NORTH MAHARASHTRA UNIVERSITY,

JALGAON (M.S.)

Fourth Year Engineering

(Civil Engineering)

Faculty of Engineering and Technology

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Course Outline

Term-VII

w.e.f. A.Y. 2015-16

BE (Civil) : Semester - VII

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
Water Resources Engineering I	D	3	---	---	3	20	80	---	---	100	3
Estimating and Costing	D	3	---	---	3	20	80	---	---	100	3
Interdisciplinary Elective	E	3	---	---	3	20	80	---	---	100	3
Elective - I	E	3	---	---	3	20	80	---	---	100	3
Geotechnical Engineering II	D	3	--	---	3	20	80	---	---	100	3
Estimating and Costing lab	D	---	---	2	2	---	---	25	25	50	1
Geotechnical Engineering II lab	D	---	---	2	2	---	---	25	25	50	1
LAB# Elective I lab	E	---	---	2	2	---	---	25	25	50	1
Project – I	D	---	---	2	2	---	---	25	25	50	2
Seminar - II	D	---	---	2	2	---	---	25	---	25	2
Industrial Visit	D	---	---	---	---	---	---	25	---	25	1
Total		15	---	10	25	100	400	150	100	750	23

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ISE: Internal Sessional Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

#Lab for Elective-I

Inter Disciplinary Elective

1. Finite Element Methods
2. Geographical Information systems

Elective I

1. Numerical Methods in Civil Engineering
2. Sustainable Building Technology
3. Watershed Management
4. Open Channel & Conduit Flow

* Note 1: For branches like Chemical Engineering and Biotech Engg, two laboratory hours can be merged to form a four hour slot. Note 2: Out of 3 practical ESE heads, all the three heads are orals. Note 3 : Interdisciplinary Elective shall be offered by the department to the students of other department. Students from one department cannot register for Interdisciplinary Elective of the same department.

* . Note 4: At least 15 students should register for offering any elective.

Water Resources Engineering-I

Short Title: WRE-I

Course Description:

The course is focused on developing the skills of students for identification and assessment of available natural and artificial water resources. It deals with the study of Hydrology and water requirement of crops related to Civil Engineering. The part of the subject is focused on irrigation engineering and development of water resources.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

General Objectives:

- To know the hydrologic cycle and analyze different components of the cycle such as precipitation, evaporation, transpiration and infiltration.
- To introduce the students with various methods of discharge measurements in streams; and also the analysis and estimation of runoff and flood using hydrographs.
- To introduce the students with ground water hydrology and hydraulics of wells and also water logging and drainage.
- To know reservoir planning and reservoir sedimentation.
- To explain various systems and methods of irrigation and water requirements of crops.

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Learning Outcomes:

Upon successful completion of this course the student will be able to:

- Demonstrate the hydrologic cycle and its applications.
- Discuss precipitation, its measurement and analysis.
- Identify other phases of the hydrologic cycle such as evaporation, transpiration and infiltration and their measurement and applications.
- Explain various methods of measurement of stage and discharge in streams.
- Assess flood hydrograph, unit hydrograph, S-curve and their applications.
- Discuss movement of ground water and its occurrence in aquifers.
- Demonstrate hydraulics of wells under steady flow in confined and unconfined aquifers.
- Analyse run off process and estimate annual yield of streams.
- Explain water logging and its control also drainage of water logged lands by subsurface pipes drains.
- Discuss planning and investigations for locating and creating a reservoir and also its benefit cost ratio.
- Identify sedimentation of reservoir and its control and asses life of reservoir.
- Identify various methods of irrigation and soil water and plant relationship.
- Asses water requirements of crops, Duty, Delta and Irrigation efficiencies and canal capacities.

Course Content

Teaching Scheme:
Lectures: 3 Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

Unit-I **(8 Hours, 16 marks)**

Hydrology and Water resources development, Hydrologic cycle, applications of hydrology and hydrological cycle.

Precipitation: Different forms, types, measurement of precipitation: different types of rain gauges - non-automatic and automatic, presentation of data: mass curve and hyetograph, methods to find out the areal average depth of precipitation, annual average precipitation and its variation, optimum number of rain gauge stations, estimation of missing data.

Disposal of Precipitation: Elementary concepts of evaporation, evapo-transpiration and infiltration, factors affecting and methods for determination of these three processes, infiltration indices.

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Unit-II **(8 Hours, 16 marks)**

Introduction to stream gauging and introduction to methods of discharge and stage measurement in streams.

Runoff: Runoff process, yield, factors affecting Runoff, estimation of runoff volume.

Floods: Estimation of peak flow, rational method and introduction to other methods, introduction to design floods for various hydraulic structures.

Hydrographs: Definition, components, factors affecting the shape, base flow separation,

Flood hydrograph, Unit hydrograph – definition, assumptions, applications, derivations and limitations, S-hydrograph.

Unit-III **(8 Hours, 16 marks)**

Ground water hydrology: Occurrences and distribution of ground water, specific yield of aquifers, movement of ground water, Darcy's law, permeability, safe yield of basins, hydraulics of wells under steady flow in confined and unconfined aquifers, well loss, specific capacity of well, well irrigation: introduction to tube wells and open wells.

Water logging and drainage: Causes, preventive and curative measures of water logging, design and spacing of the tile – drains.

Unit-IV **(7 Hours, 16 marks)**

Reservoir Planning: Types of developments: Storage and diversion works, single and multi-purposes reservoirs, introduction to various investigations for locating a reservoir, mass curve and estimation of required storage, economics of reservoir planning, Benefit – cost ratio.

Reservoir Sedimentation: Process of erosion, introduction to suspended and bed loads, critical tractive force, trap efficiency and life of reservoir, factors affecting silting and control of reservoir sedimentation.

Unit-V **(8 Hours, 16 marks)**

Introduction to irrigation: Necessity, benefits, Ill effect, irrigation systems and methods and their classifications.

Soil-water-plant relationships: Classification of soil water, saturation capacity, Field capacity, determination of field capacity, quality of irrigation water.

Water requirement of crops: Limiting soil moisture condition, depth of irrigation water and frequency, principal Indian crops and their seasons, base period, duty of water and delta, factors affecting & methods of improving the duty of water, intensity of irrigation, paleo irrigation, kor depth and kor period, outlet factor, capacity factor, time factor, crop ratio, overlap allowance, calculations of canal capacities, application of water, warabandi, National Water Policy.

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Recommended Books:

1. Subramanya K, “Engineering Hydrology”, Third Edition, 2008, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Modi P.N. 2012. “Irrigation, Water Resources and Water Power Engineering, Eight edition. Standard Book House, Delhi.
3. Garg S.K. 1998. Irrigation Engineering And Hydraulic Structures” ,Khanna Publishers, Delhi.
4. Punmia B.C., Pande B.B., .Lal, “Dams II: Irrigation and Water Power Engineering”. 1999. Laxmi Publications Pvt. Ltd., New Delhi.
5. Varshney R.S., Gupta S.C., Gupta R.L.. “Theory and Design of Irrigation Structures, Volume I and II”, 1979 Fourth edition. New Chand & Bros., Roorki.
6. Mutreja, “Applied Hydrology”, Tata McGraw Hill Company, New Delhi
7. Bharat Singh , “Irrigation Engineering”.
8. Sharma R.K., “A Text Book of Hydrology & Water Resources”, Dhanpat Rai and Sons.
9. K.B.Khushlani “ Irrigation Engineering”.
10. Justin, Hinds , “Irrigation Engineering and Practice”
11. Raghunath H.M., “Hydrology”, New Age Publications, New Delhi.
12. Raghunath H.M., “Ground Water”, New Age Publications, New Delhi.
13. P.Jayaram Reddi, “A Text Book of Hydrology”, Laxmi Publications, New Delhi

Estimating and Costing

Short Title: E & C
Course Description:

This course introduces the students about concept of Estimations of quantities of work. The topic on approximate estimate is useful for calculating approximate cost of structures which is further useful for the making budget provisions in the planned works. The information on detailed estimate based on measurements and the rate of completed item of work is useful in finding comparatively accurate costs of each item of work and total cost of the structure. The rate analysis of an item of work shall help in finding out the rate per unit on the basis of material cost, labour cost, contractors profit and other probable miscellaneous expenditure required for the completed item of the work for actual execution of the works as per lead and lift. Thus the subject shall strongly help to build professionalism among the learner by providing the knowledge and estimating skills at the project sites along with the use of software's / programmes of estimating which makes learner a perfect professional civil engineer.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

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General Objectives:

- To enable the students with working out quantities of various items involved in the construction of structures.
- Student will also be able to work out the rate analysis.

Learning Outcomes: At the end of this course, the graduate

- Attains a level of proficiency to prepare approximate as well as detailed estimate of any civil engineering project.
- Is likely to understand the bar bending schedule and other schedules related to the process of estimating.
- Is competent enough to calculate the amount of material, labours and machinery required to execute any civil engineering item.
- Attains a skill to write a specification of any civil engineering item.
- Is well proficient to compute the rate of any civil engineering item.
- Is expected to understand the terminologies associated with valuation.
- Is well trained for deciding the unit of payment of any item of civil engineering.

Course Content

Teaching Scheme:
Lectures: 3Hours/week
Practicals: 2 Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 4 Hours
Internal Sessional Examination(ISE): 20 Marks

Unit-I **(8 hours, 16 marks)**

Approximate Estimate: Definition and Necessity, General Principles, Methods of Preparing Approximate Estimates for Buildings, Roads, Bridges, Water Supply Scheme, Drainage Scheme, and Retaining Wall.
Detailed Estimate: Types of Detailed Estimate, Purpose, Data Required for Preparing Detailed Estimate, Factors to be considered during Preparing Detailed Estimate, Methods of Taking out Quantities, Abstracting, Units of Measurement.
Building Cost: Building Cost, Provisional Sum, Centage Charges, Work Charged Establishment, Administrative Approval, Budget Provision, Technical Sanction, Different Methods of Execution of Minor Works in PWD, Like Piece Work, check List, Day Work, Daily Labour. Introduction to registration as contractor in the PWD.

Unit-II **(7 hours, 16 marks)**

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Detailed Estimate: PWD Method and Center Line Method of Taking out Quantities, Using IS 1200 Rules, Estimate of Load Bearing Residential Building (1 BHK Only).

Unit-III **(8 hours, 16 marks)**

Detailed estimate: Reinforcement Quantities of RCC Elements like Slab, Beam, Column, Isolated Column Footing, Stair Case and Preparation of Bar Bending Schedule.

Unit-IV **(8 hours, 16 marks)**

Specification: Definition & Purpose, Types of Standard Specification, Red Book, Legal Aspect, Drafting Detailed Specification with Reference to Material, Quality, Workmanship, Method of Execution, Mode of Measurement and Payment for Major Items Like (Excavation, Stone/ Brick Masonry, Plastering, Ceramic Tile Flooring, R.C.C. Work Only)
Analysis Of Rates: Factors Affecting Cost of an Item of Work, Material, Sundries, Labour, Lead and Lift, Tools and Plant, Overhead and Profit. Task Work Definition and Factors affecting Task Work, Analysis of Rates of Items Mentioned in the Specification Above.

Unit-V **(8 hours, 16 marks)**

Valuation: Definition and Purpose, Price, Cost and Value, Types of Value, Factors Affecting Value of Property, Concept of Free Hold, Lease Hold Property, Years Purchase And Outgoings, Legal Aspects of Valuation, Methods of Valuation, Land and Building Method,

Rental Method, Belting Method of Valuation of Land. Standard Rent and Standard Rent Fixation, Depreciation, Various Methods of Depreciation, Sinking Fund, and Book Value. (No Numericals Should Be Asked)

Recommended Books:

1. B. N. Dutta, “Estimating and costing in civil engineering theory and Practice” , S. Dutta & company, Lucknow.
2. M. Chakraborty, “Estimating, Costing Specifications & valuation in civil Engineering”, published by M. Chakraborti , Calcutta.
3. Rangawala, “Estimating and Costing”, Charotar Publishing House, Anand.
4. B. S. Patil, “Civil Engineering Contracts & Estimates”, Orient Longman Ltd, Mumbai.
5. G. S. Biradi, “Estimating and Costing”, Dhanpat Rai & Sons.

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Finite Element Methods

Inter-Disciplinary Elective

Short Title: FEM

Course Description:

Finite element analysis is now widely used for solving complex static and dynamic problems encountered in engineering and the sciences. The course introduces theoretical basics and practical application of the finite element method. It is designed to solve practical problems related to solid mechanics, machines and structures. It describes the general assumptions, and discusses the implementation of finite element procedures for linear and nonlinear analyses. Reliable and effective finite element procedures are discussed with their applications to the solution of general problems in solid, structural mechanics. The governing continuum mechanics equations, conservation laws, virtual work, and variational principles are used to establish effective finite element discretizations and the stability, accuracy, and convergence are discussed.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

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General Objective:

- Conceptual understanding of the mathematics, numerical analysis, statistics which underpin the engineering discipline.
- Provide background solid mechanics required for the FEA contents.
- Provide an understanding of fundamental knowledge and technique of FEM.
- Application of established engineering methods to complex engineering problem solving.

Learning Outcomes:

Knowledge and understanding:

Having successfully completed the module, students will be able to demonstrate knowledge and understanding of:

- Variational principles in statics and dynamics of structure
- Fundamental concepts and method of FEA
- Direct stiffness, Rayleigh-Ritz methods and FEA.
- FEA formulation in solid mechanics.
- Fundamental isoparametric elements.

Intellectual skills:

Having successfully completed the module, students will be able to:

- Formulate finite element matrices .
- Analyse and build FEA model for various engineering problems.
- Identify information requirements and sources for design and evaluation.
- Synthesize information and ideas for use in the evaluation process.

Course Content

Teaching Scheme:
Lectures: 3Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

Unit-I **(08 Hours 16 marks)**

Concept of finite element, Classification of element for discrete and continuum structure, characteristics of an element, Displacement function, General approach for formulation of the problem, degree of freedom, assembly rules and boundary conditions, Gradient and Divergence theorems.

Matrix algebra, Concept of local and global, Coordinates, Rules of transformation of stiffness matrix from local to global axes, various methods of approximation. Approximation errors in F.E.M., Various measures of errors, Accuracy of solution, Advantages and disadvantages of F.E.M.

Unit-II **(08 Hours 16 marks)**

Discretization of the Domain into elements, shape function, Pascal triangle, selection for the order of polynomial, convergence requirement, inter element compatibility conforming and non-conforming element, concept of band width.

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Principal of minimum potential energy, Rayleigh-Ritz method, the method of weight residuals, Saints-Venant principal, Application of above methods to a field problems.

Unit-III **(08 Hours 16 marks)**

One dimensional second order and fourth order equations, Lumped and work equivalent load, theory of work equivalent load, Shape function for one dimensional analysis, Derivation of element equations.

Analysis of one dimensional structure (beam, column etc.) by F.E.M. with different loading and boundary conditions.

Unit-IV **(07 Hours 16 marks)**

Finite element method for two dimensional problems, second order equation involving scalar valued function, two dimensional finite elements and interpolation function.

Direct method for determination of stiffness matrix for plane truss, continuous beams and plane frame elements, solution for displacement unknowns and analysis.

Unit-V **(08 Hours 16 marks)**

Triangular and Rectangular elements for plane stress/strain conditions, effect of element aspect ratio, finite representation of infinite mass.

Formulation of stiffness matrix for slabs using triangular or rectangular elements with different boundary conditions. Introduction of Isoparametric1D and 2D elements, shape function and natural co-ordinate system, quadrilateral isoparametric elements for plane stress /strain conditions.

Recommended Books:

1. O. C. Zinekiewice & R. L. Tayor , "The Finite Element method".
2. J. N. Reddy, "An Introduction to the Finite Element method"
3. C.S. Desai and J.F. Abel ,"Introduction to the finite element method"
4. V. K. ManikaSelvam, ,"Rudiments of finite element method" . DhanpatRai
5. V. K. ManikaSelvam, "Finite Element Primer", DhanpatRai
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Geographical Information System

Inter-Disciplinary Elective

Short Title: GIS

Course Description

This course offers an introduction to the concepts, principles, and theories behind Geographic Information Systems (GIS), with emphasis on the nature of geographic information. This course is designed to enable student to evaluate, to apply and to analyze software's related to GIS .mainly to highlight the relevant basic knowledge of GIS modeling , spatial data analysis vector data and raster data processing. Students acquainted with related knowledge can be able to apply in design, and modelling. Apply a knowledge of GIS to be a system of hardware, software, data, people, organizations, and institutional arrangements for collecting, storing, analyzing, and disseminating information about areas of the earth.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

General Objectives:

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1. Understand the purposes of GIS and the kinds of problems to which GIS is applied.
2. Understand the fundamental types of GIS data, data conversion, including raster and vector data.
3. To become Proficient with a commercially available GIS software package.
4. Use GIS operators to perform a number of kinds of analyses.
5. Aware of geographic information that is available on the World Wide Web.
6. Understand the limitations of geographic information systems and geographic data in general.
7. Explain the components and functionality of a GIS and the differences between GIS and other information systems;
8. Design and complete a GIS project from start to finish (data capture, data storage and management, analysis, and presentation);

Learning Outcomes:

1. After successful completion of this course, a graduate is in position to identify and predict the aerial imageries with the help of GIS software.
2. The graduate can design the model.
3. The graduate is likely to predict the importance of GIS
4. The graduate is capable of planning and design 2D, 3D.
5. The graduate is likely to interpret geological, topographical prevailing under area of consideration.

Course Content

Teaching Scheme:
Lectures: 3Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

Unit-I **(07 Hours 16 marks)**

Introduction to GIS

Definition, concepts, Information System, components of GIS, History, elements of GIS, objectives of GIS, hardware and software requirements of GIS, Geospatial data architecture, Operations, Geographic co-ordinate system, Map Projections, Input data for GIS, display, types of output products, GIS categories, Level and scale of Measurement, importance of data quality.

Unit-II **(08 Hours 16 marks)**

Vector Data and Processing

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GIS data types, data Representation, Data Sources, typical GIS data sets, Data Acquisition, vector data model, relationship between classes, data structure, data verification and editing spatial data models and errors- GIS databases, attributes data input and management.

Unit-III **(08 Hours 16 marks)**

Raster Data and Processing

Elements of data model, cell, value, data structure, cell by cell encoding, run length encoding, Quad tree, Header files, format, Types of raster data, data compression, Linking and integration of vector data.

Unit-IV **(08 Hours 16 marks)**

Data Conversion and Editing

Data format conversion, Medium conversion, Spatial interpolation, measurement and analysis methods, Data accuracy and standards, Attribute data input and Management- Relational mode- Data manipulation- classification techniques, Digital Elevation Model: Need of DEM, Various structures of DEM: line, TIN, grid.

Unit-V **(08 Hours 16 marks)**

Meta Data and GIS Modelling

Meta data- data standard - OGC - open source GIS - GIS modelling, basic elements, classification, model processing, integration, Binary models, Index model, Regression models, Linear Regression model, Logistic Regression model, Process model.

Reference Books:

1.C P LO Albert K. W. Yeung, "Concept and Techniques of Geographic information System", Prentice Hall India

2.M Anji Reddy, "Textbook of Remote Sensing and Geographical Information systems", BS Publications,

3.Kang tsung Chang. "Introduction to Geographical Information System", Tata McGraw Hill, 7th edition, (2010)

4.Burrogh P.A., "Principles of Geograpical Information System for Land Resources Assessment", Oxford Publications

5.A.M. Chandra and S.K. Ghosh. "Remote Sensing and Geographical Information System".

6.Longley, Paul A., Michael F. Goodchild, David J. Maguire, David W. Rhind ,"Geographic Information Systems and Science", Second Edition 2005, , John Wiley & Sons, New York.

7. Satheesh Gopi, R. Sathikumar, N. Madhu, "Advanced Surveying (Total Station, GIS and Remote Sensing)", First Edition 2007:

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Numerical Methods in Civil Engineering

Elective-I

Short Title: NMCE

Course Description:

The numerical methods course involves solving engineering problems from all fields of engineering. Course will cover the fundamental topics in numerical methods such as numerical integration, differentiation and numerical linear algebra, solution of nonlinear algebraic systems and solution of ordinary and partial differential equations, curve fitting, interpolation. The student will be familiar in using numerical tools to solve problems in their own field of interest.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

General Objectives:

To introduces students to the mostly used numerical methods in the different engineering fields . The aim is to study and apply various numerical methods such as Gaussian Elimination Method ,Gauss Jordon Method, Method of Bisection, Method of false position, Newton Raphson Method, Method of Simple Iteration, Method of Least Square, Newton Interpolation, Lagrange Interpolation, Euler's Method, Modified Euler's Method, Runge Kutta Method and develop program for the same.

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Learning Outcomes:

After successful completion of the course, Students will be able to

- Solve an algebraic or transcendental equation using an appropriate numerical method
- Approximate a function using an appropriate numerical method
- Solve a differential equation using an appropriate numerical method
- Evaluate a derivative at a value using an appropriate numerical method
- Solve a linear system of equations using an appropriate numerical method
- Perform an error analysis for a given numerical method
- Calculate a definite integral using an appropriate numerical method
- Code a numerical method in a modern computer language.

Course Content

Teaching Scheme:
Lectures: 3Hours/week
Practicals: 2 Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

Unit-I **(8 Hours 16 marks)**

Introduction: Mathematical Modelling and Engineering Problem Solving, Algorithm Design, Flowchart, Errors in Numerical Computation.

Solution of Linear algebraic Equation: Gauss Elimination method, Gauss Seidel method, Gauss Jordan method, Partial Pivoting method and its conditions for convergence.

Unit-II **(8 Hours16 marks)**

Solution of Non Linear Algebraic and Transcendental Equations: Bisection, False position, Newton Raphson Method, Generalized Newton Raphson Method.

Linear Programming Problem: Introduction, Requirements, Assumptions, Applications, Limitations, General Mathematical Model, Formulations, Introduction to Artificial Variables, Simplex Algorithm for Maximization & Minimization Cases.

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Unit-III **(7 Hours 16 marks)**

Curve Fittings: Linear Regression, Polynomial Regression, Multiple Linear Regression, General Linear Least Squares, and Engineering Applications of Curve fitting.

Interpolation: Newton's divided difference interpolating polynomials, Non-linear regression, Lagrange Interpolating polynomials, Coefficient of interpolating polynomials.

Unit-IV **(8 Hours 16 marks)**

Numerical Differentiation: High accuracy differentiation formula, First order differentiation Equations, Second order differentiation Equations, Derivatives of Equally Spaced Data.

Numerical Integration: Trapezoidal rule, Simpson's one third and $3/8^{th}$ rule, Gaussian Quadrature 2 point Formula.

Unit-V **(8 Hours 16 marks)**

Numerical methods for Solution of ordinary differential equation: Taylor's series method, Euler's method, Modified Euler's method, Runge Kutta method, Predictor Corrector Method.

Numerical methods for Solution of Partial Differential Equation: Introduction to initial value and boundary value problem, Finite difference methods for the solution of one dimensional wave equation two dimensional (parabolic and elliptic) and higher order PDE.

Recommended Books:

1. Steven C Chapra & Raymond P. Canale, "Numerical Methods for Engineers", Tata Mc-Graw Hill Company Limited, New Delhi, 2002
2. Schilling & Harries, "Applied Numerical Methods for Engineers", THOMSON, Brooks/Cole, Newyork, 2000
3. S. Rajasekaran, "Numerical Methods in Science & Engineering", A.H.Wheeler & Company Private Limited, 2000
4. Sharma J.K., "Operation Research", MACMILLAN India Limited, 2003
5. Jain, Iyenger & Jain, "Numerical Methods", New Age Publishing Company, New Delhi, 2004
6. Sastry S.S., "Introductory Methods of Numerical Analysis", Prentice Hall (India) Limited, New Delhi, 2000
7. Kanti Swaroop & P.K.Gupta, "Operation Research", Sultan Chand & Sons, New Delhi, 1998
8. S.S.Rao, "Optimization Theory and Application", Wiley Eastern Limited, 1999

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Sustainable Building Technology

Elective-I

Short Title: SBT

Course Description:

This course deals with concepts of Sustainable Building Technology such as Sustainable development, Green Building, Assessment and the LEED rating system etc. It also elaborates design of a sustainable building for Lighting, Ventilation and Energy conservation for building envelope. It includes use of local building materials, their characteristics and effects on properties of concrete. It enables students to learn Cost Effective Techniques for Walling Roofing and other units. It also covers Water Management, Recycling, , Lightening protection, Fire protection, Thermal insulation, Air conditioning , Noise pollution-sources and control measures.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

General Objectives:

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- To describe concepts required for sustainable building design and and building practices.
- To focus Environmental issues related to building materials and construction.
- To emphasise importance of water management systems

Learning outcomes:

- Upon completion of this course, the candidate will be able to:
- Identify the key components of the LEED® Rating System
- Describe key green building concepts
- Know design principles and techniques for sustainable buildings
- Use Sustainable Building Materials and assess their impact
- Know various water management systems.

COURSE CONTENT

Teaching Scheme:
Lectures: 3Hours/week
Practicals: 2 Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

Unit-I **(8 Hours, 16 Marks)**

Concept of Green Building: Sustainable Development concept, Buildings and climate, Important considerations for the design of a sustainable buildings. Green Building Assessment, Current version of the LEED rating system.

Unit-II **(7 Hours, 16 Marks)**

Energy and Buildings: The design of a sustainable building, Lighting - day lighting; Ventilation - natural ventilation; Indoor air quality; Passive and Active systems for energy production and conservation, Elements of successful design of a building envelope.

Unit-III **(8 Hours, 16 Marks)**

Sustainable Building Materials: Environmental issues related to building materials, Local Building Materials from

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a) Agricultural waste: Rice husk, Coconut wastage, Banana leaves.

b) Industrial waste: Red mud, Blast furnaces slag, Fly Ash.

Their Physical Characteristics and effects on properties of concrete

Unit-IV **(8 Hours, 16Marks)**

Cost Effective Techniques for Sustainable Building: Stabilized Mud blocks, Stone masonry blocks, Solid and Hollow concrete blocks, Selection of building blocks. Ferro-Concrete, Properties and Uses, Practical aspects.

Alternative sustainable Roofing Systems: Concepts in Roofing alternatives, Filler slab roofs, Composite Slab panel roofs, hollow block roofs, Masonry Domes.

Unit-V **(8 Hours, 16 Marks)**

Environmental Techniques: Waste water Management**,** Rain water harvesting and conservation, Recycling, waste water treatment processes, external drainage system in building.

Lightening in building, Fire protection of building, Thermal environment inside the building, systems of air conditioning

Noise pollution: Sources and control measures Noise pollution-sources and control measures

Reference Books:

1. K.S.Jagadish, B.V.V.Reddy ,"Alternative Building Materials and Technologies", New Age International Publishers
2. "Sustainable building design Manual" by Energy research institute delhi.
3. Gevorkian ,"Green Buildings" Mc Graw hill.
4. "Fibre reinforced Cement Composites", P. N. Balaguru and S.P. Shah, McGraw Hill,
5. The engineering guide to LEED- new construction-sustainable constuction for engineers haselbach.
6. Fibre cements and Fibre Concretes", D. J.Hannant, John Wiley and Sons.
7. Properties of Concrete", A.M.Neville, ELBS, Longman.
8. Miller G. T Jr; Living in the environment; Cengage Publisher.
9. Cunningham W; Principles of Environmental Science: TMH
10. Harris CE, Prichard MS, Rabins MJ, Engineering Ethics; Cengage Pub.
11. Martin; Ethics in Engineering; TMH.
12. RanaSVS;Essentials of ecology and environment; PHI Pub.
13. Gerard Kiely, Environmental Engineering; TMH
14. Khan BH; Non Conventional energy resources; TMH Pub.

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Watershed Management

Elective-I

Short Title: WSM

Course Description:

This course is designed to enable student to assess, apply and analyze the relevant geological, ground water, irrigation principles. In this course , the topics on Morphology , ground water, irrigation, pollution, issues in irrigation, appraisals, rain water harvesting, urban water shed management are mainly to highlight for the relevant basic knowledge . Students acquainted with related knowledge can be able to apply in design, and economics of watershed projects.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

Prerequisite courses: Engineering Geology, Irrigation Engineering.

General Objective:

The basic objective of the course is to make students aware about importance of conservation of water and its management and know the methods, design, issues, appraisals used for watershed management. Students should also be aware about geology and groundwater.

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Learning Outcomes:

After successful completion of this course, a graduate is in position

1.To identify and predict the watershed area and its characteristics.
2.Evaluate the factors with respect to groundwater, rain water.
3.To predict the importance of watershed management.
4. Plan and design the watershed management programme.
5. To interpret Geological, Topographical and Metrological conditions prevailing under area of consideration.

Course Content

Teaching Scheme:
Lectures: 3Hours/week
Practicals: 2 Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

Unit-I **(8 Hours 16 Marks)**

Concept of Watershed. Significance of watershed based development. Watershed characteristics geomorphology and hydrology. Drainage basin, network and channel morphology.

Unit-II **(8 Hours 16 Marks)**

Watershed Hydrology – Hydrologic cycle, water balance, climate and precipitation, soil and infiltration, interception and evapotranspiration, groundwater, streamflow and runoff, water quality, aquatic ecosystems [eutrophication, habitat disturbance].

Unit-III **(7 Hours 16 Marks)**

Watershed Resource Appraisal-Physical, Hydrological and Land use/cover, Land Capability Classification, Watershed Management and Planning and objectives.

Unit-IV **(8 Hours 16 Marks)**

Issues in water resources – Point source pollution, agricultural and urban non-point source pollution, erosion, water scarcity, flooding, and drinking water protection, soil and water conservation measures, watershed Program, Benefit Cost Analysis.

Unit-V **(8 Hours 16 Marks)**

Urban Watershed Management – Wet weather flow, , Green Roof, Rain water harvesting from urban structures, Urban watershed management ,goals & strategies, Sustainability & UWSM, urban storm water pollution and sediment management.

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Recommended Books:

1. Murthy, J.V.S. (1994), “Watershed Management in India”, Wiley Eastern Ltd., New Delhi.
2. Paranjape, S. and Others. (1998), “Watershed – based Development”, Bharat Gyan Vigyan Samithi, New Delhi.
3. Mutreja, K.N. (1990) ,“Applied Hydrology”, Tata McGraw-Hill Pub.Co. Ltd. New Delhi.
4. Sinha R.J. (2000), “Water Planning and Management”, Yash Publishing House, Bikaner.
5. C.J. Hoan , “Hydrology & small Watersheds”.
6. D.M. Michal, “Hydrology” .

Open Channel and Conduit Flow

Elective-I

Short Title: OCCF

Course Description:

The subject deals with the applications of Fluid mechanics to the flow problems under atmospheric and imposed pressure i.e. flow through open channels and conduit flow. This subject is extended to study of Fluid Mechanics in general and its applications to open channel and conduit flows in particular.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

Course Prerequisites: Knowledge of fluid kinematics and dynamics, concepts of uniform and critical flow in open channels, concepts of pipe flow systems.

General Objectives:

- To learn uniform and critical flow in trapezoidal and circular channels and transitions in rectangular channel and their applications.
- To study Gradually Varied Flow in open channel, its computation and applications.
- To analyze Rapidly Varied Flow, Unsteady Flow and hydraulic jump & surge in open channel and their applications.
- Introduction to pipe network & design of pipes including rising main and gravity main.
- To understand unsteady flow in pipes including water hammer and design of surge tank.

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Course Outcomes: Upon successful completion of this course the student will be able to,

1. Evaluate normal and critical depth in trapezoidal and circular channel.
2. Analyze transitions in rectangular channel with a hump and change in width.
3. Demonstrate Gradually Varied Flow (GVF) and different forms of differential equation of GVF.
4. Analyze different types of GVF profiles and their characteristics.
5. Compute GVF profiles in trapezoidal channel by different methods.
6. Explain Rapidly Varied Flow (RVF) due to hydraulic jump and various flumes.
7. Assess and compute hydraulic jump in open channels.
8. Discuss unsteady flow in open channel and evaluate surges in rectangular channel.
9. Analyze three reservoir problem and pipe network.
10. Discuss practical methods of design of rising and gravity mains.
11. Evaluate economical diameter of rising main.
12. Identify unsteady flow in pipes and analyze establishment of flow and water hammer phenomenon.
13. Explain surge tanks and design of simple cylindrical surge tank.

Course Outline

Teaching Scheme:
Lectures: 3Hours/week
Practicals: 2 Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

Unit-I **(8 Hours, 16 Marks)**

Revision of concepts of open channel flow, velocity and pressure distributions, equations of continuity, energy and momentum, uniform and critical flow in trapezoidal and circular channels, calculation of normal and critical depths in trapezoidal and circular channels, the first and second hydraulic exponents (M and N). (No derivations of equations for M and N).

Unit-II **(9 Hours, 16 Marks)**

Transitions: – Rectangular channel with a hump and with a change in width.

Gradually varied flow:-Types of non uniform flow, Gradually Varied Flow theory for rectangular and trapezoidal prismatic channels, differential equation of GVF and its alternate forms, different types of GVF profiles and their characteristics and examples of their occurrence, control sections.

Computation of GVF profiles by Direct step method, only mention of other methods.

Unit-III **(7 Hours, 16 Marks)**

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Rapidly Varied Flow: - Introduction, comparison of GVF and RVF, RVF due to hydraulic jump in horizontal, frictionless, rectangular channel, specific force, conjugate depths and energy loss in hydraulic jump, classification and uses, field examples of occurrence of hydraulic jump with GVF profiles and their analysis.

Unsteady flow in open channel: - Surges and waves in open rectangular channels – simple cases of positive surges neglecting friction.

Unit-IV **(07 Hours, 16 Marks)**

1) Pipe flow: - Three reservoir problem, pipe network. Practical design methods of rising mains and gravity mains using nomograms/ charts, economical diameter of rising main.

Unit-V **(8 Lectures, 16 Marks)**

Unsteady flow in conduits: - Mention of types of unsteady flows, establishment of flow, water hammer, celerity of pressure wave thought rigid and elastic pipes (no derivation of the equations), sudden and gradual and partial opening and closing of valves, details of pressure cycles (no derivation of the equation for water hammer pressure rise).

Surge tanks: - Necessity, location, function, types, analysis of simple cylindrical surge tank considering frictional effects.

Recommended Books:

1. Dr. K. Subramanya, “Flow in Open Channels”, Tata McGraw-Hill Education Pvt., Ltd., New Delhi, 3rd Edition-2012.
2. Streeter V.L. & Wylie E.B., “Fluid Mechanics”, Tata McGraw-Hill Education Pvt., Ltd., New Delhi, 6th reprint - 2012.
3. Dr. A. K. Jain, “Fluid Mechanics, Khanna Publishers”, Delhi, Edition – 2011.
4. Dr. P.N.Modi , “Dr. S.M. Seth, Hydraulic and Fluid Mechanics”, Standard Publications, Delhi, Edition – 2011.
5. Dr. K. Subramanya, “FM & HM-Problems & Solutions”, Tata McGraw-Hill Education Pvt. Ltd. New Delhi, 6th reprint-2013.
6. Dandekar M. M. and K.N. Sharma, “Water power Engineering”, Vikas Publishing House Privet Limited, Delhi.
7. Chow Ven Tee, “Open Channel Hydraulics”, Tata McGraw Hill Publishing Company Limited, New Delhi.

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Geotechnical Engineering-II

Short Title: GTE-II

Course description:

In this course students are guided to apply the theory learnt in Geotechnical Engineering-I to the practical applications. They are introduced to the topics of bearing capacity of shallow foundations, deep foundations, etc. They are required to determine the relevant parameters necessary for prediction of bearing capacity, foundation design, design of pile foundations etc

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

General Objectives:

1. To describe the methods of soil investigation.
2. Estimation of bearing capacity of shallow foundations by various theories.
3. Understand the need for pile foundations and determine their load carrying capacity.
4. To illustrate Deep foundations and machine foundations

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Learning Outcomes: Upon successful completion of the course the student will be able to,

1. Decide type of soil investigation methods needed before commencement of the construction.
2. Estimate bearing capacity of soil.
3. Predict soil behaviour under the application of loads and come up with appropriate solutions to foundation design queries.

Course Content

Teaching Scheme:
Lectures: 3Hours/week
Practicals: 2 Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

UNIT-I **(10 Hours 16 marks)**

Soil Exploration, Sampling and Testing: Subsurface Exploration Trial Pits, Shafts and Boring, Geophysical Tests, Wash Boring, Representative and Undisturbed Samples, Bore Hole Sampling, Laboratory Evaluation of Foundation Parameters, Field Testing, Penetration Tests, Plate Load Test in Detail with Reference to IS:1888 and Its Applications and Estimation of Settlements, Bore Hole Tests.

Bearing Capacity: Definitions of Ultimate Bearing Capacity, Gross, Net and Safe Pressures, Allowable Bearing Pressure, Load Settlement Curve, Terzaghi's Bearing Capacity Analysis, Bearing Capacity Equations for Square and Circular Footings, Factors Influencing Bearing Capacity, Performance of Footings in Different Soils, Vesic's Chart, Local and Ganeral Shear, Effects of Water Table and Depth, Bearing Capacity of Layered Soils.

UNIT-II **(7 Hours 16 marks)**

Elastic settlement: Elastic Settlement, Elastic Stresses and Strains, Contact Pressure, Pressure Bulb, Empirical Relation for Settlement of Bases, Total and Differential Settlement, Tolerable Settlement, I.S. Criteria, Effect of Lowering Water Table.

UNIT-III **(7 Hours 16 marks)**

Shallow Foundations: Spread Footings, Minimum Depth, Plain and RCC Footings, Allowable Soil Pressure, Use of SPT Blow Count, I.S. Charts, Wall Footings, Column Footings, Combined Footings, Raft Foundations, Floating Foundations, Grillage Foundations. (Only Derivations, No Numerical)

UNIT-IV **(8 Hours 16 marks)**

Pile Foundation: Introduction to Pile Foundation, Necessity of Pile Foundation, Classification of Piles, Construction Methods of Bored Piles, Concrete Bored Piles, Driven Cast in-Situ Piles, Pile Capacity Based on Static Analysis, Piles in Sand, Piles in Clay, Dynamic Methods and Their Limitations, In-Situ Penetration Tests and Pile Load Test as per IS:2911 Specifications, Negative Skin Friction, Pile Groups, Ultimate Load Capacity of Groups, Settlement of Pile Groups in Sand and in Clays as Per IS: 2911 and Critical Depth Method.

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UNIT-V **(7 Hours 16 marks)**

Piers and Caissions: Hand Excavated and Drilled Piers, Method of Installation, Use of Drilling Mud, Caissions and Foundation Walls, Open, Box and Pneumatic Caissons, Sinking Method, Sand Island Method, Caisson Disease, Capacity and Settlement of Piers and Caissons, Well Foundation. Sheet Piles and Cofferdams, Temporary Supports and Braced Sheeting for Excavations, Pressure Distribution Cofferdams and Cellular, Cantilever and Anchored Sheet Piles.

Machine Foundation: Mechanical Vibrations, Single Degree Freedom Systems, Free and Forced Vibrations, Damped Systems, Natural Frequency, Resonance Magnification, Vibration Parameters , Vibration Test, Dynamic Modules ,Coefficient of Elastic Uniform Compression, Block Foundation Design Balken Method, Isolation And Control of Vibration Screen Barriers.(No Numerical and Derivations.)

Recommended Books:

1. Punmia B. C. “Soil mechanics and foundation engineering ” ,Laxmi Publications Pvt. Ltd., New Delhi, Latest edition.
2. Kasmalkar B. J. “Geotechnical Engineering”, Pune Vidyarthi Griha Prakashana, Sadashiv Peth Pune-30, Latest edition.
3. V.N.S.Murthy “Soil mechanics and foundation engineering”,Vol.1, Saikrupa Technical Consultants, Bangalore, Latest edition.
4. J.E.Bowles, “Foundation analysis and design”, McGraw Hill International ed. New York.
5. Wayne C. Teng, “Foundation Design” Prentice Hall of India, New Delhi.
6. K.R. Arora, “Soil Mechanics and Foundation Engineering” Standard Publishers Distributors.
7. Shashi K. Gulhati and Manoj Datta, “Geotechnical Engineering” Tata McGraw Hill Publication, Latest edition.
8. T.W. Lambe, “Soil Testing for Engineers”, John Wiley Publication.
9. Gopal Ranjan, Rao, “ Basic and Applied Soil Mechanics”, New age publication.

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Estimating and Costing Lab

ICA (Term Work): 25 Marks

ESE (Oral): 25 Marks

Course Description:

This course introduces the students about concept of Estimations of Quantities of work, Cost estimation of work using DSR, Approximate cost of work to be executed, specifications of work.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lab hours	02	13	26	1

General Objectives:

In this laboratory work students will be introduced to Mode of measurements of items, DSR, determination of various quantities of executed work, Preparation of approximate estimates, rate analysis of items, bar bending scheduling in RCC structures. Use of software for preparation of Estimate.

Learning outcomes:

Upon successful completion of course the student will be able to

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1. Understand units and modes of measurements of various items of work.
2. Know the method of preparation of approximate estimates of various civil engineering works.
3. Apply knowledge of preparation of check list of items of construction, rate analysis for preparation of detailed estimate of various civil engineering works.
4. Make use of DSR for Estimation, IS 1200 for measurement & can aware the methods of estimation in government organization.
5. Understand the preparation of bill of quantities by taking measurements of completed item of work and rate of the item.
6. Use computer software's to prepare estimate of works.

Lab course content:

All given Practical's are compulsory

1) Units of Measurements of Various Items of Civil Engineering Works / Study of DSR, Study and Use of Check List of PWD for Estimating of Various Building Works.
2) Approximate Estimate of
   i) Residential Building. ii) Public Building.
   iii) Elevated Service Reservoir. iv) Road and Bridges.
3) Prepare Check List of Items, Detailed Estimate of A Single Storey (Up To 2 BHK) Load Bearing Structure by Using Current DSR.

4) Prepare Check List of Items, Detailed Estimate of A Framed Residential Double Storey Structure by Using Current DSR and Estimate of Detailed Quantities of Steel Reinforcement and Prepare Bar Bending Schedule.
5) Detailed Estimate of Any Two of Following
   i) Compound Wall. ii) Septic Tank. iii) Earth Work in Road / Cannel.
6) Rate Analysis of Any Three Items.
7) Site Visit (Attached Estimate and Photographs) / Study Standard Estimate of PWD or Any Civil Organization

Note: Any One of the above Lab Course Content Should be Done Using any Estimating And Costing Software/ Prepare Excel Spread Sheet.

Guidelines for ICA:

ICA shall be based on continuous evaluation of student's performance throughout the semester and term work prepared by the students in the form of file.

Guidelines for ESE:

ESE shall be based on term work prepared by students & Evaluation will be based on performance during oral examination.

Recommended Books:

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1. B. N. Dutta, "Estimating and costing in civil engineering theory and Practice" , S. Dutta & company, Lucknow.
2. M. Chakraborty, "Estimating, Costing Specifications & valuation in civil Engineering", published by M. Chakraborti , Calcutta.
3. Rangawala, "Estimating and Costing", Charotar Publishing House, Anand.
4. B. S. Patil, "Civil Engineering Contracts & Estimates", Orient Longman Ltd, Mumbai.
5. G. S. Biradi, "Estimating and Costing", Dhanpat Rai & Sons.

Geotechnical Engineering-II

ICA (Term Work): 25 Marks

ESE (Oral): 25 Marks

Course Description:

This course deals with learning of the practical applications through assignment work such as field investigations, bearing capacity of shallow foundations, pile foundations, etc. They are required to determine the relevant parameters necessary for applications such as prediction of bearing capacity, foundation design, design of pile foundations etc.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lab hours	02	13	26	1

General Objectives:

- To apply the methods for soil investigation for field conditions.
- To estimate bearing capacity of shallow foundations by various theories.
- To assess the bearing capacity of pile foundation.

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Course Outcome:

After successful completion of the course the student will be able to,

- Implement the design philosophies in foundation design.
- Prepare soil investigation reports.
- Design foundation for different conditions of bearing capacity and other design parameters.
- Design pile foundations.

Lab Course Content:

A) Laboratory work should consist of assignments based any five of the following;

1. Preparation of Soil investigation report based on given data.
2. Problems on Plate Load Test, Standard Penetration Test and corrections.
3. Problems on bearing capacity calculations for different conditions.
4. Problems on Settlement analysis.
5. Problems on Design of pile foundations.
6. Design considerations of caissons and well foundation.
7. Design of under reamed pile.

B) Demonstration of any one of following tests;

1. Plate load test.
2. Standard penetration test.
3. Swelling pressure test.

Guidelines for ICA:

ICA shall be based on continuous evaluation of students performance throughout the semester and term work prepared by the students in the form of Journal.

Guidelines for ESE:

ESE shall be based on term work prepared by students & Evaluation will be based on performance during oral examination.

Recommended Books:

1. Punmia B. C. “Soil mechanics and foundation engineering ”,Laxmi Publications Pvt. Ltd., New Delhi, Latest edition.
2. Kasmalkar B. J. “Geotechnical Engineering”, Pune Vidyarthi Griha Prakashana, Sadashiv Peth Pune-30, Latest edition.
3. V.N.S.Murthy, “Soil mechanics and foundation engineering”,Vol.1, Saikrupa Technical Consultants, Bangalore, Latest edition.
4. J.E.Bowles, “Foundation analysis and design”, McGraw Hill International ed. New York.
5. Wayne C. Teng, “Foundation Design” Prentice Hall of India, New Delhi
6. K.R. Arora, “Soil Mechanics and Foundation Engineering” Standard Publishers Distributors.
7. Shashi K. Gulhati and Manoj Datta, “Geotechnical Engineering” Tata McGraw Hill Publication, Latest edition.
8. T.W. Lambe, “Soil Testing for Engineers”, John Wiley Publication.
9. Gopal Ranjan, Rao, “ Basic and Applied Soil Mechanics”, New age publication.

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Numerical Methods in Civil Engineering Lab

Elective I

ICA (Term Work): 25 Marks

ESE (Oral): 25 Marks

Course Description:

In this Laboratory course emphasis is given to apply the knowledge of these methods to solve practical problems and develop numerical skills required in Civil Engineering .

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lab hours	02	13	26	1

General Objectives:

The emphasis will be on understanding the concepts of the numerical methods and on applying these concepts for solving various problems.

To discuss and solve problems on methods covered in syllabus and develop programs for the same.

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Course Outcomes:

After successful completion of the course, Students will be able to

- Solve problems of various numerical methods and develop the programmes for the same.
- Solve algebraic or transcendental equation
- Solve linear systems of equations
- Approximate a function using an appropriate numerical method
- Solve a differential equation using an appropriate numerical method
- Evaluate a derivative at a value using an appropriate numerical method.
- Calculate a definite integral using an appropriate numerical method

Lab Course Content:-

A) Computer Programs Based on Following Numerical Methods – (any five)

1. Gaussian Elimination Method
2. Gauss Jordon Method
3. Method of Bisection
4. Method of false position
5. Newton Raphson Method
6. Method of Simple Iteration
7. Method of Least Square

8. Newton Interpolation
9. Lagrange Interpolation
10. Euler's Method
11. Modified Euler's Method
12. Runge Kutta Method

B) Numerical Assignment Based on Following Numerical Methods – (Minimum three)

1. LPP – Simplex Method
2. Curve Fitting
3. Boundary Value Problem
4. Simpson's One third
5. Simpson's 3/8 rule
6. Lagrange Formula
7. Gaussian Quadrature

Guidelines for ICA:

ICA shall be based on continuous evaluation of students performance throughout the semester and term work prepared by the students in the form of journal.

Guidelines for ESE:

ESE shall be based on term work prepared by students & Evaluation will be based on performance during oral examination.

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References Books:

1.Steven C Chapra & Raymond P. Canale, "Numerical Methods for Engineers", Tata Mc-Graw Hill Company Limited, New Delhi, 2002
2. Schilling & Harries, "Applied Numerical Methods for Engineers", THOMSON, Brooks/Cole, Newyork, 2000
3. S. Rajasekaran, "Numerical Methods in Science & Engineering", A.H.Wheeler & Company Private Limited, 2000
4. Sharma J.K., "Operation Research", MACMILLAN India Limited, 2003
5. Jain, Iyenger & Jain, "Numerical Methods", New Age Publishing Company, New Delhi, 2004
6. Sastry S.S., "Introductory Methods of Numerical Analysis", Prentice Hall (India) Limited, New Delhi, 2000
7. Kanti Swaroop & P.K.Gupta, "Operation Research", Sultan Chand & Sons, New Delhi, 1998
8. S.S.Rao, "Optimization Theory and Application", Wiley Eastern Limited, 1999

Sustainable Building Technology

Elective I

ICA (Term Work): 25 Marks

ESE (Oral): 25 Marks

Course Description:-

This course deals with getting knowledge of different concepts of Sustainable Building Technology through assignment work in lab on topics such as Green Building Assessment and the LEED rating system Lighting, Ventilation and Energy conservation. use of local building materials, Cost Effective Techniques for Sustainable and Water Management, ,

	Hours /weeks	Nos. of weeks	Total Hours	Semester Credit
Lab hours	2	13	26	1

General Objectives:

- Describe sustainable building design principles and building practices.
- To be familiar with various techniques used in sustainable buildings and building materials
- To focus on water management

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Learning outcomes:

- Upon completion of this course, the candidate will be able to:
- Identify the key components of the LEED® Rating System
- Describe key green building concepts
- Know design principles and techniques for sustainable buildings
- Use Sustainable Building Materials and assess their impact
- Know various water management systems.

Lab Course Content:
It shall consist of Assignments based on theory course work of each unit.

Labwork includes Any six assignements from the list given below

1. Important considerations for the design of a sustainable buildings. Green Building Assessment, Current version of the LEED rating system.
2. The design of a sustainable building, Lighting Ventilation - natural ventilation; Indoor air quality; Passive and Active systems for energy production
3. Sustainable Building Materials from Agricultural waste**:** Rice husk, Coconut wastage, Banana leaves.

4. Sustainable Building Materials from Industrial waste**:** Red mud, Blast furnaces slag, Fly Ash.
5. Cost Effective Techniques for Sustainable Building: Stabilized Mud blocks, Stone masonry blocks, Solid and Hollow concrete blocks,
6. Cost Effective Techniques for Sustainable Building Ferro-Concrete, Properties and Uses, Practical aspects.
7. Alternative Roofing Systems**:** Concepts in Roofing alternatives, Filler slab roofs, Composite Slab panel roofs, hollow block roofs, Masonry Domes.
8. Waste water Management, Recycling, waste water treatment processes
9. Rain water harvesting and conservation

10. Lightening in building, Fire protection of building, Thermal environment inside the building, systems of air conditioning
11. Noise pollution: Sources and control measures Noise pollution-sources and control measures

Guidelines for ICA:

ICA shall be based on continuous
evaluation of student's performance throughout the semester.

Guidelines for ESE:

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In ESE the student may be asked to answer questions based on ICA. Evaluation will be based on Performance in oral examination.

Reference Books:

1. K.S.Jagadish, B.V.V.Reddy ,"Alternative Building Materials and Technologies", New Age International Publishers
2. "Sustainable building design Manual" by Energy research institute delhi.
3. Gevorkian ,"Green Buildings" Mc Graw hill.
4. "Fibre reinforced Cement Composites", P. N. Balaguru and S.P. Shah, McGraw Hill,
5. The engineering guide to LEED- new construction-sustainable constuction for engineers haselbach.
6. Fibre cements and Fibre Concretes", D. J.Hannant, John Wiley and Sons.
7. Properties of Concrete", A.M.Neville, ELBS, Longman.
8. Miller G. T Jr; Living in the environment; Cengage Publisher.
9. Cunningham W; Principles of Environmental Science: TMH
10. Harris CE, Prichard MS, Rabins MJ, Engineering Ethics; Cengage Pub.
11. Martin; Ethics in Engineering; TMH.
12. RanaSVS;Essentials of ecology and environment; PHI Pub.
13. Gerard Kiely, Environmental Engineering; TMH
14. Khan BH; Non Conventional energy resources; TMH Pub.

Watershed Management

Elective-I

ICA (Term Work): 25 Marks

ESE (Oral): 25 Marks

Course Description:

In this laboratory course emphasis is given on gaining the practical oriented knowledge related to watershed management and their applications in the field.

Prerequisite courses: Engineering Geology, Groundwater, Irrigation.

	Hours /weeks	Nos. of weeks	Total Hours	Semester Credit
Lab hours	2	13	26	1

General Objective:

In this laboratory work student will solve the problems on rain gauges, groundwater contouring.

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Learning Outcomes:

- Upon successful completion of this course the student will be able to :
- Calculate optimum no. of rain gauge stations
- Prepare details of ground water contouring.
- Calculate drainage density and drainage pattern, drainage frequency.
- Estimate benefit cost analysis
- To demarcate watershed area..

Lab Course Content

Following experiments/ assignments are to be performed .Term works shall consist of journal giving details of the experiments/ assignments performed.

[Minimum six practical / Assignments shall be performed]

1. Mapping and demarcation of watershed.
2. Areal Precipitation – Thiessen Polygon, Isohyetal method. Analysis and interpretation of rainfall data.
3. Water balance estimation.
4. Estimation of Runoff and stream flow. Flow duration curve, return period. Analysis and interpretation of stream flow data.
5. Groundwater contouring and interpretation regarding movement and flow direction.

6. Land capability classification.
7. Soil loss estimation.
8. Visit to a Watershed and submission of report.

Guide lines for ICA

ICA shall be based on continuous evaluation of student performance throughout semester and practical /assignments submitted by the student in the form of journal.

Guide lines for ESE

ESE will be based on laboratory journal submitted by the student. In ESE the student may asked to answer questions based on the experiments/ assignments.

Evaluation will be based on performance in oral examination.

Recommended Books:

1.Murthy, J.V.S. (1994), "Watershed Management in India", Wiley Eastern Ltd., New Delhi.
2.Paranjape, S. and Others. (1998), "Watershed – based Development", Bharat Gyan Vigyan Samithi, New Delhi.
3.Mutreja, K.N. (1990) ,"Applied Hydrology", Tata McGraw-Hill Pub.Co. Ltd. New Delhi.
4.Sinha R.J. (2000), "Water Planning and Management", Yash Publishing House, Bikaner.
5.C.J. Hoan , "Hydrology & small Watersheds".
6. D.M. Michal, "Hydrology" .

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Open Channel and Conduit Flow

(Elective-I)

ICA (Term Work): 25 Marks

ESE (Oral): 25 Marks

Course Description:

The lab work deals with the applications of Fluid mechanics such as flow through open channels and conduit flow.

	Hours /weeks	Nos. of weeks	Total Hours	Semester Credit
Lab hours	2	13	26	1

General Objectives:

- To learn uniform and critical flow in trapezoidal and circular channels and transitions in rectangular channel and their applications.
- To study Gradually Varied Flow in open channel and its computations.
- To analyze hydraulic jump & surge in open channel.
- Introduction to pipe network & design of pipes including rising main and gravity main.
- To understand unsteady flow in pipes including water hammer and design of surge tank.

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Course Outcomes:

Upon successful completion of this course the student will be able to,

- Evaluate normal and critical depth in trapezoidal and circular channel.
- Analyze transitions in rectangular channel with a hump and change in width.
- Compute GVF profiles in trapezoidal channel by direct step method.
- Assess and compute hydraulic jump in open channels.
- Discuss unsteady flow in open channel and evaluate surges in rectangular channel.
- Discuss practical methods of design of rising and gravity mains.
- Evaluate economical diameter of rising main.
- Identify unsteady flow in pipes and analyze establishment of flow and water hammer phenomenon.
- Explain surge tanks and design of simple cylindrical surge tank.

Lab Course Content

Following assignments are to be performed. Term works shall consist of journal giving details of the assignments performed. (Any Six)

1. Calculation of normal and critical depths in trapezoidal / circular channel using graphs/ tables.

2. Example on transition in horizontal, rectangular channel.

3. Computation of G.V.F. profile in trapezoidal channel by Direct step method.

4. Calculation of hydraulic jump in horizontal, rectangular channel.

5. Calculation of surges in horizontal, rectangular channel.

6. Design of gravity/rising main (Dead end system in case of gravity mains).

7. Calculation of water hammer pressures.

8. Design of simple cylindrical surge tank.

Guide lines for ICA

ICA shall be based on continuous evaluation of student performance throughout semester and practical /assignments submitted by the student in the form of journal.

Guide lines for ESE

ESE will be based on laboratory journal submitted by the student. In ESE the student may asked to answer questions based on the experiments/ assignments.

Evaluation will be based on performance in oral examination.

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Recommended Books:

1.Dr. K. Subramanya, "Flow in Open Channels", Tata McGraw-Hill Education Pvt., Ltd., New Delhi, 3rd Edition-2012.
2.Streeter V.L. & Wylie E.B., "Fluid Mechanics", Tata McGraw-Hill Education Pvt., Ltd., New Delhi, 6th reprint - 2012.
3.Dr. A. K. Jain, "Fluid Mechanics, Khanna Publishers", Delhi, Edition – 2011.
4.Dr. P.N.Modi , "Dr. S.M. Seth, Hydraulic and Fluid Mechanics", Standard Publications, Delhi, Edition – 2011.
5.Dr. K. Subramanya, "FM & HM-Problems & Solutions", Tata McGraw-Hill Education Pvt. Ltd. New Delhi, 6th reprint-2013.
6.Dandekar M. M. and K.N. Sharma, "Water power Engineering", Vikas Publishing House Privet Limited, Delhi.
7.Chow Ven Tee, "Open Channel Hydraulics", Tata McGraw Hill Publishing Company Limited, New Delhi.

Project-I

Project-I **P-I**
Course Title Short Title Course Code

Course Description:

The course explores the knowledge of design, experiment and analysis of data. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	**2**	**15**	**30**	**2**

COURSE CONTENT

Project-I
Semester-VII

Lab:2 Hrs/week **Examination Scheme**

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Total Semester Credits: 02

Internal Continuous Assessment (ICA): 25 Marks

End Semester Examination(ESE)-Oral:25 Marks

Total:50Marks

1. It is expected that the broad area of Project-I shall be finalized by the student in the beginning of the VII semester / extension of Minor project undertaken may be Project-I.
2. A group of Minimum 3 and Maximum 5 students shall be allotted for Project-I and same project group for Project-II.
3. Exhaustive survey of literature based on a clear definition of the scope and focus of the topic should be carried out by the students. The **Synopsis/Abstract** on the selected topic, after detail literature survey should be submitted to the Project coordinator appointed by Head of the department.
4. Project-I may involve literature survey, problem identification, work methodology preparing specification and material procurement, collection of data , conduction of experiments and analysis. The project work shall involve

sufficient work so that students get acquainted with different aspects of fabrication, design or analysis.

5. Approximately more than 50% work should be completed by the end of VII semester.
6. Each student group is required to maintain log book for documenting various activities of Project-I and submit group project report in the form of thermal bound at the end of semester –VII. Submit the progress report in following format:
    a. *Title*
    b. *Abstract*
    c. *Introduction*
    d. *Problem identification and project objectives*
    e. *Literature survey*
    f. *Case study/Analysis/Design Methodology*
    g. *Work to be completed (Progress status)*
    h. *Expected result and conclusion*
    i. *References.*

7. Evaluation Committee comprising of the Guide, Project Coordinator and Expert appointed by the Head of the department will award the marks based on the work completed by the end of semester and the presentation based on the project work.

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Guide lines for ICA : The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Assessment of the project-I for award of ICA marks shall be done jointly by the guide and departmental committee as per the guidelines given in **Table-A.**

Guide lines for ESE: The End Semester Examination for Project shall consist of demonstration if any, presentation and oral examinations based on the project report**.**

Assessment of Project-I

Name of the Project: _____

Name of the Guide: _____

Table-A

SN	Name of Student	Problem Identification and project objectives	Literature Survey	Project Methodology/ Design/PCB/ hardware/ simulation/ programming	Progress Status	Presentation	Total
		5	5	5	5	5	25

Seminar-II

COURSE CONTENT

Seminar-II Course Title | **S-II** Short Title | Course Code

Course Description: The course explores the knowledge of presentation and effective communication. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	**2**	**15**	**30**	**2**

COURSE CONTENT

Seminar-II
Semester-VII

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Examination Scheme
Practical : 2 Hrs/Week **Total Semester Credits: 02**
Internal Continuous Assessment (ICA): 25 Marks

1. Each Student shall select a topic for seminar which is not covered in curriculum. Seminar topic should not be repeated and registration of the same shall be done on first come first serve basis.
2. Topic of Seminar shall be registered within a three weeks from commencement of VII Semester and shall be approved by the committee.
3. The three-member committee appointed by Head of the department shall be constituted for finalizing the topics of Seminar-II. Seminar shall be related state of the art topic of his choice approved by the committee.
4. Each student should deliver a seminar in scheduled period (Specified in time table or time framed by department) and submit the seminar report (paper bound copy/Thermal bound)in following format:
    a. *Title*
    b. *Abstract*

c. *Introduction*
d. *Literature survey*
e. *Concept*
f. *Functional and Technical Details*
g. *Applications*
h. Comparison with similar topics / methods
i. *Future scope*
j. *References*

ASSESSMENT OF SEMINAR-II

Guide lines for ICA: ICA shall be based on topic selection , presentation and Seminar-II report submitted by the student in the form of thermal bound. Assessment of the Seminar-II for award of ICA marks shall be done jointly by the guide and a departmental committee, as per the guidelines given in **Table- B**

Name of Guide: _____

Table-B

SN	Name of Student	Seminar Topic	Topic Selection	Literature survey	Report writing	Depth of under-standing	Presentation	Total
			5	5	5	5	5	25

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Industrial Visit

Industrial Visit	**IV**	
Course Title	Short Title	Course Code

Course Description: The course explores the knowledge industry organization, new trends in manufacturing, maintenance and safety. The industrial visit provide the practical visualization of theoretical study of various engineering subject.

COURSE CONTENT

Semester-VII **Examination Scheme**

Total Semester Credits: 01

Internal Continuous Assessment (ICA): 25 Marks

1. Industry visits to minimum two industries shall be carried out by each student preferably or college shall arrange the industrial visit during the vacation period otherwise during the regular VII semester.
2. The student should obtain appropriate certificates of visit from the concerned organizations just after the visits.
3. Every Student should submit Industrial Visit report individually at the end of Semester-VII(First Term of Final Year)
4. The report(Thermal Bound) should contain information about the following points:
   a. *The organization - activities of organization and administrative setup technical personnel and their main duties.*
   b. *The project / industry brief description with sketches and salient technical information.*
   c. *The work / processes observed with specification of materials, products, equipments etc. and role of engineers in that organization.*
   d. *Suggestions (if any) for improvement in the working of those organizations.*
5. The evaluation of the report of technical visits will be made by panel of three teachers appointed by Head of the department based on following points:

Guide lines for ICA : ICA shall be based on knowledge gain by student and Industrial Visit Report submitted by the student in the form of Thermal bound. Assessment of the Industrial Visit for award of ICA marks shall be done jointly by industrial visit coordinators departmental committee based on viva -voce as per the guidelines given in **Table- C**

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Table-C

SN	Name of Student	Name of Industry	Report writing	Depth of Under-standing	Total
			15	**10**	**25**

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NORTH MAHARASHTRA UNIVERSITY,

JALGAON (M.S.)

Fourth Year Engineering

(Civil Engineering)

Faculty of Engineering and Technology

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Course Outline

Term-VIII

w.e.f. A.Y. 2015-16

BE (Civil) : Semester – VIII

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
Water Resources Engineering II	D	3	---	---	3	2	80	---	--	100	3
Environmental Engineering II	D	3	---	---	3	2	80	---	--	100	3
Elective - II	E	3	---	---	3	2	80	---	--	100	3
Elective - III	E	3	---	---	3	2	80	---	--	100	3
Water Resources Engineering II lab	D	--	---	2	2	---	---	2	2	50	1
Environmental Engineering II lab	D	--	---	2	2	---	---	2	25(PR)	50	1
LAB# Elective II lab	E	--	---	2	2	---	---	2	2	50	1
Industrial Lecture*	C	--	---	1*	1	---	---	5	--	50	2
Project - II	D	--	---	4	4	---	---	7	7	150	6
Total		12	---	11	23	80	320	200	150	750	23

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ISE: Internal Sessional Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

#Lab for Elective-II

* Minimum 6 lectures to be delivered by experts from the industry in alternate weeks. Next week group discussion on the lecture delivered.

Elective II	Elective III
1. Advanced Structural Design	1. Water Power Engineering
2. Earthquake Engineering	2. Industrial Pollution & Control
3. Systems Approach in Civil Engineering	3. Architecture & Town Planning
4. Construction Safety & Disaster Management	4. Retrofitting of Structures

Note 1: For branches like Chemical Engineering and Biotech Engineering, two laboratory hours can be merged to form a four hour slot. Note 2: Out of 3 practical ESE heads, at least 1 head should be practical. Note 3: Interdisciplinary Elective shall be offered by the department to the students of other department. Students from one department can not register for Interdisciplinary Elective of the same department. Note 4: At least 15 students should register for offering any elective.

Water Resources Engineering –II

Short Title: WRE-II
Course Description

In this course students are introduced with the topics such as basics of Gravity dams & Earth dams along with study of Spillways & Diversion Head works and irrigation canals.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

Course Objectives:

1. To introduce the students with the dams including gravity and earth dam, modes of failures and stability analysis of these dams.
2. To introduce the students with the diversion head-works and explain stability analysis of weirs on permeable foundations.
3. To explain the different spillways and design principles of ogee spillway. Also to provide students with details of energy dissipation below spillway.
4. To know unlined irrigation canals and their design principles.

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Course Outcomes: Upon successful completion of this course the student will be able to

1. Identify types of dams and their selection and also selection of site for dam.
2. Demonstrate diversion head works and its components.
3. Discuss causes of failures of weirs on permeable foundation and their remedies.
4. Analyze stability of weirs on permeable foundation using Khosla's theory.
5. Explain gravity dam and its cross section; compute the forces on gravity dam.
6. Compute various stresses developed in gravity dam.
7. Discuss causes of failures of gravity dam and analyze its stability.
8. Assess and compare elementary and practical profiles of a gravity dam.
9. Identify different spillways along with their suitabilities.
10. Explain design principles of Ogee spillway.
11. State different methods of energy dissipation below spillway.
12. Discuss various types of spillway gates.
13. Demonstrate earth dams and its components.
14. Discuss causes of failures of earth dams.
15. Explain control of seepage and drainage in earth dams.
16. Analyze stability of slopes of earth dams.
17. Discuss irrigation canals, its types and alignment.
18. Design cross section of unlined alluvial irrigation canal using Kennedy's and Lacey's theories using I. S. Code.
19. Discuss design procedure for L-section of irrigation canal as per I. S. Code.

Course Outline

Teaching Scheme:
Lectures: 3Hours/week
Practicals: 2 Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

UNIT I **(08 Hours, 16 marks)**

Dams: - Introduction and scope of the subject, types of dams, reservoir storage zones, selection of site for dam, choice of a dam, economical height of dam.

Diversion head works :- Introduction, selection of site, types of weirs and barrages, layout of diversion headwork and its components and functions, causes of failures of weirs on permeable foundations and remedies, Hydraulic design of weir with respect to subsurface flow, safety against piping and uplift, Bligh‘s, Lane’ s and Khosla’s theories.

UNIT II **(09 Hours, 16 marks)**

Gravity dams: - Introduction, cross section, forces acting on dam, load combinations as specified by IS 6512-1984, stresses in dam (normal, principal and shear stresses), modes of failures, stability analysis and design of gravity dam, elementary and practical profile, low and high dam, materials of construction, control of cracking, galleries, Joints and keys.

UNIT III **(07 Hours, 16 marks)**

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Earth dams :- Introduction, types, elements of earth dam, basic design considerations, causes of failures, piping and its prevention, control of seepage, drainage in earth dams, phreatic line – its uses and characteristics, equation, procedure of construction phreatic line for various cases, stability of upstream and downstream slopes of earth dam under various situations, introduction to rock-fill dam.

UNIT IV **(08 Hours, 16 marks)**

Introduction to arch dams, types and their suitability, optimum central angle for constant angle arch dam.

Spillways: - Introduction, spillway capacity, different types of spillways and their suitabilities, design principles of Ogee spillway, working of siphon spillway.

Energy dissipation below spillway, types of hydraulic jump, jump height curves and tail water rating curves, various types of energy dissipators: Indian Standard stilling basins and buckets.

Gates: - Uses, types of spillway crest gates.

UNIT V **(07 Hours, 16 marks)**

Canal irrigation: - Types of irrigation canals, canal alignment.

Design of cross section of stable unlined channels in alluvial soil by Kennedy’s and Lacey’s theories according to IS 7112 – 1973, merits and demerits of Kennedy’s and Lacey’s theories, Garret’s diagram.

Design procedure for L – section of an irrigation canal, balancing depth, losses in canals, schedule of area statistics and channel dimensions.

Imp. Note:- Following charts should be provided to students of B.E. (civil) during theory paper.

i) Dr. A.N. Khosla's curves for design of weir on permeable foundation.

ii) Garret's diagram for design of unlined alluvial canals.

Reference books:-

1. Modi P.N. " Irrigation, Water Resources and Water Power Engineering", Eight edition. Standard Book House, Delhi2012.
2. Garg S.K, " Irrigation Engineering And Hydraulic Structures". Khanna Publishers ,1998, Delhi.
3. Punmia B.C., Pande B.B., .Lal, " Dams II: Irrigation and Water Power Engineering". Laxmi Publications Pvt. Ltd., New Delhi1999..
4. Varshney R.S., Gupta S.C., Gupta R.L. " Theory and Design of Irrigation Structures, Volume I and II", Fourth edition. New Chand & Bros., Roork1979. i.
5. Bharat Singh " Irrigation Engineering".
6. Sharma R.K., "A Text Book of Hydrology & Water Resources", Dhanpat Rai and Sons.
7. K.B.Khushlani " Irrigation Engineering ".
8. Justin, Hinds "Irrigation Engineering and Practice "

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Environmental Engineering II

Short Title: EE-II
Course description:

The course is designed to make aware the student about environmental hygiene and sanitation with specific reference to domestic wastewater and municipal solid waste. It also introduces the student with air pollution control technology. The course describes water pollution scenario, its causes, and sources. The course also describes parameters of water pollution, wastewater sampling methods, methods of examination of wastewater in laboratory and the consequences of wastewater in environment. The course includes the domestic wastewater management strategies including its removal from houses, transportation and treatment by physico-chemical and biological methods. The course covers conventional as well as advanced methods of wastewater treatment. It also covers the municipal solid waste generation rates, its methods of sampling, its bad effects, methods of transportation and final disposal. The elements of air pollution control technology are also included in the syllabus.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

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General objectives: the principal objective of the course is to train a civil engineering student in domestic and municipal sanitation. Its objective is to appraise the student about importance of municipal wastewater and solid waste management. It also enables the student to use technological tools to treat, reuse or dispose-off safely the municipal liquid and solid waste. The course also introduces the student with basics of air pollution control technology.

Learning outcomes: The major expected outcomes of the curse are listed as follows:

1. The student will learn about the sources and causes of water pollution.
2. The student will learn about the mechanism of water pollution.
3. The student will learn about the parameters of water pollution.
4. The student will learn the methods of wastewater sampling, and examination.
5. The student will learn the design and maintenance of house plumbing and sewerage facilities.
6. The student will learn the design and maintenance of physic-chemical and biological methods of wastewater treatment.
7. The student will learn the importance of municipal solid waste management.
8. The student will learn the technology of municipal solid waste management.
9. The student will learn the basics of air pollution.

Course Outline

Teaching Scheme:
Lectures: 3Hours/week
Practicals: 2 Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

Unit I **(8 Hours, 16 Marks)**

Sampling of sewage-Grab sampling, composite sampling, domestic and industrial sewage sampling plans, sample preservation.

Microbial decomposition of organic matter, role of enzymes, acclimatization, classification of microorganisms, aerobic and anaerobic cycles.

Characteristics of sewage- parameters of characterization, dissolved oxygen and its significance, biochemical oxygen demand, first stage BOD satisfaction and nitrification process chemical oxygen demand, total solids, different types of solids in water, biodegradability, factors affecting biodegradability, MLSS and F/m ratio.

Reactor flow regime-Batch reactor, continuous flow reactor, plug flow reactor, completely mixed flow reactor, kinetics of microbial degradation in batch reactor.

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Disposal of sewage- Pollution effects due to disposal of sewage on land, river, lake and sea. Oxygen sag curve, river re-aeration.

Unit II **(7 Hours, 16 Marks)**

Collection of sewage-House plumbing- elements, design.

Sewage pumping- difficulties in pumping, types of pumps used, their maintenance.

Conveyance of sewage- Quantity of domestic and storm sewage-assessment, sewer-terminologies, non-silting non-scouring velocity, coefficient of roughness, Manning's formulation, Chezy's formulation, design of circular sewer-combined and seperate, ogee shaped sewer material, sewer appurtenances, forces acting on sewers, laying of sewer, maintenance of sewer.

Unit III **(8 Hours, 16 Marks)**

Conventional sewage treatment processes- unit operations and processes, grit chamber, skimming tanks, primary sedimentation of sewage, coagulation of sewage, theory of biological treatment, suspended and attached growth system, aerobic and anaerobic treatment systems.

Activated sludge process-theory and detailed design, trickling filters- theory and detailed design, modifications in ASP, theory and design of aerated lagoons, anaerobic lagoons, rotating biological disk, anaerobic filters, UASB, fluidized bed reactor.

Unit IV **(8 Hours, 16 Marks)**

Oxidation pond- theory and design using BOD loading parameter, elevation and temperature correction, constructional features, no detailed design.

Sewage disposal in unsewered areas- septic tanks- theory and design. Low cost toilets for rural areas-theory and design.

Nitrogen removal- theory and technology. Non-biodegradable organics- sources, bad effects, present status, removal methods- introduction only, photo-catalysis-theory, reactor configurations, process variables, present day applications.

Sludge generation rates, sludge handling sludge disposal methods-introduction, sludge drying beds.

Anaerobic digestion-theory and design of digester

Unit V **(8 Hours, 16 Marks)**

Sources of solid waste. Municipal SW- bad effect, generation rates, effect of socio-economics on rate of generation, global and Indian scenario, storage- sizing of dust bin, IS specifications, multi-bin collection systems, collection, removal methods, transportation-assessment of vehicle requirement, concept of route optimization (no mathematical treatment), methods of disposal- land filling, composting, incineration, vermin-composting, hog feeding, sea disposal. Description of methods of disposal and their relative merits. Importance of Hygiene and sanitation, application to public places like colleges, parks, cinema halls, auditoriums, hospitals, offices etc.

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Definition of air pollution, elements of air pollution, global air pollution scenario- global warming and its

implications, energy-environment-economics correlation, effects on human being, animals, plants and property. Introduction to Intergovernmental panel on climatic changes. No mathematical treatment.

Reference books:-

1. E W Steel and Terence J McGhee , " Water Supply and Sewerage", International Student Edition.
2. G S Birdie, "Water supply and sanitary engineering", Dhanpat Rai publishing
3. B C Punmia, Ashok Jain and Arun Kr Jain, "Wastewater engineering", Firewall Media publication.
4. M N Rao and S K S Rao, "Air pollution", TMH publications.
5. S K Garg, "Sewage Disposal and Air Pollution Engineering", Khanna Publishers, New Delhi.
6. Pevy, Rowe & Tchobanoglous, "Environmental Engineering", McGraw Hill International, New Delhi.

Advanced Structural Design

Elective-II

Short title- ASD
Course Description:-

This course deals with the design aspects of a few special structures with a view to simulation of realistic behaviour as closely as possible. The categories of structures which are going to be dealt with in this course are study of ductile detailing for reinforced concrete frame buildings, design of rectangular combined footing, flat slabs, cantilever retaining wall, water tanks, post tension girders etc.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

General objective:-

After successful completion of the course student will able to

1. Familiar with the principles of reinforced concrete and prestressed design.
2. Calculate the loads on structural components as per IS-code provisions.
3. Prepare, read and interpret structural drawings.
4. Understand codal methods to design and analyze heavy structures such as retaining wall, water tank, prestressed concrete girders etc.
5. Analyze, design and prepare detail drawings for flat slab, retaining wall, water tank and pre-stressed concrete girders.

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Learning outcomes:-

Upon successful completion of this course the student will be able to

1. Design RCC structures such as retaining wall, combined footing, water tank, flat slab.
2. Understand principles of pre-stressing and design of post tension girder.
3. Incorporate IS-code provisions in design of structure.
4. Prepare detail drawings for the designed members of structure.

Course Outline

Teaching Scheme:
Lectures: 3Hours/week
Practicals: 2 Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 4 Hours
Internal Sessional Examination(ISE): 20 Marks

UNIT I **(9 Hours, 20 marks)**

R.C. Structures

- Ductile detailing of RC members as per Is 13920.
- Design of rectangular combined footing.
- Design of interior panel of flat slabs.

UNIT II **(10 Hours, 20 marks)**

- Design of cantilever retaining wall.
- Design of circular water tanks resting on ground based on following conditions

i. Flexible joint between walls and the base.
ii. IS code method.

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UNIT III **(10 Hours, 20 marks)**

Prestressed concrete structures

- Introduction:- Basic concept, materials, prestressing systems, stages of loading,stresses in tendons.
- Losses in pre-stresses :- Nature of losses, loss due to elastic shortening of concrete, shrinkage, creep, anchorage slip, successive pre-stressing of straight cables, relaxation of stress in steel friction in a curved cable anchorage.

UNIT IV **(10 Hours, 20 marks)**

- Transfer of pre-stress in pre-tensioned members, transmission length, end zone reinforcements. Anchorage Zone stresses in post –tensioned members – Guyan's method.
- Limit state design of pre-stressed concrete member's philosophy of design, various criteria for limit. States, design loads, strength and serviceability.
- Design of post tensioned flexural members – Rectangular and flanged sections, cable profile, Design of shear reinforcement, bond partial pre-stressing limit state method.

Reference Books:-

1. N. Krishnaraju, "Prestressed Concrete"

2. T. Y. Lin, “Design of prestressed concrete structure”.
3. S.R. Karve & V. L. Shah, “Limit State Analysis & Design of Reinforced Concrete”, Structures PublicatinsR.C.C. Structures.
4. Punmia, Jain & Jain, “Comprehensive R.C.C. Design”, Laxmi Publications.
5. S. K. Duggal, “Earthquake Resistant Design of Structures”, Oxford University Press.
6. N. C. Sinha & S. K. Roy, “Fundamentals of Reinforced Concrete”
7. S. Unnikrishna Pillai, Devdas Menon, “ Reinforced Concrete Design”, Tata McGraw-Hill Publication.
8. S. Ramamrutham, “Design of Reinforced Concrete Design”, Dhanpat Rai Publishing Company.
9. B. C. Punmia, “Reinforced Concrete Structures”, Laxmi Publication.

Reference IS Codes:-

10. IS 456-2000 Plain and Reinforced Concrete - Code of Practice.
11. IS 1343 (1980): Code of Practice for Pre-stressed Concrete.
12. IS 13920 (1993): Ductile detailing of reinforced concrete structures subjected to seismic forces.

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Earthquake Engineering

Elective-II

Short Title: EQE

Course Description:

The course allows structural engineers to consolidate their knowledge on the effect of earthquake ground motions on civil engineering structures. The course will cover the analysis and the design of structures that are located in active seismic zones. The course will also introduce the use of supplemental damping and seismic isolation systems to raise the seismic performance of buildings and bridges

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3

General objective:-

1. To know basic earthquake mechanisms, tectonics, types of ground motion, and propagation of ground motion.
2. To interpret earthquake ground motion data.
3. Seismic design of RC structure as per IS 1893:2002, IS13920 and 4326
4. Determine the base shear by equivalent static analysis method

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Course outcomes:

The student will demonstrate the ability to:

1. Understand basic earthquake mechanisms, tectonics, types of ground motion, and propagation of ground motion.
2. Understand and interpret earthquake ground motion data.
3. Understand qualitative and quantitative representations of earthquake magnitude.

a. Determine the base shear by equivalent static analysis method based on the type of structural system, irregularity, location and occupancy.

Teaching Scheme:
Lectures: 3Hours/week
Practicals: 2 Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

Unit I **(07Hrs, 16 Marks)**

Influence of geology on earthquake, causes of earthquake and their characteristics, Earthquake parameters, magnitudes, intensity, scales, seismic zoning of India, seismic coefficients for different zones, Natural disasters, mitigation and social aspects.

Unit II **(08 Hrs, 16 Marks)**

Theory of vibrations:

Vibrations - definition, causes, classifications. Single Degree of Freedom systems (SDOF) - free, forced, damped, un-damped vibrations. Introduction to Multi-degrees of Freedom systems (MDOF) - derivations of related equations and solutions to two degree and three degree of freedom systems.

Unit III **(08 Hrs, 16 Marks)**

Seismic design of RC structure as per IS 1893 and 4326, Seismic coefficient method. Basic requirement, estimation of story shear, effect of unsymmetrical geometry and masses, mass center and stiffness center, estimation of story shear and tensional moments for unsymmetrical buildings. IS code provision to response spectrum, Modal analysis for RCC frame, Design of multistoried building, concept of ductile detailing, IS 13920 provisions for RC frame.

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Unit IV **(08 Hrs, 16 Marks)**

Type of forces generated due to earthquake, effects on different types of foundation, design of RCC isolated footing for earthquake loading, liquefaction, causes and its remedial measure.

Unit V **(08 Hrs, 16 Marks)**

Introduction of different control systems, Passive control: base isolation and active control: bracing system

Reference books:-

1. Duggal , " Earthquake resistance design of structure"' Oxford University Press.
2 . David J. Downik , " Earthquake Resistant Design", Jon Wiley and Sons Publication
3. Earthquake Tips NICEE, IIT, Kanpur

4. Jaikrishna and Chandarsekaran, “ Elements of Earthquake Engineering” .
5. Kramer S. L , “ Geotechnical Earthquake Engineering.”, Prentice Hall India Publication
6. Relevant Latest Revisions of IS codes.
7. Anil K. Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, 3'd Edition, 2007.
8. D.J. Dowrick, "Earthquake Resistant Design for Engineers", Wiley.
9. Vinod Hosur, "Earthquake Resistant Design of Building Structures", Wiley, 2013

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System Approach in Civil Engineering

Elective-II

Short Title: SAC

Course Description:

Systems engineering deals with work-processes, optimization methods, and management tools in projects. Systems engineering ensures that all likely aspects of a project or system are considered, and integrated into a whole.

Aim is to develop capability in solving various civil engineering management Problems related to infrastructural projects. They should be able to analyze and come to appropriate solution.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

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General Objective:

1. To Learn different types of optimisation techniques
2. To learn Linear and non linear Programming
3. To study dynamic Programming

Learning outcomes:-

At the end of course student will have following abilities,

1. Explain the basic concept of study of system approach in civil engineering.
2. Develop a mathematical model for a given problem to optimize it.
3. Decide for optimization and utilization of resources & apply system approach in civil engineering and in industrial operations.
4. Solve the real life problems which arise in industries like transportation , assignment , decision making,
5. Do Job sequencing using operation techniques.
6. Optimize the solution for different practical problems with available constraints.
7. Gain basic knowledge for engineering analysis software.

Course Outline

Teaching Scheme:
Lectures: 3Hours/week
Practicals: 2 Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

UNIT I **(9 Hours, 16 marks)**

Introduction, System concepts, use of system approach , Optimization techniques and their applications in civil engineering , methods of analysis, mathematical representation, Various models, objective function, constraints.

Linear programming: Formulation of Linear optimization models for Civil engineering applications. The simplex method, special cases in simplex method, Method of Big M, duality, sensitivity analysis.

UNIT II **(7 Hours, 16 marks)**

Linear programming:

Distribution models: transportation and assignment problems and their Solutions

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UNIT III **(8 Hours, 16 marks)**

Dynamic programming:

Dynamic programming , principle of optimality, recursive equation. Stochastic method, Queing theory simulation, sequencing, capitalization, annuity benefit cost.

UNIT IV **(8 Hours, 16 marks)**

Non linear programming:

Single variable unconstrained optimization – Local and global optima, unimodal function, Sequential search techniques.

Multivariable problems (unconstrained) Gradient techniques, steepest techniques, Newton's method.

Multivariable optimization with equality constraints- Lagrange’s multiplier techniques.

UNIT V **(7 Hours, 16 marks)**

Games theory , Replacement model

Reference books:-

1. S.S. Rao, " Engg. Optimization Theory and Practice", John Wiley and Sons

2. Thomas K Jewell," A systems approach to civil engineering planning and design",Harper and row.
3. Samual Labi ," Introduction to civil engineering systems", Wiley
4. Hamdy A. Taha, "System approach in civil engineering", Prantice Hall.
5. Harvey M. " Principle of system approach in civil engineering"

6. Shrivastava,Shenoy and Sharma," Quantitative techniques for managerial
7. Decisions",Wiley Eastern

8. Paul J. Ossenbruggen, "An Approach to Teaching Civil Engineering System"

9. N.D. Vohra "Quantitative Techniques in Management" , Mc Graw Hill \
10. Hira , Gupta ,"Operation Research ", S. Chand

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Construction Safety & Disaster Management

Elective –II

Short Title: CS&DM
Course Description:

The subject deals with the principles of safety management in the construction industry which will enable the student to become familiar with modern and conventional techniques for construction safety. This subject also deals with the principles of disaster management

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

General objective:

The general objective of course is to understand safety concepts in construction industry and analyze activities involved in using safety methods with respect to cost, engineering economics etc. Also it aims to explain different disaster management techniques used and public awareness related to disaster mitigation.

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Learning outcomes:

Upon successful completion of these course the student will be able to :

1. Identify the construction safety management system.
2. Learn the measures to be taken for safety during construction.
3. Identify various types of disasters.
4. Learn the disaster management techniques and its analysis.
5. Learn effective implementation of safety management and public awareness regarding disaster management

Course Outline

Teaching Scheme:
Lectures: 3Hours/week
Practicals: 2 Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

Unit – I **(08 hours 16 marks)**

Construction Safety Management – Role of various parties, duties and responsibilities of top management, site managers, supervisors etc. role of safety officers, responsibilities of general employees, safety committee, safety training, incentives and monitoring. Writing safety manuals, preparing safety checklists and inspection reports.

Unit – II **(08 hours 16 marks)**

Safety in construction operations – Safety in construction operations accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, etc. First aid on site ,Prevention of accidents, Safety measures while using construction equipment e.g. vehicles, cranes, hoist and lifts etc. Safety of scaffolding and working platforms. Safety while using electrical appliances & Explosives.

Unit – III **(08 hours 16 marks)**

Natural Disasters & Manmade disasters

Natural Disasters : Natures and extent of disasters, natural calamities such as earthquake, floods, coasts hazards, landslides etc.

Manmade disasters: such as chemical and industrial hazards, nuclear hazards, fire hazards etc.

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Unit – IV **(08 hours 16 marks)**

Disaster Management – Financing relief expenditure, legal aspects, rescue operations. Casualty management, risk management. Emergency Management Programme: Administrative setup and organization. Hazard analysis, training of personnel, information management, emergency facilities and equipment necessary.

Unit – V **(07 hours 16 marks)**

Public awareness & Management- creation, preparation and execution of the emergency management programme, role of safety officers ,awareness committee,

Reference Books:

1. Construction Safety Manual - Published by National Safety Commission of India.
2. Safety Management in Construction Industry – A manual for project manager (NICMAR Mumbai)
3. *Davies* V.S.Thomasin ,"K, Thomas Construction Safety Handbook" ,Telford, London.
4. Bureau of Indian Standards , " IS for safety in Construction".
5. Girimaldi and Simonds ," Safety management",AITBS, New Delhi
6. Seetharaman ," Construction Engineering and Management"

7. K Nagarajan , “ Project Management”, New Age International Ltd.

8. Rajdeep Dasgupta, “ Disaster management & rehabilitation”, mittal Publication.

9. Dr. Kadambaui Sharma,Dr. Avinash Chiranjeev, “ Disaster management in India” Jnanda prakashan(P&D) New Delhi

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Water Power Engineering

Elective –III

Short Title: WPE

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

Course Description:

Hydropower engineering tries to tap vast amount of energy available in the flowing water on the earth's surface and convert it into electricity. The goal of this course is to become prepared for study and design of conventional and alternative power-generation plants

General objective:

To learn about:

1. Potential of hydropower that may be generated from a stream
2. Types of hydropower generation plants
3. layouts of hydropower plants
4. Analysis and preliminary design of the major systems of power plants.

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Learning outcomes:

Upon successful completion of these course the student will be able to :

1. Know basics of hydropower plants and its types
2. Estimate water power potential
3. Understand layouts of hydropower plants
4. Be acquainted with various components of power plant and their working

Course Content

Teaching Scheme:
Lectures: 3Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

Unit –I **(8 Lectures, 16 Marks)**

General:– Conventional and non- conventional sources of energy, status of electrical power in the World and India, advantages and disadvantages of hydro-electric power over other conventional sources, place of hydropower in the power system, transmission voltage.

Estimation of water power potential: – Mass curve, flow duration curve, firm power and secondary power, power duration curve and available power.

Power plant economics :– Types, connected load, maximum demand, load factor, load curve, base and peak load, plant capacity factor, plant use factor, diversity factor, load sharing between base load and peak load power stations, cost of electrical energy, energy rates (Tariff).

Unit- II **(8 Lectures, 16 Marks)**

Hydro electric power plants: – Classifications, run-of-river plant, valley dam plant, diversion canal plant, high head diversion plant – General arrangements & layouts of these four power plants, storage and pondage, pondage factor.

Pumped storage power plants: – Essential requirements, necessity, advantages and disadvantages, classification of pumped storage power plants, relative merits of two-unit and three-unit arrangements, problems in operation, layout, efficiency of Pumped storage power plants.

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Unit- III **(8 Lectures, 16 Marks)**

Tidal Power Plants: - Principles of power generation - components of power plant – Single and two basin systems – Turbines for tidal power - Estimation of energy – Maximum and minimum power ranges

Power house:- Surface Power Stations – Structure, Dimensions, Lighting & Ventilation, Variations in design Underground Power Station – Location, Types of Layout, Components, Advantages

Intake structures:- Functions, types, losses in intakes, air entrainment and inlet aeration, cavitation.

Unit- IV **(8 Lectures, 16 Marks)**

Penstock & accessories: – Classification, design criteria, economical diameter, anchor blocks, conduit valves, bends & manifolds.

Water hammer phenomenon in penstocks, celerity of pressure wave in rigid and elastic pipes, sudden and gradual and partial opening and closing of valves, details of pressure cycles (no derivation of the equations for celerity of pressure wave and water hammer pressure).

Surge Tanks: - Necessity, locations, functions, types, analysis of simple cylindrical surge tank considering frictional effects.

Unit- V **(7 Lectures, 16 Marks)**

Non conventional energy -

Biomass energy: - Bio fuel classification, energy farming, direct combustion for heat, anaerobic digestion for biogas, different digesters, applications of Biogas.

Solar energy: - Availability, solar radiation data and measurement, elementary concepts of solar energy applications, solar air and water heaters, solar chimney, crop driers, water desalination.

Wind energy: – Introduction, characteristics, variation with height and time, potential of wind power, location of wind power station and space requirement, Introduction to horizontal axis wind turbine (HAWT) and vertical axis wind turbine (VAWT), applications of wind energy.

Reference Books:-

1. Dandekar M. M. and K.N. Sharma, Water power Engineering, Vikas Publishing House Privet Limited, Delhi.
2. Sharma R K & T.K.Sharma, A text Book of Water Power Engineering.
3. John Twidell and Tony Weir, E & F.N.Spon, Renewable Energy Resources.
4. Sukhatme S. P., Solar Energy, Principles of thermal collection and storage, TMH
5. Kreith & Kreider, Solar Heating and Cooling.
6. Tony Burton, David Sharpe, Nick Jenkins and Ervin Bossanyi, Wind Energy Handbook.
7. Dr. K. Subramanya, FM & HM-Problems & Solutions, Tata McGraw-Hill Education Pvt. Ltd. New Delhi, 6th reprint-2013.
8. Sawhney, Non conventional resources of energy, PHI Learning Pvt., Limited, Delhi.
9. Dr. A. K. Jain, Fluid Mechanics, Khanna Publishers, Delhi, Edition – 2011.
10. David A. Rivkin, Marc Randall and Lanrel Silk, Wind Power Generation and Distribution.
11. Khan B. H., Non conventional energy resources, Tata McGraw-Hill, IInd edition, 2009.

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Industrial Pollution & Control

Elective-II

Short Title: IPC

Course Description:

The industries generate variety of liquid, solid and gaseous waste. The present course describes the major industries in India and at global level that are responsible for pollution. It also covers the methods of sample collection for liquid and gaseous waste from industry. The course covers the general wastewater treatment technology used for major industries and IS specification in this regard. The course describes the air pollution dispersion analysis and modeling considering meteorological parameters. It also includes the design of stack for air pollution control.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

General objectives

The main objective of the course is to enable a student to carry out an industrial wastewater, solid waste and air pollution survey, to propose environmental management technology and plan for water pollution control, air pollution control and land pollution control. It aim to appraise a student about prevailing environmental legislation and functioning of statutory bodies. It aims to enable a student to design, operate and maintain industrial pollution control facilities and may also represent the agencies in case of legislative operations.

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Learning outcomes

The main learning outcomes of the course are listed as follows:

1. The student will learn the industrial wastewater, air pollution and solid waste sampling and survey. He/she will be able to monitor hem.
2. The student will have knowledge of prevailing legislation of pollution control.
3. The student will be aware of the method of functioning of pollution control boards.
4. The student will be aware of IS specifications for design of wastewater treatment facilities for major industries.
5. The student will be aware of the disposal standards prescribed by legislative agencies for wastewater.
6. The student will be aware of the disposal standards prescribed for solid waste by legislative agencies.
7. The student will be aware of the ambient and exhaust air standards prescribed by legislative agencies.
8. The student will be able to give a complete environmental management plan for the industry and will be able to do auditing also.

Course Outline

Teaching Scheme:
Lectures: 3Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

Unit I **(7Hours,16 Marks)**

Major industries responsible for water pollution across globe and in India, water uses in major industries, industrial wastewater survey, sampling procedures, characteristics of major industries like dairy, sugar, pulp and paper, dye, metal plating, textile, petroleum, refineries, slaughterhouse, tannery, distillery etc. as per IS codes.

Unit II **(8 Hours,16 Marks)**

Treatment prescribed by IS codes for major industries like dairy, sugar, pulp and paper, dye, metal plating, textile, petroleum, refineries, slaughter house, tannery, distillery etc. Flow and quality variation and its impact on treatment, importance of flow equalization, segregation of waste streams- specific applications.

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Unit III **(8 Hours,16 Marks)**

Concept of reduce, recover, reuse and recycle in industries. Housekeeping and its importance. Optimization of industrial processes keeping in view the wastewater generation and treatment, integrated approach for industrial water and wastewater management, concept of CETP, industrial ecology, water quality index and its application in industrial wastewater management.

Environmental legislations in India, salient features of water pollution prevention act and air pollution control act, and Environmental protection act. Constitution of pollution control boards and their functioning.

Unit IV **(8 Hours,16 Marks)**

Nutrient deficiency in wastewaters, addition of nutrients, Acclimatization of biomass, biological treatment using acclimatized biomass, applications and limitations in industrial biological wastewater treatment, treatment of metal plating waste, treatment of acidic and alkaline waste, application of advance wastewater treatment technology- reverse osmosis (theory, application and design), adsorption- (theory, application and design including kinetic modeling), low cost sorbents.

Unit V **(8 Hours,16 Marks)**

Meteorological parameters affecting air pollution dispersion, Gaussian dispersion equations (no derivations), estimation of air pollution dispersion, design of stack for air pollution control, plume rise. Types of scrubbers and their applications in industries, (no mathematical treatment on scrubber design).

Industrial solid waste sampling plan, characterization, disposal of waste from thermal power plant. Disposal of solid organic industrial waste. Disposal of toxic and hazardous waste-theory only.

Reference books:-

1. Joseph D Edwards, “Industrial wastewater treatment: a guide book” , CRC Press publications.
2. Industrial wastewater management, treatment and disposal, by Water Environment Federation (WEF), Tata McGraw Hill Publications.
3. M N Rao and H V N Rao, “Air pollution”, Tata McGraw Hill Publications.
4. www.cpcb.nic.in
5. www.mpcb.gov.in
6. www.moef.nic.in/legis/**water**/wat1.html
7. www.cpcb.nic.in/upload/NewItems/(1)%20**Wateract1974**%20.doc
8. www.moef.nic.in/legis/**air**/**air**1.html
9. envfor.nic.in/legis/env/env1.html

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Architecture and Town Planning

Elective-III

Short Title: AR&TP

Course Description:-

This course introduces the student about various concepts and principles of architecture, town planning and landscaping. It also prepares the students for implementing sustainable development principles in urban planning

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

General objective:-

1. To train the students about concepts in Architecture and town planning
2. To make the students aware about Town planning legislations and municipal acts

Learning outcomes:-

After successfully completion of the course student will be

1. Able to gain knowledge of urban and regional planning
2. Familiar with the principles of architecture ,town planning and landscaping
3. aware with the need of planning for development
4. Able to develop basic skills in planning surveys, analysis, generating alternative strategies and evaluation of options and preparation of plans.
5. Implement concept in development of planned townships.
6. Use concepts of energy efficient building design.

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COURSE OUTLINE

Teaching Scheme:
Lectures: 3Hours/week

Examination Scheme:
End Semester Examination(ESE): 80 Marks
Paper Duration(ESE): 3 Hours
Internal Sessional Examination(ISE): 20 Marks

UNIT I **(8 Hours, 16 marks)**

Architecture: Definition**:** Role of "urban planner and architect" in planning and designing. Principles of architecture, Architectural composition and elements of design.

Landscaping: Environmental art and design for urban landscape, objectives, principles, elements, material, soft landscaping, hard landscaping, and garden styles: modern and historical, water body conservation and creation.

UNIT II **(8 Hours, 16 marks)**

Town planning- Objectives, principles, stages in town development, growth of towns and theories of developments (ribbon, sector zone, concentric, multiple zone etc)

Study of new towns – Study of planned towns like new Mumbai, Gandhinagar.(infrastructure, disaster management etc)

Neighbourhood- planning and role in urban development, town planning schemes, garden city & three magnet theory, green belts.

UNIT III **(9 Hours, 16 marks)**

Concept of master plan: Structure plan, detailed town planning scheme and action plan. Estimating future needs , planning standards for different land use allocation for commerce, industries, public amenities, open areas etc, planning standards for density distributions , density zones ,planning standards for traffic network ,standard of roads , Plan implementation.

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Town planning legislations and municipal acts planning of control development schemes ,urban financing , land acquisition ,slum clearance schemes ,pollution control aspects.

UNIT IV **(7 Hours, 16 marks)**

Levels in planning- regional/city/ neighbour hood.

City development plan:-Scope & purpose, Surveys- demographic, housing, land use, ws & sanitation, etc.

Traffic; transport- urban road objectives, classification, traffic management.

Legislative mechanism for dp: mrtp, planning agencies for various levels of planning. Their organisation and purpose (CIDCO-MHADA-MIDC).

UNIT V **(7 Hours, 16 marks)**

Environmental Studies in Building Science:

Components of Ecosystem; ecological principles concerning environment; climate

Responsive design; Energy efficient building design; thermal comfort; solar architecture;

Acoustics – Concepts of Acoustic, noise pollution & its control.

Reference Books:-

1. G.K .Hiraskar , “Town planning”,Dhanpatrai Publication 2002
2. S. Rangwala, “Town planning”, Charotar Publishing House Pvt. Ltd.,2009
3. G Muthu,Shobha,Mohan, “Principles of Architecture “2006
4. MRTP act 1966
5. UDPFI guidelines, ministry of urban affairs and employment, Govt. & India.
6. koenigsbeger, “Manual of tropical housing and building”, Universities Press (India)
7. Sustainable Building - Design Manual: Sustainable Building Design Practices, 2009 by TERI
8. Shah, Kale, Patki, “Building Drawing”, Tata McGraw-Hill Education, 5th edition
9. Gevorkian, “Green Buildings”, Mc Graw hill.
10. Haselbach, “The engineering guide to LEED”, new construction-sustainable construction for engineers, The McGraw-Hill, 2008.
11. Satish Chandra Agarwala , “Architecture & Town Planning”, Dhanpat Rai & Co (P) Ltd.
12. Prakash Apte, “The building of Gandhinagar”, Power publishers.
13. Annapurna Shaw, “The making of new Mumbai”, Orient Blackswan, 2004
14. http://www.cidco.maharashtra.gov.in/NM_Developmentplan.aspx

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Retrofitting of Structures

Elective-III

Short Title: RS

Course Description:-

This course focuses on the rehabilitation of the structure as per need. The repairing strategies include special concrete mortar and different types of concrete or some more contemporary methods as per the assessment or inspection of the structure. The most viable issue these days of retrofitting of structure is discussed with different techniques as per there requirement.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lecture	03	13	39	3
Tutorial	--	--	--	

General objective:-

1. To recognize need for repair and rehabilitation.

2. To Know modern Civil Engineering techniques of repair.

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3. To Have better understanding of different materials used.

4. Proper selection and specification for material

Learning outcomes:

After successfully completion of the course student will able to

1. Assess the role of civil engineer while inspecting the damaged or deteriorated structures.
2. Familiar with the different material and techniques used for repair.
3. Discuss some of the upcoming techniques like foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks.
4. Know the need of retrofitting as per the situation
5. Able to apply the right retrofitting technique as per discussion on the different situations.
6. Able to apply the knowledge on the retrofitting with the composite material.

Unit 1 **(7 Hours, 16 Marks)**

Causes for distress in structure:

Philosophy & definition, causes of failure, failure in ancient time & recent times. Deficiency in design drag, material production, maintenance etc. Failure related problems; Man made and natural failure or damage. Diagnosis of failure; change in appearance on an exposure, chemical deterioration, Mechanical deterioration. Cracking in buildings. Failure of flat roofs, balconies, trenches, dams, piles abutments piers, silos, chimney, cooling towers, R.C.C. frames, Failure information & Analysis. Format of investigation. Shear, Torsion compression failure, Erection difficulty, failure in tanks silos, space frame, precast assemblies prestressed concrete structure, formwork failure, case studies.

Unit 2 **(8 Hours, 16 Marks)**

Materials and techniques for repair:

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete. Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coating and cathodic protection. Ultra-high performance fibre reinforced concrete (UHPFRC), Fiber reinforced composites, Carbon fibre reinforced polymer (CFRP), Fibre wrapping (Carbon, Aramide, Glass)

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Unit 3 **(7 Hours, 16 Marks)**

Maintenance & repair of structures:

Need for maintenance and repairs Inspection of Structures for repairs and maintenance methods for repairs, Material and methodology for repairs, Cost of repair & maintenance, Repair to foundation columns, piles, floor, roof and walls

Unit 4 **(7 Hours, 16 Marks)**

Structural strengthening:

Strengthening and retrofitting of columns, beams, walls, footings and slabs, piers of concrete structures by jacketing, external post-tensioning, replacing or adding reinforcement, plate bonding, and textile reinforced concrete.

Unit 5 **(7Hours, 16 Marks)**

Preventive measures for durability of structures:

Proper selection and specification for material, The use of modern techniques for construction, Proper design, Better workmanship.

Reference Books:

1. Denison Campbell, “Concrete Structures, Materials, Maintenance and Repair”, Allen and Harold Roper Longman Scientific and Technical UK, 1991.
2. R.T.Allen and S.C.Edwards , “Repair of Concrete structures”, Blakie and Sons, UK, 1987
3. M. Alexander, H. D. Beushausen, F. Dehn& P. Moyo,”Concrete Repair, Rehabilitation and Retrofitting”, Taylor & Francis Publication.
4. Ted Kay "Assessment and Renovation of Concrete Structures" ed., John Wiley & Sons, Inc. New York., 1992.
5. Rakshit K. S. "Construction Maintenance & Repair of Highway Bridges", 1994.
6. Champion S., “Failure & Repair of Concrete Structures” Wiley Publishers, 1961.
7. Grass F K, Clarke J L & Armer GST., “Structural Assessment”, Butter Worths Publisher, 1987.
8. Raiker R N, “Learning from failures”.

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Water resources Engineering-II Lab

ICA (Term Work): 25 Marks

ESE (Oral): 25 Marks

Course Description:

The Lab work is focused on developing the skills of students in the areas such as analysis of Dams and its components ,design principles and causes of failures of dams

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lab hours	02	13	26	1

Course Objectives:

1. To learn modes of failures and stability analysis of gravity and earth dam
2. To describe diversion head-works and explain stability analysis of weirs on permeable foundations.
3. To explain the different spillways, Design principles of ogee spillway. details of energy dissipation below spillway.
4. To illustrate unlined irrigation canals and their design principles.

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Course Outcomes:

Upon successful completion of this course the student will be able to

1. Describe types of dams , their selection and also selection of site for dam.
2. Know causes of failures of water retaining structures.
3. Compute various stresses developed in gravity dam.
4. Demonstrate earth dams and its components.
5. Explain control of seepage and drainage in earth dams.
6. Analyze stability of slopes of earth dams.

Lab course content:-

Minimum five out of following assignments should be performed:-

1. Development of flood hydrograph from unit hydrograph and complex storm.
2. Determination of reservoir capacity from mass inflow and mass demand curve.
3. Stability analysis of a gravity dam considering all major forces.
4. Stability analysis of slope of earth dam.
5. Design of Ogee spillway with energy dissipator.

6. Analysis of weir on permeable foundation by using Khosla's charts.

7. Design of unlined canal in alluvium by using Garret's diagram /Lacey's equations (at least three sections along the alignment including calculation of design discharge from command area and kor depth and kor period) and plotting L-section; also preparing schedule of area statistics and channel dimensions.

8. Detailed report along with drawings, based on visit to any dam; including proof of the visit.

9. Benefit - cost analysis of a water resources engineering project.

Guidelines for ICA:

ICA shall be based on continuous evaluation of students performance throughout the semester and term work prepared by the students in the form of journal.

Guidelines for ESE:

ESE shall be based on term work prepared by students & Evaluation will be based on performance during oral examination

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Reference books:-

1. Modi P.N. 2012. Irrigation, Water Resources and Water Power Engineering, Eight edition. Standard Book House, Delhi.
2. Garg S.K. 1998. Irrigation Engineering And Hydraulic Structures. Khanna Publishers, Delhi.
3. Punmia B.C., Pande B.B., .Lal, 1999. Dams II: Irrigation and Water Power Engineering". Laxmi Publications Pvt. Ltd., New Delhi.
4. Varshney R.S., Gupta S.C., Gupta R.L. 1979. Theory and Design of Irrigation Structures, Volume I and II", Fourth edition. New Chand & Bros., Roorki.
5. Bharat Singh - Irrigation Engineering.
6. Sharma R.K., "A Text Book of Hydrology & Water Resources", Dhanpat Rai and Sons.
7. K.B.Khushlani - Irrigation Engineering.
8. Justin, Hinds - Irrigation Engineering and Practice.

Environmental Engineering II Lab

ICA (Term Work): 25 Marks

ESE (Practical exam): 25 Marks

Course description:

The course includes the general parameters that are used to characterize wastewater. The standard methods of examination of these parameters is included in the syllabus. The syllabus also provides an opportunity to the student to have a practical exposure through site visit.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lab hours	02	13	26	1

General objectives:

The main objective of the course is to train a student in wastewater characterization using standard methods of examination in laboratory. It also aims to give an exposure to the student about practical design, maintenance, functioning an trouble shooting of wastewater treatment plant and municipal solid waste management site through site visit.

Learning outcomes:

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1. The student will learn the methods of physical, chemical and biological characterization of wastewater.
2. The student will have an exposure to actual design, maintenance and functioning of wastewater treatment plant through site visit.
3. The student will practice design of units of sewage treatment plant and have a regressive study of the theory syllabus through assignments.

Lab experiments:

Student should do minimum 8 experiments out of the list mentioned below

1. Determination of dissolved oxygen.
2. Determination of BOD.
3. Determination of COD.
4. Determination of different types of solids
5. Determination of SVI.
6. Determination of chlorides.
7. Determination of chromium or any heavy metal.
8. Determination of water conductivity.
9. Determination of oil and grease.
10. Determination of Kjeldahl nitrogen.

Assignments:

Students must do minimum two assignments from each unit of the theory syllabus.

Guidelines for ICA:

ICA shall be based on continuous evaluation of students performance throughout the semester and term work prepared by the students in the form of journal.

Guidelines for ESE:

ESE shall be based on term work prepared by students & Evaluation will be based on performance during practical examination

Site visit:

Students should visit a wastewater treatment site and a solid waste management site.

Reference Books:

Standard methods for examination of waters and wastewaters, APHA Publication.

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Advanced Structural Design Lab

Elective-II

ICA (Term Work): 25 Marks

ESE (Practical exam): 25 Marks

Course Description:-

In this Laboratory course emphasis is given on assignments of detailing, design of rectangular combined footing, flat slabs, cantilever retaining wall, water tanks, post tension girders etc. Also students will be exposed to the advanced structural design software's.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lab hours	02	13	26	1

General objectives:

The lab work deals with

1. Design RCC structures such as retaining wall, combined footing, water tank, flat slab.
2. Design of post tension girder.
3. Understanding of IS-code provisions in design of structure.
4. Preparation of detail drawings for the designed members of structure.

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Learning outcomes:

Upon successful completion of this course the student will be able to

1. Design RCC structures such as retaining wall, combined footing, water tank, flat slab.
2. Design of post tension girder.
3. Understand IS-code provisions in design of structure.
4. Prepare detail drawings for the designed members of structure.

Lab Course Content

It shall be based on above syllabus and will consist of

i) At least three numbers of imperial size sheets based on pre-stressed & R.C. structures.

ii) Demonstration of computer software's for design of structures.

iii) Report on site visit to at least one structure based on above syllabus

Guidelines for ICA:

ICA shall be based on continuous evaluation of students performance throughout the semester and term work prepared by the students in the form of journal.

Guidelines for ESE:

In ESE the student may be asked to answer questions based on ICA. Evaluation will be based on Performance in oral examination.

Reference Books:-

1. N. Krishnaraju, “Prestressed Concrete”
2. T. Y. Lin, “Design of prestressed concrete structure”.
3. S.R. Karve & V. L. Shah, “Limit State Analysis & Design of Reinforced Concrete”, Structures PublicatinsR.C.C. Structures.
4. Punmia, Jain & Jain, “Comprehensive R.C.C. Design”, Laxmi Publications.
5. S. K. Duggal, “Earthquake Resistant Design of Structures”, Oxford University Press.
6. N. C. Sinha & S. K. Roy, “Fundamentals of Reinforced Concrete”
7. S. Unnikrishna Pillai, Devdas Menon, “ Reinforced Concrete Design”, Tata McGraw-Hill Publication.
8. S. Ramamrutham, “Design of Reinforced Concrete Design”, Dhanpat Rai Publishing Company.
9. B. C. Punmia, “Reinforced Concrete Structures”, Laxmi Publication.

Reference IS Codes:-

10. IS 456-2000 Plain and Reinforced Concrete - Code of Practice.
11. IS 1343 (1980): Code of Practice for Pre-stressed Concrete.
12. IS 13920 (1993): Ductile detailing of reinforced concrete structures subjected to seismic forces.

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Earthquake Engineering Lab

Elective-II

ICA (Term Work): 25 Marks

ESE (oral exam): 25 Marks

Course Description:-

In this Laboratory course emphasis is given assignments based on detailing and Seismic design of RC structure as per IS 1893 and 4326. Also Students will be exposed to computer aided analysis using available software

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lab hours	02	13	26	1

General objectives:

1. Recognize basic earthquake mechanisms, tectonics, ground motion, and propagation of ground motion.
2. Interpret earthquake ground motion data.
3. Seismic design of RC structure as per IS 1893:2002, IS13920 and 4326
4. Determine the base shear by equivalent static analysis method

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Learning outcome:

The student will demonstrate the ability to:

1. Design of RC structures considering effect of seismic forces
2. Computer aided analysis using available software

Lab Course Content:-

It shall consist of

1. At least one assignment from each of four units
2. Problems based on the above syllabus shall be submitted as term work
3. Exposure to computer aided analysis using available software be considered.
4. Evaluation of Lateral Loads on Multi-storeyed Building as per IS 1893 -2002
5. Ductile detailing of flexural and compression members as per IS13920

Guidelines for ICA:

ICA shall be based on continuous evaluation of students performance throughout the semester.

Guidelines for ESE:

In ESE the student may be asked to answer questions based on ICA. Evaluation will be based on performance in oral examination.

Reference Books

11. Duggal , “ Earthquake resistance design of structure”’ Oxford University Press.

2 . David J. Downik , “ Earthquake Resistant Design”, Jon Wiley and Sons Publication

3. Earthquake Tips NICEE, IIT, Kanpur

4. Jaikrishna and Chandarsekaran, “ Elements of Earthquake Engineering” .

5. Kramer S. L , “ Geotechnical Earthquake Engineering.”, Prentice Hall India Publication

6. Relevant Latest Revisions of IS codes.

7. Anil K. Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, 3'd Edition, 2007.

8. D.J. Dowrick, "Earthquake Resistant Design for Engineers", Wiley.

9. Vinod Hosur, "Earthquake Resistant Design of Building Structures", Wiley, 2013

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System Approach in Civil Engineering

Elective-II

ICA (Term Work): 25 Marks

ESE (oral exam): 25 Marks

Course Description:-

The Lab work aims to develop capability in solving various civil engineering Problems related to infrastructural projects by formulating problems. They should be able to analyze and come to appropriate solution.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lab hours	02	13	26	1

General objective:

The objective of course is to understand and analyze various activities related civil engineering projects and Select appropriate solution from various alternatives

Learning outcomes:-

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After successfully completion of the course student will able to

1.Anlyse and understand various activities related civil engineering projects

2. Analyse the problem and identify alternative solutions.

3. Select from the alternatives and develop the most viable solution

4. Evaluate the effectiveness and worth of the solution.

Lab Course Content:-

It will consist of assignments and problem solving on following

1. System concepts
2. Optimisation techniques
3. Linear programming
4. Non-linear programming
5. Constrained/unconstrained optimisation
6. Dynamic programming

Guidelines for ICA:

ICA shall be based on continuous evaluation of students performance throughout the semester and term work prepared by the students in the form of journal.

Guidelines for ESE:

In ESE the student may be asked to answer questions based on ICA. Evaluation will be based on performance in oral examination.

REFERENCE BOOKS:-

1. S.S. Rao, " Engg. Optimization Theory and Practice", John Wiley and Sons
2. Thomas K Jewell," A systems approach to civil engineering planning and design",Harper and row.
3. Samual Labi ," Introduction to civil engineering systems", Wiley
4. Hamdy A. Taha, "System approach in civil engineering", Prantice Hall.
5. Harvey M. " Principle of system approach in civil engineering"
6. Shrivastava,Shenoy and Sharma," Quantitative techniques for managerial
7. Decisions",Wiley Eastern
8. Paul J. Ossenbruggen, "An Approach to Teaching Civil Engineering System"
9. N.D. Vohra "Quantitative Techniques in Management" , Mc Graw Hill
10. Hira , Gupta ,"Operation Research ", S. Chand

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Construction Safety & Disaster Management

Elective-II

ICA (Term Work): 25 Marks

ESE (oral): 25 Marks

Course Description:

The lab work is based on assignments on safety management in the construction industry, modern and conventional techniques for construction safety and disaster management in the construction industry.

	Hours/Week	No. of Weeks	Total Hours	Semester Credits
Lab hours	02	13	26	1

General objective:

The objective of course is to understand various safety requirements in construction and analyze activities involved using safety methods with respect to cost, engineering economics etc It includes different disaster management

Learning outcomes:

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Upon successful completion of these course the student will be able to :

1. Know construction safety management system.
2. Learn the measures to be taken for safety during construction.
3. Identify various types of disasters.
4. Learn the disaster management techniques and its analysis.
5. Implement safety management and public awareness regarding disaster management

Lab Course Content:-

Two Assignment on each unit based on syllabus

Guidelines for ICA:

ICA shall be based on continuous evaluation of students performance throughout the semester and term work prepared by the students in the form of journal.

Guidelines for ESE:

In ESE the student may be asked to answer questions based on ICA. Evaluation will be based on performance in oral examination.

Recommended Books:-

1. Construction Safety Manual - Published by National Safety Commission of India.
2. Safety Management in Construction Industry – A manual for project manager (NICMAR Mumbai)
3. *Davies* V.S.Thomasin ,"K, Thomas Construction Safety Handbook" ,Telford, London.
4. Bureau of Indian Standards , " IS for safety in Construction".
5. Girimaldi and Simonds ," Safety management",AITBS, New Delhi
6. Seetharaman ," Construction Engineering and Management"
7. K Nagarajan , " Project Management", New Age International Ltd.
8. Rajdeep Dasgupta, " Disaster management & rehabilitation", mittal Publication.
9. Dr. Kadambaui Sharma,Dr. Avinash Chiranjeev, " Disaster management in India" Jnanda prakashan(P&D) New Delhi

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Industrial Lecture

COURSE CONTENT

Industrial Lecture Course Title | **IL** Short Title | Course Code

Course Description:

The gap between industry's needs and the academic community's aspirations appears to be considerably large. There exists a strong feeling, at least in the academic circles, that unless technology driven initiatives find a surer place in the industrial sector in this country, the academia-industry interaction is likely to remain confined to developmental activities with limited exploratory or research-based content As institutes committed primarily to creation and growth of technological knowledge, technical institutes have an important role to play in the industrial sector of the country's economy. This fact by way of encouraging mechanisms to foster interaction between the academia and industry. Typically, academic interest in the multidimensionality of a problem leads to a tendency to explore a variety of options to arrive at a solution. This industrial lecture develops ability of student for expectations of the industrialists from the fresh engineers.

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	1	15	14	2

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COURSE CONTENT

Semester-VIII **Examination Scheme**

Total Semester Credits: 02

Internal Continuous Assessment (ICA): 50 Marks

1. There is a need to create avenues for a close academia and industry interaction through all the phases of technology development, starting from conceptualization down to commercialization.
2. List of renowned persons from industry shall be prepared by the committee appointed by Head of the department. After approval from the Principal, Minimum five Industrial lectures in alternate week shall be arranged, which shall be delivered by the experts/Officials from Industries/Govt. organizations/ Private Sectors/Public Sectors / R&D Labs covering the various aspects.

3. Topics of Industrial Lectures shall be Technical in nature and should not be the specific contents from the curriculum.
4. Students shall submit the report based on minimum five lectures giving summary of the lecture delivered.
5. The summary should contain brief resume of the expert, brief information of his organization and brief summary of the lecture in bullet point form.

Guide lines for ICA : Assessment of the Industrial Lecture for award of ICA marks shall be done jointly by departmental committee as per attendance in industrial lecture, report submitted by student and overall performance in semester as per the guidelines given in **Table- D**

Table-D

SN	Name of Student	Attendance (05 Marks per Lecture)	Dept of Understanding (03 Marks per Lecture)	Report Writing	Total
		25	**15**	**10**	**50**

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Project-II

Project-II **P-II**
Course Title Short Title Course Code

Course Description:
The course explores the knowledge of design, experiment and analysis of data. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	**4**	**15**	**60**	**6**

COURSE CONTENT

Semester-VIII **Examination Scheme**

Total Semester Credits: 06

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Internal Continuous Assessment (ICA): 75 Marks

End Semester Examination (ISE):75 Marks

Total:150Marks

1. Project-I work decided in VII semester shall be continued as Project-II
2. Students should complete implementation of ideas given in synopsis/Abstract, so that project work should be completed before end of semester.
3. Project-II may involve fabrication, design , experimentation , data analysis within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability. The stage also includes testing , possible results and report writing
4. Each students project group is required to maintain log book for documenting various activities of Project-II and submit group project report at the end of Semester-VIII in the form of Hard bound.
    a. *Title*
    b. *Abstract*
    c. *Introduction*
    d. *Problem identification and project objectives*

e. *Literature survey*
f. *Case study/Analysis/Design Methodology*
g. *Project design and implementation details*
h. *Result and conclusion*
i. *Future scope*
j. *references.*

Guide lines for ICA : ICA shall be based on continuous evaluation of students performance throughout semester in project-II and report submitted by the students project group in the form Hard bound. Assessment of the project-II for award of ICA marks shall be done jointly by the guide and departmental committee as per the guidelines given in **Table-D.**

Guide lines for ESE:-

In ESE the student may be asked for demonstration and questions on Project. Evaluation will be based on answers given by students in oral examination.

Assessment of Project-II

Name of the Project: _____

Name of the Guide: _____

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Table-D

		Assessment by Guide (50 Marks)				Assessment by Committee (25 Marks)		
SN	**Name of Student**	**Attendance , Participa-tion and team work**	**Material procurement / assembling/ Designing/Programming**	**Case study/ Execution**	**Project Report**	**Dept of Understan-ding**	**Presentation**	**Total**
Marks		**10**	**15**	**15**	**10**	**10**	**15**	**75**