NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Third Year Engineering

(CIVIL)

Faculty of Engineering and Technology

Teacher and Examiner's Manual

TERM – V

W.E.F 2014 – 2015

STRUCTURAL DESIGN – I

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

Teacher should facilitate learning of concepts of Reinforced cement concrete design through the use of the Indian Standard (IS 456:2000) design code. The primary course objective is to equip the students with the tools necessary for designing of 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) design code, Analysis and design of singly reinforced beams etc.

Sr No.	Topic	Lecture required	Reference No
1	**A. Introduction:** Introduction to various design philosophies of R.C structures, working stress method, ultimate load method, limit state method , limit state of collapse, limit state of serviceability, limit state of durability, characteristic strength, characteristic load, partial safety factors for material strengths and loads. Study of structural properties of concrete.	03	1,2,3,4,&5
	B. Singly Reinforced section: Limit state method for flexure, Assumptions, stress & strain diagram, Balanced, under reinforced & over reinforced RC sections, Analysis and design of rectangular section.	04	1,2,3,4,&5

UNIT – II

Teacher should facilitate learning of analysis & design of doubly and flanged sections.

Sr No.	Topic	Lecture required	Reference No
2	**A. Doubly Reinforced section** Analysis and design of doubly reinforced sections.	04	1,2,3,4,&5
	B. Flanged Section Analysis and design of flanged sections	04	1,2,3,4,&5

UNIT – III

Teacher should facilitate learning of analysis & design of beam for flexure, shear, bond, and design of one way slabs.

Sr No.	Topic	Lecture required	Reference No
3	**A. Design of beams for flexure, shear and bond** Simply supported, cantilever beams & continuous beams using IS code coefficient method.	04	1,2,3,4,&5
	B. Design of slabs One way simply supported, cantilever slab & continuous slab	04	1,2,3,4,&5

UNIT – IV

Teacher should facilitate learning of analysis & design of two way slab and dog-legged staircase.

Sr No.	Topic	Lecture required	Reference No
4	**A. Design of two way slabs** Two way simply supported & continuous slabs.	04	1,2,3,4,&5
	B. Design of staircase Design of dog legged stair case.	04	1,2,4,&5

UNIT – V

Teacher should facilitate learning of analysis & design of column and footings

Sr No.	Topic	Lecture required	Reference No
5	**A. Column** Introduction, strain and stress variation diagrams, axially loaded short column with minimum eccentricity requirements, Design of short column for axial load.	04	1,2,3,4,&5
	B. Footings Design of isolated pad footing for axial load & uniaxial bending	04	1,2,3,&5

RECOMMENDED BOOKS :

1) P. Dayaratnram, Limit State Analysis and Design, Wheeler Publishing company, Delhi.

2) Ramamruthum S., Reinforced Concrete Structure, Dhanapat Rai & Sons Publiation.

3) Punmia, Jain and Jain, Comprehensive Design of R.C. Structures, Standard Book House.

4) Shah V.L. and Karve S.R., Limit State Theory and Design :– Pune Vidyarthi Publication.

5) Sinha, RCC Analysis and Design Vol. I and II, S.Chand and Co., New Delhi.

INFRASTRUCTURAL ENGINEERING-I

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

Unit - I

. Teacher should facilitate learning of; Role of civil engineer in infrastructural development, tracks, permanent way, defects in rail, sleepers etc.

1.			Lectures required	Reference No.
	a	**Introduction:** Role of Civil Engineers in Infrastructure Development, Advantages of Railways as mode of transport, Organizational structure, Permanent Way**,** definition of track, basic components, and ideal requirements.	2	1,2
	b	**Railway Track Gauge:** Different gauges on Indian Railways, loading gauge, construction gauge, Unigauge , Problems caused by change of gauge.	2	1,2
	c	**Track and Track stresses:** requirements, forces acting on Track, coning of Wheels, Tilting of Rails, Rails: Functions, types of rails, rail joints, rail failure, function suitability and drainage, treatment, Defects, Standard rail sections,	2	1,2
	d	**Sleeper:** Functions, requirements, types of sleepers; Concrete sleepers, Pre stressed, sleeper density, manufacturing and spacing of sleepers, Ballast: Function, specifications of track ballast, Track fittings: Fittings and fastening	2	1,2

Unit – II

Teacher should facilitate learning of; Alignment of track, geometric design of track, creep, creep measurement, construction & maintenance of track etc.

2.			Lectures required	Reference No.
	A	**Alignment of Railway lines:** Importance, Basic requirements of an ideal alignment, selection of a good alignment, Geometric design of Track: Necessity for geometric design, Gradients, Grade compensation on curves, Super elevation, equilibrium cant, cant deficiency, maximum permissible speed, negative super	3	1,2

			Lectures required	Reference No.
		elevation.		
	B	**Resistance to Traction:** Resistance to-friction, wave action, Causes of creep, Effects of creep, Measures to reduce creep. Speed, track irregularity, wind, gradient, curvature. Stress in rails, sleepers, ballast and formation,	2	1,2
	C	**Construction and Track maintenance:** Plate laying method, operations involved Tools & common items of track maintenance.	2	1,2

Unit – III

Teacher should facilitate learning of; Points and crossings, signaling systems, stations yards, modernization & safety aspects etc.

3.			Lectures required	Reference No.
	A	**Points and crossings:** Important terms, types of track layouts and sketches of turn out, diamond crossing, triangle, double junction, scissors cross over, Single slip, Double slip, Gathering line, Signaling and interlocking: objectives of signaling, classification of signals, CTC and ATC system, Interlocking & it's Principles.	3	1,2
	B	**Railway Stations and yards:** Classification of Railway stations, Purpose, facilities required at railway stations, Requirements of station yard, Types of Yards,	2	1,2
	C	**Modernization in railways:** Types of railways, high speeds, improvements in track structure: components, Automation, Safety aspects, Introduction to Skybus, Monorail & Metro rails.	2	1,2

Unit – IV

Teacher should facilitate learning of; runway, taxiway, wind rose diagram its importance in planning of Airport, terminal building & Heliport etc.

4.			Lectures required	Reference No.
	A	**Basic definition & terms:** Runway, Taxiway, Apron, Hanger, Airport obstruction, Airport Classification (ICAO), selection of site for airport.	2	3,4,5,6,10
	B	**Wind Rose Diagram**, characteristics of aircraft, corrections to basic length of runway, Runway Geometrics, Taxiway Geometrics.	3	3,4,5,6,10
	C	**Terminal Building requirements**, Airport Drainage, Heliports, Main characteristics of Helicopters, nature of helicopters transport, site selection for helicopters.	2	3,4,5,6,10

Unit – V

Teacher should facilitate learning of Harbour, Classification, breakwater, tides, wind waves, dry dock, wet dock, signals etc.

5.			Lectures required	Reference No.
	A	**Introduction**: Classification of harbors, selection of site for harbor. Definitions/ methods of Breakwater, Quay walls, Bulkhead, Wharves, Jetty, Dolphins, Dock fenders, piers, slips, moles, berths , pier heads, Jetties, , mooring accessories- function.	3	7,8,9,11
	B	**Natural Phenomena**: Inland water transport in India, tide winds and waves erosion, littoral drift, coast protection,	2	7,8,9,11
	C	**Other Facilities**: Dry Dock, Wet docks-purpose, Lift docks, repair docks, graving docks, floating docks, marine railway, signals, buoys, beacons, light house, ware house and Transit sheds.	2	7,8,9,11

RECOMMENDED BOOKS:

1) Saxena S.C. & Arora S. P. A course of Railway Engineering, Dhanpat Rai & Sons, New Delhi.,7th edition,2010
2) Agarwal M. M. – Indian Railway Track, Sachdeva Press, Mayapuri, New Delhi.,5th edition 2013
3) Khanna & Arora, Airport planning & design, Nemchand Bros, Roorkee, Delhi.,3rd edition 2005
4) Rangwala, Airport Engineering, 13th edition,2013
5) G. Venkatappa Rao, Airport Engineering,1st edition,1992.
6) Rao G. V., Airport Engineering, Tata Mc Graw Hill
7) Bindra S. P., Docks & Harbour Engineering, Dhanpat Rai & Sons,1992
8) R. Shrinivasan, Harbour dock & tunnel Engineering, New Delhi.,26th edition,2013
9) Rangwala, Docks and Harbour ,3rd editon,2004
10) K. L. Bhanot & S. B. Sehgal, Highway Engineering & Airport.,3rd edition 1996
11) S. Ponnuswamy, Bridge Harbour.2nd edition,2012

FLUID MECHANICS- II

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

Unit - I

Teacher should facilitate learning of boundary layer concepts and calculate forces exerted by flow around submerged bodies.

1.			Lectures required	Reference No.
	a	**Boundary Layer Theory**: Concept of boundary layer, various thicknesses of boundary layer, applications of Von Karman momentum equation (no derivation of the equation), boundary layer over a flat plate, laminar and turbulent boundary layers, local and average drag coefficients, separation of boundary layer and control of separation.	05	1, 3, 5, 6, 7
	b	**Fluid Flow around submerged Bodies**: Practical problems involving fluid flow around submerged objects, definitions and expressions of drag & lift, drag & lift coefficients, types of drags, drag on cylinder. Circulation, Magnus effect and lift on cylinder and airfoil, polar diagram.	04	1, 3, 5, 6, 7

Unit – II

Teacher should facilitate learning of (1) turbulent flow in pipes and smooth and rough boundaries and (2) pipe flow systems

2.			Lectures required	Reference No.
	a	**Turbulence Flow Theory**: Turbulence phenomenon, instantaneous & temporal mean velocities, Reynolds's expression for turbulent shear stress, introduction to Prandtl's mixing length theory, Karman-Prandtl equation (no derivation), hydro-dynamically smooth and rough boundaries and mentions of equations for velocity distributions; (no derivations of equations of	03	1, 3, 5, 6, 7

		velocity distributions).		
	b	Darcy-Weisbach equation (no derivation), only mention of different equations (no derivations) for friction factors for smooth, rough & transition boundaries, Moody's diagram.	02	1, 3, 5, 6, 7
	c	**Pipe flow systems**: major and minor losses, pipes in series & parallel and their equivalent pipes, siphon.	03	1, 3, 5, 6, 7

Unit – III

Teacher should facilitate learning of elements of open channel flow and uniform and critical flows in open channel.

3.			Lectures required	Reference No.
	a	**Open Channel flow** – Classification of open channels, geometric elements, steady and unsteady, uniform and non uniform flows, continuity and energy equations, kinetic energy correction factor.	02	1, 2, 3, 5, 7
	b	**Uniform flow**: Chezy's and Manning's equations, concept of normal depth, calculation of normal depth for triangular & wide rectangular channels. Hydraulically efficient sections.	03	1, 2, 3, 5, 7
	c	**Critical flow**: Specific energy, specific energy diagrams, fundamental equation of critical flow, calculation of critical depth in rectangular and triangular channels.	03	1, 2, 3, 5, 7

Unit – IV

 Teacher should facilitate learning of (1) gradually varied flow in open channel, (2) hydraulic jump and its calculations.

1.			Lectures required	Reference No.
	a	**Gradually varied flow:** Types of non-uniform flows, differential equation of gradually varies flow (GVF) - alternate forms, introduction to different types of GVF profiles and practical examples of their occurrence, control sections; (no mathematical treatment for gradually varied flow).	03	1, 2, 3, 5, 7
	b	**Hydraulic Jump :** Phenomenon of hydraulic jump, application of momentum equation to hydraulic jump in horizontal, frictionless, rectangular channel, specific force, conjugate depths & relation between conjugate depths, energy loss in hydraulic jump, length of jump, classification & practical uses of hydraulic jump.	04	1, 2, 3, 5, 7

Unit – V

 Teacher should facilitate learning of (1) use of linear and angular momentum equations for calculating forces of impact of jet on plates; (2) primary concepts of hydraulic turbines and centrifugal pumps.

1.			Lectures required	Reference No.
	a	**Impact of Jet**: Impact of jet on stationary & moving, flat & curved plates using linear momentum principle, work done, introduction to principle of angular momentum, mention of Euler's momentum equation for turbine & pumps (no derivation).	03	1, 3, 4, 7, 9
	b	**Hydraulic Turbines:** Elements of hydro electric power plant, unit & specific quantities, classification of hydraulic turbines, introduction to work done, heads & efficiencies of turbines, (no mathematical treatment for hydraulic turbines).	02	1, 4, 7, 9

		Centrifugal Pumps: Classification of centrifugal pumps, specific speed, priming, introduction to work done by impeller, heads & efficiencies. Characteristics of hydraulic turbines and centrifugal pumps (no mathematical treatment for centrifugal pumps).	02	1, 4, 7, 9
	c			

RECOMMENDED BOOKS:-

1. Dr. A. K. Jain, Fluid Mechanics, Khanna Publishers, Delhi, Edition – 2011.
2. Dr. K. Subramanya, Flow in Open Channels, Tata McGraw-Hill Education Pvt., Ltd., New Delhi, 3rd Edition-2012.
3. Dr. K. Subramanya, FM & HM-Problems & Solutions, Tata McGraw-Hill Education Pvt. Ltd. New Delhi, 6th reprint-2013.
4. Dr. Jagdish Lal, Hydraulic Machines, Metropolitan Book Co. Pvt. Ltd., New Delhi.
5. Dr. P.N.Modi , Dr. S.M. Seth, Hydraulic and Fluid Mechanics, Standard Publications, Delhi, Edition – 2011.
6. Dr. R.K.Bansal, A Textbook of Fluid Mechanics & Hydraulic Machines, Laxmi Publications (P) Limited, 9th Edition, 2012.
7. Streeter V.L. & Wylie E.B., Fluid Mechanics, Tata McGraw-Hill Education Pvt., Ltd., New Delhi, 6th reprint - 2012.
8. Dr.Garde and Mirajgaokar. - Fluid Mechanics.---
9. Rajput -Hydraulic Machines
10. Som S K and Biswas G – Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
11. John M. Cimbala, Yunus A. Cengel – Fluid Mechanics : Fundamentals and Applications, McGraw-Hill Higher Education. Second Edition 2010.

ENVIRONMENTAL ENGINEERING-I

The basic objective of this syllabus is to make aware the students of the importance of water purification and must know the methods used for purifying the water to make it fit for drinking purpose as per the standards. The student should be aware about public health engineering principles.

The time weight to be given to the various elements of the syllabus is indicated as follows:

Unit No.	Topic	No. of lectures required to cover the topic	Books recommended	Remark
I	Introduction to water supply schemes: data collection for water supply scheme, components and layout, design period, factors affecting design period.	02	(1)	Theoretical description. Students should do assignments and study case studies from literature/internet
	Water intake structures: General design considerations, intake structures, such as river intake, canal and reservoir intake, conveyance of raw water, hydraulic design of pumping station.	02	(1), (2)	Theoretical description. Demonstration by sketches, models and site visit. Numerical on hydraulic design of Pumping station.
	Water demand, rate of water consumption for various purposes, like domestic, industrial and institutional and commercial. Fire demand. Water system losses. Factors affecting the rate of demand.	01	(1), (2),(8)	Theoretical description. Various formulae on fire demand. Numerical.
	Population forecasting: arithmetical increase method geometrical increases method, incremental increase method logistic curve methods.	02	(1), (2)	Theory and mathematical treatment.
II	Water quality: impurities in water, physical, chemical and biological characteristics, water quality standards as per IS 10500-1991, USEPA and WHO.	03	(1), (2), (9)	Sources, acceptable limit, cause of rejection limit, bad effects and methods of determination of

				various impurities in water.
	Water treatment processes: introduction to different water treatment processes, flow sheets, aeration- principle, concept, necessity, methods and design of aeration fountains (Stepped aerators), Flash mixer, function, design and power requirements	02	(1), (2), (7)	Theoretical description of flow sheets for various types of waters, depending upon the raw water quality. Sketches of aerators and numerical design. Site visit. Model studies.
	Flocculation and sedimentation: coagulation, flocculation theory, zeta potential and its significance, mean velocity gradient G, power consumption, common coagulants, coagulant aids, principle of sedimentation, efficiency of ideal settling basin, types of settling and related theory. Design of settling tanks, clariflocculators, tube settlers.	03	(1), (2),(8)	Theory of flocculation and sedimentation. Types. Constructional details with sketches. Design. Numerical. Site visit. Model studies
III	Filtration: theory of filtration, mechanism of filtration, filter materials, types of filters, rapid Sand Filter, Slow Sand Filter, multimedia and dual media filters, components- under drainage system, working and cleaning of filters. Operational troubles, design of filters-RSF and SSF. Design of under drainage system.	04	(1), (2)	Theoretical aspects, constructional details through sketches and design numerical. Site visit. Model studies.
	Disinfection- objectives, theory, types of disinfection, chlorination, free and combined chlorine, effect of pH, types of chlorination, pre and post chlorination, break point chlorination, de-chlorination	04	(1), (2)	Water born diseases, significance of disinfections, efforts of WHO and Govt of India. Theory of chlorination and numerical. Site visit.

				bleaching powder estimation.			
IV	Water softening- theory, methods, lime soda, geolite, and ion exchange processes, quantity estimation of lime soda process, re-carbonization.	02	(1), (2)	Theory of hardness, softening, numerical. Importance of softening.
	Demineralization- methods like reverse osmosis, electro-dialysis.	01	(1), (2)	Theory: source and effect of minerals. Significance. Basic theory of demineralization. Methods. No mathematical treatment. Theory: source and effect of minerals. Significance. Basic theory of demineralization. Methods. No mathematical treatment.
	Miscellaneous methods- adsorption: theory, Frendlich isotherms design.	02	(3)	Theory of adsorption, numerical, low cost sorbents.
	Effect of fluoride, fluoridation and de-fluoridation Water treatment of swimming pool.	02	(1), (2)	Theory only. No mathematical treatment.
V	**A. Water distribution system:** types of distribution system, continuous and intermittent system, gravity, pumping and combined system. Wastage of water- detection and prevention. Design of hydraulic network. Residual pressure, Hardy-Cross method, design of ESR capacity.	03	(1), (2),(4)	Significance of distribution system. Schismatic representation - Lay out of distribution system.
	B. Service reservoir: ESR, GSR, balancing reservoir- necessity, location, capacity calculation by arithmetic and mass curve method. types of pipes. types of valves, Functions and locations.	02	(4) (2)	Visit- ESR, GSR for detail understanding.

C. Presence of heavy metals in water: Effects and remedy. Presence of non-biodegradable organics in water, their effects, halide formations. Their removal methods including osmosis, ultra-filtration, and adsorption Basic idea of photo-catalysis technology from removal of non-degradable organics.	03	(4), (5), (6)	Students should do assignments with practical approach and study case studies from literature

RECOMMENDED BOOKS:-

1. E W Steel and Terence J McGhee : Water supply and Sewerage" Tata McGraw Hill Publishing Co.
2. Water supply and Sanitary Engineering by J S Birdie, Dhanpat Rai and Sons Publication, New Delhi
3. Physici-chemical processes for water quality control by Walter J Weber, Wiley Inter-science Publications.
4. Garg S.K., "Water Supply Engineering", Khanna Publisher, New Delhi
5. Punamia, Jain & Jain, "Water Supply Engineering", Laxmi Publications, New Delhi
6. Manual on Water Supply & Treatment, Central Public Health & Environmental Engineering, Organization, Ministry of Urban Affairs, Government of India
7. Therous, Eldridge & Mallmann, "Laboratory Manual for Chemical & Bacteriological Analysis of Water & Sewage", Agro Botanic Publisher, India
8. Benergee & Jain, "Handbook of Technical Analysis", Jain Brothers New Delhi.
9. Laboratory Manual for Environmental Quality Testing, Environmental Protection Research Foundation, Sangli

CONSTRUCTION MANAGEMENT – I

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

Unit - I

Teacher should facilitate learning of various construction activities and stages.

1.	Introduction to construction Industry and their activities		Lecture required	Reference No
	a	Construction industry, construction team, Construction activities	01	3,4
	b	Classification of construction, stages in construction	01	4
	c	Need of management in construction	01	4
	d	Job layout and value engineering.	01	2,4
	e	Leadership and its quality, Organization, meaning and function	01	4
	f	Forms of organization - line, line and staff, functional, Type A, Type B and Type C	02	4,5

Unit – II

Teacher should facilitate learning of network analysis using CPM and PERT methods.

2.	Introduction to network techniques and their methods		Lecture required	Reference No
	a	Network Technique: - History, Advantages, Bar charts, S – Curve etc	02	2,4,5
	b	Various terms used in network technique, activity	02	4,5
	c	Various event, critical path, duration, etc	01	2,4,5

d	Development of networks, network scheduling, to find various times and float, EST, EFT, TF etc	03	2,4
e	Monitoring of Network, Three phases of network technique	01	2,4,8,5
f	PERT - its concept and PERT Time.	01	4

Unit – III

Teacher should facilitate learning of cost analysis with their technical concepts.

3.	Introduction to cost analysis, cost curve and crashing of network	Lecture required	Reference No
a	Cost analysis, Cost Curve, Optimization and crashing of networks.	03	2,4,5
b	During monitoring, resource leveling, allocation, leveling and smoothening.	03	2,4
c	Line of balance- Concept and uses. (no problems on crashing of network)	02	1,2,4,5

Unit – IV

Teacher should facilitate learning of engineering economics, factors affecting on demand and supply with cost concepts and banking system.

4.	Concept of engg. Economics its importance, demand &supply, profit and loss	Lecture required	Reference No
a	Engineering economics, its definition and importance, demand and supply, factors affecting demand and supply, cost concept.	03	7
b	Bank, its type, uses and functions, banking systems	03	5,7
c	Profit and loss account, appreciation and depreciation of money.	01	7

Unit - V

Teacher should facilitate learning of variousexcavating and hauling equipments.

5.	Introduction to excavating and hauling equipments	Lecture required	Reference No
	a	Power shovels; size, basic parts, selection,factors affecting output.	03	2,9,10
	b	Draglines: - types, size, basic parts. Bulldozers-types, moving earth with bull dozers.	03	2,9
	c	Clamshells – Clamshell buckets.	01	2,9,10

RECOMMENDED BOOKS:-

1) Mahesh Varma - Construction planning and management
2) S.V.Deodhar - Construction equipment and job planning-2010
3) U.K.Shrivastava - Construction Management-+2013
4) Gehlot and Dhir - Construction Management-2010
5) L.S.Srinath - CPM and PERT2001
6) Peurifoy - Construction Planning and Management-
7) Tarachand - Engineering Economics
8) Chitkara - Construction Project Management-2009,2011
9) R.L.Peurifoy - Construction planning ,Equipments and Methods.-2002
10) Mahesh Verma - Construction equipments and its planning and application.

STRUCTURAL DESIGN – I (Lab)

Teacher should facilitate learning following lab experiments:

Sr No.	Name of Project	Lab hours required
1.	**Structural Layout**	
	a) To prepare a plan of G+2 building (Residential/ Commercial).	02
	b) To draw layout of Ground beam, plinth bean, floor beam, column, slabs etc	02
2.	**Analysis and design of various beams and slabs**	
	a) To calculate of loads and internal forces on beams and slabs.	03
	b) To decide the sections and calculate steel reinforcement.	02
	c) Detailing & drawing of beams, slab.	02
3.	**Analysis and design of column and footing**	
	a) To calculate loads and internal forces on columns and footings.	03
	b) To decide the sections and calculate steel reinforcement.	02
	c) Detailing & drawing of column, footings.	02

4.	**Analysis and design of dog-legged staircase**	
	a) To calculate loads and internal forces.	02
	b) To calculate steel reinforcement.	02
	c) Detailing & drawing of staircase.	02
5.	**A report on at least one site visit**	
	a) A report on at least one site visit shall be submitted in term work.	02

Note-

a) A design report shall be prepared along with showing details on half imperial drawing sheets.
b) A few typical details of beam column etc. shall be shown on A4 / A3 size sheets using drafting software also.

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 drawing sheets 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) P. Dayaratnram, Limit State Analysis and Design, Wheeler Publishing company, Delhi.

2) Ramamruthum S., Reinforced Concrete Structure, Dhanapat Rai & Sons Publiation.

3) Punmia, Jain and Jain, Comprehensive Design of R.C. Structures, Standard Book House.

4) Shah V.L. and Karve S.R., Limit State Theory and Design :– Pune Vidyarthi Publication.

5) Sinha, RCC Analysis and Design Vol. I and II, S.Chand and Co., New Delhi.

INFRASTRUCTURAL ENGINEERING – I(LAB)

Teacher should facilitate learning following lab experiments:

Sr No.	Name of Project	Lab hours required
1.	**Sketch Layout**	
	Draw neat labeled sketches of railway track in cutting for single line, double line, Electrified section	02
	Or Draw neat labeled sketches of railway track in embankment for single line, double line, Electrified section	02
2.	**Numerical on geometric design**	
	Numerical on geometric design of railway track.	02
	Numerical on speed limit of trains	02
3.	**Sketch**	
	Draw neat labeled sketches of left hand turnout, right hand turnout and different, Types of crossings.	02
	Draw neat labeled plans of different types of railway stations	02
4.	**Airport engineering**	
	Wind rose diagrams: types and their uses	02
	Planning of a terminal building showing all the accessories and spaces	02
	Numerical on basic runway length & corrections	02
5.	**A report on at least one site visit**	
	A Visit to Railway/Airport/ port site & preparation of report	02

Note-

The sketches must be drawn on bond paper showing details..

Guidelines for ICA:

ICA shall be based on continuous evaluation of students' performance throughout the semester and term work, sketches, visit report submitted by the students.

RECOMMENDED BOOKS:

1. Saxena S.C. & Arora S. P. A course of Railway Engineering, Dhanpat Rai & Sons, New Delhi
2. Rangwala, Railway Engineering,
3. Agarwal M. M. – Indian Railway Track, Sachdeva Press, Mayapuri, New Delhi
4. Khanna & Arora, Airport planning & design, Nemchand Bros, Roorkee
5. Rangwala, Airport Engineering,
6. G. Venkatappa Rao, Airport Engineering
7. Rao G. V., Airport Engineering, Tata Mc Graw Hill
8. Bindra S. P., Docks & Harbour Engineering, Dhanpat Rai & Sons
9. R. Shrinivasan, Harbour dock & tunnel Engineering
10. Rangwala, Docks and Harbour
11. Horonjeff & Mcklerey, Planning & Design of Airport
12. Quinn A. D., Design & construction of Port & Marine Structure

Fluid Mechanics-II Lab

Teachers and Examiners should follow the following guidelines.

1. Teacher should facilitate following laboratory experiments/assignment:

Sr No.	Name of experiment	Lab hours required
1	**Study of boundary layer on flat plate.** a. To measure velocities of flow by pitot tube at various points along the length over a flat plate at various depths (in wind tunnel). b. To plot velocity profiles at various points along the length and hence analyze development of boundary layer on flat plate.	02
2	**Measurement of drag and lift on airfoil.** a. To measure drag and lift forces on an airfoil at various angles of attack in wind tunnel with the help of digital force measuring transducer. b. To calculate coefficients of drag and lift at various angles of attack and plot polar diagram for studying characteristics of the airfoil.	02
3	**Determination and analysis of Pressure distribution over circular cylinder.** a. To measure pressure at various points on surface of circular cylinder in wind tunnel by multi-limbed manometer. a. To calculate coefficients of pressure at these points and plot pressure distribution diagram for analyzing development of drag and lift on cylinder.	02
4	**Determination of friction factor and calibration equation for given pipe** a. To measure pressure difference between two points on a horizontal pipe. b. To calculate discharge experimentally through the pipe by measuring volume of water and the required time and hence to calculate the average velocity. c. To compute friction factor by using Darcy-Weisbach equation. d. To develop the calibration equation for given pipe by plotting graph of log h_f versus log Q and also compute the graphical value	02

	of friction factor.	
5	**Study of uniform flow formulae in open channel (Manning's and Chezy's formulae).** a. To measure depths of flow at two sections by pointer gauge in an open channel. b. To calculate discharge experimentally through the open channel by measuring volume of water and the required time and hence to calculate the average velocity. c. To compute Manning's and Chezy's coefficients by knowing the bed slope of the channel.	02
6	**Study of specific energy and specific force in open channel flow.** a. To measure depths of flow at two sections by pointer gauge for a given discharge and for various bed slopes of an open channel. b. To calculate discharge experimentally through the open channel by measuring volume of water and the required time and hence to calculate the average velocity. **c.** To calculate specific energies and specific forces and plot these diagrams on graph papers.	02
7	**Determination of velocity distribution in open channel flow.** a. To measure velocity of flow by pitot tube at various points in a cross section. b. To plot velocities at these points and draw contours of equal velocities, i.e. isovels. c. To calculate discharge experimentally through the open channel by measuring volume of water and the required time and hence to calculate the average velocity.	02
8	**Calibration of venturiflume.** a. To measure depths of flow at inlet and throat of venturiflume by pointer gauge in an open channel. b. To calculate discharge experimentally through the open channel by measuring volume of water and the required time. c. To compute the discharge analytically by knowing the depths of flow at inlet and throat. d. To calculate the coefficient of discharge of the venturiflume.	02
9	**Measurement of different parameters of hydraulic jump in laboratory or on site.** a. To calculate discharge experimentally through the open channel by measuring volume of water and the required time.	02

	b. To measure conjugate depths of the hydraulic jump. c. To compute velocities, Froude numbers, energy loss, length and height of the jump.	
10	**Study of operating characteristics of Pelton wheel.** a. To measure (i) discharge (Q) supplied to the turbine with the help of venturimeter or any other equipment, (ii) pressure by pressure gauge at inlet to turbine, (iii) load on turbine by spring balance and attached loads on brake drum and (iv) speed of the turbine by tachometer. b. To compute head on turbine, input power (P_a) and output power (P_t), specific speed and overall efficiency (η_t) of the turbine. c. To plot the operating characteristics (i.e. constant speed) curves for Pelton wheel, i.e. graphs of (i) P_t and η_t versus Q and (ii) η_t versus P_t.	02
11	**Study of main characteristics of Kaplan turbine.** a. To measure (i) discharge (Q) supplied to the turbine with the help of orificemeter or any other equipment, (ii) pressures by pressure gauge at inlet of turbine and by vacuum gauge at outlet of runner, (iii) load on turbine by spring balance and attached loads on brake drum and (iv) speed of the turbine by tachometer. b. To compute net head across turbine, input power (P_a) and output power (P_t), specific speed (N_S) and overall efficiency (η_t) of the turbine. c. To plot the main characteristics (i.e. constant head) curves for the Kaplan turbine, i.e. graphs of (i) unit discharge, unit output power and overall efficiency versus unit speed and (ii) overall efficiency versus specific speed.	02
12	**Study of operating characteristics of Francis turbine.** a. To measure (i) discharge (Q) supplied to the turbine with the help of triangular notch installed in the sump or any other equipment, (ii) pressures by pressure gauge at inlet of turbine and by vacuum gauge at outlet of runner, (iii) load on turbine by spring balance and attached loads on brake drum and (iv) speed of the turbine by tachometer. b. To compute net head across turbine, input power (P_a) and output power (P_t), specific speed (N_S) and overall efficiency (η_t) of the turbine. c. To plot the operating characteristics (i.e. constant speed) curves	02

	for the Francis turbine, i.e. graphs of (i) P_t and η_t versus Q and (ii) η_t versus P_t.	
13	**Study of performance of centrifugal pump** a. To measure (i) discharge (Q) supplied to the pump with the help of triangular notch installed in the sump or any other equipment, (ii) pressures by pressure gauge installed on delivery pipe at outlet of pump and by vacuum gauge installed on suction pipe at inlet of pump, (iii) time for one revolution of the energy meter for calculating input power to the pump. b. To compute manomerric head (H_m) developed by the pump, input power (P_a) to the pump and output power (P_t), specific speed (N_S) and overall efficiency (η_o) of the pump. c. To plot the operating characteristics (i.e. constant speed) curves for the centrifugal pump, i.e. graphs of manometeric head (H_m), overall efficiency (η_o) and output power (P_t) versus discharge (Q) and hence to find the discharge, manometeric head and the output power corresponding to the maximum efficiency.	02
14	**Visit to any hydropower plant.** a. The students should study layout of the hydropower plant, type of the turbines installed and their salient features and submit a detailed report of the visit. **Note:** The necessary permission and proof of the visit should be obtained from the concerned authorities and should be available with the head of the department of Civil Engineering.	One day

Note: The Term Work will consist of a laboratory journal consisting of minimum seven experiments/assignment.

Guidelines for ICA :

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

Guide lines for ESE:-

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

RECOMMENDED BOOKS:-

12. Dr. A. K. Jain, Fluid Mechanics, Khanna Publishers, Delhi, Edition – 2011.
13. Dr. K. Subramanya, Flow in Open Channels, Tata McGraw-Hill Education Pvt., Ltd., New Delhi, 3rd Edition-2012.
14. Dr. Jagdish Lal, Hydraulic Machines, Metropolitan Book Co. Pvt. Ltd., New Delhi.
15. Dr. P.N.Modi , Dr. S.M. Seth, Hydraulic and Fluid Mechanics, Standard Publications, Delhi, Edition – 2011.
16. Dr. R.K.Bansal, A Textbook of Fluid Mechanics & Hydraulic Machines, Laxmi Publications (P) Limited, 9th Edition, 2012.
17. Som S K and Biswas G – Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
18. John M. Cimbala, Yunus A. Cengel – Fluid Mechanics : Fundamentals and Applications, McGraw-Hill Higher Education. Second Edition 2010.

ENVIRONMENTAL ENGINEERING -I (LAB)

The basic objective of this syllabus is to train the students in methods of examination of waters.

Experiment No.	Objective	Books recommended
1	Determination of different forms of alkalinity, and acidity	Standard Methods for examinations of waters and wastewaters, APHA publication.
2	Determination of Solids (TS, TDS, SS, FS, VS).	
3	Determination of Turbidity and optimum dose of coagulant	
4	Determination of Total and mineral acidity	
5	Determination of hardness in water, classification as Carbonate and Non-carbonate hardness.	
6	Determination of Chlorine demand of water	
7	Determination of Fluoride Content	
8	MPN Test	
9	Plate count test	
10	Determination of nitrate in water.	

It is expected that the students should collect the real samples as per standard protocols and do the labeling etc. The samples must be preserved as per protocols. The chemical solutions should be prepared by the students themselves. They must understand the weighing methods, concepts of normality, solution preparation etc. They should learn to preserve the chemicals. They must now the primary and secondary chemicals and must know the methods of standardization of secondary chemicals. The titrations should not be done by a batch of more than two students. The titration protocols like pilot reading and concurrent readings etc. They must also learn the general laboratory protocols of chemistry labs. They must be familiar with the safety norms.

In addition to the experiments, the students should do site visits and assignments as prescribed by the curriculum.

General Objectives:

The basic objective of this syllabus is to make aware the students of the importance of water purification and must know the methods used for purifying the water to make it fit for drinking purpose as per the standards. The student should be aware about public health engineering principles.

Learning outcomes:

1. An ability to apply scientific and engineering principles as well as contemporary technology to the discipline.

2. An ability to design and conduct experiments, as well as to analyze and interpret data, in several areas which can include air quality and resources, water and land quality and resources, energy systems and environmental and human health impacts.

3. An ability to identify, formulate and solve engineering problems and to design a system, component, or process to meet desired needs.

4. An ability to convey technical material through oral presentations and written communications.

5. A knowledge of contemporary and emerging environmental issues and a recognition of the need for, and an ability to engage in, life-long learning.

6. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice with an integrated understanding of professional, societal, and ethical responsibilities and the importance of, and role for, multidisciplinary teams in professional practice.

RECOMMENDED BOOKS:-

1. Physici-chemical processes for water quality control by Walter J Weber, Wiley Inter-science Publications.
2. Garg S.K., "Water Supply Engineering", Khanna Publisher, New Delhi
3. Manual on Water Supply & Treatment, Central Public Health & Environmental Engineering, Organization, Ministry of Urban Affairs, Government of India
4. Therous, Eldridge & Mallmann, "Laboratory Manual for Chemical & Bacteriological Analysis of Water & Sewage", Agro Botanic Publisher, India
5. Laboratory Manual for Environmental Quality Testing, Environmental Protection Research Foundation, Sangli.

TESTING OF MATERIAL-I LAB

Teachers and Examiners should follow the following guidelines.

1. Teacher should facilitate following laboratory experiments/assignment:

Sr No.	Name of experiment	Lab hours required
1	**Concrete Mix Design** By I S Method.	06
2	**Concrete Mix Design** By IRC method.	06
3	**Non destructive testing** Rebound hammer test: To find compressive strength of concrete with rebound hammer.. To determine relation between rebound number and compressive strength of concrete.	02
4	**Non Destructive testing** Ultrasonic Pulse velocity test: To assess the quality of concrete by the Ultrasonic Pulse velocity test.	02
5	**Determination of Modulus of Elasticity of Concrete**.	02
6	**Effect of admixtures on concrete strength** To determine the effect of mixing admixtures on the strength of concrete at different time intervals i) Surkhi or flyash. Or ii) Gypsum or plaster of paris or iii) calcium chloride and sodium chloride	02
7	**Experimental investigation of effect of aggregate gradation and fineness on concrete properties.** To determine effect of fineness of sand and aggregate gradation on various properties of concrete.	02
8	**Compressive strength of Paver blocks**	02
9	**Compressive strength of Solid/ Hollow blocks**	02
10	**Site Visit** visit to civil engineering project/ready mix concrete plant should be arranged. **Note:** The necessary permission and proof of the visit should be obtained from the concerned authorities and should be available with the head of the department of Civil Engineering.	One day

Note: The Term Work will consist of a laboratory journal consisting of minimum five experiments and one site visit report.

Guidelines for ICA :

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

RECOMMENDED BOOKS:-

1. M L Gambhir Neha Jamwal : Building & construction materials lab manual : McGraw Hill Education (India) Pvt. Ltd.
2. Dr. Janardan, Jha, Engineering Materials, Khanna Publishers
3. R. K Rajput, Engineering Materials, S. Chand
4. Parbin Singh, Civil Engineering Materials, S. K.Kataria & Sos New Delhi.
5. Dr. A. V. Narasimha Rao, Fundamentals of Soil Mechanics, University Science press.
6. S.K. Duggal, Building Materials, New Age International Publishers.
7. M. S. Shetty, Concrete Technology, S Chand Publication.
8. M. L. Gambhir, Concrete Technology, TMH Publication.
9. S. V. Deodhar, Concrete Technology, Central Techno Publication
10. N.V. Nayak & A.K. Jain, Concrete Technology, Narosa Publishing House Pvt. Ltd.
11. Kulkarni P.D. Ghosh, R.K. Phull Y.R., Concrete Technology, New Age International.
12. M.L. Gambhir, Concrete Manual, Dhanpat Rai & Co.

NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Third Year Engineering

(CIVIL)

Faculty of Engineering and Technology

Teacher and Examiner's Manual

TERM – VI

W.E.F 2014 – 2015

STRUCTURAL DESIGN – II

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

Teacher should facilitate learning of concepts of structural steel design through the use of the Indian Standard (IS 800:2007) design code. The primary course objective is to equip the students with the tools necessary for designing steel structures, its components and to familiarize them with the relevant ntional design code.

UNIT – I

Teacher should facilitate learning of use of Indian Standard (IS 800:2007) design code, types of connections, etc.

Sr. No.	Topic	Lecture required	Reference No
1.	**A. Introduction:** Types of steel structures, grades of structural steel, various rolled steel sections, relevant IS specifications such as IS 800-2007, IS:808-1989, IS:875 part I to III & V, SP: 6(1), SP: 6(6), IS:4000-1992, codes for welded connections. Limit state method of design for strength and serviceability, partial safety factor for load and resistance, various design load combinations.	03	1, 2, 3 & 4
	B. Types of Connections: Strength of bolted & welded Connections, Design of connections subjected to Axial Forces & Moments. Beam to beam & beam to column connection (framed connections)	04	1, 2, 3 & 4

UNIT – II

Teacher should facilitate learning of analysis & design of tension & compression member.

Sr. No.	Topic	Lecture required	Reference No
2.	**A. Tension member:** Behaviour, Modes of failure – Yielding of cross-section, Rupture, block shear. Design of single and double angle sections with gusset plate with bolted and welded end connections.	04	2, 3, 4 & 5
	B. Compression member: Behaviour – effective length, slenderness ratio, Modes of failure- failure with full strength, local buckling, torsional buckling. Classification of cross sections, Buckling curves, Design of compression members with bolted and welded connection using single and double angle sections.	04	2, 3, 4 & 5

UNIT – III

Teacher should facilitate learning of analysis & design of built-up column & roof truss.

Sr. No.	Topic	Lecture required	Reference No
3.	**A. Design of built-up column:** Built up Column. Design of lacing. Introduction to battened column, design of connections.	04	2, 3, 4 & 5
	B. Roof truss: Design of members for DL, LL and WL, detailing of typical joints and supports.	04	3, 4, 5 & 6

UNIT – IV

Teacher should facilitate learning of analysis & design of flexural members & column bases.

Sr. No.	Topic	Lecture required	Reference No
4.	**A. Flexural member**- Laterally supported beams using single rolled steel section with and without flange plate, strength in flexure, low and high shear, check for deflection. Secondary and main beam arrangement for floor of a building, design of beam to beam and beam to column connections using bolt / weld. Design of purlin.	04	2, 3, 4 & 5
	B. Column bases: Column bases under axial load: design of slab base, gusseted base	04	2, 3, 4 & 5

UNIT – V

Teacher should facilitate learning of analysis & design of compound beams & welded plate girder.

Sr. No.	Topic	Lecture required	Reference No
5.	**A. Compound beams:** Design of compound beams	02	2, 3, 4 & 5
	B. Design of welded plate girder: Design of cross section, curtailment of flange plates, stiffeners and connections	06	3, 4, 5 & 6

RECOMMENDED BOOKS:-

1. Subramanian N.,Design of Steel Structures., Oxford University Press, New Delhi, 2008
2. Shah V. L. & Gore ,Limit state design of Steel Structure, Structures Publication, Pune, 5th Edition.
3. Duggal S. K.,Limit State Design of Steel Structures, Tata Mc Graw Hill publishing company Ltd., New Delhi, 3rd Edition, 2009
4. Bhavikatti S. S ,Design of Steel Structure by Limit State Method as per IS: 800- 2007., I K International Publishing House, New Delhi, 3rd Edition
5. Ram Chandra, Design of Steel Structures Vol.I & Vol.II, Standard Book House, New Delhi, 10th Edition, 2011

THEORY OF STRUCTURE-II

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

Unit – I

Teacher should facilitate learning of basic of (i) Types of structures, static and kinematics indeterminacy, and (ii) Use of slope and deflection method to analyze indeterminate structure.

1.	A. Theory Part		Lecture required	Reference No
	a	Types of skeletal structures, static and kinematics indeterminacy	1	3
	b	Equilibrium and compatibility conditions, stress-strain relations, force-displacement relations. Concept of linear /non-linear structures. Energy theorem, Miller Breslau principle, concept of complementary energy, Fundamental concept of Force and the Displacement method of analysis.	2	3
	B. Slope deflection method			
	a	Applied to continuous and rigid jointed frames, transverse and rotational yielding of supports.(up to three unknown).	5	1&2

Unit – II

Teacher should facilitate learning of concept of finding forces in members of trusses and deflection for determinate and redundant trusses.

2.	A. Moment Distribution Method		Lecture required	Reference No
	a	Applied to continuous beams and rigid jointed rectangular frames, transnational and rotational yielding of supports.	6	2 & 3

		B. Approximate Analysis of Multistory Frames		
	b	Vertical and lateral loads, substitute frame, portal frame and cantilever method.	2	1 & 3

Unit – III

Teacher should facilitate learning of basic concepts of flexibility method applied to fixed, continuous beams and frames also to draw SFD & BMD for same under different loading conditions.

3.		Flexibility Method	Lecture required	Reference No
	a	Fundamental concept of flexibility	1	5,6&7
	b	To study generation of flexibility matrix	1	5,6&7
	c	Analysis of continuous beams using flexibility matrix	3	5,6&7
	d	Analysis of continuous frames using flexibility matrix	3	5,6&7

Unit – IV

Teacher should facilitate learning of basic concepts of stiffness method applied to fixed, continuous beams and frames also to draw SFD & BMD for same under different loading conditions.

4.		Stiffness Method	Lecture required	Reference No
	a	Fundamental concept of Stiffness	1	2
	b	Matrix formulation for stiffness methods	1	1 &3
	c	Analysis of continuous beams using flexibility matrix	2	1 & 4
	d	Analysis of continuous frames using flexibility matrix	3	3

Unit - V

Teacher should facilitate learning of concept of calculation of shape factor, study of collapse mechanism, formation of plastic hinges etc.

5.		A. Plastic Theory	Lecture required	Reference No
	a	Basic concepts of plastic analysis of steel structures	1	1
	b	Calculation of shape factor	3	2
	c	Collapse mechanism, upper bound and lower bound theories	1	1,2&3
	d	Application to continuous, fixed and single bay single storey rectangular frames.	3	1,2&3

RECOMMENDED BOOKS:-

1. Punmia B. C. – Theory of Structure, Laxmi Publication.
2. Bavikatti S. S. - Structural Analysis, New Age Publicatio.
3. Ramamruthum S. Theory of Structure, Dhanpat Rai & Sons Publication.
4. Pandit & Gupta -Structural Analysis, Tata McGrawHill,Pub. Co.Ltd ., New Delhi
5. Wang C.K.-Intermediate structural analysis, McGraw Hill, New York.
6. Kinney- Streling J. Indeterminate structural Analysis, Addition Wesley.
7. Reddy C.S.-Basic Structural Analysis, Tata McGraw Hill Pub. Co. New Delhi.
8. Weaver W & Gere J.M-Matrix Method of framed Structures CBS Publishers & Distributors, Delhi.
9. Ghali A & Neville M. Structural Analysis- A Unified classical and matrix Approach, Chapman and Hall, New York.
10. Vaidyanathan & Perumal – Theory of Structure Vol. I & II, Laxmi Publication.
11. Negi L. S. & Jangid - Theory of Structures, Tata McGraw Hill Pub. Co. New Delhi.

GEOTECHNICAL ENGINEERING I

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

Unit - I

Teacher should facilitate learning of soil as construction material and properties of soil for civil engineering interest.

1.			Lectures required	Reference No.
	a	**Soil as Engg. Material:** Origin and formation of soil, geotechnical problems, volume-weight relationships, three phase system, definitions, functional relationships.	04	1, 3, 5, 8
	b	**Geotechnical Properties:** Index properties, engineering properties, Atterberg's limits, sieve analysis and its classification systems, and identification of soil.	04	1, 3, 5, 6, 7, 8

Unit – II

Teacher should facilitate learning of stresses in soil in open and underground conditions and soil compaction and stabilization.

2.			Lectures required	Reference No.
	a	**Stresses in soil**: Geostatic stresses, Boussinesq's Theory, point load, circular load, pressure bulb and its significance, Introduction to Westergaard's theory and Newmark's chart, stress strain relationship soil modulus, elastic settlement.	04	1, 3, 5, 6, 7
	b	**Soil Compaction and Stabilization:** Methods of Compaction, M.D.D. and O.M.C., standard proctors test, heavy compaction test, Concept of stabilization and its methods.	04	1, 3, 5, 6, 7

Unit – III
Teacher should facilitate learning of consolidation of soil and flow of water through soil.

3.			Lectures required	Reference No.
	a	**Consolidation Theory**: Terzaghi's theory, consolidation test, rate of settlements, Normal consolidated and over consolidated deposits, Pre consolidation pressure.	05	1, 2, 3, 5, 7
	b	**Flow of water through soils**: soil water, capillarity, Darcy's law, laboratory measurement of permeability, simple field measurement, flow net, its construction and uses, seepage force, quick sand, critical gradient.	04	1, 2, 3, 5, 7

Unit – IV
Teacher should facilitate learning of shear resistance in soil and measurement of shear strength.

4.			Lectures required	Reference No.
	a	**Shear resistance in soil**: Pore pressure and effective stresses failure theories, Mohr stress circle, Mohr's Coulomb's failure theory, law of shear strength.	03	1, 2, 3, 5, 7
	b	**Measurement of Shear Strength:** Direct shear test, Tri-axial test, Unconfined compression test, Vane shear test, factors affecting the shear strength, effect of drainage conditions.	04	1, 2, 3, 5, 7

Unit – V
Teacher should facilitate learning of earth pressure and determination of earth pressure.

5.			Lectures required	Reference No.
	a	**Introduction to Earth Pressure:** Introduction, Rankine's state of Plastic Equilibrium in soils, Active and Passive states due to wall movement, Earth	03	1, 3, 4, 7, 9

		Pressure at rest.		
	b	**Earth Pressure determination:** Rankine's Theory-Earth pressure on Retaining wall due to submerged backfill, Backfill with uniform surcharge, backfill with sloping surface, layered backfill. Coulomb's Wedge theory, Rebhann's and Culmann's graphical method of determination of earth pressure.	04	1, 4, 7, 9

RECOMMENDED BOOKS:-

1) Dr. B.C.Punmia, Soil Mechanics and Foundation Engineering, Laxmi Publications,16th Edition 2005.

2) Gulhati and Datta , GeoTechnical Engineering, 2000 4th Edition,Tata McGraw Hill.

3) Dr. Alam Singh, Soil Engineering in Theory and Practice (Vol.II), CBS Publication,2006 2nd Edition Delhi.

4) Dr. Alam Singh, Modern Geotechnical Engineering & Foundation, CBS Publication, Delhi.

5) Ramamurthy T.N. and Sitharam T.G., GeoTechnical Engineering,5th Edition,S.CHAND publication.

6) Venkatramaiah C., Geotechnical Engineering,2013 4th Edition.

7) V. N. S. Murthy, Soil Mechanics and Foundation Engineering, Saitech Publications.2004 1st Edition.

8) K. R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers and Distributors, New Delhi.2010 7th Edition.

9) Taylor, D. W., Fundamentals of Soil Engineering, John Wiley & Sons

10) K. Terzaghi, Soil Mechanics in Engg. Pracice, John Wiley & Sons

11) Relevant Indian Standard Specifications & Codes, BSI Publications, New Delhi.

INFRASTRUCTURAL ENGINEERING II

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

Unit – I
Teacher should facilitate learning of Highway planning, surveys for planning, highway geometric design, camber super elevation etc.

1.			Lectures required	Reference No.
	A	**Highway Planning and Development:** Highway planning in India, development, rural and urban roads, road, departments in India, road classification, road authorities i.e. IRC, CRRI, NHAI, etc., Financing of road projects, road safety audit.	2	1,2,3,4
	B	**Field Surveys:** Reconnaissance, aerial surveys, location surveys, location of bridges. Highway alignment: Basic requirements of an ideal alignment and factors controlling it, special requirements for hill roads.	3	1,2,3,4
	C	**Highway Geometric Design:** Topography and physical features, cross section elements like carriageway width, formation width, right of way, etc., friction, Light reflecting characteristics, roughness, camber, sight distances, horizontal alignment, design speed, super-elevation, transition curve, gradients.	3	1,2,3,4

Unit – II
Teacher should facilitate learning of; different road materials, quality testing, types of road, construction method, pavement design etc.

2.			Lectures required	Reference No.
	A	**Road Materials:** Aggregates and their types, physical and engineering properties, Fillers, bitumen, characteristics, emulsions and cutbacks, basic tests on all materials, soil investigation, test on soil; CBR, plate load test.	3	1,2,3,4
	B	Construction of Roads: Stabilized earth, Gravel roads, W.B.M. roads, High Cost Roads: bituminous roads, cement concrete roads. Highway Drainage: Surface and sub-surface drainage arrangements,	2	1,2,3,4

			Lectures required	Reference No.
	C	**Highway Pavements:** Design of Flexible (G.I. method and CBR method using IRC recommendations) and rigid pavements (Westergaurd wheel load analysis), Maintenance & Strengthening of pavements.	3	1,2,3,4

Unit – III

Teacher should facilitate learning of Traffic study, traffic control devices, traffic simulation, road side development, mass transport & its advantages etc.

3.			Lectures required	Reference No.
	A	**Traffic Engineering:** Road user characteristics, vehicular characteristics, traffic flow characteristics, speed, traffic volume studies, parking studies - definition, purpose, types, survey methods. Accident studies - purpose, types, causes, collision diagram, condition diagram, preventive measures	3	1,2,3,4,9
	B	**Traffic control devices**: pavement marking, signs, signals, Traffic management, various types of intersection and their design criteria, Traffic Simulation & it's advantages, **Roadside Developments:** Arboriculture, street lighting.	3	1,2,3,4,9
	C	**Advanced Urban Transport Technology:** Classification, mass and rapid transit system, introduction to intelligent transportation System (ITS), electronic toll Collection.	2	1,2,3,4,9

Unit – IV

Teacher should facilitate learning of Bridge site investigation, classification of superstructures, construction & maintenance of bridges, types of bearings etc.

4.			Lectures required	Reference No.
	A	**Bridges:** Site investigation, waterway calculations, scours depth, afflux, and economic span	2	5,6
	B	**Classification & suitability:** Classification of superstructures with respect to structural behavior and material used types of substructures, flooring joints, movable bridges, and temporary bridges.	2	5,6

		Construction methods & Maintenance: Methods of erection of various types of bridges, testing and strengthening of bridges.	2	5,6
	C			
	D	Bridge Bearings & Foundation: Suitability for each type of bridges	2	5,6

Unit – V

Teacher should facilitate learning of tunneling, open cut, tunneling in hard & soft rocks, safety during tunneling etc.

5.			Lectures required	Reference No.
	A	Introduction to Tunneling: Need, classification, advantages and disadvantages of tunnels compared to open cuts, shape and size of tunnel shafts, pilot tunnels, Alignment of Tunnel.	2	7,8
	B	Tunneling in hard rock: Meaning of the term 'Faces of Attack', Mucking, methods of removal of muck, heading and benching method, drilling-patterns, blasting, tunnel lining(rock bolting and strata anchoring), methods of Ventilation, Lighting and aspects of drainage, Dust control, Safety in tunnel construction	3	7,8
	C	Tunneling in soft materials: mucking, forepoling and shield methods, needle beam method, modern tunneling methods.	2	7,8

RECOMMENDED BOOKS:

1. L. R. Kadiyali, N B. Lal, Principles & practice of Highway Engineering, Khanna Publication, 2005.
2. Khanna & Justo, Highway Engineering, Nemchand Bros
3. Rangwala, Highway Engineering, Charotar
4. K. L. Bhanot & S. B. Sehgal, Highway Engineering & Airport
5. S. P. Bindra, Bridge Engineering, Khanna Publication
6. S. Ponnuswamy, Bridge Harbour.
7. Rangwala, Tunnel Engineering,Charotar
8. S. C. Saxena, Tunnel Engineering,Charotar
9. L. R. Kadiyali, Traffic Engineering & Transport Planning, Khanna Publishers

CONSTRUCTION MANAGEMENT – II

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

Unit - I

Teacher should facilitate learning of various Acts and Laws, safety measures while demolishing of building and material handling

1.	Introduction to Acts & Laws. Safety measures taken at construction activities	Lecture required	Reference No
a	Important Acts and Laws related to Constructions Industry- Factory act, The Employees Provident Fund Act,	01	4,9,10
b	Minimum wage Act, Workman Compensation Act, Indian Trade Union Act, arbitration act,	02	4,9,10
c	Safety measures in handling of building materials, construction of elements of building,	01	10
d	Demolition of buildings, hot bituminous works, scaffolding, formwork and other equipments, excavation.	02	10
e	Causes of accidents and preparing accidents report.	01	10

Unit – II

Teacher should facilitate learning of Material management systems at construction site

2.	Introduction to material management, quality control and supervision at site	Lecture required	Reference No
a	Materials management, its aims and functions, inventory analysis, inventory models,	01	3,4,6,10
b	ABC analysis, inventory management, buffer stock, lead time, EOQ.	02	4,10
c	Material requirement, planning, market research, system of purchase of materials, stock of material at site	03	4,7,9

			Lecture required	Reference No
	d	MAS account. supervision and quality control, concept of quality	01	4,5,9
	e	Stages of control, measures of control, quality control management, introduction to ISO 9000 and ISO 14000.	01	4,5,9

Unit – III

Teacher should facilitate learning of contract and tendering system in the construction industry.

3.	Introduction to Study of Contact and Tendering procedure with various documents in tendering systems and their methods		Lecture required	Reference No
	a	Contract, essentials, types, registration and law of contract, free consent,	01	6,7,8
		Contract documents, performance of contract, breach of contract, advances to contractor	01	6,7,8
	b	bills of contract and payments , subletting , inspection of works, tender, tender notice ,	02	6,7,8
	c	Various terms used in tender notice such as SD, EMD, estimated cost,	01	6,7,8
	d	Time period of work ,cost of tender form, invitation of tender, concept of e-tendering, time schedule of calling tender	02	6,7,8
	e	Tender documents two envelopes system, scrutiny and acceptance , revocation of tender, extra items	02	6,7,8
	f	Additions and alterations , defect liability , liquidated and un-liquidated damages , escalation of rates, work order	01	6,7,8

Unit – IV

Teacher should facilitate learning of pile driving equipments, Crushers and equipments used in ready mix concrete plants with all details.

4.	Introduction to Pile driving, crushers and ready mix concrete plants		Lecture required	Reference No
	a	Pile driving Equipments:- Pile hammers, drop, single acting steam, double acting steam, differential acting steam, diesel, vibratory , hydraulic hammers , sonic hammers, selection of pile driving hammers.	03	1,2,4
	b	Crushers – types, primary, secondary, tertiary crushers, jaw, gyratory, cone crushers, hammer mills, roll crushers, rod and ball mills Screening aggregate, revolving, vibrating screens	02	1,2,4
	c	Ready mix concrete plants: - central concrete batch plant, portable concrete batch plant, ready mixed concrete – central mixed , shrink mixed, truck mixed concrete, concrete pumps.	03	1,2,4

Unit - V

Teacher should facilitate learning of compacting and hoisting equipments selection criteria and properties

5.	Introduction to various material used in construction		Lecture required	Reference No
	a	Compacting Equipments:- Types of compacting equipments. Such as tamping rollers, smooth wheel rollers, pneumatic tired rollers,	03	1,2,4
	b	Hoisting equipments: Cranes: Classification, derrick crane, mobile crane, Tower crane, Hydraulic crane	03	1,2,4
	c	Overhead or gantry crane, use of cranes in steel construction, use of cranes in concrete construction and safety in crane operation.	01	1,2,4

RECOMMENDED BOOKS:-

1) R.L.Peurifoy - Construction planning, Equipments and Methods.
2) Mahesh Verma - Construction equipments and its planning and application, Vikas publication
3) U.K. Shrivastava - Construction planning and Management, 3rd edition 2005 reprint 2013
4) S.V.Deodhar - Construction equipment and job planning,Khanna publishers,4th edition 2010 reprint2012.
5) Chitkara - Construction Project Management, TMH,NewDelhi,2009
6) B.N.Dutta - Estimating and Costing, UBS Publishers
7) M.Chakroborty - Estimating and Costing, EWP
8) B.S.Patil - Estimating and Costing -Vol-1& 2, Orient Blackson
9) Seetharaman – Construction Engineering and Management, Umesh Publication
10) P.S.Gahlot & B.M.Dhir – Construction Planning & Management-2010

STRUCTURAL DESIGN – II LAB

LAB COURSE CONTENT

Teacher should facilitate learning following lab experiments:

Sr. No.	Name of Project	Lab hours required
1.	**Design of roof Truss**	
	a) Load analysis-Deal load, Live load, Wind load as per IS: 875 part I to III	03
	b) Design of various components roof truss by IS 800:2007	03
	c) Detailing & drawing of roof truss.	02
2.	**Design of an industrial building**	
	a) Analysis of industrial building: Calculations of member forces.	02
	b) Design of main beam & secondary beams, connections, columns, column bases.	03
	c) Detailing & drawing of various components of industrial building.	03
3.	**Design of welded plate Girder**	
	a) Analysis of welded plate girder- Calculation of maximum shear force and maximum bending moment.	04

	b) Design of web plate for shear, design of flange plate for bending moment, design of web stiffeners, design of intermediate stiffeners, design of bearing stiffeners, curtailment of flange plate	04
4.	**A report on at least one site visit.**	
	a) A site visit report shall include all details of site such as types of structures & its components, connection details, differtnt rolled steel sections used, &photographs of different structural components, etc.	02

Drawing shall be on half imperial sheets. At least one sheet of above 3 designs shall be in A3/A4 size sheets using drafting software.

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 drawing sheets 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. Subramanian N.,Design of Steel Structures., Oxford University Press, New Delhi, 2008
2. Shah V. L. & Gore ,Limit state design of Steel Structure, Structures Publication, Pune, 5th Edition.
3. Duggal S. K.,Limit State Design of Steel Structures, Tata Mc Graw Hill publishing company Ltd., New Delhi, 3rd Edition, 2009
4. Bhavikatti S. S ,Design of Steel Structure by Limit State Method as per IS: 800- 2007., I K International Publishing House, New Delhi, 3rd Edition
5. Ram Chandra, Design of Steel Structures Vol.I & Vol.II, Standard Book House, New Delhi, 10th Edition, 2011

GEOTECHNICAL ENGINEERING – I LAB

Teacher should facilitate learning of following lab experiments

Sr. No.	List of Practical / Assignments	No. of lab hours required
Group A) Any **SEVEN** experiments out of following		
1)	Specific gravity determination by voluminometer/ pychnometer	2
2)	Sieve analysis and particle size determination or hydrometer analysis.	2
3)	Determination of liquid limit and plastic limit	2
4)	Determination of shrinkage limit	2
5)	Determination of MDD and OMC by Proctor's test.	2
6)	Field density by core cutter method, sand replacement method.	2
7)	Determination of co-efficient of permeability by constant head or by variable head permeameter	2
8)	Determine strength of soil by Direct shear test	2
9)	Determine strength of soil by Unconfined compression test	2
10)	Determine strength of soil by Vane shear test	2
11)	Determine strength of soil by Tri- axial test	2
12)	Determine strength of soil by C.B.R. test or Consolidation test	2
13)	Differential free swell test or swelling test.	2
Group B) Any **ONE** assignments out of following		

1)	Any one of the following assignments using software / programming
	    a) Classification of Soils.
	    b) Construction of Pressure bulb.
		4

2)	Assignments on the following topics a) Rebhann's and Cullman's graphical method for determination of	4

	earth pressure. b) Solution of problems on shear strength parameters using graph.	

RECOMMENDED BOOKS:

1) Dr. B.C.Punmia, Soil Mechanics and Foundation Engineering, Laxmi Publications,16th Edition 2005.
2) Gulhati and Datta , GeoTechnical Engineering, 2000 4th Edition,Tata McGraw Hill.
3) Dr. Alam Singh, Soil Engineering in Theory and Practice (Vol.II), CBS Publication,2006 2nd Edition Delhi.
4) Dr. Alam Singh, Modern Geotechnical Engineering & Foundation, CBS Publication, Delhi.
5) Ramamurthy T.N. and Sitharam T.G., GeoTechnical Engineering,5th Edition,S.CHAND publication.
6) Venkatramaiah C., Geotechnical Engineering,2013 4th Edition.
7) V. N. S. Murthy, Soil Mechanics and Foundation Engineering, Saitech Publications.2004 1st Edition.
8) K. R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers and Distributors, New Delhi.2010 7th Edition.
9) Taylor, D. W., Fundamentals of Soil Engineering, John Wiley & Sons
10) K. Terzaghi, Soil Mechanics in Engg. Pracice, John Wiley & Sons
11) Relevant Indian Standard Specifications & Codes, BSI Publications, New Delhi.

INFRASTRUCTURAL ENGINEERING II LAB

Teachers and Examiners should follow the following guidelines.

1. Teacher should facilitate following laboratory experiments/assignment:

Sr. No.	Name of experiment	Lab hours required
A	1. Penetration test To determine the consistency of Bituminous material and assess its suitability under different climatic conditions and type of construction.	02
2	2. Ductility of Bitumen To determine the ductility of given sample of bitumen and assess its suitability for its use in road construction	02
3	3. Softening point of Bitumen To determine softening point of bitumen / Tar	02
4	4. Flash & fire point To determine flash and fire point of bituminous material	02
5	5. Specific gravity of Bitumen To determine Specific gravity of bituminous material	02
6	6. Viscosity of Bitumen To determine Viscosity of bituminous material	02
7	7. Stripping value of road aggregates To determine the stripping value of aggregates and ascertain the suitability of road aggregates for bituminous road construction.	02
8	8. Bitumen extraction test(on premix sample) To determine quantity of bitumen in hot mix paving mixture and pavement sample.	02
B	Bituminous mix design Marshal Stability test To determine the optimum binder content of the bituminous material by Marshall method & determine Marshall stability of bituminous mixture.	02
C	Numerical based on Flexible Pavement Design Assignment	
D	Numerical based on Rigid Pavement Design Assignment	
E	**Site Visit** a. Visit to construction site of major road projects, hot mix plant etc.	One day

	should be arranged. **Note:** The necessary permission and proof of the visit should be obtained from the concerned authorities and should be available with the head of the department of Civil Engineering.	

Note: The Term Work will consist of a laboratory journal consisting of minimum five experiments and one site visit report.

Guidelines for ICA :

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

Guide line for ESE:

ESE will be based on term work submitted by the student. In ESE the student may ask to answer questions based on practical performed/ assignments. Evaluation will be based on performance in oral examination.

RECOMMENDED BOOKS:
1. L. R. Kadiyali, N B. Lal, Principles & practice of Highway Engineering, Khanna Publication, 2005.
2. Khanna & Justo, Highway Engineering, Charotar Publishers
3. Rangwala, Highway Engineering, Charotar Publishers,
4. Khanna S.K, Highway Materials And Pavement Testing, Nem Chand & Brothers-Roorkee
5. M L Gambhir Neha Jamwal : Building & construction materials lab manual : McGraw Hill Education (India) Pvt. Ltd.

TESTING OF MATERIAL II LAB

Teachers and Examiners should follow the following guidelines.

1. Teacher should facilitate following laboratory experiments/assignment:

Sr No.	Name of experiment	Lab hours required
A	1. Water Absorption by Burnt Brick / Fly ash bricks	02
2	2. Compressive strength of Brick/ Fly ash bricks	02
3	3. Abrasion test on tile	02
4	4. Transverse test on flooring / roof tile	02
5	5. Moisture content in timber	02
6	6. Bending/Flexural test on timber	02
7	7. Compressive strength of timber (load parallel to grain and perpendicular to grain and comparison of results)	02
8	**8.** Tensile strength, Bend/Re-bend test on tor Steel	02
B	Minimum **three** assignments / Study Report on following topics. 1. Study of High-Strength concrete design 2. Study of Polymer Modified Bitumen (PMB) 3. Study of Crumb rubber Modified Bitumen (CRMB) 4. Study of New Building Construction Materials 5. Study of Low-cost Building Construction Materials 6. Study of Eco-Friendly material	06

Note: The Term Work will consist of a laboratory journal consisting of minimum six experiments and three assignments.

Guidelines for ICA :

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

RECOMMENDED BOOKS:
1. L. R. Kadiyali, N B. Lal, Principles & practice of Highway Engineering, Khanna Publication, 2005.
2. Khanna & Justo, Highway Engineering, Nemchand Bros
3. Rangwala, Highway Engineering, Charotar Publication
4. M.S.Shetty, Concrete Technology, S Chand
5. M.L.Gambhir, Concrete Technology, TMH Publcation.
6. A.N.Neville, J.J.Books- Concrete Technology

7. R.S.Varshney, Concrete Technology-Oxford & IBH
8. Handbook of Low-Cost Housing, A.K.Lal, New Age International Publishers
9. Pacheco Torgal, Fernando et.al, Eco-efficient Construction & Building Materials, Springer
10. M L Gambhir Neha Jamwal : Building & construction materials lab manual : McGraw Hill Education (India) Pvt. Ltd.