NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Fourth Year Engineering

(Civil Engineering)

Faculty of Engineering and Technology

Teachers and Examiner Manual

Term-VII

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

Water Resources Engineering – I

Teacher, Paper setter and Examiner should follow the following guidelines.

Unit - I
Teacher should facilitate learning of Hydrologic cycle and its various components.

1.		Topic	Lectures required	Reference No.
	a	Hydrology and Water resources development, Hydrologic cycle, applications of hydrology and hydrologic cycle.	01	1,2,3,4,6,7
	b	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.	04	1,2,3,4,6,7
	c	Disposal of Precipitation: Elementary concepts of evaporation, evapo-transpiration and infiltration, factors affecting and methods for determination of these three processes, infiltration indices.	03	1,2,3,4,6,7

Unit - II

Teacher should facilitate learning stream gauging, runoff and hydrographs.

2.		Topic	Lectures required	Reference No.
	a	Introduction to stream gauging and introduction to methods of discharge and stage measurement in streams.	01	1,2,3,4,6,7
	b	Runoff: Runoff process, yield, factors affecting Runoff, estimation of runoff volume.	01	1,2,3,4,6,7
	c	Floods: Estimation of peak flow, rational method and introduction to other methods, introduction to design floods for various hydraulic structures.	01	1,2,3,4,6,7
	d	Hydrographs: Definition, components, factors affecting the shape, base flow separation. Flood hydrograph, Unit hydrograph – definition, assumptions, applications, derivations and limitations, S-hydrograph.	05	1,2,3,4,6,7

Unit – III

Teacher should facilitate learning of (1) Ground water hydrology – steady flow in aquifers and (2) water logging and design of closed pipe drains.

3.			Lectures required	Reference No.
	a	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.	05	1,2,3,4,6,7
	b	Water logging and drainage: Causes, preventive and curative measures of water logging, design and spacing of the tile – drains.	03	2,3,4,5,7

Unit – IV

Teacher should facilitate learning of (1) Reservoir planning and estimation its capacity (2) economics of reservoir planning (3) Process of reservoir sedimentation and estimation of life of reservoir.

4.		Topic	Lectures required	Reference No.
	a	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.	04	2,3,4,5,7
	b	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.	03	2,3,4,5,7

Unit – V

Teacher should facilitate learning of methods of irrigation, water requirements of crops etc.

5.		Topic	Lectures required	Reference No.

	a	Introduction to irrigation: Necessity, benefits, Ill effect, irrigation systems and methods and their classifications.	01	2,3,4,5,7
	b	Soil-water-plant relationships: Classification of soil water, saturation capacity, Field capacity, determination of field capacity, quality of irrigation water.	02	2,3,4,5,7
	c	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.	05	2,3,4,5,7

Reference 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, 1999. Dams II: Irrigation and Water Power Engineering". Laxmi Publications Pvt. Ltd., New Delhi.
5. 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.
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

Teacher, Paper setter and Examiner should follow the guidelines as given below.

Teacher should facilitate learning of Estimations of quantities of work, calculating approximate cost of structures, 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, 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.

UNIT – I

Sr No.	Topic	Lecture required	Reference No
1	**Approximate Estimate:** Definition and Necessity, General Principles, Methods of Preparing Approximate Estimates for Buildings, Roads, Bridges, Water Supply Scheme, Drainage Scheme, and Retaining Wall.	2	1,2
	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.	3	1,2
	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, Rate List, Day Work, Daily Labour. Introduction to registration as contractor in the PWD.	3	1,2,3

UNIT – II

Sr No.	Topic	Lecture required	Reference No
2	**Detailed Estimate:** PWD Method and centre Line Method of Taking out Quantities, Using IS 1200 Rules, Estimate of Load Bearing Residential Building (1 BHK Only).	7	2,3

UNIT – III

Sr No.	Topic	Lecture required	Reference No
3	**Detailed estimate:** Reinforcement Quantities of RCC Elements like Slab, Beam, Column, Isolated Column Footing, Stair Case and Preparation of Bar Bending Schedule.	8	1,2,3,4

UNIT – IV

Sr No.	Topic	Lecture required	Reference No
4	**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)	4	2,3
	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.	4	1,3,4

UNIT – V

Sr No.	Topic	Lecture required	Reference No
5	**Valuation:** Definition and Purpose, Price, Cost and Value, Various Types of Value, Factors Affecting Value of Property, Concept of Free Hold, Lease Hold Property, Years Purchase And Outgoings, Legal Aspects of Valuation.	4	2,4,5

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)	4	2,3,4,5

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.

Finite Element Methods
Interdesciplinery Elective

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit – I
Teacher should facilitate learning of basics concept of finite elements, formulation of problems, errors, etc.

1.		Topic	Lectures required	References
	a	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.	04	1 to 5
	b	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.	04	1 to 5

Unit – II
Teacher should facilitate learning of Discretization, concept of band width, Principal of minimum potential energy,etc.

2.		Topic	Lectures required	References
	a	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.	04	1 to 5
	b	Principal of minimum potential energy, Rayleigh-Ritz method, the method of weight residuals, Saints-Venant principal, Application of above methods to a field problem.	04	1 to 5

Unit – III
Teacher should facilitate learning ofOne Dimensional problem.

3.		Topic	Lectures required	References
	a	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.	04	1 to 5
	b	Analysis of one dimensional structure (beam, column etc.) by F.E.M. with different loading and boundary conditions.	04	1 to 5

Unit – IV

Teacher should facilitate learning of 2D problem.

4.		Topic	Lectures required	References
	a	Finite element method for two dimensional problems, second order equation involving scalar valued function, two dimensional finite elements and interpolation function.	04	1 to 5
	b	Direct method for determination of stiffness matrix for plane truss, continuous beams and plane frame elements, solution for displacement unknowns and analysis.	03	1 to 5

Unit – V

Teacher should facilitate learning of Triangular and Rectangular elements for plane stress/strain conditions, Introduction of Isoparametric1D and 2D elements,etc.

5.		Topic	Lectures required	References
	a	Triangular and Rectangular elements for plane stress/strain conditions, effect of element aspect ratio, finite representation of infinite mass.	04	1 to 5
	b	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.	04	1 to 5

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

Geographical Information System

Interdisciplinary elective

Teacher, Paper setter and Examiner should follow the guidelines as given below:-

Teacher should facilitate learning of various concepts and principles of GIS and apply 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.

Topic	Lecture required	Reference
UNIT-I		
INTRODUCTION TO GIS:		
A. **Introduction :-** Definition, concepts, Information System, components of GIS, History, elements of GIS, objectives of GIS	**2**	1,2,3,5,7
B. **Elements of GIS :-** Hardware and software requirements of GIS, Geospatial data architecture, Operations, Geographic co-ordinate system, Map Projections	**3**	1,2,3,5,7
C. **Data management:-** Input data for GIS, display, types of output products, GIS categories, Level and scale of Measurement, importance of data quality.	**2**	1,2,3,5
UNIT-II		
VECTOR DATA & PROCESSING:-		
A. **Vector data:-** GIS data types, data Representation, Data Sources, typical GIS data sets, Data Acquisition, vector data model, relationship between classes	**4**	1,4,6
B. **Data processing:-** Data structure, data verification and editing spatial data models and errors- GIS databases, Attributes data input and management	**4**	1,4,6
UNIT-III		
RASTER DATA AND PROCESSING		
A. **Raster data** – elements of data model, cell, value, data structure, cell by cell encoding, run length encoding, Quad tree, Header files, format, Types of raster data	**4**	1,4,6
B. **Data processing:-**, data compression, Linking and integration of vector data	**4**	1,4,6
UNIT-IV		
DATA CONVERSION AND EDITING:-		
A. **Methods of conversion:-** Data format conversion, Medium conversion, Spatial interpolation, measurement and analysis methods, Data accuracy and standards	**3**	1,3,4,6
B. **Data manipulation and management:-** Attribute data input and Management- Relational mode- Data manipulation-classification techniques	**3**	1,3,4,6
C. **Digital Elevation Model**: Need of DEM, Various structures of DEM: line, TIN, grid	**2**	3,4,6
UNIT-V		
META DATA AND GIS MODELING		

A.	**Meta data** – Data standard- OGC – open source GIS	**1**	2,4,5
B.	**Model processing ;-** GIS modeling, basic elements, classification, model processing, integration	**3**	2,4,5
C.	**Types of model:-** Binary models, index model, regression models, linear regression model, logistic regression model, process model	**4**	2,4,5

REFERENCE:-

1. Concept and Techniques of Geographic information System, C P LO Albert K. W. Yeung, 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. Geographic Information Systems and Science, Second Edition 2005: Longley, Paul A., Michael F. Goodchild, David J. Maguire, David W. Rhind, John Wiley & Sons, New York.

7. Advanced Surveying (Total Station, GIS and Remote Sensing) First Edition 2007:

Satheesh Gopi, R. Sathikumar, N. Madhu

Numerical Methods in Civil Engineering
Elective I

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit – I

Teacher should facilitate learning of Computer and Numerical Software and Solution of Linear algebraic Equationetc.

1.	**Introduction &Linear algebraic Equation**		Lectures required	References
	a	**Computer and Numerical Software:** Introduction, Mathematical Modeling and Engineering Problem Solving, Algorithm Design, Flowchart, Errors in Numerical Computation.	04	1 to 8
	b	**Solution of Linear algebraic Equation:** Gauss Elimination method, Gauss Seidel method, Gauss Jordan method, partial pivoting method, and its condition for convergence.	04	1 to 8

Unit – II

Teacher should facilitate learning of Solution of Non Linear Algebraic and Transcendental Equations and Linear programming.

2.	**Transcendental Equations & Linear Programming Problem**		Lectures required	References
	a	**Solution of Non Linear Algebraic and Transcendental Equations:** Bisection, False position, Newton Rapson Method, Generalized Newton Raphson Method.	04	1 to 8
	b	**Linear Programming Problem**: Introduction, Requirements, Assumptions, Applications, Limitations, General Mathematical Model, Formulations, Introduction to Artificial Variables, Simplex Algorithm for Maximization & Minimization Cases.	04	1 to 8

Unit – III

Teacher should facilitate learning of basics Curve Fittings and Interpolation.

3.	**Curve Fittings and Interpolation**		Lectures required	References
	a	**Curve Fittings**: Linear Regression, Polynomial Regression, Multiple Linear Regression, General Linear Least Squares,and Engineering Applications of curve fitting.	03	1 to 8
	b	**Interpolation:** Newton's divided difference interpolating polynomials, Non-linear regression, Lagrange Interpolating polynomials, Coefficient of interpolating polynomials.	04	1 to 8

Unit – IV

Teacher should facilitate learning of basics Numerical Differentiation and Numerical Integration.

4.		**Numerical Differentiation and Numerical Integration**	Lectures required	References
	a	**Numerical Differentiation:** High accuracy differentiation formula, First order differentiation Equations, Second order differentiation Equations, Derivatives of Equally Spaced Data.	04	1 to 8
	b	**Numerical Integration:** Trapezoidal rule, Simpson's one third and 3/8thrule, Gaussian Quadrature 2 point Formula.	04	1 to 8

Unit – V

Teacher should facilitate learning of Numerical methods for Solution of ODE & PDE.

5.		**Numerical methods for Solution of ODE & PDE**	Lectures required	References
	a	**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.	04	1 to 8
	b	**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.	04	1 to 8

REFERENCE 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 NumericalMethods for Engineers", THOMSON, Brooks/Cole, Newyork, 2000
3) S. Rajasekaran, "Numerical Methods inScience& 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) KantiSwaroop&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

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit – I
Teacher should facilitate learning of basic concept of Green buildings.

1.	**Concepts of Green Buildings**		Lectures required	References
	a	Sustainable Development concept, Buildings and climate	02	1,2,3,5
	b	Important considerations for the design of a sustainable buildings	02	
	c	Green Building Assessment	02	
	d	Current version of the LEED rating system	02	

Unit – II
Teacher should facilitate learning of relation between Energy and building.

2.	**Energy and Buildings**		Lectures required	References
	a	The design of a sustainable building: lighting – day-lighting; ventilation - natural ventilation; indoor air quality;	03	2,3,5,14
	b	Passive and active systems for energy production and conservation,	02	
	c	Elements of successful design of a building envelope	02	

Unit – III
Teacher should facilitate learning of Sustainable Building Materials.

3.	**Sustainable Building Materials**		Lectures required	References
	a	Environmental issues related to building materials,	02	1,8 to 13
	b	Local Building Materials from **a) Agricultural waste:** Rice husk, Coconut wastage, Banana leaves.	02	
	c	**b) Industrial waste:** Red mud, Blast furnaces slag, fly Ash	02	
	d	Physical characteristics and effects on properties of concretes	02	

Unit – IV
Teacher should facilitate learning of Cost Effective Techniques for Sustainable Building.

4.	**Cost Effective Techniques for Sustainable Building**		Lectures required	References
	a	Stabilized Mud blocks, Stone masonry blocks, Solid and Hollow concrete blocks, Selection of building blocks.	02	1,2,3,4,6,7

	b	Ferro-Concrete, Properties and Uses, Practical aspects	02	
	c	Alternative sustainable Roofing Systems : Concepts in roofing alternatives, Filler slab roofs, Composite Slab panel roofs, hollow block roofs, Masonry Domes	04	

Unit – V

Teacher should facilitate learning of Cost Effective Techniques for Sustainable

Building.

5.		**Environmental Techniques**	Lectures required	References
	a	**Waste water** Management ,Rain water harvesting and conservation, Recycling, waste water treatment processes, external drainage system in building	03	1,8 to 13
	b	Lightening in building, Fire protection of building, Thermal environment inside the building , systems of air conditioning	03	
	c	Noise pollution-sources and control measures Noise pollution-sources and control measures	02	

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

Teacher, Paper setter and examiner should follow the guidelines as given below.

Teacher should facilitate learning of various concepts Watershed. Significance of watershed based development and issues in water resources – Point source pollution, agricultural and urban non-point source pollution, erosion, water scarcity.

Unit – I

Sr No.	Topic	Lecture required	Reference No
1.	Concept of Watershed. Significance of watershed based development. Watershed characteristics.	4	1,5,6
	Geomorphology and hydrology. Drainage basin, network and channel morphology.	4	5,6

Unit – II

Sr No.	Topic	Lecture required	Reference No
2	Watershed Hydrology – Hydrologic cycle, water balance, climate and precipitation, soil and infiltration.	4	2,3,4
	Interception and evapotranspiration, groundwater, streamflow and runoff, water quality, aquatic ecosystems [eutrophication, habitat disturbance].	4	4,5,6

Unit – III

Sr No.	Topic	Lecture required	Reference No
3	Watershed Resource appraisal-physical, hydrological and land use/cover.	4	1,3,5
	Land Capability Classification, Watershed Management and	4	1,3,4,5

	planning and objectives.		

Unit – IV

Sr No.	Topic	Lecture required	Reference No
4	Issues in water resources – point source pollution, agricultural and urban non-point source pollution, erosion, water scarcity.	4	1,2,5,6
	Flooding, and drinking water protection, soil and water conservation measures, watershed Program, Benefit Cost Analysis.	4	3,2,5,6

UNIT-V

Sr No.	Topic	Lecture required	Reference No
5	Urban Watershed Management – wet weather flow, green roof, rain water harvesting from urban structures, urban watershed management.	4	1,3,4,5
	Goals & strategies, sustainability & UWSM, urban storm water pollution and sediment management.	3	1,2,5,6

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

Teacher, Paper setter and Examiner should follow the following guidelines.

Unit - I

Teacher should facilitate learning of (1) basic concepts of open channel flow and (2) uniform and critical flow and calculation of normal and critical depths in trapezoidal and circular channels.

1.		Topic	Lectures required	Reference No.
	a	Revision of concepts of open channel flow, velocity and pressure distributions, equations of continuity, energy and momentum.	02	1,3,4,5,7
	b	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).	06	1,3,4,5,7

Unit - II

Teacher should facilitate learning of (1) Transitions, (2) Gradually varied flow.

2.		Topic	Lectures required	Reference No.
	a	Transitions: – Rectangular channel with a hump and with a change in width.	04	1,3,4,5,7
	b	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.	04	1,3,4,5,7
	c	Computation of GVF profiles by Direct step method, only mention of other methods.	01	1,3,4,5,7

Unit – III

Teacher should facilitate learning of (1) Hydraulic jump and (2) Surges in horizontal, frictionless, rectangular channels.

3.		Topic	Lectures required	Reference No.
	a	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.	04	1,3,4,5,7
	b	Unsteady flow in open channel: - Surges and waves in open rectangular channels – simple cases of positive surges neglecting friction.	03	1,2,3,4,5,7

Unit – IV

Teacher should facilitate learning of (1) Arch dams, (2) Spillways: their sutabilities and design of Ogee spillway, (3) Energy dissipation below spillway and (4) Spillway gates.

4.		Topic	Lectures required	Reference No.
	a	Pipe flow: - Three reservoir problem, pipe network.	03	2,3,4,5
	b	Practical design methods of rising mains and gravity mains using nomograms/ charts, economical diameter of rising main.	04	2,3,4,5

Unit – V

Teacher should facilitate learning of water hammer phenomenon and surge tank.

5.		Topic	Lectures required	Reference No.
	a	Unsteady flow in conduits: - Mention of types of unsteady flows, establishment of flow.	02	2,3,4,5
	b	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	03	2,3,4,5,6

		equation for water hammer pressure).		
	c	Surge tanks: - Necessity, locations, functions, types, analysis of simple cylindrical surge tank considering frictional effects.	03	2,3,4,5,6

Reference 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.

Geotechnical Engineering-II

Teacher, Paper setter and Examiner should follow the guidelines as given below.

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, pile foundations, etc. They are required to determine the relevant parameters necessary for prediction of bearing capacity, foundation design, design of pile foundations etc.

.Unit – I

Sr No.	Topic	Lecture required	Reference No
1	**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.	4	1,2
	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.	6	1,2

Unit – II

Sr No.	Topic	Lecture required	Reference No
2	**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.	7	1,2,6

Unit – III

Sr No.	Topic	Lecture required	Reference No
3	**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)	7	1,2,3,5

Unit – IV

Sr No.	Topic	Lecture required	Reference No
4	**Pile Foundation:** Introduction to Pile Foundations, 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	4	1,3,6
	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.	4	1,3,6

Unit – V

Sr No.	Topic	Lecture required	Reference No
5	**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,	4	1,3,7,9

	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.)	3	2,6,9

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.
 Gopal Ranjan, Rao, " Basic and Applied Soil Mechanics", New age publication.

Estimating and Costing Lab

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.

Sr No	Name of Assinment/Project	Lab hours required
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.	4
2	Approximate Estimate of i) Residential Building ii) Public Building iii) Elevated Service Reservoir iv) Road And Bridges	4
3	Prepare Check List of Items, Detailed Estimate of A Single Storey (Up To 2 BHK) Load Bearing Structure by Using Current DSR.	4
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.	4
5	Detailed Estimate of Any Two of Following i) Compound Wall ii) Septic Tank iii) Earth Work in Road / Cannel.	4
6	Rate Analysis of Any Three Items.	4

Compulsory activities

1. Site Visit (Attached Estimate and Photographs) / Study Standard Estimate of PWD or Any Civil Organization.
2. 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 students' performance throughout the semester and term work submitted by the students.

Guide lines for ESE:

ESE will be based on assignments submitted by the student. In ESE the student may be asked to answer questions based on the term work. Evaluation will be based on performance in **oral** examination.

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

Geotechnical Engineering-II Lab

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, pile foundations, etc. They are required to determine the relevant parameters necessary for prediction of bearing capacity, foundation design, design of pile foundations etc.

.Sr No	Name of Assinment/Project	Lab hours required
1	Preparation of Soil investigation report based on given data.	4
2	Problems on Plate Load Test, Standard Penetration Test and corrections.	4
3	Problems on bearing capacity calculations for different conditions.	4
4	Problems on Settlement analysis.	4
5	Problems on Design of pile foundations.	4
6	Design considerations of caissons and well foundation.	4
7	Design of under reamed pile.	4
8	Demonstration of any one of following tests; 1. Plate load test. 2. Standard penetration test. 3. Swelling pressure test.	2

Guidelines for ICA:

ICA shall be based on continuous evaluation of students' performance throughout the semester and term work drawing sheets submitted by the students.

Guide lines for ESE:

ESE will be based on assignments submitted by the student. In ESE the student may be asked to answer questions based on term work. Evaluation will be based on performance in **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.

Numerical Methods in Civil Engineering Lab

(Elective I)

Teacher should facilitate learning of following lab course assignments

Sr. No.	Particulars	No. of lab hours required
GROUP A Computer Programs Based on Following Numerical Methods – (Minimum five)		
1	Gaussian Elimination Method / Gauss Jordon Method	02
2	Method of Bisection / Method of false position	02
3	Newton Raphson Method / Method of Simple Iteration	02
4	Method of Least Square / Newton Interpolation / Lagrange Interpolation	02
5	Euler's Method / Modified Euler's Method / RungeKutte Method	02
GROUP B Numerical Assignment Based on Following Numerical Methods – (Minimum three)		
1	LPP – Simplex Method	02
2	Curve Fitting	02
3	Boundary Value Problem	02
4	Simpson's One third/ Simpson's 3/8 rule	02
5	Lagrange Formula / Gaussian quardature	02

Reference 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 NumericalMethods for Engineers", THOMSON, Brooks/Cole, Newyork, 2000
3. S. Rajasekaran, "Numerical Methods inScience& 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. KantiSwaroop&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 Lab

Elective I

Teacher should facilitate learning of course concepts through Assignments on each unit.
Minimum six practical / Assignments from the list given below shall be performed

Sr No	Name of Assinment/Project	Lab hours required
1	Important considerations for the design of a sustainable buildings. Green Building Assessment, Current version of the LEED rating system.	4
2	The design of a sustainable building, Lighting Ventilation - natural ventilation; Indoor air quality; Passive and Active systems for energy production	4
3	Sustainable Building Materials from Agricultural waste: Rice husk, Coconut wastage, Banana leaves	4
4	Sustainable Building Materials from Industrial waste: Red mud, Blast furnaces slag, Fly Ash.	4
5	Cost Effective Techniques for Sustainable Building: Stabilized Mud blocks, Stone masonry blocks, Solid and Hollow concrete blocks,	4
6	Cost Effective Techniques for Sustainable Building Ferro-Concrete, Properties and Uses, Practical aspects.	4
7	Alternative Roofing Systems: Concepts in Roofing alternatives, Filler slab roofs, Composite Slab panel roofs, hollow block roofs, Masonry Domes.	4
8	Waste water Management, Recycling, waste water treatment processes	4
9	Rain water harvesting and conservation	4
10	Lightening in building, Fire protection of building, Thermal environment inside the building, systems of air conditioning	4
11	Noise pollution: Sources and control measures Noise pollution-sources and control measures.	4

Guidelines for ICA:

ICA shall be based on continuous evaluation of students' performance throughout the semester and term work drawing sheets submitted by the students.

Guide lines for ESE:

ESE will be based on assignments submitted by the student. In ESE the student may be asked to answer questions based on term work. 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 Lab

Elective-I

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

Minimum six practical / Assignments from the list given below shall be performed

Sr No	Name of Assignment/Project	Lab hours required.
1	Mapping and demarcation of watershed.	04
2	Areal Precipitation – Thiessen Polygon, Isohyetal method. Analysis and interpretation of rainfall data.	04
3	Water balance estimation.	04
4	Estimation of Runoff and stream flow. flow duration curve, return period. Analysis and interpretation of stream flow data.	04
5	Groundwater contouring and interpretation regarding movement and flow direction.	04
6	Land capability classification.	04
7	Soil loss estimation.	04
8	Visit to a Watershed and submission of report.	04

Guidelines for ICA:

ICA shall be based on continuous evaluation of students' performance throughout the semester and term work drawing sheets submitted by the students.

Guide lines for ESE:

ESE will be based on assignments submitted by the student. In ESE the student may be asked to answer questions based on term work. 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" .

Open Channel and Conduit Flow Lab

Elective I

Teachers and Examiners should follow the following guidelines.

1. Teacher should facilitate following lab experiments/assignments:

Sr No.	Name of experiment	Lab hours required
1	Calculation of normal and critical depths in trapezoidal / circular channel using graphs/ tables.	02
2	Example on transition in horizontal, rectangular channel.	04
3	Computation of G.V.F. profile in trapezoidal channel by Direct step method.	02
4	Calculation of hydraulic jump in horizontal, rectangular channel.	04
5	Calculation of surges in horizontal, rectangular channel.	02
6	Design of gravity/rising main (Dead end system in case of gravity mains).	04
7	Calculation of water hammer pressures.	04
8	Design of simple cylindrical surge tank.	02

Note: The Term Work will consist of a laboratory journal consisting of minimum six assignment.

Guidelines for ICA :

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

Guide lines for ESE:-

ESE will be based on journal submitted by the student. In ESE the student may asked to answer questions based on assignments. Evaluation will be based on performance in **oral** examination.

Reference 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.

NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Fourth Year Engineering

(Civil Engineering)

Faculty of Engineering and Technology

Teachers and Examiner Manual

Term-VIII

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

Water Resources Engineering – II

Teacher, Paper setter and Examiner should follow the following guidelines.

Unit - I

Teacher should facilitate learning of classification of dam and diversion head works.

1.		TOPIC	Lectures required	Reference No.
	a	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.	02	1,2,3,4
	b	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	03	1,2,3,4
	c	Hydraulic design of weir with respect to subsurface flow, safety against piping and uplift, Bligh's, Lane' s and Khosla's theories.	03	1,2,3,4

Unit - II

Teacher should facilitate learning of gravity dam including forces acting, stresses developed and stability and also elementary profile of gravity dam.

2.		TOPIC	Lectures required	Reference No.
	a	Gravity dams: - Introduction, cross section, forces acting on dam, load combinations as specified by IS 6512-1984.	03	1,2,3,4
	b	Stresses in dam (normal, principal and shear stresses), modes of failures, stability analysis and design of gravity dam	03	1,2,3,4
	c	Elementary and practical profile, low and high dam, materials of construction, control of cracking, galleries, Joints and keys.	03	1,2,3,4

Unit – III

Teacher should facilitate learning of (1) earth dam – its parts and their functions, (2) Phreatic line – its characteristics, construction and uses, (3) Modes of failure and stability analysis of earth dam.

3.		TOPIC	Lectures required	Reference No.
	a	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	03	1,2,3,4
	b	Phreatic line – its uses and characteristics, equation, procedure of construction phreatic line for various cases	02	1,2,3,4
	c	Stability of upstream and downstream slopes of earth dam under various situations, introduction to rock-fill dam.	02	1,2,3,4

Unit – IV

Teacher should facilitate learning of (1) Arch dams, (2) Spillways: their sutabilities and design of Ogee spillway, (3) Energy dissipation below spillway and (4) Spillway gates.

4.		TOPIC	Lectures required	Reference No.
	a	Introduction to arch dams, types and their sutabilities, optimum central angle for constant angle arch dam.	01	1,2,3,4
	b	Spillways: - Introduction, spillway capacity, different types of spillways and their suitabilities, design principles of Ogee spillway, working of siphon spillway.	04	1,2,3,4,5
	c	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.	02	1,2,3,4,5
	d	Gates: - Uses, types of spillway crest gates.	01	1,2,3,4,5

Unit – V

Teacher should facilitate learning of design of unlined alluvial irrigation canals Kennedy's and Lacey's by silt theories.

5.		TOPIC	Lectures required	Reference No.
	a	Canal irrigation: - Types of irrigation canals, canal alignment.	02	1,2,3,4
	b	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.	03	1,2,3,4
	c	Design procedure for L – section of an irrigation canal, balancing depth, losses in canals, schedule of area statistics and channel dimensions.	02	1,2,3,4

Reference Books:-

14. Modi P.N. 2012. Irrigation, Water Resources and Water Power Engineering, Eight edition. Standard Book House, Delhi.
15. Garg S.K. 1998. Irrigation Engineering And Hydraulic Structures. Khanna Publishers, Delhi.
16. Punmia B.C., Pande B.B., .Lal, 1999. Dams II: Irrigation and Water Power Engineering". Laxmi Publications Pvt. Ltd., New Delhi.
17. 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.
18. Bharat Singh - Irrigation Engineering.
19. Sharma R.K., "A Text Book of Hydrology & Water Resources", Dhanpat Rai and Sons.
20. K.B.Khushlani - Irrigation Engineering.
21. Justin, Hinds - Irrigation Engineering and Practice

Environmental Engineering II

Teacher, Paper setter and Examiner should follow the guidelines as given below.

Teacher should facilitate learning of environmental hygiene and sanitation with specific reference to domestic wastewater and municipal solid waste. The course also describes parameters of water pollution, wastewater sampling methods, methods of examination of wastewater in laboratory. The course includes the domestic wastewater management strategies including its removal from houses, transportation and treatment by physico-chemical and biological methods.

UNIT – I

Teacher should facilitate learning of Sampling, characteristics & disposal of sewage:

Sr No.	Topic	Lectures required	Reference No
1	a) *Sampling of sewage-*Grab sampling, composite sampling, domestic and industrial sewage sampling plans, sample preservation. b) **Microbial decomposition of organic matter**, role of enzymes, acclimatization, classification of microorganisms, aerobic and anaerobic cycles.	3	1,2,3,5
	c) *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. d) *Reactor flow regime-*Batch reactor, continuous flow reactor, plug flow reactor, completely mixed flow reactor, kinetics of microbial degradation in batch reactor. e) *Disposal of sewage-* Pollution effects due to disposal of sewage on land, river, lake and sea. Oxygen sag curve, river re-aeration.	5	1,2,3,5

UNIT – II

Teacher should facilitate learning of Collection, pumping & Conveyance of sewage:

Sr No.	Topic	Lectures required	Reference No

	a) *Collection of sewage*-House plumbing- elements, design. b) *Sewage pumping*- difficulties in pumping, types of pumps used, their maintenance.	3	1,2,3,5
2	c) *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.	4	1,2,3,5

UNIT – III

Teacher should facilitate learning of conventional sewage treatment processes:

Sr No.	Topic	Lectures required	Reference No
3	a) *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.	4	1,2,3,5
	b) **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.	4	1,2,3,5

UNIT – IV

Teacher should facilitate learning of oxidation pond & Nitrogen removal:

Sr No.	Topic	Lectures required	Reference No
4	a) *Oxidation pond-* theory and design using BOD loading parameter, elevation and temperature correction, constructional features, no detailed design. b) *Sewage disposal in unsewered areas*- septic tanks- theory and design. Low cost toilets for rural areas-theory and design.	4	1,2,3,5
	c) **Nitrogen removal**- theory and technology. Non-biodegradable organics- sources, bad effects, present status, removal methods-	4	1,2,3,5

	introduction only, photo-catalysis-theory, reactor configurations, process variables, present day applications. **d) Sludge generation rates**, sludge handling sludge disposal methods-introduction, sludge drying beds. **e) Anaerobic digestion**-theory and design of digester		

UNIT – V

Teacher should facilitate learning of solid waste management & Air pollution:

Sr No.	Topic	Lectures required	Reference No
5	**a) 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.	5	1,5,6
	b) 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.	3	4,5,6

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

Teacher, Paper setter and Examiner should follow the guidelines as given below.

Teacher should facilitate learning concepts in design of reinforced concrete structure, design of pre-stressed concrete members, ductile detailing of reinforced concrete structure through the use of **IS 456:2000, IS 1343:1980 and IS 13920:1993.** The primary course objective is to equip the with the tool necessary for designing RCC structures and its components also to familiarize them with the relevant national design codes.

Unit–I

Teacher should facilitate learning of use of Indian Standard (**IS 456:2000**, **IS 1343:1980 and IS 13920:1993**) design and detailing code, Analysis and design of reinforced concrete structures such as rectangular combined footing, interior panel of flat slab etc.

Sr. No.	Topic	Lectures required	Reference No.
1.	**A. Ductile detailing of RC members as per IS 13920:1993.** This standard covers the requirements for designing and detailing of monolithic reinforced concrete buildings so as to give them adequate toughness and ductility to resist severe earthquake shocks without collapse.	2	5, 12
	B. Design of rectangular combined footing. It is used when the two column are so close to each other that their individual footings would overlap. A combined footing is also provided when the property line is so close to one column that a spread footing would be eccentrically loaded when kept entirely within the property line. By combining it with that of an interior column, the load is evenly distributed. A combine footing may be rectangular or trapezoidal in plan	4	3, 4
	C. Design of interior panel of flat slabs. The term flat slab means a reinforced concrete slab with or without drops, supported generally without beams, by columns with or without	3	3,4,9

	flared column heads.		

Unit–II

Teacher should facilitate design of cantilever retaining wall, design of circular water tanks.

Sr. No.	Topic	Lectures required	Reference No.
2.	**A. Design of cantilever retaining wall** It covers structural design of cantilever retaining wall supporting backfill.	**5**	**3, 4,7**
	B. Design of circular water tank It covers design of water tank by two different methods i. Flexible joint between walls and the base ii. IS code method.	**5**	**8, 9**

Unit–III

Teacher should facilitate basic concept pre-stressing.

Sr. No.	Topic	Lectures required	Reference No.
3.	**A. Introduction to pre-stress** It covers basic concept, materials, pre-stressing systems, stages of loading, and stresses in tendons.	**5**	**1,2**
	B. Losses in pre-stressing 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.	**5**	**1,2**

Unit–IV

Teacher should facilitate design of pre-stressed concrete member's.

Sr. No.	Topic	Lectures required	Reference No.
4.	**A. Theory regarding pre-stress.** Transfer of pre-stress in pre-tensioned members,	**2**	**1,2**

	transmission length, end zone reinforcements. Anchorage Zone stresses in post –tensioned members – Guyan's method.		
	B. Design philosophy of pre-stress Limit state design of pre-stressed concrete member's philosophy of design, various c.riteria for limit. States, design loads, strength and serviceability.	**3**	**1,2**
	C. Design of post tensioned flexural member. It includes design of rectangular and flanged sections, cable profile, Design of shear reinforcement, bond partial pre-stressing limit state method.	**5**	**1,2**

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.

Earthquake Engineering

ElectiveII

Teacher, Paper setter and Examiner should follow the guidelines as given below.

Teacher should facilitate learning of the effect of earthquake ground motions on civil engineering structures. It includes the analysis and the design of structures that are located in active seismic zones.

Unit – I

Sr No.	Topic	Lecture required	Reference No
1	Influence of Geology on earthquake, causes of earthquake and their characteristics	02	1,5
	Earthquake parameters, magnitudes, intensity, scales, seismic zoning of India, seismic coefficients for different zones.	03	1,5
	Natural disasters, mitigation and social aspects.	02	1,5

Unit – II

Sr No	Topic	Lecture required	Reference No
2	Vibrations - definition, causes, classifications. Single Degree of Freedom systems (SDOF) - free, forced, damped, un-damped vibrations.	04	1, 7

Sr No.	Topic	Lecture required	Reference No
	Introduction to Multi-degrees of Freedom systems (MDOF) - derivations of related equations and solutions to two degree and three degree of freedom systems	04	1, 7

Unit – III

Sr No.	Topic	Lecture required	Reference No
3	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.	04	1, 2, 3
	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.	04	1, 2, 3

Unit – IV

Sr No.	Topic	Lecture required	Reference No
4	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.	08	1,2,4,6

Unit – V

Sr	Topic	Lecture	Reference

No.		required	No
5	Introduction of different control systems, Passive control: base isolation and active control: bracing system	08	1, 7, 9

Reference Books

1. Earthquake resistance design of structure by Duggal Oxford University Press.

2 .Earthquake Resistant Design by David J. Downik, John Wiley and Sons Publication

3. Earthquake Tips NICEE, IIT, Kanpur

4. Elements of Earthquake Engineering by Jaikrishna and Chandarsekaran.

5. Geotechnical Earthquake Engineering by Kramer S. L. 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

System Approach in Civil Engineering

Elective-II

Teacher, Paper setter and Examiner should follow the guidelines as given below.

Teacher should facilitate learning of capability in solving various civil engineering activities related to infrastructural projects by formulating p[problems and modules related to LPP, distribution, queuing. They should be able to analyze and come to appropriate decision

.**UNIT – I**

Sr No.	Topic	Lecture required	Reference No
1	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.	4	2,3
	Linear programming: Formulation of Linear optimization models for Civil engineeringapplications. The simplex method, special cases in simplex method, Method of Big M,duality, sensitivity analysis.	5	1,2,3,6,10

UNIT – II

Sr No.	Topic	Lecture required	Reference No
2	Distribution models: transportation problems and their solutions	4	2,3,4,10
	Assignment problems and their Solutions.	4	4,5,6,10

UNIT – III

Sr No.	Topic	Lecture required	Reference No
4	**Dynamic programming:** principle of optimality, recursive equation. Stochastic method Queing theory simulation,	5	2,5,6
	sequencing, capitalization, annuity benefit cost.	3	2,5,6,10

UNIT – IV

Sr No.	Topic	Lecture required	Reference No
3	**Non linear programming:** Single variable unconstrained optimization – Local and global optima, unimodal function, Sequential search techniques.	2	2,3,6,7,8
	Multivariable problems (unconstrained) Gradient techniques, steepest techniques, Newton's method.	3	1,2,3,6
	Multivariable optimization with equality constraints- Lagrange's multiplier techniques.	3	1,2,3,6

UNIT – V

Sr No.	Topic	Lecture required	Reference No
5	Games theory	4	1,2,4,10
	Replacement models	3	1,2,4,10

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

Construction Safety & Disaster Management
Elective –II

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit – I

Teacher should facilitate learning of basics of Construction Safety Management.

1.	Construction Safety Management		Lectures required	References
	a	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.	08	6,7

Unit – II

Teacher should facilitate learning of basics of Safety in construction operations.

2.	Safety in construction operations		Lectures required	References
	a	Safety of accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, etc. First aid on site, Prevention of accidents, Safety measures while usingconstruction equipmente.g. Vehicles, cranes, hoist and lifts etc. Safety of scaffolding and working platforms. Safety while using electrical appliances & Explosives.	08	1 to 5

Unit – III

Teacher should facilitate learning of basics of Natural Disasters & Manmade disasters.

3.	Natural Disasters & Manmade disasters		Lectures required	References
	a	**Natural Disasters :** Natures and extent of disasters, natural calamities such as earthquake, floods, coasts hazards, landslides etc.	04	8,9
	b	**Manmade disasters** : such as chemical and industrial hazards, nuclear hazards, fire hazards etc.	04	8,9

Unit – IV

Teacher should facilitate learning of basics of Disaster Management.

4.	Disaster Management		Lectures required	References
	a	Financing relief expenditure, legal aspects, rescue operations. Casually management, risk management.	08	6,7

		Emergency Management Programme: Administrative setup and organization. Hazard analysis, training of personnel, information management, emergency facilities and equipment necessary.		

Unit – V

Teacher should facilitate learning of basics of Public Awareness & Management.

5.	**Public awareness & Management**		Lectures required	References
	a	**C**reation, preparation and execution of the emergency management programme, role of safety officers ,awareness committee,	07	1 to 5

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. Construction Safety Handbook – *Davies* V.S.Thomasin K, Thomas(Telford, London.)
4. ISI for safety in Construction – Bureau of Indian Standards.
5. Safety management – Girimaldi and Simonds (AITBS, New Delhi)
6. Construction Engineering and Management – Seetharaman
7. Project Management – K Nagarajan (New Age International Ltd.)
8. Disaster management & rehabilitation- RajdeepDasgupta, A mittal Publication.
9. Disaster management in India- Dr. KadambauiSharma,Dr. AvinashChiranjeev, Jnandaprakashan(P&D) New Delhi

Water Power Engineering

Elective III

Teacher, Paper setter and Examiner should follow the following guidelines.

Unit - I

Teacher should facilitate learning of (1) basic concepts of hydro power engineering and its determination.

1.			Lectures required	Reference No.
	a	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.	02	1,2,3,8,11
	b	Estimation of water power potential: – Mass curve, flow duration curve, firm power and secondary power, power duration curve and available power.	03	1,2,3,8,11
	c	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).	03	1,2,3,8,11

Unit - II

Teacher should facilitate learning of various types of hydropower plants.

2.			Lectures required	Reference No.
	a	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.	04	1,2,3,8,11
	b	Pumped storage power plants: – Essential requirements, necessity, advantages and disadvantages, classification of pumped storage power plants, relative merits of two-unit	04	1,2,3,8,11

			Lectures required	Reference No.
		and three-unit arrangements, problems in operation, layout, efficiency of Pumped storage power plants.		

Unit – III

Teacher should facilitate learning of (1) Tidal power plants, (2) surface and underground power houses and (3) intake structures.

3.			Lectures required	Reference No.
	a	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.	03	1,2,3,8,11
	b	Power house:- Surface Power Stations – Structure, Dimensions, Lighting & Ventilation, Variations in design Underground Power Station – Location, Types of Layout, Components, Advantages.	03	1,2,3,8,11
	c	Intake structures:- Functions, types, losses in intakes, air entrainment and inlet aeration, cavitation.	02	1,2,3,8,11

Unit – IV

Teacher should facilitate learning of Penstocks, phenomenon of water hammer and design of surge tanks.

1.			Lectures required	Reference No.
	a	Penstock & accessories: – Classification, design criteria, economical diameter, anchor blocks, conduit valves, bends & manifolds.	03	1,2,7
	b	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).	03	1,2,7,9
	c	Surge Tanks: - Necessity, locations, functions, types, analysis of simple cylindrical surge tank considering frictional effects.	02	1,2,7,9

Unit – V

Teacher should facilitate learning of non conventional energy sources such as biomass energy, solar energy and wind energy.

1.			Lectures required	Reference No.
	a	Biomass energy: - Bio fuel classification, energy farming, direct combustion for heat, anaerobic digestion for biogas, different digesters, applications of Biogas.	02	3,8,11
	b	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.	02	3,4,5,8,11
	c	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.	03	3,6,8,10,11

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.

Industrial Pollution & Control

ELECTIVE-III

Teacher, Paper setter and Examiner should follow the guidelines as given below.

Teacher should facilitate learning of various concepts responsible for water pollution across globe and in India, water uses in major industries.

UNIT – I

Sr No.	Topic	Lecture required	Reference No
1	Major industries responsible for water pollution across globe and in India, water uses in major industries, industrial wastewater survey, sampling procedures.	04	1,2,4,5,8,9
	characteristics of major industries like dairy, sugar, pulp and paper, dye, metal plating, textile, petroleum, refineries, slaughterhouse, tannery, distillery etc. as per IS codes.	03	1,2,3,8,9

UNIT – II

Sr No.	Topic	Lecture required	Reference No
2	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.	4	1,2,4,5,6,7
	Flow and quality variation and its impact on treatment, importance of flow equalization, segregation of waste streams- specific applications.	4	1,2,4,5,8,9

UNIT – III

Sr No.	Topic	Lecture required	Reference No
3	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.	4	1,2,5,6,7
	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.	4	1,2,3,7,8,9

UNIT – IV

Sr No.	Topic	Lecture required	Reference No
4	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.	04	1,2,4,5,11
	application of advance wastewater treatment technology- reverse osmosis (theory, application and design), adsorption- (theory, application and design including kinetic modeling), low cost sorbents.	04	1,2,3,4,5

UNIT – V

Sr No.	Topic	Lecture required	Reference No
5	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.	3	7,8,9
	Types of scrubbers and their applications in industries, (no mathematical treatment on scrubber design).	2	1,7,8,9
	Industrial solid waste sampling plan, characterization, disposal of waste from thermal power plant. Disposal of solid organic	3	1,2,3,9

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

ARCHITECTURE AND TOWN PLANNING

ELECTIVE-III

Teacher, Paper setter and Examiner should follow the guidelines as given below.Teacher should facilitate learning of various concepts and principles of town planning and develop ability for implementing sustainable development principles in urban planning

UNIT – I

Sr No.	Topic	Lecture required	Reference No
1	**a. Architecture**: Definition**:** Role of "urban planner and architect" in planning and designing. Principles of architecture, Architectural composition and elements of design.	04	1,2,3,8
	b. **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.	04	1,2,3,8,11

UNIT – II

Sr No.	Topic	Lecture required	Reference No
2	**a.Town planning**- Objectives, principles, stages in town development, growth of towns and theories of developments (ribbon, sector zone, concentric, multiple zone etc)	3	1,2,11
	b.Study of new towns – study of planned towns like new Mumbai, Gandhinagar.(infrastructure, disaster management etc)	3	12,13,14
	c.Neighborhood- planning and role in urban development, town planning schemes, garden city & three magnet theory, green belts.	2	1,2,3,8,11

UNIT – III

Sr No.	Topic	Lecture required	Reference No
3	**a. 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.	5	1,2,11
	b.Town planning legislations and municipal acts – planning of control development schemes – urban financing – land acquisition –slum clearance schemes – pollution control aspects.	4	1,2,11

UNIT – IV

Sr No.	Topic	Lecture required	Reference No
4	A. **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.	05	1,2,4,5,11
	B. **Legislative mechanism for dp**: mrtp, planning agencies for various levels of planning. Their organisation and purpose (CIDCO-MHADA-MIDC).	02	4,5

UNIT – V

Sr No.	Topic	Lecture required	Reference No
5	**a.Components of Ecosystem**; ecological principles concerning environment; climate	2	6,7,9,10
	b. responsive design; energy efficient building design; thermal comfort; solar architecture;	2	6,7,9,10

c. Acoustics – Concepts of Acoustic, noise pollution & its control.	3	1,2,3,8,11

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

Retrofitting of Structures

Elective-III

Teacher, Paper setter and Examiner should follow the guidelines as given below.

Teacher should facilitate learning of concepts on the rehabilitation of the structure as per need. The primary course objective is to focus on 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.

Unit–I

Teacher should facilitate learning of Causes for distress in structure:

Sr. No.	Topic	Lectures required	Reference No.
1.	**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.	7	1,2,6

Unit–II

Teacher should facilitate learning of Materials and techniques for repair

Sr. No.	Topic	Lectures required	Reference No.
2.	**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)	8	1,2,3,5,8

Unit–III

Teacher should facilitate learning of maintenance & repair of structures:

Sr. No.	Topic	Lectures required	Reference No.
3.	**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.	7	1,2,3,5

Unit–IV

Teacher should facilitate learning of concept of Structural strengthening.

Sr. No.	Topic	Lectures required	Reference No.
4.	**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.	7	1,2,4,7

Unit–V

Teacher should facilitate learning of use of preventive measures for durability of structures:

Sr. No.	Topic	Lectures required	Reference No.
5.	**Preventive measures for durability of structures:** 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.	7	1,2,6

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".

Water Resources Engineering – II: Lab

Teachers and Examiners should follow the following guidelines.

1. Teacher should facilitate following lab experiments/assignments:

Sr No.	Name of experiment	Lab hours required

1	Development of flood hydrograph from unit hydrograph and complex storm.
	  a) To find and draw the hyetograph of Rainfall Excess of given storm.
	  b) To find base flow using appropriate method.
	  c) To calculate and plot the resulting flood hydrograph and also the hyetograph of Rainfall Excess on A4 size graph paper.
		02

2	Determination of reservoir capacity from mass inflow and mass demand curve. a) To plot the mass inflow and mass demand curves on A4 size graph paper and calculate the required reservoir capacity.	02

3	Stability analysis of a gravity dam considering all forces as per I.S. 6512-1984 load combination E.
	  a) To draw the detailed cross section of dam showing all forces.
	  b) To calculate all the forces and their moments about toe.
	  c) To calculate all the stresses and factors of safety.
		04

4	Stability analysis of slope of earth dam.
	  a) To draw the detailed cross section of dam.
	  b) To draw the slip circle from given data of radius and centre of slip circle as per Fellinius method.
	  c) To find the factor of safety for the given slope of the dam.
		04

5	Design of Ogee spillway with energy dissipater.
	  a) To find the design head over the crest from given data.
	  b) To design the upstream and downstream profile of the crest as per USWES method and plot the same on A4 size graph paper.
	  c) To determine the appropriate Indian Standard stilling basin or bucket for energy dissipation.
		02

6	Analysis of weir on permeable foundation by using Khosla's charts.
	  a) To find uplift pressures at key points of sheet piles of the weir/ barrage and also exit gradient by using Khosla's charts.
	  b) To calculate the required thicknesses of the floor and safety of the structure against piping failure.
		04

7	Design of unlined canal in alluvium by using Lacey's or Kennedy's theory.
	  a) To calculate the design discharge from command area and kor depth and kor period.
	  b) To design at least three cross sections along the alignment by using Garret's diagram or Lacey's equations.
	  c) To prepare the schedule of area statistics and channel dimensions
		04

	and plot L-section of the canal on A4 size graph paper.	
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. a) To study and write all the relevant benefits and costs of any existing dam or barrage or canal and hence find benefit-cost ratio.	02

Note: The Term Work will consist of a laboratory journal consisting of minimum five assignment.

Guidelines for ICA :

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

Guide lines for ESE:-

ESE will be based on journal submitted by the student. In ESE the student may asked to answer questions based on assignments. Evaluation will be based on performance in **oral** examination.

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

Teacher should facilitate learning of following laboratory experiments:

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

Sr No	Name of Experiment	Lab hours required
1	Determination of dissolved oxygen.	02
2	Determination of BOD.	06
3	Determination of COD.	04
4	Determination of different types of solids	04
5	Determination of SVI.	02
6	Determination of chlorides.	02
7	Determination of chromium or any heavy metal	04
8	Determination of water conductivity.	02
9	Determination of oil and grease.	02
10	Determination of Kjeldahl nitrogen.	04

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 student's 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.

Advanced Structural Design Lab

Elective II

Teacher should facilitate learning concepts related to 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.

Sr. No.	Name of project	Lab Hours Required
1.	**Ductile detailing of RC members as per IS 13920:1993.** Study and preparation of short notes based on IS 13920:1993.	2
2.	**Design of rectangular combined footing.**	
	To study and understand problem statement	1
	Actual analysis and design based on problem statement	2
	Detailing and drawing	2
3.	**Design of interior panel of flat slabs.**	
	To study and understand problem statement	1
	Actual analysis and design based on problem statement	2
	Detailing and drawing	2
4.	**Design of cantilever retaining wall**	
	To study and understand problem statement	1
	Actual analysis and design based on problem statement	2
	Detailing and drawing	2
5.	**Design of circular water tank**	
	To study and understand problem statement	1
	Actual analysis and design based on problem statement	2
	Detailing and drawing	2
6.	**Pre-stress**	
	Assignments based on analysis of pre-stress structure.	4
	Design of post tensioned flexural member.	
	To study and understand problem statement	1
	Actual analysis and design based on problem statement	2
	Detailing and drawing	2

Note-

a) A design report shall be prepared along with showing details on full/half imperial drawing sheets.

Guidelines for ICA:

ICA shall be based on continuous valuation of student's performance throughout the semester and term work drawing sheets submitted by the students.

Guidelines for ESE:

ESE shall be based drawing sheets submitted by the students. In ESE the students 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 Publications R.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:-

1. IS 456-2000 Plain and Reinforced Concrete - Code of Practice.

2. IS 1343 (1980): Code of Practice for Pre-stressed Concrete.

3. IS 13920 (1993): Ductile detailing of reinforced concrete structures subjected to seismic forces.

Earthquake Engineering Lab

Elective II

Teacher should facilitate learning of seismic design and detailing of RC structure as per IS 1893 and 4326. Also students will be exposed to computer aided analysis using available software.

Sr No	Name of Assignment/Project	Lab hours required
1	At least one assignment from each of four units	02
2	Problems based on the above syllabus shall be submitted as term work	06
3	Exposure to computer aided analysis using available software is considered	02
4	Evaluation of Lateral Loads on Multistoried Building as per IS 1893 -2002	04
5	Ductile detailing of flexural and compression members as per IS13920	06

Guidelines for ICA:

ICA shall be based on continuous evaluation of students' performance throughout the semester and term work drawing sheets submitted by the students.

Guide lines for ESE:

ESE will be based on assignments submitted by the student. In ESE the student may be asked to answer questions based on term work. Evaluation will be based on performance in **oral** examination.

Reference Books

1. Earthquake resistance design of structure by Duggal Oxford University Press.
2 .Earthquake Resistant Design by David J. Downik, John Wiley and Sons Publication
3. Earthquake Tips NICEE, IIT, Kanpur
4. Elements of Earthquake Engineering by Jaikrishna and Chandarsekaran.
5. Geotechnical Earthquake Engineering by Kramer S. L. 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

System Approach In Civil Engineering Lab

Elective II

Teacher should facilitate solving of various civil engineering Problems related to infrastructural projects It shall be based on syllabus and will consist of assignments, problem solving and use of Software's on followings

Sr No	Name of Assinment/Project	Lab hours required
1	System concepts	04
2	Optimisation techniques	04
3	Linear programming	04
4	Non-linear programming	04
5	Constrained/unconstrained optimisation	04
6	Dynamic programming/ queing theory	04

Guidelines for ICA:

ICA shall be based on continuous evaluation of students' performance throughout the semester and term work drawing sheets submitted by the students.

Guide lines for ESE:

ESE will be based on assignments submitted by the student. In ESE the student may be asked to answer questions based on term work. 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

Construction Safety & Disaster Management Lab
Elective –II

Teacher should facilitate learning of   course concepts through Assignments on each unit.
Minimum six practical / Assignments from the list given below shall be performed

Sr No	Name of Assinment/Project	Lab hours required
1	**Construction Safety Management** – Writing safety inspection reports.	4
2	**Assignment on activities related to safety in construction operations** Accidents on construction sites various construction sites such as buildings, dams, tunnels, bridges, roads, etc. First aid on site ,Prevention of accidents,	4
3	**Assignment on activities related to use of construction equipments.** 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	4
4	**Case studies of natural disasters :** Natures and extent of disasters, natural calamities such as earthquake, floods, coasts hazards, landslides etc.	4
5	**Case studies of manmade disasters :** such as chemical and industrial hazards, nuclear hazards, fire hazards etc.	4
6	**Assignment on disaster management** 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.	4
7	**Assignment on Public awareness & Management-** creation, preparation and execution of the emergency management programme, role of safety officers ,awareness	4

	committee.	

Guidelines for ICA:

ICA shall be based on continuous evaluation of students' performance throughout the semester and term work drawing sheets submitted by the students.

Guide lines for ESE:

ESE will be based on assignments submitted by the student. In ESE the student may be asked to answer questions based on term work. Evaluation will be based on performance in **oral** examination.

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