M.KUMARASAMY COLLEGE OF ENGINEERING (Autonomous) – KARUR 639113

Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE01	INTRODUCTION TO REMOTE SENSING	3	0	0	3	45	100	

Course Objective (s):

- To enable students to have the knowledge about GIS techniques and its application in the field of Civil Engineering.

Course Outcomes: After successful completion of this course, the students will be able to

1. Apply the basic concepts of electromagnetic energy, spectrum signature in practical problems.
2. Assess remote sensing data related to land use and natural resources
3. Apply remote sensing in the field of Civil Engineering and natural resource management
4. Interpret the knowledge on importance of remote sensing in agriculture, soil and forest.
5. Illustrate the lithological mapping and identify the engineering geological concepts.

Unit I	INTRODUCTIONTO REMOTESENSING	9

Definition - Physics of remote sensing - electromagnetic radiation (EMR) - Atmospheric windows - Interaction of EMR with atmosphere, earth surface, soils, water and vegetation - Platform and sensors - image interpretations.

Unit II	LAND USESTUDIES	9

Definition of land use - Land use / land cover classification - Schemes and levels of classification systems with RS data - Land use mapping - Change detection - Urban land use planning, site suitability analysis, transport action planning

Unit III	WATER RESOURCES	9

Areal assessment of surface water bodies - Capacity survey of water bodies - Mapping of snow - Covered Areas - Flood risk zone mapping - Identification of ground water potential zones, recharge areas - Droughts, definition, drought assessment and management.

Unit IV	AGRICULTURE,SOILAND FORESTRY	9

Crop inventory mapping - Production estimation - Command area monitoring - Soil mapping - Crop stress detection - Estimation of soil erosion - Forest types and density mapping - Forest fire risk zone mapping.

Unit V	EARTHSCIENCE	9

Lithology - Lithological mapping - Structural mapping - Geomorphology - Nature and type of land forms - Identification - Use of remote sensing data for landslides - Targeting mineral resources -Engineering geology and environmental geology.

TEXT BOOK(S):

1. Lillesand .T.M and Kiefer R.W., Remote Sensing and Image interpretation. John Willey and sons, inc. New York, 2007.
2. Michael Hord,R., Remote sensing methodsandapplication,JohnWileyandSons,NewYork,1986
3. Anji Reddy .M, "Remote Sensing and Geographical Information Systems" Third Edition, BS Publications, 2014.

REFERENCE(S):

1. Steven M.D, and Cllark, J.A. "Application of Remote sensing in Agriculture, Butterworths, London, 1990.
2. Sabins .F.F.Jr. Remote sensing principles and interpretation, W.H. Freeman & Co., 2007.
3. Satellite data, Report No. IRS-UP/SAC/FMDD/TN/16/90,1990
4. Manual of Remote Sensing Vol.II. American Society of Photogrammetry.

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Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CE002	MAINTENANCE AND REHABILITATION OF STRUCTURES	3	0	0	3	45	100	

Course Objective (s):

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

Course Outcomes: After successful completion of this course, the students will be able to

1. Interpret the difference between repair and rehabilitation
2. Explain the techniques to resist corrosion
3. Use suitable materials and techniques for repair
4. Select suitable special concretes for repair works
5. Select suitable demolition techniques for structures

Unit I	MAINTENANCE AND REPAIR STRATEGIES	9

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

Unit II	STRENGTH AND DURABILITY OF CONCRETE	9

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

Unit III	REPAIR MATERIALS	9

Patching materials - Cementitious Materials - Grouts - Resurfacing materials - Protective coating - Intumescent coatings - Resin based toppings - Surface hardeners - Overlays - Types of overlays

Unit IV	TECHNIQUES FOR REPAIR AND PROTECTION METHODS	9

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

Unit V	REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES	9

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake - Demolition Techniques - Engineered demolition methods - Case studies.

TEXT BOOK(S):

1. Dr.B.Vidivelli, “Rehabilitation of Concrete Structures”, Standard Publishers Disributors,2007.
2. Denison Campbell, Allen and Harold Roper, “Concrete Structures, Materials, Maintenance and Repair”, Longman Scientific and Technical UK, 1991.
3. Dr. Sumithra, "Repair and Rehabilitation of Structures" Sree Kamalamani publication, Chennai

REFERENCE(S):

1. Shetty M.S., "Concrete Technology - Theory and Practice", S.Chand and Company, 2008.
2. Dov Kominetzky.M.S., "Design and Construction Failures", Galgotia Publications Pvt. Ltd., 2001
3. Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
4. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
5. Gambhir .M.L., "Concrete Technology", McGraw Hill, 2013

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Department	CIVIL ENGINEERING					R 2016	Semester	
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		L	T	P	C			
16CEE03	BASICS OF DYNAMICS AND ASEISMIC DESIGN	3	0	0	3	45	100	

Course Objective (s):

- To learn the basics of various dynamic forces and its effects on the structure.
- To enhance the ability to identify the mode shapes of the structure under dynamic loading.
- To enhance the ability to design earthquake resistant structures by using IS codal provisions.

Course Outcomes: After successful completion of this course, the students will be able to

1. Understand the principles of vibration with regard to single degree of freedom system.
2. Identify the natural frequencies and mode shapes for multi degree of freedom systems.
3. Summarize the phenomenon, causes and measurement of earthquakes.
4. Understand the concepts of behavior of soil and its interaction effects.
5. Introduce the concept of ductility and corresponding detailing and ability design earthquake resistant structures by using IS codal provisions.

UNIT I	THEORY OF VIBRATIONS	9

Difference between static loading and dynamic loading - Degree of freedom - idealisation of structure as single degree of freedom system - Formulation of Equations of motion of SDOF system - D'Alemberts principles - effect of damping - free and forced vibration of damped and undamped structures - Response to harmonic and periodic forces.

UNIT II	MULTIPLE DEGREE OF FREEDOM SYSTEM	9

Two degree of freedom system - modes of vibrations - formulation of equations of motion of multidegree of freedom (MDOF) system - Eigen values and Eigen vectors.

UNIT III	ELEMENTS OF SEISMOLOGY	9

Elements of Engineering Seismology - Causes of Earthquake - Plate Tectonic theory - Elasticrebound Theory - Seismic waves - Characteristic of earthquake - Magnitude and intensity of earthquakes - History of earthquakes.

UNIT IV	BEHAVIOUR OF STRUCTURES AND SOIL	9

Effect of earthquake on different type of structures - Lessons learnt from past earthquakes - Soil Liquefaction - Soil Structure Interaction effects.

UNIT V	CODAL PROVISIONSAND NEW TECHNIQUES	9

IS 1893, IS 13920 and IS 4326 - Codal provisions - design as per the codes - Base isolation techniques - Vibration control measures - Important points in mitigating effects of earthquakes on structures.

TEXT BOOK(S):

1. Chopra, A.K., "Dynamics of Structures - Theory and Applications to Earthquake Engineering", 4th Edition, Pearson Education, 2011.
2. Damodarasamy,S.R., Kavitha,S. "Basics of Structural Dynamics and Aseismic Design", PHI Publishers, New Delhi.
3. Agarwal. P and Shrikhande. M., "Earthquake Resistant Design of Structures", Prentice Hall of India Pvt. Ltd. 2007.

REFERENCE(S):

1. Paz .M., "Structural Dynamics - Theory & Computation", CSB Publishers & Distributors, Shahdara, Delhi,2010.
2. Biggs, J.M., "Introduction to Structural Dynamics", McGraw - Hill Book Co., Ny., 2014.
3. Dowrick, D.J., "Earthquake Resistant Design", John Wiley & Sons, London, 2009

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Department	CIVIL ENGINEERING					R 2016	Semester	
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		L	T	P	C			
16CEE04	EARTHQUAKE ENGINEERING	3	0	0	3	45	100	

Course Objective(s):

- To provide a coherent development to the students for the courses in sector of Earthquake Engineering.
- To present the foundations of many basic engineering concepts related Earthquake Engineering.
- To give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering
- To enhance the ability to design earthquake resistant structures by using IS codal provisions.

Course Outcome(s): After successful completion of this course, the students will be able to

1. Identify earthquake fault sources and summarize the phenomenon, causes and measurement of earthquakes
2. Apply the concept of inertia and damping, equation of motion for SDOF system
3. Analyse the structure by using linear coefficient method
4. Design masonry structure for Earthquake Resistant Design
5. Design RC structure for Earthquake Resistant Design

UNIT I	BASICS OF SEISMOLOGY	9

Earth and its interior - Plate Tectonics - Convection Currents - Inter Plate Earthquake (Convergent Boundaries, Divergent Boundaries and Transform Boundaries) - Intra Plate Earthquake (Faults and Types of Faults) - Seismic Waves - Basic Terminology - Measuring Units and Instruments.

UNIT II	FUNDAMENTALS OF EARTHQUAKE VIBRATIONS OF STRUCTURES	9

Equation of Motion - Degrees of Freedom - Single and multiple degrees of Freedom - Mathematical Modeling - Equation of Motion for Free Vibration for Damped and Un damped System - Equation of Motion for Forced Vibration (SDOF Only).

UNIT III	EARTHQUAKE LOAD ANALYSIS ON STRUCTURES	9

Introduction to methods of Earthquake Load Analysis (Linear Static, Linear Dynamic, Non Linear Static, Non Linear Dynamic) - Analysis of Structure by Linear Static Method (Seismic Coefficient Method) - Analysis of Structure by Linear Dynamic Method (Random Response Method).

UNIT IV	EARTHQUAKE RESISTANT DESIGN ON MASONRY STRUCTURES	9

Structural Systems - Types of Buildings - Causes of damage - Planning Considerations -Philosophy and Principle of Earthquake Resistant Design - Guidelines for Earthquake Resistant Design - Earthquake Resistant Masonry Buildings - Design consideration - Guidelines.

UNIT V	EARTHQUAKE RESISTANT DESIGN ON RC STRUCTURES	9

Earthquake Resistant Design of R.C.C. Buildings - Material properties - Lateral load analysis - Capacity based Design and detailing - Rigid Frames - Shear wall frame systems- Khan and Saboronis method - Coupled shear wall system - Rosman's method.

TEXT BOOK(S):

1. Chopra, A.K., "Dynamics of Structures - Theory and Applications to Earthquake Engineering", 4th Edition, Pearson Education, 2011.
2. Agarwal. P and Shrikhande. M., "Earthquake Resistant Design of Structures", Prentice Hall of India Pvt. Ltd. 2007.
3. Duggal.S.K. "Earthquake Resistant Design of Structures",Oxford, 2007.

REFERENCE(S):

1. Biggs, J.M., "Introduction to Structural Dynamics", McGraw - Hill Book Co., Ny., 1964.
2. Damodarasamy,S.R.,Kavitha,S. "Basics of Structural Dynamics and Aseismic Design", PHI Publishers, New Delhi.

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Department	CIVIL ENGINEERING					R 2016	Semester	
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		L	T	P	C			
16CEE05	INTEGRATED WATER RESOURCE MANAGEMENT	3	0	0	3	45	100	

Course Objective (s):

At the end of this course students will able to

- To make the students conversant with different aspects of the management, reservoir planning, cost analysis of water resources.

Course Outcome(s): After successful completion of this course, the students will be able to

1. Assess the impacts on water resources of the country.
2. Design the optimum rain gauge network and summarize the various components of hydrological cycle
3. Prepare the water budget and development plan
4. Analyze the importance of utilizing water and reservoir storage
5. Perform economic analysis of water resource projects.

Unit I	INTRODUCTION	9

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

Unit II	HYDROLOGIC CYCLE	9

Components of Hydrological cycle - system representation- Historical development of hydrology - Weather system - cloud and cloud seeding - General atmospheric circulation - Types and forms of precipitation - measurement of rainfall - optimum rain gauge network design

Unit III	WATER RESOURCE NEEDS	9

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

Unit IV	RESERVOIR PLANNING AND MANAGEMENT	9

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

Unit V	ECONOMIC ANALYSIS	9

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

TEXT BOOK(S):

1.	Linsley R.K. and Franzini J.B, “Water Resources Engineering”, McGraw-Hill Inc, 2000.
2.	Douglas J.L. and Lee R.R., “Economics of Water Resources Planning”, Tata McGraw-HillInc. 2000.
3.	Garg S. K. “Hydrology and Water Resources Engineering” McGraw-Hill Inc, 1995
4.	Punmia.B.C, “Irrigation and Water Power Engineering”Laxmi Publications, 2016

REFERENCE(S):

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

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Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE06	MUNICIPAL SOLID WASTE MANAGEMENT	3	0	0	3	45	100	

Course Objective(s):

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

Course Outcomes: After successful completion of this course, the students will be able to

1. Summarize the characteristics of solid waste and the effects of solid waste public and economic aspects.
2. Identify the storage containers and processing techniques for municipal solid waste.
3. Explain how to identify collection options for municipal solid waste and transfer process.
4. Illustrate the possible solution to reuse and energy management.
5. Develop the disposal alternative methods through case studies and team-oriented technical presentations.

Unit I	SOURCES AND TYPES OF MUNICIPAL SOLID WASTES	9

Sources and types of solid wastes - Quantity - factors affecting generation of solid wastes; characteristics - methods of sampling and characterization; Effects of improper disposal of solid wastes - public health effects. Principle of solid waste management - social & economic aspects; Public awareness; Role of NGOs; Legislation.

Unit II	ON-SITE STORAGE & PROCESSING	9

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

Unit III	COLLECTION AND TRANSFER	9

Methods of Collection - analysis of collection system (HCS and SCS) - types of vehicles - Manpower requirement - collection routes - route optimization - preparation of master schedule - transfer stations - selection of location, operation & maintenance; options under Indian conditions.

Unit IV	OFF-SITE PROCESSING	9

Processing techniques and Equipment; Resource recovery from solid wastes - sorting and separation - composting, incineration, Pyrolysis - options under Indian conditions.

Unit V	DISPOSAL	9

Dumping of solid waste; sanitary landfills - site selection, design and operation of sanitary landfills - Leachate collection & treatment.

TEXT BOOK(S):

1.	Tchobanoglous, G., Theisen, H. M., and Eliassen, R. "Solid. Wastes: Engineering Principles and Management Issues". McGraw Hill, New York, (1993).
2.	Paul T Willams, "Waste Treatment and Disposal", John Wiley and Sons, (2000).
3	Ganesaguru.S., “Municiplal Solid Waste Management” AR publications,(2016).

REFERENCE(S):

1.	Government of India, "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, New Delhi, (2000).
2.	GeorgeTchobanoglous and Frank Kreith" Handbook of Solid waste Management”, McGraw Hill, New York, (2002).
3.	Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal,(2001).

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Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE07	GEO ENVIRONMENTAL ENGINEERING	3	0	0	3	45	100	

Course Objective(s):

- To learn concepts of geo environmental engineering, and planning and designof waste in landfills, ash ponds and tailing ponds.

Course Outcomes: After successful completion of this course, the students will be able to

1. Assess the impacts of soil pollution and physcio-chemical behavior of soil.
2. Design the landfill system and summarize the various components of Hazardous waste management
3. Prepare the transport model for contaminants
4. Analyze the importance of testing of contaminated ground soil.
5. Interpret remediation methods for contaminated soil.

UNIT I **SOIL- POLLUTANT INTERACTION**

Introduction to geo environmental engineering - environmental cycle - sources, production and classification of waste - causes of soil pollution - factors governing soil-pollutant interaction Physico-chemical behavior and modelling -failures of foundations due to pollutants.

UNIT II **CHARACTERIZATION, STABILIZATION AND DISPOSAL**

Safe disposal of waste - site selection for landfills - characterization of land fill sites - waste characterization -stability of landfills - current practice of waste disposal- passive contaminant system - Hazardous waste control and storage system - mechanism of stabilization - solidification of wastes - micro and macro encapsulation - absorption, adsorption, precipitation- detoxification -- organic and inorganic stabilization.

UNIT III **TRANSPORT OF CONTAMINANTS**

Contaminant transport in sub surface - advection - diffusion - dispersion - governing equations - contaminant transformation - sorption - biodegradation - ion exchange - precipitation - hydrological consideration in land fill design - ground water pollution - bearing capacity of compacted fills - pollution of aquifers by mixing of liquid waste - protecting aquifers.

UNIT IV **DETECTION AND TESTING METHODS**

Methodology- review of current soil testing concepts - Proposed approach for characterization and identification of contaminated ground soil for engineering purposes

UNIT V **REMEDIATION OF CONTAMINATED SOILS**

Rational approach to evaluate and remediate contaminated sites - monitored natural attenuation - exsitu and insitu remediation - solidification, bio - remediation, incineration, soil washing, electro kinetics, soil heating, verification, bio venting - Ground water remediation - pump and treat, air sparging, reactive well- application of geo synthetics in solid waste management - rigid or flexible liners.

TEXT BOOK(S):

1. Qian, X., Koerner, R., and Gray, D.H., Geotechnical aspects of landfill design and construction, Prentice Hall, 2002.
2. Daniel, D.E., Geotechnical practice for waste disposal, Chapman and Hall, 1993.
3. Sarsby, R., Environmental Geotechnics, Thomas Telford, 2000.
   Bagchi, A., Design, construction and monitoring of landfills, Wiley Interscience, 1994.

REFERENCE(S):

1. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989.
2. Fang, H.Y. Introduction to environmental Geotechnology, CRC press New York, 1997.
3. Lagrega, M.d., Bukingham, P.L., and Evans, J.C., Hazardous Waste Management, McGraw Hill,Inc. Singapore, 1994.

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Department	CIVIL ENGINEERING					R 2016	Semester	
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		L	T	P	C			
16CEE08	ENVIRONMENTAL IMPACT ASSESSMENT	3	0	0	3	45	100	

Course Objective(s):

- To emphasize the need for EIA.
- To provide basic knowledge on the components, methods and quality control measures of EIA
- To make the students understand the importance of documentation and monitoring of EIA along with case studies.

Course Outcomes: After successful completion of this course, the students will be able to

1. Find the various impacts of infrastructure projects on the components of environment
2. Apply the knowledge acquired to the process of environmental impact modeling and prediction as a design tool with application to a number of case studies
3. Explain the different methodologies for environmental impact prediction and assessment
4. Identify environmental impact assessment and environmental management plans.
5. Comprehend the various impacts of development projects on environment and the mitigating measures**.**

Unit I	INTRODUCTION	9

Impact of development projects - Sustainable development- Need for Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) - EIA capability and limitations- EIA in project cycle - Legal provisions on EIA-Stages of EIA.

Unit II	METHODOLOGIES	9

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

Unit III	PREDICTION AND ASSESSMENT	9

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

Unit IV	ENVIRONMENTAL MANAGEMENT PLAN	9

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

Unit V	CASE STUDIES	9

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

TEXT BOOK(S):

1. Canter, R.L. Environmental impact Assessment, McGraw Hill Inc., New Delhi 1996.
2. Anjaneyulu, Y, Environmental Impact Assessment methodologies B.S. Publications, Hyderabad, 2002.
3. S.K. Shukla and P.R. Srivastava, Concepts in Environmental Impact Analysis, Common Wealth Publishers, New Delhi, 1992.

REFERENCE(S):

1. John G. Rao and David C.Hooten (Ed.), Environmental Impact Analysis Handbook, McGraw Hill Book Company, 1990.
2. Environmental Assessment Source book, Vol. II and III. The World Bank, Washington, D.C., 1991.
3. Judith Petts,Handbook of Environmental Impact Assessment Vol.I and II, Blackwell Science, New York, 1998.

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Department	CIVIL ENGINEERING					R 2016	Semester	
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		L	T	P	C			
16CEE09	GROUNDWATER ENGINEERING	3	0	0	3	45	100	

Course Objective(s):

- To introduce the student to the principles of Groundwater governing Equations and Characteristics of different aquifers,
- To understand the techniques of development and management of groundwater.

Course Outcomes: After successful completion of this course, the students will be able to\

1. Distinguish the essential components and function of the hydrologic cycle
2. Develop unit hydrographs based on stream flow data, and conduct basic unit hydrograph analysis.
3. Gives an exposure towards well design and practical problems of groundwater aquifers.
4. Assess the importance of artificial recharge and groundwater quality concepts.
5. Design of Distribution systems for canal irrigation and unlined and lined irrigation canals.

Unit I	HYDROGEOLOGICAL PARAMETERS	9

Introduction - Water bearing Properties of Rock - Type of aquifers - Aquifer properties - permeability, specific yield, transmissivity and storage coefficient - Methods of Estimation- Ground water table fluctuation and its interpretations - Groundwater development and Potential in India - GEC norms.

Unit II	WELL HYDRAULICS	9

Objectives of Groundwater hydraulics - Darcy's Law - Groundwater equation - steady state flow - Dupuit Forchheimer assumption - Unsteady state flow - Thesis method - Image well theory - Partial penetrations of wells.

Unit III	GROUNDWATER MANAGEMENT	9

Need for Management Model - Database for groundwater management -groundwater balance study - Introduction to Mathematical model - Conjunctive use - Collector well and Infiltration gallery.

Unit IV	GROUNDWATER QUALITY	9

Ground water chemistry - Origin, movement and quality - Water quality standards - Health and aesthetic aspects of water quality - Saline intrusion - Environmental concern and Regulatory requirements

Unit V	GROUNDWATER CONSERVATION	9

Artificial recharge techniques - Remediation of Saline intrusion- Ground water management studies - Protection zone delineation, Contamination source inventory, remediation schemes - Ground water Pollution and legislation.

TEXT BOOK(S):

1.	Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.
2.	Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.

REFERENCE(S):

1.	Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2002.
2.	Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.

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Department	CIVIL ENGINEERING					R 2016	Semester	
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		L	T	P	C			
16CEE10	WATER RESOURCES SYSTEMS ENGINEERING	3	0	0	3	45	100	

Course Objective(s):

- Students will be introduced to application of systems concept to water resources planning and management. Optimization technique for modeling water resources systems and advanced optimization techniques to cover the socio-technical aspects will be taught.

Course Outcomes: After successful completion of this course, the students will be able to

1. Distinguish the essential components and function of the system engineering to water resources
2. Develop linear programming for sensitivity analysis and design of reservoirs
3. Gives an exposure towards dynamic programming for practical problems in reservoirs
4. Assess the importance of reservoir simulation models
5. Design of advance optimization techniques resolves the various socio-technical aspects of water resources systems

Unit I	SYSTEM CONCEPTS	9

Definition, classification, and characteristics of systems - Scope and steps in systems engineering - Need for systems approach to water resources and irrigation.

Unit II	LINEAR PROGRAMMING	9

Introduction to operations research - Linear programming, problem formulation, graphical solution, solution by simplex method - Sensitivity analysis, application to design and operation of reservoir- Case studies.

Unit III	DYNAMIC PROGRAMMING	9

Bellman's optimality criteria, problem formulation and solutions - Application to design and operation of reservoirs, Single and multipurpose reservoir development plans - Case studies

Unit IV	SIMULATION	9

Basic principles and concepts - Random variant and random process - Monte Carlo techniques - Model development - Inputs and outputs - Single and multipurpose reservoir simulation models - Case studies.

Unit V	ADVANCED OPTIMIZATION TECHNIQUES	9

Integer and parametric linear programming - Goal programming models with applications Discrete differential dynamic programming and incremental dynamic programming - Linear decision rule models with application -

TEXT BOOK(S):

1.	Gupta P.K and Man Mohan, Problems in Operations Research Solutions Sultan Chand and sons, New Delhi, 1995
2.	Hiller F.S and Liebermann G.J., Operations Research CBS Publications and distributions. New Delhi, 1992.
3.	Chaturvedi. M.C., Water Resources Systems Planning and Management. Tata McGraw Hill, New Delhi, 1997.

REFERENCE(S):

1.	Mays L.W., and Tung YK, Hydro systems Engineering and Management. McGraw Hill Inc., New York, 1992
2.	Goodman Alvin S., Principles of Water Resources Planning, Prentice Hall Inc., Englewood Cliffs, New Jersey, 1995.
3.	Course material, Micro Computer Application to Systems Analysis in Irrigation Water Management, CWR, Anna University, 1992.
4.	Wagner H.M., Principles of Operations Research with Application to Management Decisions, Prentice Hall, India, New Delhi, 1993.

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Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE11	GROUND IMPROVEMENT TECHNIQUES	3	1	0	3	45	100	

Course Objective(s):

- At the end of the course student is able to identify the problematic soil and to suggest suitable techniques to improve the behavior of soil.

Course Outcomes: After successful completion of this course, the students will be able to

1. Find the dewatering techniques available in practice
2. Describe the compaction types and its process
3. Select suitable ground improvement techniques to enhance the properties of soil structure
4. Know the types, methods and applications of reinforcement materials for soil stablization
5. Know types and design methods of grouts, monitoring aspects in ground improvement

Unit I	DEWATERING	9

Introduction - Scope and necessity of ground improvement - New Technologies - Basic concepts - Drainage methods- Ground water lowering by well points - Deep well, Vacuum and Electro - Osmosis methods.

Unit II	COMPACTION AND SAND DRAINS	9

In-situ compaction of cohesion less and cohesive soil - Shallow and deep compaction - Vibration methods - Vibrocompaction, Blasting, Vibrating probe, Vibratory rollers, Vibroflotation - Concept, Factors influencing compaction -Heavy Tamping - Vertical drains - Preloading with sand drains, Fabric drains, Wick drains -Relative merits of different methods - Limitations

Unit III	STONE COLUMN AND CONSOLIDATION	9

Precompression and consolidation - Dynamic consolidation - Electro-osmotic consolidation - Stone column - Lime piles- Earth reinforcement - Soil Nailing

Unit IV	SOIL STABILIZATION	9

Introduction - Stabilization methods - Mechanical, Chemical stabilisation-Cement, Lime, Bitumen - Electrical stabilization- Stabilization of expansive clays - Prewetting.

Unit V	GROUTING	9

Introduction - Applications - Functions - Characteristics of grouts - Types of grout - Suspension and solution grouts -Basic requirements of grout - Displacement grouting - Compaction grouting - Permeation grouting - Grouting equipment- Grout monitoring

TEXT BOOK(S):

1. Purushothama Raj, P., “Ground Improvement Techniques”, Laxmi Publications (P) Ltd., New Delhi, 2005.
2. Petros P. Xanthakos, Lee W. Abramson and Donald A. Bruce, Ground Control and Improvement, JohnWilley& Sons Inc., 1994
3. Mittal.S, “An Introduction to Ground Improvement Engineering”, Medtech Publisher, 2013.

REFERENCE(S):

1. Moseley M.D., “Ground Treatment, Blackie Academic and Professional”, 1998.
2. Shroff, A.V., “Grouting Technology, in Tunneling and Dam”, Oxford & IBH Publishing Co. Pvt. Ltd., NewDelhi,
3. Koerner, R.M., “Designing with Geosynthetics (fourth edition)”, Prentice Hall, New Jersey, 1999.
4. M. R. Hausman, Engineering Principles of Ground Modification, McGraw Hill Book Co., Singapore,1990

M.KUMARASAMY COLLEGE OF ENGINEERING (Autonomous) – KARUR 639113

Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE12	AIR POLLUTION CONTROL					45	100	

Course Objective(s):

- This subject covers the sources, characteristics and effects of air and noise pollution and the methods of controlling the same. The student is expected to know about source inventory and control mechanism.

Course Outcomes: After successful completion of this course, the students will be able to

1. Relate the basic concepts of air pollution and its effects on human and ecosystem health.
2. Explain how atmospheric chemical composition both drives and responds to changes in the earth system, including climate change
3. Find the major air pollution control technologies
4. Review current air pollution policies applied in Europe for criteria pollutants
5. Adopt interpretation of meteorological data for atmospheric stability and sampling of air pollutants

Unit I	INTRODUCTION	9

Classification of air pollutants - Particulates and gaseous pollutants - Sources of air pollution - Effects of air pollution on human beings, materials, vegetation, animals - Air pollution indices - Indoor Air Pollutants

Unit II	TRANSPORT OF POLLUTION IN ATMOSPHERE	9

Elements of atmosphere - Meteorological factors - Wind roses - Lapse rate - Atmospheric stability and turbulence - Plume rise - Dispersion of pollutants - Gaussian plume Dispjersion models -Applications.

Unit III	AIR POLLUTION CONTROL	9

Concepts of control - Principles of control measures - Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation - Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion -Pollution control for specific major industries.

Unit IV	EMERGING TRENDS	9

Radioactive pollution and its control - Automobile Air Pollution and its Control - Ultraviolet photolysis - High efficiency Particulate Air Filters - Control of Indoor Air Quality.

UNIT V	AIR QUALITY SAMPLING AND MONITORING	9

Stack sampling- instrumentation and methods of analysis of gases- Analytical methods-Air pollution legislation and regulations

TEXT BOOK(S):

1.	Rao C.S., Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi,1996.
2.	M N Rao and H V N Rao.,AirPollution,McGraw Hill Education(India) Private Limited.,New Delhi,2016.

REFERENCE(S):

1.	Lawrence K.Wang, Norman C Perelra, Yung-Tse-Hung, Air Pollution Control Engineering,Tokyo, 2004.
2.	Noel de Nevors, Air Pollution Control Engineering, McGraw Hill, New York, 1995.
3.	W.L.Heumann, Industrial Air Pollution Control Systems, McGraw Hill, New York, 1997.

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Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE13	INDUSTRIAL WASTE WATER ENGINEERING	3	0	0	3	45	100	

Course Objective(s):

- To impart knowledge on sources and characteristics of various industrial wastes and strategies for its prevention and control.

Course Outcomes: After successful completion of this course, the students will be able to

1. Summarize the characteristics of industrial wastewaters and the effects of industrial wastewaters in India
2. Identify the waste minimization techniques for industrial wastewater pollution.
3. Explain how to identify treatment options for industrial wastewater and treatment process.
4. Illustrate the possible solution to reuse and residual management.
5. Develop the treatment alternative flow sheets through case studies and team-oriented technical presentations.

Unit I	INTRODUCTION	9

Types and industrial pollution - Characteristics of industrial wastes - Population equivalent - Bioassay studies - effects of industrial effluents on streams, sewer, land, sewagetreatment plants and human health - Environmental legislations.

Unit II	CLEANER PRODUCTION	9

Waste management Approach - Waste Audit - Volume and strength reduction - Material and process modifications - Recycle, reuse and byproduct recovery - Applications.

Unit III	TREATMENT OF INDUSTRIAL WASTEWATER	10

Physico - chemical treatment processes - Equalization, Neutralization, Oil Separation, Precipitation, Biological treatment processes - Aerobic and Anaerobic Reactors, Tertiary Treatment Processes for removal of dissolved organics and inorganics.

Unit IV	WASTEWATER REUSE AND RESIDUAL MANAGEMENT	8

Zero Liquid discharge systems - Quality requirements for reuse - sludge treatment - Solidification - Incineration - secured Landfills - Regulatory Requirements - Leachate Treatment

Unit V	CASE STUDIES	9

Sources, characteristics and waste treatment Flow sheets for selected industries - Tanneries, Textiles, Diary, Pulp and Paper, Sugar & Distilleries, Refineries, Thermal Power Plants.

TEXT BOOK(S):

1.	Rao M. N. &Dutta A. K. , “Wastewater Treatment”, Oxford - IBH Publication, 1995.
2	Nelson Leonard Nemerow., “Industrial Waste Treatment: Contemporary Practice and Vision for the Future”,Elsevier,2010.
3	Eckenfelder W.W. Jr., “Industrial Water Pollution Control”, McGraw Hill Book Company,New Delhi, 2000.
4	Patwardhan. A.D., Industrial Wastewater Treatment", Prentice Hall of India, New Delhi 2010.

REFERENCE(S):

1.	Shen T.T., “Industrial Pollution Prevention”, Springer, 1999.
2.	Stephenson R.L. and Blackburn J.B., Jr., “Industrial Wastewater Systems Hand book”,Lewis Publisher, New York, 1998.
3.	Bishop, P.L., “Pollution Prevention: Fundamental & Practice”, McGraw Hill, 2000.
4.	Pandey, "Environmental Management" Vikas Publications, 2010.
5.	Industrial Wastewater Management, Treatment and Disposal",(WEF - MOP - FD3) McGraw Hill, 2008.

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Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE14	PREFABRICATED STRUCTURES	3	0	0	3	45	100	

Course Objective(s):

- To get the knowledge on the need for prefabrication systems and the structural components used with respect to the design principles as per codal provisions.

Course Outcomes: After successful completion of this course, the students will be able to

1. Apply the principles and systems of prefabrication in the field, and safely transport and erect prefabricated elements.
2. Identify suitable prefabricated components for specific use.
3. Adopt the design principles for prefabricated structures.
4. Classify the structural connections.
5. Utilize the various code provisions regarding progressive collapse.

Unit I	INTRODUCTION	9

Need for prefabrication - Principles - Materials - Modular coordination - Standarization - Systems - Production - Transportation - Erection.

Unit II	PREFABRICATED COMPONENTS	9

Behaviour of structural components - Large panel constructions - Construction of roof and floor slabs - Wall panels - Columns - Shear walls

Unit III	DESIGN PRINCIPLES	9

Disuniting of structures- Design of cross section based on efficiency of material used - Problems in design because of joint flexibility - Allowance for joint deformation.

Unit IV	JOINT IN STRUCTURAL MEMBERS	9

Joints for different structural connections - Dimensions and detailing - Design of expansion joints

Unit V	DESIGN FOR ABNORMAL LOADS	9

Progressive collapse - Code provisions - Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse

TEXT BOOK(S):

1.	prefabricated structures" by DrGanesan, sreeKamalamani publication
2.	Gerostiza C.Z., Hendrikson C. and Rehat D.R., "Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994

REFERENCE(S):

1.	Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
2.	"Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland BetorVerlag, 2009

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Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE15	DESIGN OF PRESTESSED CONCRETE STRUCTURES	3	0	0	3	60	100	

Course Objective(s):

- To understand the fundamental principle of prestressing concrete.
- To learn the design of prestressed concrete structures. Compare the behaviour of prestressed concrete members with that of the normal reinforced concrete structures.

Course Outcomes: After successful completion of this course, the students will be able to

1. Select suitable method of prestressing for the given condition.
2. Design of pre-stressed concrete beam
3. Design flexural members with partial pre-stressing
4. Design pre-stressed composite beams
5. Design pre-stressed concrete tanks, poles and sleepers, bridges.

UNIT I	PRINCIPLES OF PRESTRESSING	9

Basic concepts - Advantages - Materials required - Systems and methods of prestressing - Analysis of sections - Stress concept - Strength concept - Load balancing concept - Effect of loading on the tensile stresses in tendons.

Unit II	DEFLECTION OF PRESTRESSED CONCRETE MEMBER	9

Losses of prestress - factors affecting the losses of prestress. Deflections of prestressed concrete members - Factors influencing deflections - Effect on tendon profile on deflections. Short term and long term deflections.

Unit III	DESIGN OF PRESTRESSED CONCRETE MEMBER	9

Strain compatibility method - Flexural strength - Simplified procedures as per codes – Basic concepts in selection of cross section for bending - stress distribution in end block, Design of anchorage zone reinforcement - Limit state design criteria - Partial prestressing and its Applications.

Unit IV	COMPOSITE CONSTRUCTION	9

Analysis for stresses - Estimation of deflections - Flexural and shear strength of composite members - Differential Shrinkage - Shrinkage induced stresses.

Unit V	SPECIAL STRUCTURES	9

Prestressed concrete tanks, poles, sleepers. Prestressed concrete bridges - Introduction - General aspects - Types of prestressed bridge decks & Post Tensioned prestressedbridge decks - Advantages - design principles

TEXT BOOK(S):

1.	Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, New Delhi, 1998
2.	N Rajagopal, Prestressed concrete, Second Edition, Narosa Publications, New Delhi, 2007
3.	Sinha N C, Sujit Kumar Roy, “Fundamentals of Pre-Stressed Concrete” S Chand Publishing; Third edition, 2011.

REFERENCE(S):

1.	Mallic S.K. and Gupta A.P., Prestressed concrete, Oxford and IBH publishing Co.Pvt. Ltd.
2.	Ramaswamy G.S., Modern prestressed concrete design, ArnoldHeinimen, New Delhi,1990.
3.	Lin T.Y.,Design of prestressed concrete structures, Asia Publishing House, Bombay,1995.
4.	David A.Sheppard, William R. and Philips, Plant Cast precast and prestressed concrete - A design guide, McGraw Hill, New Delhi, 1992.

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Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE16	URBAN PLANNING AND DEVELOPMENT	3	0	0	3	45	100	

Course Objective(s):

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

Course Outcomes: After successful completion of this course, the students will be able to

1. Describe basic issues in urban planning
2. Perform the skills to formulate plans for urban and rural development
3. Apply and analyse socio economic aspects of urban and rural planning
4. Prepare and design of urban development projects
5. Explain legislation, development and management of urban system

Unit I	BASIC ISSUES	9

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

Unit II	PLANNING PROCESS	9

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

Unit III	DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION	9

Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development , Control Rules, Transfer of Development Rights , Special Economic Zones.

Unit IV	PLANNING AND DESIGN OF URBAN DEVELOPMENT PROJECTS	9

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

Unit V	LEGISLATION, DEVELOPMENT AND MANAGEMENT OF URBAN SYSTEM	9

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

TEXT BOOK(S):

1. Prakash M Apte, “Urban planning and Development: An Indian Perspective” Zorba Publishers, 2013
2. Hiraskar G K “Fundamental of Town Planning” DhanpatRai Publications, 2012

REFERENCE(S):

1. Rangwala. S.C. “Town Planning” Charotar Publishing House.,Anand 2005.
2. National Building Code of India., SP7 (Group 1)Bureau of Indian Standards, New Delhi,2005

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Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE17	AIRPORT AND HARBOUR ENGINEERING	3	0	0	3	45	100	

Course Objective(s):

- To introduce the fundamentals related to the Planning of Airport components.
- To provide knowledge on various airport facilities such as runway Geometric Design.
- To create awareness about the various processes involved in the Air Traffic Control process.
- To impart knowledge on various planning standards related to harbour construction.
- To provide knowledge on various components of harbour and ports.

Course Outcomes: After successful completion of this course, the students will be able to

1. Know the locations of the components of the airports
2. Design the airport components and their geometric design
3. Perform the air traffic control of aircrafts
4. Describe the components of the harbour
5. Design the harbour components such as breakwaters and docks

Unit I	AIRPORT PLANNING	9

Aircraft characteristics and its influence on airport planning. Topographical and geographical features-air traffic characteristics. New airports- factors affecting airport site selection. Airport obstruction-Zoning laws-classification of obstruction, imaginary surfaces.

Unit II	AIRPORT GEOMETRIC DESIGN	9

Runway orientation- wind rose diagrams - basic runway length-Corrections for runway length- airport classification - airport capacity- runway configuration- taxiway design- geometric standards-exit taxiways. Holding aprons - location of terminal buildings - aircraft hangers.

Unit III	AIR TRAFFIC CONTROL	9

Airport marking and lighting of runways - taxiways and approach areas. Terminals - planning of terminal building. Apron - size of the gate position - number of gate position - aircraft parking system. Air traffic control- air traffic control aids: Enroute aids - landing aids. Airport Drainage: requirements and advantages.

Unit IV	HARBOUR PLANNING	9

Wind-Waves-tides-Selection of site-draft conditions - entrance and channel requirement- Harbours-Ports-Difference between port and harbour. Ship characteristics - their influence on ports management - operations. Harbour layouts.

Unit V	HARBOUR Engineering	9

Harbour components - break waters-types-special blocks- tetrapod - hexapod - tribars. Jetties- wharves- piers - transit sheds-warehouses. Mooring - accessories - berthing facilities - dolphins. Docks-types - Navigational aids - buoys - lighthouses - lightships - becons - containerisation - containers - container yards and handling equipments - Construction of Port - Dredging

TEXT BOOK(S):

1. S.K.Khanna, M.G.Arora, S.S.Jain, Airport Planning & Design, Nemchand Bros, Roorkee,6th Edition, 2011.
2. Bindra S.P., Docks &Harbour Engineering, DhanpatRai Publications (P) Ltd,New Delhi,2013.
3. S B Seghal and K L Bahnot, A Text Book on Highway Engineering and Airports, S Chand, New Delhi,1980

REFERENCE(S):

1. Subramanian K.P., “Highways, Railways, Airport and Harbor Engineering”, Scitech Publications (India) Chennai, 2010.
2. Robert M. Horonjeff, Francis X. Mckelvey Planning *and* Design of Airports*,* TMH publishers,2010

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Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE18	GEOGRAPHIC INFORMATION SYSTEM	3	0	0	3	45	100	

Course Objective(s):

- To enable students to have the knowledge about GIS techniques and its application in the field of Civil Engineering.

Course Outcomes: After successful completion of this course, the students will be able to

1. Describe basic concept of geographic information system
2. Perform the skills to formulate data analysis and modeling
3. Analyze the data error
4. Explain GIS application in resource management
5. Extend GIS application in advance

Unit I	GIS TECHNIQUE AND DATA INPUT	9

MAP - Types of maps - Development of GIS - Components of GIS - Hardware, software, and organization- Types of data - Spatial and non-spatial data - Point, line and polygon - Vector and raster data -Database structures - Files - Vector and raster data structures.

Unit II	DATA ANALYSIS AND MODELLING	9

Data retrieval - Query - Simple analysis - Spatial analysis - Overlay - Vector data analysis - Raster data analysis - Modelling using GIS - Digital elevation model - Cost and path analysis - Expert systems - Artificial intelligence - Integration with GIS

Unit III	DATA OUTPUT AND ERROR ANALYSIS	9

Data output - Types - Devices used - Raster and vector display devices - Printers - Plotters - Photo write devices - Sources of errors - Types of errors - Elimination - Accuracies

Unit IV	GIS APPLICATIONS IN RESOURCE MANAGEMENT	9

Fields of applications - Natural resources - Agriculture - Soil - Water resources - Wasteland management - Social resources - Cadastral records - LIS

Unit V	ADVANCED GIS APPLICATION	9

AM/FM - Utility network management - Integration with remote sensing - Knowledge based techniques - Multicriteria techniques - Introduction to object oriented data base models.

TEXT BOOK(S):

1. Burrough PA, Principles of GIS for Land Resources Assessment, Oxford Publication, 2000.
2. Michael N Demers, Fundamentals of Geographical Information Systems, Third Edition, John Wiley Publications, 2008.

REFERENCE(S):

1. Paul A Longley, Michae lF Good child, Geographical Information Systems Volume I and II, Second Edition, John Wiley Publications, 2010.

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Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE19	DESIGN OF PLATE AND SHELL STRUCTURES	3	0	0	3	45	100	

Course Objective(s):

- To impart Knowledge on the analysis of different types of plates and shells under different boundary conditions.
- To impart knowledge on the methods of design of RC folded plates and shell roof structures.

Course Outcomes: After successful completion of this course, the students will be able to

1. Analyse of rectangular plate with different boundary condition
2. Analyse of circular plates with UDL and partially Distributed load
3. Analyse and design RC folded plates
4. Analyse of shell structures with different shapes
5. Design various types of shells structures.

UNIT I	ANALYSIS OF RECTANGULAR PLATES	9

Introduction- General Behavior of plates-Assumptions - Small deflection theory of thin plates -Governing differential equation for deflection of plate - Boundary conditions. Bending of Isotropic Rectangular Plates: Navier solution for an all - round simply supported rectangular plate subjected to uniformly distributed load sinusoidal load and point load - Levy's solution for a rectangular plate with different boundary conditions and subjected to uniformly distributed load.

UNIT II	ANALYSIS OF CIRCULAR PLATES	9

Symmetrical bending of circular Plates - Simply supported solid circular plate subjected to a uniformly distributed load, an end moment and partially distributed load.

UNIT III	ANALYSIS AND DESIGN OF FOLDED PLATES	9

Structural behavior of folded plates - Assumptions - Analysis of folded plates - Design of prismatic folded plate roofs as per ACI- ASCE task committee recommendations -Reinforcements details.

UNIT IV	ANALYSIS OF SHELL STRUCTURES	9

Structural behavior of thin Shells - Classification of shells - methods of generating the surface of different shells like conoid, hyperbolic and elliptic paraboloid - Membrane Theory of shells -Edge disturbances - Geometry of hypar Shell - Analysis of membrane forces - forces in the edge members

UNIT V	DESIGN OF SHELL STRUCTURES	9

Design of cylindrical shells with edge beams using theory for long shells - Design of cylindrical shell with ASCE manual No.31 coefficients - Detailing of reinforcement in shells and edge beams - Design of R.C. hypar shell roof of the inverted and tilted inverted umbrella type - Design and detailing of RC spherical shell and conical shells - Design examples.

TEXT BOOK(S):

1. Ramasamy G.S., Design and Construction of Concrete Shell Roofs, CBS Publishers and Distributors, New Delhi, 2003.
2. Timoshenko .S and S.W. Kreiger, Theory of Plates and Shells, McGraw - Hill Book Company, New York, 1990.
3. Chatterjee B.K., Theory and Design of Concrete Shells, Chapman and Hall Ltd., London.

REFERENCE(S):

1. Design of Cylindrical Concrete Shell Roofs ASCE - Manuals of Engineering Practice - No.31, ASCE, New York, 1952.
2. Chandrashekahara.K, Theory of Plates, University Press (India) Ltd., Hyderabad, 2001.

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Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE20	TALL STRUCTURES	3	0	0	3	45	100	

Course Objective(s):

- The design aspects and analysis methodologies of tall buildings will be introduced. The stability analysis of tall buildings is another important objective of this course.

Course Outcomes: After successful completion of this course, the students will be able to

1. Implement design philosophies for the development of high rise structures
2. Find out the design loads for high rise buildings, and analyze the behavior of tall buildings subjected to lateral loading.
3. Understand the behaviour of various structural member
4. Perform, and computerized general three dimensional analysis for high rise building
5. Perform stability analysis using various methods for tall buildings and analyze effect of foundation rotation in tall buildings.

UNIT I	DESIGN CRITERIA AND MATERIALS	9

Development of High Rise Structures - General Planning Considerations - Design philosophies - Materials used for Construction-High Strength Concrete - High Performance Concrete-Self Compacting Concrete - Glass - High Strength Steel

UNIT II	LOADING	9

Gravity Loading-Dead Load-Live Load - Live load reduction technique-Impact Load-Construction Load-Sequential Loading. Lateral Loading-Wind load-Earthquake Load. Combination of Loads.

UNIT III	BEHAVIOUR OF VARIOUS STRUCTURAL	9

Factors affecting growth, Height and Structural form. High rise behaviour of Various structural Systems -Rigid frames, braced frames, Infilled frames, shear walls, coupled shear walls, wall-frames, tubular structures, cores, outrigger-braced and hybrid mega systems.

UNIT IV	ANALYSIS AND DESIGN	9

Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of buildings as total structural system considering overall integrity and major subsystem interaction, Analysis for member forces, drift and twist, computerised general three dimensional analysis.

UNIT V	STABILITY OF TALL BUILDINGS	9

Overall buckling analysis of frames, wall-frames, Approximate methods, second order effects ofgravity of loading, P-Delta analysis, simultaneous first-order and P-Delta analysis, Translational, Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation.

TEXT BOOK(S):

1. Bryan Stafford Smith, Alexcoull, “Tall Building Structures, Analysis and Design”, John Wiley and Sons,Inc., 1991.
2. Taranath B.S., “Structural Analysis and Design of Tall Buildings”, McGraw Hill,2011

REFERENCE(S):

1. Lin.T.Y, Stotes Burry.D, “Structural Concepts and systems for Architects and Engineers”, John Wiley, 1988.
2. Lynn S.Beedle, “Advances in Tall Buildings”, CBS Publishers and Distributors, Delhi, 1986.
3. Wolfgang Schueller "High Rise Building Structures", John Wiley and Sons, New York 1977

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Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE21	BRIDGE STRUCTURES	3	0	0	3	45	100	

Course Objective(s):

- To understand the different codal provisions for design of bridges
- To study the concepts for the design of reinforced concrete slab bridge decks, Tee beam and slab bridge decks, plate girder bridges, balanced cantilever bridges and continuous bridges.
- To study the concepts for the design of different types of bridge bearings, piers and abutments, and bridge foundations

Course Outcomes: After successful completion of this course, the students will be able to

1. Dtudy the components reinforced concrete bridge
2. Design R.C girder bridges
3. Design of long span girder bridges, plate girder bridges
4. Design of prestressed concrete bridges
5. Design bearings for different types of bridges

Unit I	INTRODUCTION TO BRIDGE,TYPES AND LOADS ON BRIDGES	9

Classification - Importance of bridges - Investigation for bridges -Selection of bridge site componentsof bridges - Economical span - Traffic projection - Choice of bridge type-Specification of road bridges- Width of carriageway - Loads to be considered - Dead load -IRC Standard live load - Impact effect.

Unit II	R.C. GIRDER BRIDGES	9

Analysis of Slab bridges - effective width dispersion method- Pigeaud's curve method -Design of solid slab bridges- Load distribution theories-Design of tee beam and slab bridges.

Unit III	LONG SPAN GIRDER BRIDGES	9

Design Principles of balanced cantilever bridges and Continuous girder bridges- Railway bridge- Design of plate girder bridges.

Unit IV	PRESTRESSED CONCRETE BRIDGES	9

Prestressed concrete bridges- design concepts - design of prestressed concrete solid slab bridges - design principles of pre tensioned and post tensioned girder bridges.

Unit V	BEARING, SUBSTRUCTURES FOR BIRDGES	9

Type of foundations -Evaluation of sub structures -types of piers and abutments - analysis and Design of piers andAbutments -Importance and types of Bearings - Bearings for girder bridges -Elastomeric bearing -Expansion Joints- Maintenance of bridges.

TEXT BOOK(S):

1.	Krishna Raju.N , Design of Bridges, Oxford and IBH Publishing Co., Pvt Ltd., New Delhi, 2009.
2.	Jagadeesh .T.R, Jayaram. M.A, "Design of Bridge Structures" Prentice-Hall India, New Delhi, 2004.

REFERENCE(S):

1.	Ponnuswamy.S , Bridge Engineering, Tata McGraw-Hill Publishing Company Limited, New Delhi,2003
2.	Raina V.K. "Concrete Bridge Practice", Tata McGraw-Hill Publishing Company, New Delhi, 1991.
3.	Johnson Victor. D, Essentials of Bridge Engineering, Oxford and IBH Publishing Co., New Delhi,2001

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Department	CIVIL ENGINEERING					R 2016	Semester	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CEE22	HYDROLOGY AND WATER RESOURCE MANAGEMENT	3	0	0	3	45	100	

Course Objective(s):

- At the end of the course, student will have the knowledge about the hydrological cycle in earth system, components, reservoir planning and its applications in civil engineering as well as flood and drought management

Course Outcomes: After successful completion of this course, the students will be able to

1. Assess the knowledge on the various components of hydrologic cycle.
2. Illustrate background in hydrology and hydraulics an understanding of water resources systems.
3. Explore the importance of rivers, reservoirs and its planning.
4. Summarize the concepts of simple methods of flood routing and ground water hydrology.
5. Analyze hydraulics in flood and drought management and identify the causes and effects of water logging.

UNIT I	SURFACE WATER HYDROLOGY	9

Introduction, Hydrologic cycle, Climate and water availability, Water balances, Precipitation: Forms, Classification, Variability, Measurement, Data analysis, Rain gauges - average rainfall over a basin - Arithmetic mean, Thiessen polygon and Isohyetal method - missing precipitation - optimum number of rain gauge station - Runoff process-infiltration, evaporation, transpiration and depression storage. Estimation of Runoff.

UNIT II	HYDROGRAPH	9

Factors affecting Hydrograph - Base flow separation - Unit hydrograph - Derivation of unit hydrograph - S curve hydrograph - Unit hydrograph of different deviations - Synthetic Unit Hydrograph, Flow duration curve
Groundwater: Occurrence, Darcy's law, Well hydraulics, Well losses, Yield, Pumping and recuperation test

UNIT III	RESERVOIR PLANNING	9

Reservoir-Types, Investigations, Site selection, Zones of storage, Safe yield, Reservoir capacity, Reservoir sedimentation and control.
Dams-Types of dams, spillways and ancillary works, Site assessment and selection of type of dam, Information about major dams and reservoirs of India.

UNIT IV	FLOOD MANAGEMENT	9

Indian rivers and floods, Causes of floods, Flood frequency studies - Recurrence interval - Design flood-, Flood estimation, Frequency analysis - Gumbel's method - Floodways, Channel improvement,. -, Flood routing through reservoirs and open channels- Flood damage analysis

UNIT V	DROUGHT MANAGEMENT AND WATER HARVESTING	9

Definition of drought, Causes of drought, measures for water conservation and augmentation, drought contingency planning. Water logging - causes and effects of water logging - remedial measures - land reclamation - land drainage - benefits - classification of drains - surface drains - subsurface drains - design principles and maintenance of drainage systems.-Rain water harvesting.

TEXT BOOK(S):

1.	K. Subramanya, Engineering Hydrology, Tata McGraw Hill Pub. Co. New Delhi
2.	Raghunath, H.M., "Hydrology", Wiley Eastern Ltd., 2000
3.	R.A. Wurbs and W.P. James, Water Resources Engineering, Prentice Hall of India, New Delhi.
4.	R.K. Sharma and T.K. Sharma, Hydrology and Water Resources Engineering, DhanpatRai Publications, New Delhi

REFERENCE(S):

1.	R.K. Linsley, J.B. Franzini, D.L. Freyberg and G. Tchobanoglous, Water Resources Engineering, McGraw Hill Singapore.
2.	V.P. Singh, Elementary Hydrology, Prentice Hall, Englewood Cliffs, New Jersey.