areas, space standards for facility areas and utilities, Provisions of Town Planning Act, zoning, subdivision practice, metro region concept.	**7**	**15**
SECOND INTERNAL EXAMINATION			
V	**Concept of New Towns:** Meaning, role and functions: Special planning and development considerations, scope and limitations of new town development, Indian experience of planning and development of new towns. Urban Renewal: Meaning, significance, scope and limitations, urban renewal as a part of metropolitan plan	**8**	**20**
VI	Town Development Plan: Scope, contents and preparation. A case study of development plan, scope, content and preparation of zonal development plans, plan implementation - organizational legal and financial aspects, public participation in plan formulation and implementation - Techniques of Preparation of Base Maps: Drawing size, scale, format, orientation, reduction and enlargement of base maps.	**8**	**20**
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN (End semester examination)

Maximum Marks :100 **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1.Each part should have at least one question from each module

2.Each question can have a maximum of 4 subdivisions (a, b, c, d)

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE464	REINFORCED SOIL STRUCTURES AND GEO - - SYNTHETICS	3-0-0-3	2016

Prerequisite : CE305 Geotechnical Engineering - II

Course objectives:

- To understand the history and mechanism of reinforced soil
- To know the various types of geosynthetics, their functions and applications.
- To enable the design of reinforced soil retaining structures.

Syllabus :

Introduction- Functions of geosynthetics. Reinforcement action – Mechanism of reinforced soil. Component materials and their properties – fill, various types of reinforcements with advantages, disadvantages, facings. - Factors affecting the performance and behaviour of reinforced soil.

Design and analysis of reinforced soil retaining walls-General aspects - External stability of vertically faced reinforced soil retaining wall. Internal stability – Tie back wedge analysis or coherent gravity analysis or reinforced soil retaining walls with metallic strip and continuous geosynthetic reinforcements. Assumptions and problems. Construction methods of reinforced retaining walls. Bearing capacity improvement using soil reinforcement – Binquet and Lee's analysis - Simple problems in bearing capacity of reinforced soil foundation. Concept of Geocells, encased stone columns, prefabricated vertical drains, geocomposites, soil nailing, geotubes, geobags (only basic concepts). Natural geotextiles using coir and jute with relative advantages and disadvantages, application areas.

Expected Outcomes:

The students will

i. Understand the history and mechanism of reinforced soil

ii. Become aware about situations where geosynthetics can be used.

iii. Know about various types of geosynthetics and their functions

iv. Be able to do dimple design of reinforced soil retaining walls and reinforced earth beds.

Text Books / References:

1. Jones, C.J.F.P. (1985). Earth reinforcement and soil structures. Butterworth, London.
2. Koerner, R.M. (1999). Designing with Geosynthetics, Prentice Hall, New Jersey, USA, 4th edition.
3. Rao, G.V. (2007). Geosynthetics – An Introduction. Sai Master Geoenvironmental Services Pvt. Ltd., Hyderabad
4. Rao, G.V., Kumar, S. J. and Raju, G.V.S.S. (Eds.). Earth Reinforcement – Design and Construction. Publication No. 314, Central Board of Irrigation and Power, New Delhi, 2012.
5. Sivakumar Babu, G.L. (2006). An introduction to Soil reinforcement and geosynthetics. United Press (India) Pvt. Ltd.

COURSE PLAN

Module	Contents	Hours	Sem. Exam Marks %
I	Introduction -history –ancient and modern structures- Types of geosynthetics, advantages, disadvantages. Functions of geosynthetics and application areas where these functions are	5	15

	utilized such as in retaining walls, slopes, embankments, railway tracks, pavements etc. (general overview)		
II	Raw materials used for geosynthetics, manufacturing process of woven and non woven geotextiles, geomembranes, geogrids. Properties of geosynthetics. Creep and long term performance. Reinforced soil - Advantages and disadvantages. Fills, Types of facings, Factors affecting the performance of reinforced soil.	7	15
FIRST INTERNAL EXAMINATION			
III	Mechanism of reinforcement action - Equivalent Confining Stress Concept, Pseudo Cohesion Concept, Concept of Expanding soil mass. – Simple problems.	7	15
IV	Design and analysis of vertically faced reinforced soil retaining walls- External stability and Internal stability – Tie back wedge analysis and coherent gravity analysis. Assumptions, limitations and numerical problems. Construction methods of reinforced retaining walls. Geosynthetics in pavements, function and benefits.	7	15
SECOND INTERNAL EXAMINATION			
V	Bearing capacity improvement using soil reinforcement – Binquet and Lee's analysis – Assumptions, failure mechanisms. Simple problems in bearing capacity. Geosynthetics for short term stability of embankments on soft soils. Natural geotextiles, Advantages and disadvantages, functions, erosion control- types of erosion control products, installation methods.	9	20
VI	Prefabricated vertical drains along with design principles and installation method Concept of Geocells, Gabion Walls, encased stone columns, geocomposites, soil nailing, geotubes, geobags (only basic concepts), application in landfills.	7	20
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN (End semester examination)

Maximum Marks :100 **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1.Each part should have at least one question from each module

2.Each question can have a maximum of 4 subdivisions (a, b, c, d)

Course No.	Course Name	L-T-P Credits	Year of Introduction
CE466	FINITE ELEMENT METHODS	3-0-0-3	2016

Prerequisite : Nil

Course Objectives

- To provide a fundamental knowledge on FEM
- To equip to solve basic Engineering problems using FEM

Syllabus

Introduction to FEM- Basics of 2D elasticity -Development of shape functions for truss, beam and frame elements -The Direct Stiffness Method- Lagrangian and Hermitian interpolation functions - Isoparametric formulation

Expected Outcome

- Students successfully completing this course are expected to implement FEM for solving basic engineering problems.

Text Books

1. Bathe K J, *Finite Element Procedures in Engineering Analysis*, Prentice Hall, New Delhi., 1982
2. Cook R D, Malkus D S, and Plesha M E, *Concepts and Applications of Finite Element Analysis*, John Wiley & Sons, Singapore., 1981
3. Krishnamoorthy C S, *Finite Element Analysis- Theory and Programming*, Tata McGraw Hill, New Delhi., 1994

Reference Books

1. Chandrupatla T R and Belegundu A D, *Introduction to Finite Elements in Engineering*, Pearson Education, New Delhi., 1998
2. Hutton D V, *Fundamentals of Finite Element Analysis*, Tata McGraw Hill Education Private Ltd, New Delhi., 2005
3. Mukhopadhyay M and Abdul Hamid Sheikh, *Matrix and Finite Element Analyses of Structures*, Ane Books Pvt. Ltd., New Delhi., 2009
4. Rajasekharan S, *Finite Element Analysis in Engineering Design*, Wheeler, New Delhi., 1998
5. Reddy J N, An Introduction to FEM, McGraw Hill Book Co. New York, 1984
6. Zienkiewicz O C and Taylor R W., Finite Element Method, Elsevier Butterworth-Heinemann, UK., 2005

Course Plan

Module	Contents	Hours	Sem. Max. Marks %
I	Introduction to FEM- out line of the procedure – Element properties- polynomial form- shape function form- equilibrium and compatibility in the solution- convergence requirements. Development of shape functions for truss elements	7	15
II	Basics of 2D elasticity - Strain displacement relations- constitutive relations- Energy principles-Principles of virtual work- Total potential energy- Rayleigh-Ritz method- method of weighted residuals. Gauss elimination - Solution of equations	7	15

FIRST INTERNAL EXAM			
III	The Direct Stiffness Method:- Structure stiffness equations – Properties of [K] – Solution of unknowns – Element stiffness equations – Assembly of elements - Static condensation. Displacement boundary conditions – Stress computation – Support reactions	**8**	**15**
IV	Shape functions for C0 and C1 elements – Lagrangian and Hermitian interpolation functions for one dimensional elements Development of shape functions for beam, and frame elements	**6**	**15**
SECOND INTERNAL EXAM			
V	Lagrangian interpolation functions for two and three dimensional elements constant strain triangle- Linear strain triangle- Bilinear plane rectangular elements- Consistent nodal loads- lumped loads- patch test- stress computation	**7**	**20**
VI	Isoparametric formulation – Line elements- Plane bilinear element- Iso parametric formulation of Quadratic plane elements- Sub parametric elements and super parametric elements- Gauss quadrature- Plate and shell elements	**7**	**20**
END SEMESTER EXAM			

QUESTION PAPER PATTERN (External Evaluation) :

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1.Each part should have at least one question from each module

2.Each question can have a maximum of 4 subdivisions (a, b, c, d)

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE468	STRUCTURAL DYNAMICS AND EARTHQUAKE RESISTANT DESIGN	3-0-0-3	2016

Prerequisite : CE403 Structural Analysis III

Course objectives:

- To have an understanding on Earthquakes and Design of structures for earthquake resistance

Syllabus :

Introduction to structural dynamics, Multi degree freedom systems, Earthquake Engineering, IS Code provisions, detailing and codal provisions, Aseismic planning, Shear walls

Expected Outcomes:

1. An ability to Write the equations of motion for damped and undamped vibrations for SDOF systems
2. An ability to analyse the MDOF systems and calculate the frequency & mode shapes
3. An ability to describe engineering seismology including causes and effects of earthquakes.
4. An ability to analyze, design multi-storeyed structure using Seismic Coefficient and Response Spectrum methods
5. An ability to use the concept of aseismic planning for earthquake resistance.
6. An ability to detail the structures as per IS code and design and detail shear walls using IS 13920

Text Books / References:

1. Mario Paz, *"Structural Dynamics - Theory and Computations"*, 6th Edition, CBS Publishers
2. PankajAgarwal& Manish Shrikhande, *"Earthquake Resistant Design of Structures"*, 5thEdition, Prentice Hall of India, New Delhi, 2009.
3. Jai Krishna A.R, Chandrasekharan A.R, Brijesh Chandra, *"Elements of Earthquake Engineering"*, 2nd Edition, South Asian Publishers, New Delhi, 2001.
4. Chopra A.K., *"Dynamics of Structures"*, 5th Edition, Pearson Education, Indian Branch, Delhi, 2007.
5. S.K.Duggal, *"Earth Quake Resistant Design of Structures"*, Oxford university Press, 1st Edition, 2012
6. Clough &Penzien, *"Dynamics of Structures"*, 4th Edition, McGraw Hill, International Edition, 2008

IS Codes :

IS: 1893, IS: 4326 and IS:13920, Bureau of Indian Standards, New Delhi

COURSE PLAN

Module	Contents	Hours	End Sem. Exam Marks %
I	INTRODUCTION TO STRUCTURAL DYNAMICS : Theory of vibrations – Lumped mass and continuous mass systems– Single Degree of Freedom (SDOF) Systems – Formulation of equations of motion – Un damped and damped free vibration – Damped – Force vibrations – Response to harmonic excitation – Concept of response spectrum.	6	15
II	MULTI-DEGREES OF FREEDOM (MDOF) SYSTEMS (LIMITEDTO 2 DOF):Formulation of equations of motion – Free	6	15

	vibration – Determination of natural frequencies of vibration and mode shapes – Orthogonal properties of normal modes – Mode superposition method of obtaining response.		
FIRST INTERNAL EXAMINATION			
III	EARTHQUAKE ENGINEERING :Engineering Seismology – Earthquake phenomenon – Causes and effects of earthquakes – Faults – Structure of earth – Plate Tectonics– Elastic Rebound Theory – Earthquake Terminology – Source, Focus, Epicenter etc – Earthquake size – Magnitude and intensity of earthquakes – Classification of earthquakes – Seismic waves – Seismic zones – Seismic Zoning Map of India – Seismograms and Accelerograms.	6	15
IV	CODAL DESIGN PROVISIONS : Review of the latest Indian seismic code IS:1893 – 2002 (Part-I) provisions for buildings – Earthquake design philosophy – Assumptions – Analysis by seismic coefficient and response spectrum methods – Displacements and drift requirements – Provisions for torsion – Analysis of a multistoried building using Seismic Coefficient method.	8	15
SECOND INTERNAL EXAMINATION			
V	SEISMIC PLANNING : Plan Configurations – Torsion Irregularities – Re-entrant corners –Non-parallel systems – Diaphragm Discontinuity – Vertical Discontinuities in load path – Irregularity in strength and stiffness – Mass Irregularities – Vertical Geometric Irregularity – Proximity of Adjacent Buildings.	7	20
VI	CODAL DETAILING PROVISIONS: Review of the latest Indian codes IS: 4326 and IS: 13920 Provisions for ductile detailing of R.C buildings – Beam, column and joints.SHEAR WALLS: Types – Design of Shear walls as per IS: 13920 – Detailing of reinforcements.	9	20
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN (End semester exam)

Maximum Marks: 100 **Exam Duration: 3 hours**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each
Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each
Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1.Each part should have at least one question from each module
2.Each question can have a maximum of 4 subdivisions (a,b,c,d)

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE472	TRANSPORTATION PLANNING	3-0-0-3	2016

Prerequisite: NIL

Course Objectives:

- To expose the students to the dynamics of urban travel patterns, land use transport interaction, the steps and techniques involved in transportation planning process.

Syllabus:

Transportation planning process – Transportation Systems - Urban Travel Patterns and Urban Transportation Technologies - Urban Activity System - Four Step Planning process - Land use transport models.

Course Outcome:

The student will be able to calibrate and validate planning models, evaluate various transportation planning alternatives.

Text Books:

1. Bruton, M. J., Introduction to Transportation Planning, Hutchinson of London
2. Dickey, J. W. Metropolitan Transportation Planning, Tata McGraw Hill
3. Papacostas, C. S. and Prevedouros, P.D., Transportation Engineering and Planning, Prentice Hall.

References:

1. Gallion, A.B. and Eisner, S., The Urban Pattern, East-West Press, New Delhi.
2. Hutchinson, B.G., Principles of Urban Transportation System Planning, McGraw Hill
3. Mayer, M.D and Miller, E .J, Urban Transportation Planning a Decision Oriented Approach, McGraw Hill.

Module	Contents	Hours	End Sem. Exam Marks %
I	Introduction: Role of transportation in the development of a society - Land use-Transportation interaction - Goal, objectives and constraints in transportation planning process – Transportation Systems overview - Transportation issues and challenges – Basic steps in systems planning process	6	**15**
II	Different modes of transport - Characteristics of different modes - integration of modes and interactions - impact on environment - Relationship between Movement and Accessibility – Hierarchy of transportation facilities - Brief Study of Urban Travel Patterns and Urban Transportation Technologies - Comprehensive Mobility Plan	**7**	**15**
FIRST INTERNAL EXAMINATION			
III	Urban Transportation Planning:Urban Activity System - Trip-based and Activity-based approaches - inventory, model building, forecasting and evaluation stages –Definition of study area – zoning - Urban Structure and its Characteristics	**6**	**15**

IV	Four Step Planning process – Trip generation – trip production and trip attraction models – regression and category analysis - Trip Distribution-Growth factor models, Gravity models - mode split models	**8**	**15**
SECOND INTERNAL EXAMINATION			
V	Route choice modeling - diversion curves - basic elements of transportation networks, coding, minimum path trees - traffic assignment - all- or- nothing assignments, capacity restraint techniques	**8**	**20**
VI	Land use transport models - Lowry derivative models - Quick response techniques - Non-Transport solutions for transport problems.	**7**	**20**
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN (End semester exam)

Maximum Marks :100 **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each
Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each
Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1.Each part should have at least one question from each module
2.Each question can have a maximum of 4 subdivisions (a,b,c,d)

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE474	MUNICIPAL SOLID WASTE MANAGEMENT	3-0-0-3	2016

Prerequisites: Nil

Course objectives:

1. To create an awareness of different types of solid waste generated in our environment and their ill effects
2. To study the various methods of collection, processing and disposal of solid wastes

Syllabus:

Solid wastes-Types, Properties, Characteristics. Generation of solid wastes, Collection of solid wastes. Processing techniques. Disposal technologies-Physical, Thermal, Biological methods. Energy from solid wastes

Course Outcomes:

- Students will have an awareness of the ill effects of increasing solid wastes
- Students will be able to understand the various methods available for managing solid wastes generated

Text Books

1. George Tchobanoglous, Frank Kreith et al "Hand book of solid waste management." Mc Graw hill publications -Newyork.
2. William A Worrell, Aarne Vesilind, Solid waste Engineering, Cengage learning
3. Howard S Peavy, Donald R Rowe, George Tchobanoglous,"Environmental Engineering" McGrawhill Education

References:

1. John Pichtel " Waste management Practices" Taylor& Francis publishers
2. David . A . Cornwell, Mackenzie . L .Davis "Introduction to Environmental Engineering" Mc Graw Hill International Edition .
3. Daniel . B. Botkin, Edward .A. Keller "Environmental Science" (Earth as a living plant) IV Edition ,John wiley& Sons Inc.
4. Robert . A. Corbitt "Hand Book of Environmental Engineering" Mc Graw hill publishing Company

COURSE PLAN

Module	Contents	Hours	End Sem. Exam Marks %
I	Wastes-Sources and characteristics - Categories of wastes- Municipal, Industrial, Medical, Universal, Construction and demolition debris, Radioactive, Mining, e wastes, Agricultural waste.	7	15
II	Waste generation-Methods of estimation of Generation rate- Measure of quantities, Composition- Physical and chemical (simple problems). Storage of solid waste	7	15
FIRST INTERNAL EXAMINATION			

III	**Collection** – collection services- collection systems, collection routes-Need for transfer operation. Resource conservation and recovery.	6	15
IV	Processing techniques- Mechanical volume and size reduction, chemical volume reduction, component separation, Drying (simple problems)	6	15
SECOND INTERNAL EXAMINATION			
V	Disposal of solid waste; Sanitary land fill- area method, trench method-advantages and disadvantages, Incineration- types of incinerators -parts of an incinerator-incinerator effluent gas composition	8	20
VI	Composting- types of composting-Indore process, Bangalore process (advantages and disadvantages). Anaerobic digestion of wastes, Biogas digesters	8	20
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN (End Semester Exam)

Maximum Marks :100 **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1.Each part should have at least one question from each module

2.Each question can have a maximum of 4 subdivisions (a,b,c,d)

Course Code	Course Name	L-T-P	Credits	Year of Introduction
BT362	Sustainable Energy Processes	3-0-0	3	2016

Prerequisite: Nil

Course Objectives

- To introduce the current and potential future energy systems, covering resources, extraction, conversion, and applications, with emphasis on meeting regional and global energy needs in a sustainable manner.

Syllabus

Classification of energy, extraction, conversion, and applications of solar energy, wind energy, ocean energy, biomass energy, fuel cells and hydro-dynamic systems, merits and demerits of various energy systems, energy storage.

Expected outcome

Students who successfully complete this course should be able to

i. Identify global and Indian energy sources.
ii. Explain capture, conversion and application of solar and wind energy.
iii. Explain conversion of biomass to energy.
iv. Explain the capture of energy from oceans.
v. Explain fuel cells and energy storage routes.

Reference Books

1. Bansal N K, Kleemann M, Michael Meliss, *Renewable Energy Sources & Conversion Technology*, Tata McGraw Hill publishing Company, New Delhi, 1990.
2. Boyle, Godfrey, *Renewable Energy*, 3/e, Oxford University Press, 2012.
3. S P Sukhatme, *Solar Energy - Principles of Thermal Collection and Storage*, 2/e, Tata McGraw- Hill Publishing company, New Delhi,1996.
4. Pramod Jain, *Wind Energy Engineering*, McGraw Hill, 2011.
5. Donald L Klass, *Biomass for Renewable Energy, Fuels and Chemicals*, Academic Press, 1998.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	**General classification of energy**. Conventional and non-conventional. Renewable and non-renewable. Global and Indian energy sources. Global and Indian energy consumption. Problems of fossil fuels. Environmental aspects of energy utilization. Energy and sustainable development. Energy planning. Renewable energy sources, potentials, achievements and applications.	7	15%
II	**Solar energy**. Solar radiation. Solar thermal systems. Flat plate and concentrating collectors. Solar desalination. Solar pond. Solar cookers. Solar dryers. Solar thermal electric power plant. Solar photovoltaic conversion. Semiconductor and thin film technology. Solar cells. Solar photovoltaic power generation. Hybrid systems. Merits and limitations of solar energy.	7	15%
FIRST INTERNAL EXAM			

III	**Wind energy**. Availability of wind energy, Site characteristics, Wind turbine types-horizontal axis and vertical axis-design principles of wind turbine. Wind power plants, Wind energy storage. Safety and environmental aspects. Merits and limitations of wind energy.	7	15%
IV	**Biomass energy**. Biomass resources, Biomass conversion technologies-direct combustion, pyrolysis, biomass gasification. Biogas production. Biomethanation as an aid to environment improvement. Bioethanol, biodiesel and biobutanol production. Hydrogen as fuel. Biohydrogen production. Storage of hydrogen.	7	15%
SECOND INTERNAL EXAM			
V	**Energy from the oceans**. Ocean thermal electric conversion. Tidal energy conversion. Geothermal energy conversion. Hydro power-global and Indian scenario. Positive and negative attributes of hydropower. Electricity from hydropower. Small hydropower.	7	20%
VI	**Fuel cells.** Alkaline fuel cells. Phosphoric acid fuel cell. Molten carbonate fuel cell. Solid oxide fuel cell, Solid polymer electrolyte fuel cell. Magneto-hydrodynamic systems. Electric vehicles. Energy storage routes like thermal, chemical, mechanical, electrical storage. Batteries.	7	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3 hours

The question paper consists of Part A, Part B and Part C.

Part A consists of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer two questions (15×2=30 marks).

Part B consists of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer two questions (15×2=30 marks).

Part C consists of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer two questions (20×2=40 marks).

For each question there can be a maximum of 4 subparts.

Course code	Course Name	Credits	Year of Introduction
*492	PROJECT	6	2016

Prerequisite : Nil

Course Objectives

- To apply engineering knowledge in practical problem solving
- To foster innovation in design of products, processes or systems
- To develop creative thinking in finding viable solutions to engineering problems

Course Plan

In depth study of the topic assigned in the light of the preliminary report prepared in the seventh semester
Review and finalization of the approach to the problem relating to the assigned topic
Preparing a detailed action plan for conducting the investigation, including team work
Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed
Final development of product/process, testing, results, conclusions and future directions
Preparing a paper for Conference presentation/Publication in Journals, if possible
Preparing a report in the standard format for being evaluated by the dept. assessment board
Final project presentation and viva voce by the assessment board including external expert

Expected outcome

The students will be able to

iii. Think innovatively on the development of components, products, processes or technologies in the engineering field
iv. Apply knowledge gained in solving real life engineering problems

Evaluation

Maximum Marks : 100

(i) Two progress assessments	20% by the faculty supervisor(s)
(ii) Final project report	30% by the assessment board
(iii) Project presentation and viva voce	50% by the assessment board

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.