

UNIVERSITY OF MUMBAI

No. UG/249 of 2010

CIRCULAR:-

A reference is invited to the Ordinances, Regulations and syllabi relating to the Bachelor of Engineering (B.E.) degree course vide this office Circular No.UG/60 of 2004, dated 24th February, 2004 and the Principals of the affiliated Colleges in Engineering are hereby informed that the recommendation made by the faculty of Technology at its meeting held on 9th December, 2009 has been accepted by the Academic Council at its meeting held on 27th July, 2010 vide item No. 4.1 and that, in accordance therewith, the revised syllabus of Fourth Year (Semester VII & VIII) of the B.E. Degree Course in branch of Civil Engineering is as per Appendix and that the same has been brought into force with effect from the academic year 2010-2011.

MUMBAI-400 032
12th August, 2010

L. R. Mane
Offg Registrar

To,

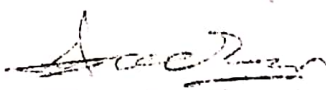
The Principals of the affiliated Colleges in Engineering.

A.C./4.1/27/07/2010

No. UG/249-A of 2010, MUMBAI-400 032 12th August, 2010

Copy forwarded with compliments for information to:-

- 1) The Dean, Faculty of Technology,
- 2) The Chairman, Board of Studies Civil Engineering.
- 3) The Controller of Examinations,
- 4) The Co-Ordinator, University Computerization Centre,


(D. N. Jadhav)
Ag. Deputy Registrar
(UG/PG Section)

Copy to:-

The Director, Board of College and University Development, the Deputy Registrar (Eligibility and Migration Section), the Director of Students Welfare, the Executive Secretary to the Vice-Chancellor, the Pro-Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative sub-center, Ratnagiri for information.

The Controller of Examinations (10 copies), the Finance and Accounts Officer (2 copies), Record Section (5 copies), Publications Section (5 copies), the Deputy Registrar, Enrolment, Eligibility and Migration Section (3 copies), the Deputy Registrar, Statistical Unit (2 copies), the Deputy Registrar (Accounts Section), Vidyanaagari (2 copies), the Deputy Registrar, Affiliation Section (2 copies), the Professor-cum-Director, Institute of Distance and Open Learning Education, (10 copies) the Director University Computer Center (IDE Building), Vidyanaagari, (2 copies) the Deputy Registrar (Special Cell), the Deputy Registrar, (PRO) the Assistant Registrar, Academic Authorities Unit (2 copies) and the Assistant Registrar, Executive Authorities Unit (2 copies). They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action Taken Report will be sent in this connection. The Assistant Registrar Constituent Colleges (Unit 2)

UNIVERSITY OF MUMBAI



**Revised Syllabus
for the
Final Year
(Semester VII & VIII)
of the
B.E. Degree Course
in
Civil Engineering**

(with effect from the academic year 2010 - 2011)

UNIVERSITY OF MUMBAI
SCHEME OF INSTRUCTIONS AND EXAMINATION
(RR-2007)

FOURTH YEAR ENGINEERING: (Civil Engineering)

Semester VII

	Subjects	No. of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory Paper	Term Work	Practical	Oral	Total
1.	Limit State Method for Reinforced Concrete Structures*	4	-	2	3	100	25	-	-	125
2.	Quantity Survey, Estimation and Valuation*	4	-	2	4	100	25	-	25	150
3.	Irrigation Engineering*	4	-	2	3	100	25	-	25	150
4.	Environmental Engineering-II	4	2	-	3	100	25	-	25	150
5.	Elective-I	4	-	2	3	100	25	-	25	150
6.	Project-A*	-	-	4	-	-	50	-	25@	75
Total		20	2	12	-	500	175	-	125	800

* Common to Construction Engineering

@ Seminar on project (Internal)

Semester - VIII

	Subjects	No. of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory Paper	Term Work	Practical	Oral	Total
1.	Design and Drawing of Reinforced Concrete Structures*	4	-	2	4	100	25	-	25	150
2.	Construction Engineering	4	-	2	3	100	25	-	25	150
3.	Construction Management	4	-	2	3	100	25	-	25	150
4.	Elective-II	4	-	2	3	100	25	-	25	150
5.	Project-B*	-	-	4	-	-	50	-	50#	100
Total		16	-	12	-	400	150	-	150	700

* Common to Construction Engineering

Presentation on project & Oral

FORTH YEAR ENGINEERING: (Civil Engineering)

List of Electives

Semester VII Elective-I (Lecture-4, Practical / Tutorial-2)	
1	Advanced Surveying *
2	Advanced Engineering Geology*
3	Applied Hydrology and Flood Control
4	Solid Waste Management
5	Systems Approach in Civil Engineering*
6	Risk and Value Management *
7	Advanced Structural Analysis
8	Structural Dynamics
9	Advanced Structural Mechanics
10	Advanced Foundation Engineering
11	Ground Water Hydrology
12	Pavement Subgrade & Materials
13	Air Pollution
14	Prestressed Concrete
15	Traffic Engineering and Control
16	Reinforced Concrete Repairs and Maintenance*
17	Advanced Computational Techniques

* Common to Construction Engineering

Semester VIII Elective-II (Lecture-4, Practical / Tutorial-2)	
1	Advanced Construction Engineering*
2	Rock Mechanics
3	Geographical Information System
4	Water Resources Engineering & Management*
5	Bridge Design & Engineering
6	Environmental Impact Assessment and Audit*
7	Appraisal & Implementation of Infrastructure Projects*
8	Disaster Management*
9	Pavement Design and Construction
10	Advanced Design of Steel Structures
11	Earthquake Engineering
12	Soil Dynamics
13	Building Services*
14	Design of Hydraulic Structures
15	Industrial Waste Treatment
16	Transportation planning and Economics
17	Advanced Repairs and Rehabilitation of Structures*

* Common to Construction Engineering

Class:-B E (Civil/Construction)		Semester VII	
Subject:- Limit State Method for Reinforced Concrete Structures			
Periods/week – each Period of 60 minutes duration	Lecture		
	Practical	04	
	Tutorial	-	
		02	
Evaluation System	Theory Examination	Hours 03	Marks 100
	Practical	-	-
	Oral	-	-
	Term Work	-	-
	Total		25
Detailed Syllabus		125	

Detailed Syllabus

Module	Topics	No. of Lectures
1	Ultimate Load Method: Brief introduction to fundamentals of ultimate strength theory: curved stress distribution, compressive stress block, simplified rectangular stress block as per Whitney's approach, ultimate moment of resistance of singly reinforced section and doubly reinforced sections.	05
2	Limit State Method: Introduction to limit state method of design as per IS 456 (latest edition): concepts of probability and reliability, characteristic loads, characteristic strength, partial safety factors for loads and materials, introduction to various limit states.	04
3	Limit State of Collapse - Flexure: Limit state of collapse in flexure, shear and Limit state of serviceability in deflection and cracking, design of singly and doubly reinforced rectangular and T sections for flexure, design of members in shear and bond, design of beam subjected to bending and torsion. Requirements governing reinforcement detailing.	16
4	Design of Slabs: Design of one way and two way slabs.	05
5	Limit State of Collapse - Compression: Limit state of collapse - compression for short and slender column. Members subjected to combined axial and uni-axial as well as biaxial bending. Development of interactive curves and their use in column design.	08
6	Design of Foundations: Isolated square and rectangular footings subjected to axial load and moments. Design of combined rectangular pad footings, slab beam type footing and strap footing	10

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Term work:-

Each student has to appear for at least one written test during the term. Assignments consisting of minimum twenty problems covering entire syllabus and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

	:	15marks
Assignments	:	10 marks
Written test (at least one)		

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Design of Reinforced Concrete Structures: Dayaratnam P, Oxford & IBH.
2. Limit State design - Reinforced Concrete: Jain A K, New Chand.
3. Limit State Design - Reinforced Concrete: Shah & Karve, Structure Publication, Pune.
4. Ultimate Strength Design for Structural Concrete: Arthur P D & Ramkrishnan V, Wheeler & Co. Pvt Ltd.
5. Limit State Theory for Reinforced Concrete Design: Huges B P, Pitman.
6. Reinforced Concrete: Warner R F, Rangan B C & Hall A S, Pitman.
7. Reinforced Concrete: H.J. Shah, Charotar Publisher.
8. Fundamentals of Reinforced Concrete: Sinha & Roy, S. Chand & Co. Ltd
9. Illustrated Reinforced Concrete Design: Dr. V.L. Shah & Dr. S.R. Karve, Structure Publication, Pune.
10. Reinforced Concrete Design: Wang, C. K., Salmon, C.G., and Pincheira, J.A , 7th Edition, John Wiley, 2007.
11. Reinforced Concrete Fundamentals: Ferguson, P.M., Breen J.E., and Jirsa J.O., 5th Edition, John Wiley & Sons, 1988.

Class:- B E (Civil/Construction)		Semester VII	
Subject:- Quantity Survey, Estimation & Valuation			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
Evaluation System		Hours	Marks
	Theory Examination	04	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Estimates: Various types, their relative importance, factors to be considered, complete set of Estimate. Approximate estimates: importance, purpose, different methods. Use of CBRI Equations for the same. Methods of preparation of estimates for projects such as i) Building R.C.C., Load bearing ii) Road	14
2	Measurements for various items: Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams	06
3	Material survey: Approximate estimates of requirement of various materials for building works, percentage breakup of the cost, cost sensitive index, market survey of basic materials	05
4	Specifications: types, requirements and importance, detailing of specifications for various items	03
5	Rate analysis: purpose, importance and necessity of the same, factors affecting, task work.	06
6	Tender: preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification, general and special conditions, termination of contracts, extra work and items, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc.	06
7	Valuation : different terms used, the role of a valuer, purpose and necessity of the same. Capitalised Value, Years purchase, sinking fund, depreciation, types of values, Purpose of valuation Different methods of valuation for i. open plots. ii. open plots with existing residential & commercial structures iii. lease hold properties Use of valuation tables and formulae	06
8	Introduction to Acts related to construction	02

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

The term work shall consist of the following:

- i. To find out the approximate estimate of a multistoried building by approximate method.
- ii. Detailed estimate of any FOUR of the following with the required material survey for the same.
 - a. An R.C.C. structure
 - b. a retaining wall
 - c. a factory building
 - d. a road work
 - e. an overhead and underground water tank
 - f. a load bearing structure
- iii. Assignments on rate analysis, market survey, specifications and simple estimates.
- iv. Detailed estimate of minor structure
- v. Bar bending schedule
- vi. Use of quantity survey software and use of worksheets / databases for some of the above assignments.
- vii. Assignments on Tenders, Contracts & Valuation

Each student has to appear for at least one written test during the term. The termwork detailed above and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least minimum passing in the term-work.

Recommended Books:-

1. Estimating, Costing Specifications & Valuation: M Chakraborty, M. Chakraborty, Kolkata.
2. Building & Engineering Contracts: B.S. Patil, University Press, Hyderabad.
3. Estimating & costing: B N Datta, UBS Publications
4. Relevant Indian Standard Specifications, BIS Publications
5. World Bank approved contract documents

Class:- B E (Civil/Construction)		Semester VII	
Subject:- Irrigation Engineering			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Introduction: Irrigation, water resources in India, need of irrigation in India, development of irrigation in India, impact of irrigation on human environment, irrigation systems: minor and major, command area development.	4
2	Water requirement of crops: Crops and crop seasons in India, cropping pattern, duty and delta. Quality of irrigation water. Soil water relationship: soil characteristics significant from irrigation considerations, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation. Methods of applying water to the fields: surface, sub-surface, sprinkler and drip irrigation.	8
3	Hydrology: Hydrologic cycle, rainfall and its measurement, streamflow measurement runoff process, factors affecting runoff, runoff hydrograph, runoff computations, flood discharge calculations, unit hydrograph, S-hydrograph.	8
4	Ground water and well hydraulics: Ground water resources, occurrence of ground water, methods of ground water exploration, well irrigation. Well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifer, aquifer tests, design of water wells.	6
5	Reservoir planning: Investigations, selection of site, zones of storage, storage capacity and yield, reservoir sedimentation.	4
6	Dams: Introduction, classification. Gravity dams: forces acting on gravity dam, modes of failure, stability analysis, design, galleries, joints, keys, water seals. Earth and rockfill dams: types, causes of failure, seepage analysis, stability analysis, design, rockfill dams. Arch and buttress dams: types. Spillways and other energy dissipating devices: types.	14

7	Distribution systems: Canal systems, alignment of canals, canal losses, estimation of design discharge. Bandhara irrigation Canal outlets: non-modular, semi-modular and modular outlets Waterlogging: causes, effects and remedial measures. Lining of canals: economics of lining. Drainage of irrigated land: necessity, methods. Canal regulation works. Cross drainage works.	8
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Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least seven assignments covering the entire syllabus and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Irrigation and Water Power Engineering: Dr. B.C. Punmia and Dr. Pande B.B.Lal, Laxmi Publications Pvt. Ltd. New Delhi.
2. Irrigation Water Resources and Water Power Engineering: Dr. P.N. Modi, Standard Book House. Delhi.
3. Irrigation Engineering and Hydraulics Structures: S. K. Garg, Khanna Publishers. Delhi.
4. Design of Irrigation Structures: S. K. Sharma, S. Chand and Co.
5. Theory and Design of Irrigation Structures: R. S. Varshney and R. C. Gupta, Nem Chand.
6. Irrigation and Water Resources Engineering: G.L.Asawa, New Age International Publishers.

Class:-B E (Civil)		Semester VII	
Subject:- Environmental Engineering – II			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	02	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Air Pollution: Definition of air pollution, major episodes, classification of air pollutants, units of quantification, sources of air pollution, natural & man made effects of air pollution on human health, animals. plants, properties. Global atmospheric change, green house effect, ozone depletion, carbon cycle. Effects of carbon dioxide, chlorofluorocarbons, green house gases, effects of temperature increase, emission control. Noise Pollution: Basic concepts, measurement, standards, effects on human health, and various control methods.	08
2	Sewage: Conveyance of Sewage: Sewers- shapes and materials of sewers, sanitary, storm and combined sewers, capacities and designs, appurtenances, maintenance of sewers. Sewage pumping: Consideration of the selection of pump and location of pumping stations.	04
3	Sewage Characteristics of sewage: Composition, chemistry of sanitary sewage, B.O.D., C.O.D., aerobic and anaerobic decomposition. Sewage Disposal: discharge of raw and treated sewage on land and water, standards for disposal, raw and treated sewage on land and water, limits of dilution. Self purification of streams: oxygen economy, sewage farming. Sewage treatment: aims, methods of treatments and various flow-sheets for preliminary, primary, secondary and, tertiary treatment, screens, grit chambers, primary and secondary clarifiers, disposal of screenings and grit. Biological treatment methods, principles, trickling filter operation, recirculation, activated sludge process and its modifications, hydraulic design of trickling filter and activated sludge process, sludge volume index, operational problems in activated sludge process and trickling filters, stabilization ponds Sludge digestion: Principles of anaerobic digestion, quantity and characterization of sludge, design of sludge digestion tanks, disposal of digested sludge, drying beds Low cost sanitation: Septic tanks and Imhoff tanks – principles, operation	28

	and suitability, design values, disposal of treated effluent.	08
4	Plumbing: Building water supply: Introduction, per capita supply, service connections from main, storage of water supply systems in a building, sizing of pipes, water meters Sanitary Fixtures and fittings: Introduction, classification of fixtures, soil fixtures, bathroom accessories, special accessories, fittings. Building Drainage System: Introduction, general principles governing building drainage, nature of drainage phenomena, systems of plumbing, design of pipes, primary & secondary branches, antisyphonic and vent piping, installation of pipes, testing of drains and pipes. Rain/Storm Water Drainage: Introduction, collection of run-off, piping system, storm water drainage, design considerations, hydraulic design, disposal of rainwater.	

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

List of Practicals

List of experiments on sewage samples:

1. Measurement of Noise Level
2. Measurements of air pollutants.
3. Plumbing Demonstration of accessories, fittings and fixtures
4. Determination of pH of sewage
5. Determination of Chlorides
6. Solids: Suspended solids, dissolved solids, total solids, volatile solids
7. Determination of Dissolved oxygen
8. Determination of Chemical oxygen demand(COD) of sewage sample
9. Determination of Biochemical oxygen demand(BOD) of sewage sample
10. To find Sludge volume index (SVI) of sewage sample
11. Measurement of Air Quality standard by High Volume Sampler.

Term work:-

Each student has to appear for at least one written test during the term. Reports on experiments performed as detailed above and the graded answer paper of term test shall be submitted as term work. A brief report on the visit to sewage treatment plant should also be included in the journal work. Demonstration of available software for design of water and sewage treatment plant and sewer network is to be done.

The distribution of term work marks will be as follows:

Reports on experiments performed	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and at least passing in the term-work.

Recommended Books:-

1. Water Supply and Sanitary Engineering: S.K.Hussain, Oxford & IBH Publication, New Delhi.
2. Manual on Water Supply and Treatment,(latest Ed.): Ministry of & Housing, New Delhi
3. Plumbing Engineering Theory and Practice: S.M. Patil, Seema Publication, Mumbai
4. Water Supply & Sewage: E.W.Steel, McGraw Hill, New York.
5. Water Supply & Sewage: T.J.McGhee, McGraw Hill, New York
6. Relevant Indian Standard Specifications, BIS Publications
7. CPHEEO Manual on Water Supply & Treatment
8. CPHEEO Manual on Sewage & Treatment
9. Sewage Treatment & Disposal & waste water engineering- Dr. P.N.Modi
10. Sewage Disposal & Air Pollution: Garg S. K., Khanna Publication
11. Air Pollution: M.N.Rao, Tata McGraw Hill, New Delhi.
12. Text book of Environment and Ecology, Pratibha Singh, Piyush Malaviya and Anup singh, A Learning Pvt Ltd., New Delhi

Class:-BE(Civil/Construction)		Semester-VII	
Subject:- Elective-I: Advanced Surveying		04	
Periods/week – each Period of 60 minutes duration	Lecture	02	
	Practical	-	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Modern Surveying Equipment: Data and equipment needed for engineering projects. Changing scene in surveying and mapping, map substitutes, use and advantage of modern surveying equipment in project. Modern surveying electronic equipment, their principles, constructions working and use – Electronic Theodolite, E.D.M. Instruments- Distomat, Total station. Application of lasers in distance and angular measurements. Introduction of electronic navigation and position fixing. Different systems and their characteristics.	05
2	Global Positioning System : Introduction to navigation and positioning, Geodesy; geospatial reference systems, overview of GPS; GPS segments, 2D and 3D positioning, GPS error sources and handling, GPS applications.	05
3	Geographic information system: Geographic Information System (GIS) – Definition of GIS, Geographical concepts and terminology, Components of GIS. Data acquisition, Raster and vector formats, scanners and digitizers. Advantages of GPS and GIS in the storage thematic information extracted from remotely sensed images.	05
4	Photogrammetry: Definition of photogrammetric terms, geometry of aerial and terrestrial photographs, aerial camera and phototheodolite, scales of photographs, tilt and height displacements , stereoscopic version and stereoscopes, height determination from parallax measurements, flight planning , maps and map substitutes and their uses.	06
5	Remote sensing: Introduction and definition of remote sensing terms, remote sensing system, principles of remote sensing, Interaction of EMR, Fundamentals of aerial photography, platforms and orbits, sensors, data products, principles of visual interpretation, principles and uses; thermal remote sensing, microwave remote sensing.	08
6	Image interpretation: Principles of interpretation of aerial and satellite images, equipments and aids required for interpretation, ground truth-collection and verification, advantages of multirate and multiband images, digital image processing; introduction, image enhancement techniques, digital image classification.	06
7	Field astronomy: Terms, coordinate systems, hour angle, right ascension, declination, altitude, azimuth: study of astronomical charts, determination of latitude and bearing by observation on the sun and polestar, time, standard time, local time, universal time, equation of time.	08

8	Hydrographic surveying: Uses ,Method of hydrographic surveys, mean sea-level, tide gauges, sounding equipments, location of soundings, the capacity of reservoir, stream gauging.	05
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Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

List of Practicals:-

At least THREE practicals shall be performed from the list given below.

1. Traversing using Total Station
2. Establishing Waypoints / Network using GPS receivers
3. Demonstration of GIS software
4. Measurement of Relief Displacement using Mirror Stereoscope

Term work:-

Each student has to appear for at least one written test during the term. Report on the practicals conducted, at least five Assignments covering entire syllabus and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

A report of practicals performed and assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and at least passing in the term-work.

Recommended Books:-

1. Higher surveying: A.M. Chandra New Age International publishers.
2. Higher surveying: B.C. Punamia, Ashok jain, Arun k. jain Laxmi publications (P), Ltd,
3. Geographic Information Systems and Science, Second Edition: Longley, Paul A., Michael F. Goodchild, David J. Maguire, David W. Rhind. 2005.. John Wiley & Sons, New York.
4. Modeling Our World: The ESRI Guide to Geodatabase Design: Zeiler, M. 1999,. ESRI Press, Redlands, California
5. GIS, Spatial Analysis, and Modeling: Maguire, D., M. Batty, and M. Goodchild. 2005. ESRI Press (G70.212 .G584 2005)
6. Global Positioning System: Signals, Measurements, and Performance, Second Edition (2006): Pratap Misra and Per Enge, Ganga Jamuna Press.
7. Remote Sensing Principles and Interpretation: Floyd, F. Sabins, Jr., Freeman and Co., San Francisco, 1978.
8. Remote Sensing and Image interpretation: Lillesand and Kiefer:, John Wiley, 1987, India.
9. A remote sensing perspective: Introductory Digital Image Processing:, John R. Jensen, Prentice Hall.
10. Imaging Radar for Resource Survey: Remote Sensing Applications: W Travelet, Chapman & Hall, London
11. Remote Sensing – Principles and Applications: B. C. Panda, Viva Book.

Class:-B E (Civil/Construction)		Semester VII	
Subject:-Elective-I : Advanced Engineering Geology			
Periods/week – each Period of 60 minutes duration	Lecture		
	Practical	04	
	Tutorial	02	
		-	
Evaluation System	Theory Examination	Hours	Marks
	Practical	03	100
	Oral	-	-
	Term Work	-	25
	Total	-	25
		150	

Detailed Syllabus

Module	Topics	No. of Lectures
1	Introduction Importance of geological studies in engineering investigations, precautions to avoid misleading conclusions likely to be drawn while interpreting drilling data with particular reference to RQD, case studies illustrating economics made possible by proper geological studies.	04
2	Engineering Geology of Deccan trap basalts. Factors affecting strength and water tightness, stability of cuts and ability to stand without support, significance of features like gas cavities, jointing, weathering, hydrothermal alteration, volcanic breccias, tachylytes, dykes, fractures, field structures of flows, stratigraphic sequence of flows etc. and their significance in civil engineering projects.	05
3	Dams Strength and water tightness of deccan trap rocks from foundation point of view, physical properties such as compressive strength, water absorption etc. of basalts, effect of weathering and hydrothermal alteration on engineering properties of rocks, deterioration of rock masses on exposure to atmosphere and suitable treatment for such rocks. Investigations for determining the foundation treatment for adverse geological features, determination of foundation levels/cutoff levels for dams, groutability of rocks, correction of adverse feature by grouting, purpose of consolidated and curtain grouting, determining depth and zones of grouting, relation of zones of grouting with height of dams, foundation treatment for fractures having different manifestations, jointed rocks, tachylytes and dykes. Erosion of tail channel as a factor in selecting site for spillway causes of rapid erosion from side spillways, geological conditions leading to erosion. Case histories.	08
4	Tunneling Methodologies of investigations for different types of tunnels for different purposes, location spacing, angles & depths of drill holes for different types of tunnels, difference in behaviour of basalts because of jointing as exemplified by compact basalts & amygdaloidal basalts. Difficulties introduced by tachylytes, volcanic breccias, tuffs, intertrappean beds, fractures, dykes, hydrothermal alteration, flow contacts unfavourable field characters. Computing structural discontinuities in rock masses, RQD,	08

	joint frequency index. RMR values, Q system, standup time. Selection & provision of protective measures such as guniting, rock bolting, shotcreting, steel supports depending on geological conditions. Suitability of TBM for tunneling. Case histories.	
5	Bridges Investigations for bridge foundations, computing SBC for bridge foundation based on nature & structure of rock, foundation settlements. Case histories.	04
6	Geology of soil formation Residual & transported soils. Rock weathering conditions favourable for decomposition & disintegration, influence of climate on residual & transported soils in the deccan trap area. Nature of alluvium of deccan trap rivers & its engineering character. Effect of deposition of calcium carbonate. Scarcity of sand in the rivers in deccan trap area.	05
7	Geophysical Investigations Seismic and electrical resistivity methods of explorations	04
8	Construction material Deccan trap basalts and sedimentary rocks as construction material. Use of compact basalt and amygdaloidal basalt as rubble for masonry and concrete making.	05
9	Earthquakes Terminology, Classification, Causes, Effects, Recording of an earthquake, Location of Epicenter, Earthquake problems in India.	05

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

List of Practicals

1. Logging of drill core, preparation of litho logs and interpreting drilling data, calculation of RQD and joint frequency index. Preparing geological cross sections from drill hole data and using them for designing of civil engineering structures.
2. Use of electrical resistivity method for determining depth of bed rock.
3. Study of geological aspects of an engineering projects and writing a report based on studies carried out during visit to civil engineering projects.

Term work:-

Each student has to appear for at least one written test during the term Reports on experiments performed as detailed above and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Reports on experiments performed

: 15 marks

Written test (at least one)

: 10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. PWD Hand Book, Engineering Geology, Government of Maharashtra
2. Text Book of Engineering Geology: R.B.Gupte, PVC Prakashan
3. Geology of India: D.H.Wadia, McGraw Hill, New Delhi.
4. Geology of India and Burma: M,S,Krishnan, CBS Publications
5. Engineering and General Geology: Parbin Singh, Kataria S. K., New Delhi
6. Test book of Engineering Geology: N.Chenna.Kesavulu
7. Principles of Geomorphology: Thornbury, W.D
8. Earthquake Geography and Management: Srivastav, H,N

Semester-VII			
Class:-BE(Civil)			
Subject:- Elective-I: Applied Hydrology and Flood Control			
Periods/week – each		Lecture	04
Period of 60		Practical	-
minutes duration		Tutorial	02
		Hours	Marks
		03	100
Evaluation System	Theory Examination		-
	Practical		-
	Oral		25
	Term Work		25
	Total		150

Detailed Syllabus		
Module	Topics	No. of Lectures
1	Introduction: Hydrological cycle, scope of hydrology, water budget equation, sources of data.	2
2	Precipitation: Measurement, rainfall records, missing data, mass curve analysis, station year method, depth - area - duration relationship, intensity - duration - frequency relationship.	5
3	Water losses: Evaporation, evapotranspiration, interception, initial loss, infiltration. Determination of water losses.	5
4	Streamflows: Stream gauging techniques, latest methods of measuring depths, current meter-types-calibration, mid section and mean section methods, rating curves.	4
5	Runoff: Factors affecting runoff, rainfall-runoff relationship, runoff estimation, droughts.	5
6	Hydrograph analysis: Characteristics, base flow separation, unit hydrograph, S-hydrograph, complex hydrograph, synthetic hydrograph, dimensionless unit hydrograph, instantaneous unit hydrograph.	10
7	Floods: Estimation, envelope curves, flood frequency studies, probability and stochastic methods, estimation of design flood, flood control methods, limitations, risk-reliability and safety factor.	5
8	Flood routing: Reservoir routing, channel routing.	5
9	Hydrological forecasting: General operation of flood forecasting, forecasting methods adopted in India, forecasting by unit hydrograph method.	2
10	Ground water hydrology: Yield, transmissibility, Darcy's law, Dupuit's theory of unconfined flow, steady flow towards fully penetrating wells (confined and unconfined) Unsteady flow towards wells: Jacob's curve and other methods, use of well function, pumping tests for aquifer characteristics, methods of recharge.	6

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. Assignments (on each module) consisting of theory and problems covering entire syllabus and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and at least passing in the term-work.

Recommended Books:-

1. Engineering Hydrology: K. Subramanya, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Hydrology: H. M. Raghunath, New Age International Publishers, New Delhi
3. Elementary Hydrology: V. P. Singh, Prentice Hall
4. Engineering Hydrology: Principles and practice: V. M. Ponce, Prentice Hall
5. Hydrology and Water Resources Engineering: K. C. Patra, Narosa Publishing House, New Delhi.
6. A Text Book of Hydrology: Dr. P. Jayarami Reddi, Laxmi Publications Pvt. Ltd. New Delhi.

Class:-B E (Civil)		Semester VII	
Subject:-Elective-I : Solid Waste Management			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Detailed Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Definition of solid waste Domestic: garbage, ashes, rubbish, dust, debris. Commercial: wastes from offices, shops and markets etc. Hazardous waste: household, industrial.	04
2	Sources of solid wastes : Household wastes. Waste from commercial establishments, offices, vegetable markets, fish and meat markets, stables. Solid waste from construction activities. Hospital wastes, dead animals.	05
3	Quantity, composition and properties of solid wastes : Per capita municipal solid waste. Quantity of industrial solid waste per unit produced. Compositions: physical, chemical and biological constituents. Sampling and characterization of solid wastes.	05
4	Collection, segregation, storage and transportation of solid waste : House to house collection, collection centers: location, sizes, types and maintenance. Transportation methods: manual, mechanical, methods with or without compaction, economy in transportation of waste, optimization of transportation routes.	05
5	Effects of solid waste on environment: effects on air, soil, water surface and ground, health hazards	04
6	Disposal of solid waste : Segregation, reduction at source, recovery and recycle Disposal methods : pen dumping, sanitary land filling, composting-anaerobic and aerobic, incineration, sea disposal, vermin-composting	08
7	Modern trends : Thermal, biological and chemical conversion technologies.	05
8	Industrial solid waste: Waste products during manufacture, filling and parking, operation of pollution control facilities, generation, minimization at source, recycling and disposal.	05
9	Introduction to hazardous waste: generation, minimization at source, treatment and disposal.	03

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student shall prepare a report on any industrial / hazardous / municipal solid waste comprising source, characterization, transportation, recycles, treatment and disposal.

Each student has to appear for at least one written test during the term. The report mentioned above, assignments and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Report and assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Integrated Solid Waste Management: Techobanglous, Thisen and Vigil, McGraw Hill International.
2. Hazardous Waste Management: Lagrega, Buckingham and Evans, McGraw Hill International.
3. Solid Waste Management in Developing Countries: A.D. Bhide, Nagpur publications
4. Environmental Pollution Control Engineering: C.S. Rao, Wiley Eastern, Manual of solid waste of management, CPHEEO

Class:-B E (Civil/Construction)		Semester VII	
Subject:-Elective-I : Systems Approach in Civil Engineering			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Concept of systems approach: system, boundaries of system, goals and objectives, optimality, mathematical models, objective function and constraints, problem solving mechanism, types of problems, modeling / problem formulation, sub-optimization, solution techniques, sensitivity analysis	06
2	Decision theory: classification of decision situations, decision tables and decision tree, criteria for decision making under certain, uncertain and risk conditions, utility theory	05
3	Time series analysis: variations in time series, trend analysis: method of moving averages, method of least squares	05
4	Index numbers: basic requirements of index numbers, constructing index numbers: using relatives, using aggregates	04
5	Linear programming: general nature of problem, formulation of problems, graphical method of solution, simplex method, dual, sensitivity analysis	07
6	Distribution models: transportation and assignment problems and their solutions	06
7	Queuing models: various situations, queue discipline and customer behaviour, single server model	06
8	Basic functions of inventory and inventory decisions, Inventory control model – economic order quantity	04
9	Simulation: general approach, Monte Carlo simulation, simple problems using hand calculations	05

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least two assignments and 3 problems on each of the topic and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Quantitative Techniques for Managerial Decisions: Shrivastava, Shenoy & Sharma, Wiley Eastern

Class:-B E (Civil/Construction)			Semester VII
Subject:-Elective-I : Risk and Value Management			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Detailed Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Risks: Definition, dynamic and static risk, uncertainty and risk	01
2	Risk and construction: Time, money and technology, the people and the risks, processes and risks, risks and clients, consultants and contractors, decision making in construction, contracts and risks	04
3	Risk management system: Risk identification, sources of risks, risk classification, types, impact and consequences of risk, risk analysis, risk quantification, scenario analysis, risk response: retention, reduction, transfer, avoidance	12
4	Value: Definitions: Value, value engineering, value analysis, value management, habits, roadblocks & attitudes and their relation to value engineering	01
5	Value Engineering Job Plan: Various versions of job plan, phases of job plan: information, creative, analytical, investigation, recommendation, implementation	04
6	Function Analysis: Function & its role in achieving value, function in terms of its cost & worth, Graphical function analysis, function analysis system technique	06
7	Creative thinking: Definition, creative people, creative processes, conducting creative session	04
8	Life cycle costing: Definition, purpose & implications, economic principles for life cycle costing, types of life cycle costs.	02
9	Energy: Energy resources & consumption, energy embodiment of construction materials, factors affecting energy consumption, impact of maintenance on energy saving.	04
10	Integrated approach to value and risk management	02

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least five assignments and at least one case study report with complete job plan and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments and case study report	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Value Engineering: L.W. Zimmerman, G.D.Hart, CBS publishers & distributors
2. Value & risk management, M F Dallas, Blackwell Publishing
3. Value Engineering in the Construction Industry: Dell'Isola, A J, Construction Publication Company.
4. Value Analysis in Design & Construction: O'brien, J J, McGraw Hill
5. Risk management and Construction: R Flagnan R and G Norman, Blackwell Scientific.
6. Engineering Construction Risks- A guide to Project risk analysis and risk management: Thompson P A and Perry J G, Thomas Telford.

Class:-B E (Civil)		Semester VII	
Subject:-Elective-I : Advanced Structural Analysis		04	
Periods/week – each Period of 60 minutes duration	Lecture	-	
	Practical	02	
	Tutorial		
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Introduction to Stiffness Method in Matrix Form: Basic concepts of stiffness coefficients, member stiffness matrix for member of plane truss, member of rigid jointed plane frame, member of plane grid and member of space frame. Properties of stiffness matrix, co-ordinate transformation matrix, stiffness matrix in local and global co-ordinate axes system, assemblage of structural stiffness matrix and application of boundary conditions. Joint loads, Equivalent joint loads, method of solution for displacements and computation of internal forces in members. Application of stiffness method to beams, pin jointed trusses, rigid jointed plane frames and simple plane grid structures.	13
2	Conventional Form of Stiffness Method, Modified Moment Distribution Method: Symmetric structure, Symmetric and anti-symmetric loads, Modification of stiffness and carryover factors for symmetric and anti-symmetric loads both for sway and non-sway cases for frames with different support conditions. Application to frames involving side sways.	07
3	Flexibility Method in Matrix Form: Review of concepts of flexibility coefficients, Selection of primary structure, concept of structure flexibility matrix, compatibility equations, solution for redundant forces, computational of internal forces, and joint displacements. Application to pin jointed trusses and rigid jointed plane frames for different loading including the effect of settlement of support, temperature changes and elastic supports.	06
4	Conventional Form of Flexibility Method: Elastic Center Method and its application to rectangular box, rigid jointed portal frames and fixed arches. Column Analogy Method and its application to analysis of non prismatic beams, simple rectangular frames, determination of stiffness coefficients and carry over factors for non prismatic beam members.	08
5	Influence Line Diagrams for Indeterminate Structures: Muller Breslau's Principle for drawing influence line diagrams for statically indeterminate structures. Influence Lines Diagrams for propped cantilevers, fixed beams and continuous beams.	06

6	Approximate Methods for Analysis of Building Frames: Approximate methods for gravity loads: Substitute frame and equivalent frames. Approximate methods for lateral loads: Portal and cantilever method.	05
7	Plastic Analysis of Steel Structures: Application to single bay single storey rectangular frames.	03

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least 20 (twenty) solved problems based on the above syllabus and the graded answer paper of term test shall be submitted as term work. Exposure to computer aided analysis using available software be considered. The distribution of term work marks will be as follows:

Assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Matrix Method in Structural Analysis: Livesley R. K., Pergamon Press, London.
2. Analysis of Framed Structures: Gere and Weaver, East-West Press.
3. Elementary Structural Analysis: Wilber, McGraw Hill, New York.
4. Analytical Method in Structural Analysis: S.A. Raz, New Age Int Publishers
5. Modern Methods in Structural Analysis: Dr. B.N. Thadani and Dr. J. P. Desai, Weinall Book Corporation.
6. Basic Structural Analysis: Reddy C.S., Tata McGraw hill.
7. Plastic Methods of Structural Analysis: B.G. Neal, Chapman & Hall, London.
8. Structural Analysis Vol. I and Vol. II: Pandit and Gupta, Tata McGraw hill.
9. Intermediate Structural Analysis: Wang C.K., Tata McGraw hill.
10. Matrix Method in Structural Analysis: Pandit and Gupta, Tata McGraw hill.
11. Matrix Methods of Structural Analysis: Dr. A. S. Meghre, S. K. Deshmukh, Charotar Publishing House.

Class:-B E (Civil)		Semester VII	
Subject:-Elective-I : Structural Dynamics			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Introduction: Introduction to structural dynamics, definition of basic problem in dynamics, static v/s dynamic loads, different types of dynamic loads.	02
2	Single degree of Freedom (SDOF) systems: Undamped vibration of SDOF system, natural frequency and period of vibration, damping in structures, viscous damping and coulomb damping, effect of damping on frequency of vibration and amplitude of vibration, logarithmic decrement. Forced vibration, response to harmonic forces, periodic loading, dynamic load factors, response of structure subjected to general dynamic load, Duhamel's integral, numerical evaluation of dynamics response of SDOF systems subjected to different types of dynamic loads. Introduction to frequency domain analysis, response of structure in frequency domain subjected to general periodic and non-periodic / impulsive forces of short duration, use of complex frequency response function. Use of Fourier Series for periodic forces, introduction to vibration isolation. Distributed mass system idealized as SDOF system, use of Rayleigh's method, response of SDOF system subjected to ground motion.	16
3	Generalized Single-Degree of Freedom System: Generalized properties, assemblages of rigid bodies, systems with distributed mass and elasticity, expressions for generalized system properties.	03
4	Lumped mass multi degree of freedom (MDOF) system: Coupled and uncoupled systems, direct determination of frequencies of vibration and mode shapes, orthogonality principle, vibration of MDOF systems with initial conditions, approximate methods of determination of natural frequencies of vibration and mode shapes-vector iteration methods, energy methods and use of Lagrange's method in writing equations of motions. Decoupling of equations of motion, modal equation of motion, concept of modal mass and modal stiffness, forced vibration of MDOF system, modal analysis, application to multi storey rigid frames subjected to lateral dynamic loads.	10

5	Structure with distributed mass system: Use of partial differential equation, free vibration analysis of single span beams with various boundary conditions, determination of frequencies of vibration and mode shapes, forced vibration of single span beams subjected to the action of specified dynamic loads.	04
6	Random Vibrations: Probability theory: Single random variable, important averages of single random variable, two random variables, important averages of two variables, principal axis of joint probability density function, Rayleigh's probability density function. Random processes, stationary and ergodic processes, autocorrelation function, power spectral density function, relationship between power spectral and autocorrelation functions, power spectral density and autocorrelation functions for derivatives of processes, superposition of stationary processes, stationary Gaussian processes, stationary white noise, probability distribution for maxima and extreme values.	08
7	Stochastic Response of Linear SDOF Systems: Transfer functions, relationship between input and output autocorrelation functions, relationship between input and output power spectral density functions, response characteristics for narrowband systems	05

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least 20 (twenty) solved problems based on the above syllabus and the graded answer paper of term test shall be submitted as term work. Exposure to computer aided analysis using available software be considered.

The distribution of term work marks will be as follows:

Assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Structural Dynamics-An Introduction to Computer Methods: Craig R.R., John Wiley & Sons.
2. Dynamics of Structures: Anil K. Chopra, Prentice Hall. India.
3. Dynamics of Structures: Cloguh & Penzein, Tata McGraw Hill.
4. Structural Dynamics, John M. Biggs. Tata McGraw Hill.

Class:-B E (Civil)		Semester VII	
Subject:-Elective-I : Advanced Structural Mechanics			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Shear Centre for symmetrical and non-symmetrical (about both axis) thin walled open sections	06
2	Bending of beams with large initial curvature loaded in their plane of curvature. Application to analysis of hooks, circular closed rings, chain links with straight length and semi-circular ends.	08
3	Beams on elastic foundation: Analysis of beams of infinite length subjected to concentrated force/moment and semi infinite length subjected to concentrated load/moment at one end. Semi infinite beam hinged at one end (origin)& subjected to UDL throughout.	08
4	Beams curved in plan: Analysis of beams loaded perpendicular to their own plane, simply supported, fixed and continuous beams.	06
5	Theories of Failure: Maximum principal stress theory, Maximum principal strain theory, Maximum shear stress theory, maximum total strain energy theory..	06
6	Analysis of deep beams: Determination of deflection. Determination of shear correction factor for various sections rectangular solid and hollow section and circular solid and hollow section and I-section	06
7	Torsion in non circular solid section rectangle, triangular and hexagon section	08

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least 20 solved problems based on the above syllabus and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Mechanics of Materials: E.P. Popov, Prentice Hall of India Pvt. Ltd.
2. Mechanics of Materials: James M. Gere, Thomson Brooks.
3. Mechanics of Materials: F.P. Beer, E. Russell Johnston and John T. DeWolf, TMH, New Delhi.
4. Advanced Mechanics of Materials: Arthur p. Boresi and Omar M. Sidebottom, Wiley & Sons.
5. Advanced Mechanics of Materials: Arthur p. Boresi and Richard Schmidt, John Wiley & Sons.
6. Strength of Material Part I and Part II: Timoshenko, McGraw Hill, New York.
7. Mechanics of Solids: Shames I & J.M. Pitarresi, Prentice Hall, New Delhi.
8. Strength of Materials: Subramanian, Oxford University Press.

Semester VII		
Class:-B E (Civil)		
Subject:-Elective-I : Advanced Foundation Engineering		
Periods/week – each	Lecture	04
Period of 60 minutes duration	Practical	-
	Tutorial	02
	Hours	Marks
Evaluation System	Theory Examination	03
	Practical	100
	Oral	-
	Term Work	25
	Total	25
		150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Site Exploration and Characterization Purpose and scope, influence of soil conditions and type of foundation on exploratory programme, project assessment, phasing of site exploration, excavation and boring methods of exploration, types of samplers and their design features, subsurface soundings – static and dynamic methods, planning of subsurface investigations, type and sequence of operations, lateral extent and depth of exploration, interpretation of field and laboratory data.	06
2	Consolidation Terzaghi's theory of one-d consolidation – derivation of equation (solution in detail need not be covered), estimation of C_c and C_v from laboratory tests, estimation of P_c by various methods, field consolidation curves, Quasi-preconsolidation and secondary consolidation, practical applications.	10
3	Stress and Strain Behaviour of Soils Triaxial test - drained and undrained behaviour of sands and clays, failure criteria in soils - only Mohr - Coulomb's criteria, ideal, plastic and real soil behaviour, shear strength of sands and clays.	06
4	Estimation of Stresses Boussinesq's theory, vertical stress due to concentrated load, horizontal and shear stress due to concentrated load, Isobar diagram, vertical stress distribution on horizontal plane, influence diagram, vertical stress distribution on vertical plane, vertical stress due to line load, vertical stress under strip load, maximum shear stress at points under strip loads, vertical stresses under a circular area, vertical stress under a corner of a rectangular area, Newmark's influence charts, Westergard's theory.	04
5	Bearing Capacity and Settlement Analysis of Shallow Foundations Modes of failure, failure criteria, – Terzaghi solutions, Vesic's solutions, IS Code recommendations, assumptions in estimates of ultimate loads, effect of shape, embedment of footing, eccentricity in loading, compressibility (including critical rigidity index), choice of factor safety, settlement of foundations on sand – Schmertmann method, Plate load test, evaluation of bearing capacity using standard penetration test, Housel Method	12

6	Pile Foundations Use of load tests, Estimation of single pile capacity by static and dynamic methods, Group capacity in sand and clay deposits, Separation of skin friction and end-bearing capacity. Settlement of single and group of piles,	06
7	Ground Improvement Improvement of deep cohesionless soils and cohesive soils (including stone columns / band drains), instrumentation – mainly pore pressure gauges and settlement gauges and their applications.	04

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. A project report covering the selection of soil parameters and design of shallow / pile foundations and ground improvements, using stone columns and sand drains and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

A project report	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Soil Mechanics and Foundation Engineering, Volume I and II: V. N. S. Murthy, Saitech Publication.
2. Soil Mechanics in Engineering Practice: K. Terzaghi and R. B. Peck – Second Edition, Wiley International Edition.
3. Foundation Engineering Handbook: Winterkorn and Fang, Galgotia Publications.
4. Foundation Design Manual: N. V. Nayak - Dhanpat Rai Publications (P) Ltd.
5. Principles of Foundation Engineering: Braja M. Das – PWS Publishing
6. Relevant IS Codes, BIS Publications

Class:-B E (Civil)		Semester VII	
Subject:-Elective-I : Ground Water Hydrology			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Detailed Syllabus			
Module			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Principles of ground water flow: Ground water occurrence, Darcy's Law, aquifers, estimation of aquifer parameters, steady and unsteady flow equations, steady one dimensional flow in confined and unconfined aquifers, drainage using tiles, flow through leaky aquifer, flow into infiltration galleries.	08
2	Well Hydraulics: Steady and Unsteady flow into a well, spacing of wells, well loss, ground water quality, sea water intrusion, Surface and subsurface investigations of ground water, ground water recharge estimation, ground water budgeting, water logging, flow net analysis , methods of well construction, well completion, development of wells.	07
3	Ground water modeling techniques: Porous media models, analog and electric analog models, digital computer models, Numerical modeling of ground water flow, Finite difference methods, one dimensional flow model, Explicit approximation , Implicit approximation for 1-D flow domain and 2-D flow domain, Boundary conditions	12
4	Ground water levels and Environmental influences: Time variation of levels, ground water fluctuations, urbanization, earthquakes and tsunami, land subsidence and ground water	08
5	Pollution of ground water: Pollution in relation to water use, sources and causes-municipal, agricultural, industrial, miscellaneous, attenuation of pollution , evaluation of pollution potential, monitoring ground water quality	06
6	Management of Groundwater: Concept of basin management, Ground water basin investigations, basin management and conjunctive use, basin yields	07

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. Assignments consisting of minimum 30 problems covering entire syllabus and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Numerical Ground Water Hydrology: A.K. Rastogi, Penram International Publishing, Mumbai, 2007
2. Ground Wter Hydrology: D.K.Todd, John Wiley & Sons, New York, USA, 1980
3. Engineering Hydrology: C.S.P.Ojha, R.Berndtsson, & P.Bhunya:, Oxford University Press
4. Hydrology- Principles, Analysis, Design: H.M.Raghunath, New Age International Publishers.

Class:-B E (Civil)		Semester VII	
Subject:-Elective-I : Pavement Subgrade and Materials			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Detailed Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Subgrade: Functions, Importance of subgrade soil properties on pavement performance, subgrade soil classification for highway engineering purpose soils as per PRA system, revised PRA system, Burmister system, Compaction system.	10
2	Pavement Materials: Grading requirements for aggregate, selection of bases and subbase material (including stabilized materials), selection of different grade of bitumen, bituminous mix design, Marshall stability test, design aspect of paving concrete, Experimental characteristics of road aggregate. New Pavement Materials: Modified Binders like Tar – Bitumen mixtures, Rubberised tar and bitumen, polymer modified bitumen, tar – polymer blend, addition of admixture to bitumen, sheet asphalt, mastic asphalt, stone mastic asphalt, bituminous cold mix, recycling of bituminous layers,	07
3	Soil Survey: Soil Survey Procedure for Highway and Ground Water Investigation. Identification and Significance of soil Characteristics, effect of water in soil Swelling/shrinkage, cohesion, plasticity in soil. Soil Moisture movement-ground water, gravitational water, held water, soil suction.	07
4	Storm water Drainage: General principles, subsoil Drainage. Frost action soil: Frost susceptible soils, depth of frost penetration, loss of strength during frost melting. Compaction of soils, field and laboratory method of soil compaction, equipments used in field compaction. Design of surface and subsurface drainage system, pumping system, water body, holding ponds.	08
5	Stress in soil: Theories of elastic and plastic behaviour of soils, Methods of reducing settlement, estimation of rate of settlement due to consolidation in foundation of road embankment., static and cyclic triaxial test on subgrade soils, resilient deformation, resilient strain, resilient modulus. CBR test, effect of lateral confinement on CBR and E – value of Subgrade soil. Static and cyclic plate load test, estimation of modulus of subgrade reaction, correction for plate size, correction for worst moisture content.	08

6	Ground Improvement Technique: Different method of soil stabilization, use of geo-textile, geogrid and fibres in highway subgrade. Vertical sand drain: design criteria, construction and uses	08
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Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least 10 assignments covering entire syllabus and the graded answer paper of term test shall be submitted as term work. The distribution of term work marks will be as follows:

Assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Principles of Pavement Design, Second edition, 1975: Yoder, E. J., John Wiley & Sons, Inc., New York
2. Concrete Roads: HMSO, Road Research Laboratory, London.
3. Highway Engineering: Khanna & Justo, New Chand & Brothers, Roorkee.
4. Principles and Practices of Highway Engineering: Dr. L. R. Kadiyali and Dr. N. B. Lal, Khanna Publication, New Delhi.

Semester VII		
Class:-B E (Civil)		
Subject:-Elective-I : Air Pollution		
Periods/week – each	Lecture	04
Period of 60 minutes duration	Practical	-
	Tutorial	02
		Hours
		Marks
Evaluation System	Theory Examination	03
	Practical	-
	Oral	-
	Term Work	-
	Total	150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Composition of dry ambient air Properties of air, Function of air, Definition of pollution. Classification of air pollutants. Units for Qualification of air pollution History of air pollution, Global and national scope of the problem-general, urban, rural, specific.	05
2	Sources of air pollution natural and man made Major pollutants from different sources in Greater Bombay area (or any metropolis of Maharashtra), Emission factors.	05
3	Effects of air and noise pollution on human health, plants ,animals, properties and visibility, indoor air pollution and personal exposure to air pollution , simple numerical problems based on COH, CoHb	05
4	Meteorological aspects of air pollution Large scale wind circulation geotropic wind, gradient wind, cyclone, anticyclone, planetary boundary layer. Lapse rate, stability conditions, wind velocity profile, maximum mixing depth, topographic effects.	06
5	Plum patterns, plum dispersion, Gaussian model for predicting concentration, downwind from a single source, diffusion coefficients, Turner's stability categories and graphs for dispersion estimates. Maximum ground level concentration, inversion effects, distance touching ground modification of Gaussian model to predict particulate dispersion, plume rise, modified Holland equation for small source. ASME equation for large source, Brigg's equation for buoyant plum rise, Brigg's equation for momentum plum rise.	09
6	Methods and instruments for sampling and analysis of air for stack and ambient air monitoring.	04
7	Government of India: air pollution laws. Indian standards- emission and air quality standards.	04
8	Control Devices Principles, operations and types, simple hoods and ducts. Settling chambers, cyclones, electrostatic precipitators (ESP), Filters, scrubbers, absorption towers and incinerators. Collection efficiencies for laminar and turbulent flows for settling chambers, particle cut size for cyclone, ESP Concept of frictional and overall efficiencies. Design criteria for filters, scrubbers, absorption towers and incinerators.	10

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student shall prepare a report on at least one of the following :

- 1) A stack monitoring report of at least one stacks describing the methods of sampling and analysis used.
- 2) An ambient air quality survey of a particular location.

Each student has to appear for at least one written test during the term. At least ten assignments, report as mentioned above and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments and report	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Air Pollution: Henry Capeskins, McGraw Hill publication.
2. Air Pollution: Part A- Analysis and part B-Prevention and control: J.O. Ledbetter, Make Dekker Inc., New York.
3. Air Pollution: Wark and Warner, Harper & Row, New York.
4. Air Pollution Control Guidebook for Management: Edited by A.T. Rossano, Environ Science Service Division. ERA Inc., USA
5. Air Pollution Control Theory: Martin Crawford, Mc Graw Hill publication.
6. Government of India's Publication of laws related to air pollution, Maharashtra Pollution Control Board's (MPCB) Publication of standards. Indian standards relevant to air pollution monitoring, definitions, standards.
7. Air Pollution: Rao M N & Rao H V N, Tata McGraw Hill Pub., New Delhi.
8. Air Pollution Vol.1: Tripathi A.K (editor) Ashish Publication House, New Delhi.
9. Air Pollution (Bio-pollutants in air): Srivastava A.K., Ashish Publication House, New Delhi.
10. Environmental Engineers Handbook Vol. II, Air pollution: B,G Liptak (ed) . Chilton Book Co .USA.
11. Air Pollution Handbook: PL Magill *et al.*, Mc Graw Hill publication.
12. Industrial Air Pollution Handbook: A Parker Tata McGraw Hills Publication.
13. Air pollution, M N Rao, H V N Rao, Tata McGraw Hill.

Class:-B E (Civil)		Semester VII	
Subject:-Elective-I : Prestressed Concrete			
Periods/week – each	Lecture	04	
Period of 60	Practical	-	
minutes duration	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Introduction to prestressed concrete: Basic concept and general principles, materials used and their properties, methods, techniques and systems of prestressing.	02
2	Analysis of prestressed concrete sections: Loading stages and computation of section properties, critical section under working load for pre tensioned and post tensioned members, stress method, load balancing method and internal resisting couple method, kern points, choice and efficiency of sections, cable p/c files.	08
3	Loss of prestress: Loss of stresses due to elastic deformation of concrete, creep in concrete, creep in steel, shrinkage in concrete, relaxation in steel, anchorage slip and friction.	05
4	Deflections of prestressed concrete members: Short time and long time deflection, deflection of uncracked sections, uni-linear and bi-linear methods for cracked sections.	04
5	Design of prestressed concrete sections for flexure in working stress and limit state method: General philosophy of design, permissible stresses in concrete and steel, suitability of section, safe cable zone, design of simply supported pretension and post tension slabs and beams using limit state method	10
6	Design for shear: Calculation of principle tension under working load, permissible principle tension, shear strength calculation under limit state of collapse for both sections cracked and uncracked in flexure.	05
7	End zone stresses in prestressed concrete members: Pretension transfer bond, transmission length, end block of post-tensioned members.	06
8	Introduction to application of prestressing to continuous beams and slabs, linear transformation and concordancy of cables.	08

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.
6. IS 1343-1980 is permitted.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least 10 solved problems based on the above syllabus, one design report along with one half imperial size drawing sheet on design of a post-tensioned prestressed concrete beam (as a project) and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Problems, Design report and drawing sheet	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Prestressed Concrete: N. Krishna Raju, McGraw Hill, New York.
2. Prestressed Concrete: N. Rajgopalan, Narosa Publishing House.
3. Fundamentals of Prestressed Concrete: Sinha N.C & S.K. Roy, S.C. Chand & Company.
4. Prestressed Concrete Structures: Dayaratnam P, Oxford & mH
5. Design of Prestressed Concrete Structures: T.Y.Lin & N.H. Burns, John Willey, New York..
6. Design of Prestressed Concrete: Nilson Arthur, McGraw Hill Book Company.
7. Prestressed Concrete Vol-I: IY.Guyon, Contractors Record, London.
8. Prestressed Concrete: S. Ramamurtham, Dhanpat Rai & Son's
9. Relevant latest IS codes.

Class:-B E (Civil)		Semester VII	
Subject:-Elective-I : Traffic Engineering and Control			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Detailed Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Traffic Engineering and control: Various traffic surveys and traffic studies: Speed, Journey time and Delay survey and studies, vehicle volume counts classification and occupancy, Origin – Destination surveys, Parking surveys. Statistical methods for traffic engineering and their applications: Distributions, Sampling theory and Significance testing, Regression and Correlation. Intersection Design: Principles, various available alternatives, rotary design, mini roundabout, Traffic signals: types of traffic signals, advantages, determination of optimal cycle time and signal setting for an intersection with fixed time signals, co-ordination of signals, types, area traffic control, delay at signalized intersection. Accident and road safety: accident causes, recording system, analysis and preventive measures, accident cost, alternative methodologies for calculation. Traffic management: various measures and their scope, relative merits and demerits. Highway capacity: passengers car units, level of service, factor affecting capacity and level of service, influence of mixed traffic, capacity and level of service analysis. Highway Lighting: Need for street lighting, important definitions, laws of illumination, Discernment by artificial lighting, Mounting height, spacing, lantern arrangements, types of lamps, lighting of some important highway structures. Traffic signs and Markings : General principal of traffic signing, Types of traffic signs, Design of Signs, Location and maintenance of signs, Different types of road markings, marking design, marking maintenance Introduction to intelligent transportation systems.	08 03 04 07 03 02 03 04 04 02
2	Theory of traffic flow: Scope, definitions and basic relationship, review of flow density speed studies, hydrodynamic analogies, Application of hydrodynamic analogy, Lighthill and Whitham's theory, Car-following theory and its application to traffic engineering, probabilistic description of traffic flow, an introduction to queuing theory as applied to traffic flow problems for study state conditions, Fundamentals of traffic simulation modeling.	05

3	Network Flow Problems and entropy in Transportation; Wardrop principles of equilibrium, graph theoretic approach, network flows, minimum path trees, primal level solutions. Introduction to entropy in transportation.	03
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Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. Project based on traffic studies- data collection and analysis, proposals for new facilities or improvement to existing facility / Application of traffic engineering software, at least 10 assignments covering entire syllabus and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments and Project report	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Traffic Engineering and Transport Planning: L.R. Kadiyali, Khanna publishers Delhi
2. Principles of Traffic Engineering: G.J. Pingnataro, Mc Graw-Hill, 1970.
3. Traffic System Analysis for Engineering and Planners: Wohl and Martin, Mc Graw Hill, 1983.
4. Principles of Transportation Engineering: Partha Chakroborty and Animesh Das, Prentice hall (India)
5. Traffic Flow Theory and Control: Drew D.R., McGraw – Hill , New York, 1964
6. Highway Capacity Manual, Transportation Research Board, National Research Council, Washinton D.C.

Semester-VII		
Class:-BE(Civil/Construction)		
Subject:- Elective-I: Reinforced Concrete Repairs and Maintenance		
Periods/week – each	Lecture	04
Period of 60 minutes duration	Practical	02
	Tutorial	-
	Hours	Marks
Evaluation System	Theory Examination	100
	Practical	-
	Oral	25
	Term Work	25
	Total	150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Introduction: Causes of deterioration of concrete structures. Effects of climate, moisture, temperature, chemicals, wear, erosion and loading on serviceability and durability. Design and construction errors. Causes of seepage and leakage in concrete structures. Formation of cracks including those due to corrosion.	6
2	Condition Survey, Evaluation and Assessment of Damage: Diagnostic methods and analysis. Destructive, Semi destructive and Non-Destructive methods including Core test, Carbonation test, Chloride test, Petrography, Corrosion Analysis, Cover meter test, Rebound Hammer test, Ultrasonic Pulse Velocity test, Crack measurement techniques, Concrete Endoscopy and Thermal imaging, Pull-off test and Pull-out test etc.	12
3	Materials and Methodology of Repairs: Repair analysis and design. Repair materials and their properties. Methodologies of crack and patch repair used of Polymer modified mortar, Polymer modified concrete, Polymer concrete. Injection grouting. Shortcreting. Joints and sealants. Rebar corrosion crack repair.	10
4	Protection of Concrete Structures: Protective materials and their properties for moisture barrier systems, Above-grade and below grade waterproofing of concrete structures. Systems like integral, crystalline, coatings, membranes etc., Thermal protection coatings.	8
5	Rebar Corrosion Protection: Methods of Corrosion protection. Corrosion inhibitors, Corrosion resistant steels, Cathodic Protection, Pre-packaged zinc sacrificial anode, Snap-on zinc mesh anode CP system	8
6	Maintenance of concrete structures: Facets of maintenance. Planned preventive maintenance. Maintenance cycles. Statutory legislation and obligation.	4

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

List of Practical:- (Minimum six experiments out of Sr. No 2 to 10)

1. Condition survey of any damaged structures by visual observation, crack measurement and preparing a report
2. Rapid chloride penetration test
3. Carbonation test by spraying phenolphthalein
4. Non destructive testing of concrete structures by Rebound hammer, UPV meter etc.
5. Corrosion analyzer by half-cell potential meter
6. Tests on polymer modified mortar/concrete and coating for adhesion by Pull-off test method
7. Outdoor exposure test to measure weathering of coating
8. Test for flexibility of coating by applying on a tin sheet
9. Test for effectiveness by measuring temperature difference of a thermal protection coating and concrete substrate on terrace
10. Test for effectiveness by measuring water absorption of coating applied on a card board

Term work:-

Each student has to appear for at least one written test during the term. Report on condition survey and minimum six experiments performed and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Report on experiments and condition survey	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and at least passing in the term-work.

Recommended Books:-

1. Concrete Repair and Maintenance: Peter H .Emmons and Gajanan M. Sabnis, Galgotia Publication.
2. Repairs and Rehabilitation-Compilation from Indian Concrete Journal-ACC Publication.
3. Guide to Concrete Repair and Protection, HB84-2006, A joint publication of Australia Concrete Repair Association, CSIRO and Standards Australia.
4. CPWD hand book on Repairs and Rehabilitation of RCC buildings published by DG(Works), CPWD, Government of India (Nirman Bhawan), <http://www.cpwd.gov.in/handbook.pdf>
5. Guide to Concrete Repair, Glenn Smoak, US Department of the Interior Bureau of Reclamation, Technical Service Center , <http://books.google.co.in>
6. Management of Deteriorating Concrete Structures: George Somerville, Taylor and Francis Publication
7. Concrete Building Pathology: Susan Macdonald, Blackwell Publishing.
8. Testing of Concrete in Structures: John H. Bungey, Stephen G. Millard & Michael G. Grantham, Taylor & Francis Publication.
9. Durability of concrete and cement composites: C.L.Page & M.M. Page, Woodhead Publishing

Class:-BE(Civil)		Semester-VII	
Subject:- Elective-I: Advanced Computational Techniques			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Detailed Syllabus			
Module	Topics		

Detailed Syllabus

Module	Topics	No. of Lectures
1	Review of basic statistics and probability : Probability Distributions, Theoretical : binomial, poisson, normal, exponential, hypergeometric, uniform	7
2	Sampling and Sampling Distributions Probability and non-probability samples, sampling and non-sampling errors Sample size, sampling distributions : t, F and χ^2 distributions	5
3	Hypothesis Testing Type I and II error, testing of mean, proportion, tests for equality of mean and variances of two populations, confidence interval, χ^2 test for goodness of fit, ANOVA (one way classification), Non parametric tests : sign test, U test	8
4	Correlation and Regression Karl Pearson's and Rank Correlation coefficient, simple linear regression : least squares method	5
5	Management Decision Making System approach, decision making under uncertainty and risk: decision tables and decision tree.	7
6	Linear Programming Graphical solution, simplex method, dual, sensitivity analysis, transportation and assignment problems	10
7	Introduction to Generic Algorithms	6

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. Minimum eight assignments and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Report on experiments
Written test (at least one)

: 15 marks
: 10 marks

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and at least passing in the term-work.

Recommended Books:-

1. Quantitative Techniques for Managerial Decisions: Shrivastava, Shenoy & Sharma, Wiley
2. Research Methodology: Kothari C R, Wiley Eastern
3. Methods in Social Research: Goode W J & Hatt P K, McGraw Hill
4. Handbook of Genetic Algorithms (1991): L. D. Davis, Melanie Mitchell. Van Nostrand Reinham
5. An Introduction to Genetic Algorithms (1998): Melanie Mitchell, Van Nostrand Reinham

Class:-BE(Civil/Construction)			Semester-VII
Subject:- Project A			
Periods/week – each Period of 60 minutes duration	Lecture	-	
	Practical	-	
	Tutorial	04	
		Hours	Marks
Evaluation System	Theory Examination	-	-
	Seminar	-	25
	Oral	-	-
	Term Work	-	25
	Total		50 (Internal)

A group of students is expected to take up a project from Civil Engineering field which is to be completed in Semester VII and Semester VIII.

The project work may include,

- experimental analysis / verification,
- development of design methods and verification,
- design and fabrication of a model for a civil engineering project,
- design for civil engineering structures and preparation of working drawings,
- developing a software for analysis and / or design of decision making in civil engineering and management practice
- technical and / or economic feasibility study
- study on new materials / methodology for construction

The students may be asked to work in groups with not more than four students in each group.

Basic study through review of literature on the topic selected shall be completed. The scope of the project, necessary data, sources of such data etc. shall be identified. The group of students has to prepare a brief report on the work done during the semester and is to be submitted. The report should at least include Introduction, Aim and objective of the project, scope of the project, methodology, review of literature and reference list. The group shall prepare and present a seminar based on this work.

Class:-B E (Civil/Construction)		Semester VIII	
Subject:- Design and drawing of Reinforced Concrete structures			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	04	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Design of Foundations: (limit state method of design) Design of simple raft subjected to symmetrical loading	08
2	Design of staircases: (limit state method of design) Design of Dog legged, Open well type staircase.	06
3	Complete design of residential, commercial or Industrial building including staircase and foundations. (limit state method of design)	12
4	Design of retaining walls: (limit state method of design) Design of Cantilever, Counter fort type retaining wall.	08
5	Design of water tanks: (working stress method) Circular and rectangular, at ground level, underground and overhead water tanks both by IS coefficient and - approximate methods, including supporting structure for overhead water tanks.	14

Note: Relevant and latest IS codes of practice shall be followed for all the topics

Theory Examination:-

1. Question paper will consist of total five questions.
2. Question number 1 will be compulsory having 40 marks and two options.
3. Remaining four questions will be of 20 marks each.
4. Only three questions need to be attempted from remaining four questions.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral and sketching Examination:-

Oral and sketching examination will be based on entire syllabus.

Term work:-

Design report and at least four A1 (Full imperial) size drawings sheets for three projects covering the above syllabus shall be submitted as term work. All drawing work is to be done in pencil only. Exposure to design by available software for design is also to be considered.

Each student has to appear for at least one written test during the term. The term work mentioned as above and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Design report and drawing sheets	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Limit State Theory for Reinforced Concrete Design: Huges B. P., Pitman
2. Limit State Design - Reinforced Concrete: Jain A. K., New Chand, India
3. Reinforced Concrete: Warener R. F., Rangar, B.C. & Hall A. S.
4. Illustrated Design of G+3 Building: Shah & Karve, Structural Publishers.
5. Reinforced Concrete: S. N. Sinha, TMH, New Delhi
6. Reinforced Concrete: H. J. Shah, Charotar Publisher
7. Relevant I.S. codes and design aids, BIS Publications.
8. Reinforced Concrete Fundamentals: Ferguson P.M., Breen J.E., and Jirsa J.O., 5th Edition, John Wiley & Sons, 1988.
9. Illustrated Reinforced Concrete Design: Dr. V.L. Shah & Dr. S.R. Karve, Structural Publishers.

Class:-B E (Civil)		Semester VIII	
Subject:-Construction Engineering			
Periods/week – each of 60 minutes duration	Lecture		
	Practical	04	
	Tutorial	-	
		02	
Evaluation System		Hours	Marks
	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Construction equipment: Standard types of equipment, special equipment, cost of owning and operating equipment, depreciation costs, investment and operating costs, economic life, sources of construction equipment, factors affecting selection of construction equipment, balancing of equipment Study of equipments with reference to available types and their capacities, operations and factors affecting their performance: Earthmoving equipment: tractors and attachments, dozers and rippers, scrapers, shovels, draglines, trenching machines, clamshell, hoes, trucks and wagons, dumpers, dozers, trenching machines, rollers and compactors Drilling and blasting equipment: bits, jackhammers, drifters, drills, blasting material, firing charge, safety fuse, electric blasting caps, drilling patterns, transporting and handling of explosives Pile driving equipment: types, pile driving hammers: single acting and double acting, differential acting hammers, hydraulic and diesel hammers, vibratory pile drivers Pumping equipment: reciprocating, diaphragm & centrifugal pumps, wellpoint system Stone crushing equipment: jaw, gyratory and cone crushers, hammer mills, roll crushers, rod and ball crushers, aggregate screens and screening plants, portable plants Air compressor Equipment for moving materials: builder's hoists, forklifts, cranes, belt-conveyors, cableways, ropeways	04 03 03 04 03 02 02 02 03
2	Tunneling: Selection of alignment, methods of tunneling in soft soils and in hard rock, sequence of operations for drilling and blasting method, mechanical moles, boomers, tunnel boring machines, mucking, ventilation of tunnels, dust control, types of tunnel supports, sequence of lining operation, lining with pneumatic placers and by pumpcrete method	10
3	Soil stabilization techniques: sand drains, stone columns, use of geotextiles and chemicals, diaphragm wall, rock anchors, foundation grouting	05
4	Concrete: mass concreting, vacuum concrete, forms for concrete construction: slip forms, collapsible forms, forms for cantilevers	05

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least two site visits should be arranged to give an exposure to various construction techniques discussed in the above syllabus. A report on site visit, at least 10 assignments (including sketches for various equipment and construction details) and the graded answer paper of term test shall be submitted as term work. The distribution of term work marks will be as follows:

Report on site visits and assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Construction Equipment and Planning: R L Purifoy and Ledbetter, McGraw Hill
2. USBR, Earth Manual
3. USBR, Concrete Manual
4. Handbook of Heavy Construction: O'Brien, Havers & Stubb, McGraw Hill
5. Foundation Analysis and Design: Bowels J E,
6. Construction Engineering & Management: S Seetharaman, Umesh, S Chand, New Delhi
7. Concrete Technology: M S Shetty, Khanna
8. Construction Equipment & Its Management: S C Sharma, Khanna Publications

Class:-B E (Civil)		Semester VIII	
Subject:-Construction Management			
Periods/week – each of 60 Period minutes duration	Lecture		
	Practical	04	
	Tutorial	-	
		02	
Evaluation System		Hours	Marks
	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Construction: Unique features of construction, construction project, types and features, phases of a project, agencies involved and their methods of execution.	03
2	Construction project planning: Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, estimating durations, sequence of activities, activity utility data	07
3	Techniques of planning: Bar charts, Networks: basic terminology, single and overlapping relationships preparation of CPM networks: activity on link and activity on node representation, analysis of single relationship (finish to start) networks, computation of float values, critical and semi-critical paths, calendering networks	10
4	Resource Scheduling: Bar chart, line of balance technique, resource constraints and conflicts, resource aggregation, allocation, smoothening and leveling	05
5	PERT: Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion	06
6	Planning and organizing construction site and resources: Site: site layout, developing site organization, record keeping at site, Manpower: planning, organizing, staffing, motivation, Materials: concepts of planning, procurement and inventory control, Equipment: basic concepts of planning and organizing, Funds: cash flow, sources of funds	07
7	Construction costs: Classification of costs, time cost trade-off in construction projects, compression and decompression	03
8	Monitoring & control: Supervision, record keeping, periodic progress reports, periodical progress meetings Updating of plans: purpose, frequency and methods of updating Common causes of time and cost overruns and corrective measures Quality control: concept of quality, quality of constructed structure, use of	04

	manuals and checklists for quality control, role of inspection, basics of statistical quality control Safety and health on project sites: accidents; their causes and effects, costs of accidents, occupational health problems in construction, organizing for safety and health	
9	Purpose and brief provisions in brief of following acts: Minimum wages act, The building and other construction workers (regulation of employment and conditions of service) Act, The building and other construction workers welfare cess Act, Contract Act, Alternative disputes resolution methods	03

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least 12 assignments including numerical problems and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Professional Construction Management: Barrie D.S. & Paulson B C, McGraw Hill
2. Construction Project Management: Chitkara K K, Tata McGraw Hill
3. Handbook of Construction Management: P K Joy, Macmillan, India
4. Construction Hazard and Safety Handbook: King & Hudson, , Butterworths
5. Critical Path Methods in Construction Practice: Antill J M & Woodhead R W, Wiley
6. Relevant acts

Class:-BE(Civil/Construction)		Semester-VIII	
Subject:- Elective-II: Advanced Construction Engineering			
Subject:- each Periods/week - 60 Period of minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
Evaluation System		Hours	Marks
	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Syllabus			

Detailed Syllabus		
Module	Topics	No. of Lectures
1	Large and heavy engineering projects: Characteristics and complexities, methods statement for major activities like excavation, concreting, steel fabrication and erection for projects like earthen dams, hydropower projects, nuclear power plant, refineries and other industrial projects etc.	06
2	Excavation for heavy engineering projects: Excavation in various types of soils, selection of equipment, safety measures in excavation, drainage in excavation	06
3	Concrete construction for heavy engineering projects: Selection of equipment for batching, mixing, transporting, placing and compacting for various types of jobs, safety measures during concreting, Special concretes and mortars: preplaced aggregate concrete, roller compacted concrete, grouting	06
4	Prefabricated construction: Planning for pre-casting, selection of equipment for fabrication, transport and erection, quality measures, safety measures during erection	05
5	Steel construction: Planning for field operations, selection of equipment and erection tools, tools and methods of welding, tools and methods of cutting and joining, bridge erection, quality measures, safety measures during fabrication and erection	05
6	Specific issues related to planning, site layouts, equipment selection and pre-project activities for large size construction projects like earthen dams, concrete dams, thermal power stations, nuclear power stations, light houses, airports and ports, bridges	05
7	Information related to special equipments and their applications to Off-shore construction, underground utility construction	05
8	New materials and equipment for construction	05
9	Case studies of heavy construction projects	05

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. A detail report of site visit to any heavy construction work, at least five assignments and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

A report of site visit and assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and at least passing in the term-work.

Recommended Books:-

1. Handbook of Heavy Construction: Stubbs, McGraw Hill, New York
2. Construction equipments: Jagdish Lal.

Class:-B E (Civil)		Semester VIII	
Subject:-Elective-II : Rock Mechanics			
Periods/week – each of 60 minutes duration	Lecture	04	
	Practical	02	
	Tutorial	-	
Evaluation System		Hours	Marks
	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Structural Geology of Rocks:	04
2	Subsurface Investigations in Rocks and Engineering Characteristics of Rock Masses:	04
3	Engineering Classification of Rocks and Rock Masses: Classification of intact rocks, rock mass classifications {rock quality designation, rock structural rating, geomechanics classification (RMR)}, strength and modulus from classifications, classification based on strength and modulus, geo-engineering classification, Deere and Miller's Engineering Classification.	05
4	Stress Distribution in Rocks: Field and Laboratory Tests on Rocks	05
5	Strength, Modulus and Stress-Strain Responses of Rocks: Factors influencing rock responses, strength criteria for isotropic intact rocks, modulus of isotropic intact rocks with confining pressure, uni-axial compressive strength of intact anisotropic rocks, strength due to induced anisotropy in rocks, compressive strength and modulus from SPT, stress-strain models (constitutive models, elastic stress-strain model, elasto-plastic stress-strain model, equivalent material concept), influence of intermediate principal stress.	06
6	Bearing Capacity of Rocks: Estimation of bearing capacity (foundation on intact rock, heavily fractured rock, UBC with Hoek-Brown criterion, foundation on slope), stress distribution in rocks, factor of safety, strengthening measures (concrete shear keys, bored concrete piles, tensioned cable anchors, concrete block at toe), settlement in rocks (from joint factor, for horizontal joints, from field tests).	06
7	Stability of Rock Slopes: Modes of failure, rotational failure, plane failure, wedge method of analysis, buckling failure, toppling failure, improvement of slope stability and protection.	06
8	Opening in Rocks: Introduction to theory of elasticity, lines and unlined tunnels, pressure tunnels and tunnels for other purposes.	06
9	Rock Bolting and Grouting: Grouting in rocks, objectives, contact grouting, consolidation grouting,	05

process of grouting, grout requirement, types of grout, stage grouting, grout curtain.

Rock bolts, rock bolt types and applications, theory of rock bolting, rock anchors, modes of failure, uplift capacity.

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

List of Practicals

Practicals include confined and unconfined compression test, point load test, Brazilian tensile test, permeability test and modulus of elasticity of rocks.

Term work:-

Each student shall prepare a report on experiments conducted and a project report covering the selection of design parameters, design analysis including drawing on any aspect of rock mechanics included in the syllabus.

Each student has to appear for at least one written test during the term. The project report referred above, at least five examples report on experiments and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments and reports	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Fundamentals of Rock Mechanics: J. C. Jaeger and N. G. W. Cook, Oxford Press.
2. Rock Mechanics and Design of Structures on Rock: Obert, Leon and W. I. Duvall
3. Rock Mechanics in Engineering Practice: K. G. Stagg and O. C. Zienkiewicz, John Wiley & Sons, New York.
4. Rock Mechanics - Vol. I & II: Jumukis, Trans Tech Publication, USA.

Class:- B E (Civil)

Subject:- Elective-II : Geographical Information System

Semester VIII

Periods/week - each
Period of 60
minutes duration

Lecture

Practical

Tutorial

04

02

Evaluation System

Theory Examination

Hours

Marks

Practical

03

100

Oral

-

-

Term Work

-

25

Total

-

25

150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Introduction to GIS: Definition, sources of data, types of data, concept of space and time in GIS, spatial information theory, history of GIS, elements of GIS, objectives of GIS, hardware and software requirements of GIS, application of GIS	08
2	Data models of spatial information: Layers and coverage, conceptual models of spatial information, representation of spatial data models in computer: raster and vector models, comparative overview between raster and vector models	10
3	Data models of non-spatial information: Database management systems, hierarchical structure, network structure, relational structure	06
4	Digitizing, Editing and Structuring of map data: Digitizing: manual, semi-automatic and automatic, editing: error detection and correction, tolerances, topology creation, attribute map generation	10
5	Digital Elevation Model: Need of DEM, Various structures of DEM: line, TIN, grid.	08
6	Application of Remote sensing and GIS: Forest resource management, agriculture and soil management, water resource management, land use and land suitability, disaster management	06

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

List of Practicals:

At least TEN practicals shall be performed from the list given below.

1. Installation of GIS software
2. Getting Familiarized with GIS menu and Tools
3. Map Projections
4. Map digitization
5. Geo-referencing
6. Creating Vector data
7. Creating Raster data
8. Creating attribute table
9. Measure road length and area of the buildings
10. Data viewing based on Single Symbol
11. Data viewing on Graduated Symbol
12. Data viewing on Continuous color
13. Data viewing on unique value
14. Labeling the features
15. Selection tool
16. Coordinate capture – to save in notepad
17. Geo-processing tool (Buffer, Clip, intersect and difference)
18. Joining layers based on common field
19. Data conversion
20. Convert polygon to polyline
21. Add Graphic overlay to a vector layer
22. Import and export data
23. Map Layout

Term work:-

Each student has to appear for at least one written test during the term. Report on practicals conducted, at least 5 assignments and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Report on practicals conducted and assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. 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.
2. Modeling Our World: The ESRI Guide to Geodatabase Design: Zeiler, M. 1999. ESRI Press, Redlands, California
3. GIS, Spatial Analysis and Modeling: Maguire, D., M. Batty, and M. Goodchild. 2005, ESRI Press.
4. Introduction to geographic Information Systems: Kang-tsung Chang, Tata mcgraw Hill.
5. Advanced Surveying (Total Station, GIS and Remote Sensing) First Edition 2007: SatheeshGopi, R. Sathikumar, N. Madhu, Darling Kindersley (India) Pvt. Ltd.
6. Concepts of Techniques of Geographic Information Systems, C.P.Lo and Albert K.W. Yeung, Prentice Hall India Pvt. Ltd., New Delhi.

Class:-B E (Civil/Construction)		Semester VIII	
Subject:-Elective-II : Water Resources Engineering and Management			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
Evaluation System		Hours	Marks
	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Water resources project planning: Investigations in project planning, planning data requirement and collection, levels of planning and objectives, project formulation and evaluation, multipurpose project planning, Drawbacks in planning, system approach in water resources planning.	08
2	Water resources development and environment: Objects of water resources development, Water resources system design, Water resources assessment, augmentation of water resources, Economics of water resources development, Integrated and conjunctive use of water development, Irrigation and water management, Constraints in irrigation development, National water policy, Environmental planning, environmental impact assessment, measurement of EI, status of EIA in India.	12
3	Engineering economy in flood control projects: Flood estimation and flood control measures, flood forecasting and warning, effect of urbanization on runoff, peak flow methods in urban area, Flood routing through reservoirs and channels, discounting formulae, discounting methods, economics of flood control, estimating flood damages, estimating flood control benefits, reservoir sedimentation and control.	08
4	Modeling watershed hydrology: Hydrologic processes, rainfall-runoff measurement and analysis, Hydrographs and IUH, Mathematical models in hydrology, Nash and Clark model, Generalised watershed simulation models, GIS tool in watershed management, probability and stochastic models, frequency analysis, Regression and correlation, optimisation techniques for water resources projects by linear programming, non-linear programming and dynamic programming, mathematical models for large scale multipurpose projects, different case studies.	14
5	Multipurpose developmental issues: hydro-electric power development and power sector, inland water transportation, micro-level planning, watershed management, rainwater harvesting, cloud seeding, cost-benefit considerations in water resources planning, River basin management.	06

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. Minimum 10 assignments covering entire syllabus and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Water Resources Engineering: Ralph A Wurbs, Weseley P James, Prentice Hall, India
2. Economics of Water Resources Planning: L D James, R R Leo, MC Graw Hill
3. Elements of Water Resources Engineering: K N Duggal & J P Soni, New Age International Publishers
4. Environmental Impact Assessment: Larry W Canter, MC Graw Hill, 1997
5. Introduction to Hydrology: Warren Viessman, Jr. & Gary L Lewis, Pearson Education, 2007
6. Hydrology- Principles, Analysis, Design: H.M.Raghunath, New Age International Publishers

Class:-B E (Civil)		Semester VIII	
Subject:-Elective-II : Bridge Design and Engineering			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Introduction: Types of Bridges, selection of suitable type of bridge, aesthetics, economic span.	08
2	Design loads and their distribution: IRC loads, analysis of deck slab and IRC loads, load distribution among longitudinal beams of a bridge, railway loading.	10
3	Design of superstructure: Design of balanced cantilever concrete bridge, design of prestressed concrete bridge, design of lattice girder railway bridge, introduction to design of RC Arch bridges and box girder bridges.	15
4	Design of substructure: Different types of foundations, their choice and methods of construction, design of well foundation, design of piers and abutments, various types of bearings and their suitability.	12
5	Construction Methods: Erection of bridge superstructure, cantilever construction.	03

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least five design problems in the assignments, ten sketches and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments	: 15 marks
Written test (at least one)	: 10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Design of Bridges: Raju N. K., Oxford & IDH
2. Bridge Engineering: Ponnuswamy S., Tata McGraw Hill.
3. Concrete Bridge Practice: Raina V.K., Tata McGraw Hill.
4. Essentials of Bridge Engineering: Victor D. J., Oxford & IDH
5. Design of Bridge Structures: T.R Jagdeesh & M.A Jayaram, Prentice Hall India Private Ltd. New Delhi.

Class:-B E (Civil/Construction)		Semester VIII	
Subject:-Elective-II : Environmental Impact Assessment & Audit			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
Evaluation System		Hours	Marks
	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus		
Module	Topics	No. of Lectures
1	Environmental impact assessment What is it, Environmental attitudes, Brief history of EIA, Significance of EIA, Role of EIA in planning & decision making process, objectives of EIA.	06
2	Environmental assessment process Assessment methodology , Socioeconomic impact assessment, Air quality impact analysis, Noise impact analysis, Energy impact analysis, Water quality impact analysis, Vegetation & wild life impact analysis, Cumulative impact assessment, Ecological impact assessment, Risk assessment.	12
3	Environmental Impact Assessment Basic concept behind EIS, Stages in EIS production: Screening, scoping, prediction, evaluation, reducing impact, monitoring, conclusions, typical EIS outline,	06
4	Rapid EIA	06
5	Environmental Auditing Definition, aims & objectives, audit principles, incentives to undertake audit, partial environmental audits, stages of implementing environmental audits, scope of audit	06
6	Provisions of various environmental acts of India	06
7	Case Studies	06

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least 10 assignments and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

15 marks

10 marks

Assignments

Written test (at least one)

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Corporate Environmental Management: Welford R, University Press
2. Environmental Assessment: Jain R K, McGraw Hill
3. Environmental Impact Assessment: Harry W Conter, McGraw Hill
4. Environmental Impact Assessment – Handbook: John G Rau & D C Wooren, McGraw Hill.

Class:-B E (Civil/Construction)		Semester VIII	
Subject:-Elective-II : Appraisal and Implementation of Infrastructure Projects			
Periods/week – each of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Syllabus		No. of	

Detailed Syllabus

Module	Topics	No. of Lectures
1	Project report preparation Basic study, investigations and feasibility studies, project formulation, SWOT analysis, project report	07
2	Appraisal What is an infrastructure project, project development cycle, what is appraisal, Need of appraisal, steps of appraisal	05
3	Market appraisal Demand analysis, forecasting demand, sources of information, market survey, uncertainties in demand forecasting	06
4	Management appraisal Assessment of entrepreneur, chief executive, board of directors, departmental heads, organization as a whole	06
5	Technical appraisal Location, land, buildings, technology and its appropriateness, size of plant, plant and machinery, raw materials, energy requirements, water supply, effluent disposal	07
6	Financial and economic appraisal: Cost of project, means of financing, profitability, break-even analysis, financial projections, financial appraisal tools: urgency, payback period, accounting rate of return, net present value, internal rate of return, benefit cost ratio, cost of capital, risk analysis, social cost benefit analysis	06
7	Ecological appraisal: Environmental impact analysis	04
8	Project implementation Agencies involved in implementation, methods of implementation like Build, operate and transfer (BOT) method and its variants like BOO, BOOT, BOLT etc. Project financing: types and sources (local and international)	07

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least 10 assignments and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

	:	15 marks
Assignments	:	10 marks

Written test (at least one)

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Project Preparation, Appraisal, Budgeting, and Implementation: Prasanna Chandra, Tata McGraw Hill.

Class:-B E (Civil/Construction)		Semester VIII	
Subject:-Elective-II : Disaster Management			
Periods/week – each of 60 Period minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
Evaluation System		Hours	Marks
	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Disasters: Definitions & terminologies – hazard, risk, accident, disaster, vulnerability, disaster management, Significance of disaster management and role of civil engineers in it	04
2	Types of hazards and disasters: Natural and human made, geological, biological, environmental, climatic, chemical, nuclear and other industrial, civil and political hazards, earthquakes, landslides, floods, cyclones, draughts, pest attacks, cold and heat waves, tsunami, terrorist attacks, war and other industrial accidents etc and their impact on constructed facilities and the construction activity in general	04
3	Performance of structures during earthquakes, landslides, liquefaction, fires, tsunamis, floods, radiation, chemical spills etc., effect on life of the structure due to exposures to hazardous environment	10
4	Safe construction of facilities: Design concepts and construction materials for Earthquake / cyclone / fire resistant facilities	12
5	National disaster management acts, policies, guidelines and plans, National Disaster Management framework and role of local / state/ national government and non-government and other multilateral agencies	05
6	Survey of recent regional disasters, forecasts and disaster preparedness plans	05

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least 10 assignments and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments : 15 marks

Written test (at least one) : 10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Manual natural disaster management in India, M C Gupta, NIDM, New Delhi
2. Encyclopedia of disaster management, VOL I, II and III, S L Goyal, Deep & Deep, New Delhi
3. Disaster management act 2005, Govt. of India
4. Publications of NDMA on various templates and guidelines for disaster management

Class:-B E (Civil)		Semester VIII	
Subject:-Elective-II : Pavement Design and Construction			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus

Module	Topics	No. of Lectures
1	Pavement structure and functional attributes, factor affecting pavement design, types of wheel loads for highways and airports, development of design method for highway and airport pavements.	03
2	Stresses in flexible pavements, 1-layer, 2-layer, 3-layers theories, EWLF, ESWL Stresses in Rigid pavement: load and temperature stresses, combined stresses.	03
3	Flexible Pavement Design Airport pavement: Corps of Engineer's method, FAA method CDOT method, Asphalt institute method. Highway Pavement: Empirical methods using no soil strength criteria, empirical method based on soil strength criteria: CBR method as specified by IRC, Road note 29 methods, AASHTO method, Asphalt institute method. Fatigue and rutting as a failure criterion.	08
4	Rigid Pavement Design: Airport pavements: PCA methods, corps of Engineer's method, FAA method. Joints and reinforcement requirement. Highway pavement: Current British procedure, IRC method.	06
5	Evaluation and strengthening: flexible and rigid pavement distresses, condition and evaluation surveys, present serviceability index, roughness measurement, Benkaleman beam deflections, design of overlays, skid resistance and measurement.	06
6	Concrete road construction: Mix design, concrete strength, size of aggregates, gradation, and workability, preparation of base form work, placing of reinforcement, compaction, and finishing, curing, joints.	04
7	Low Cost Roads (Rural Areas) Classification of low cost roads, construction of low cost roads, stabilization of subgrade, base and its advantages, construction of granular base courses, macadam surface, macadam bases, low cost materials and methods used for highway construction, suitability of different types of roads under different situation. Soils.	05
8	Road making machinery Role of labour versus machinery, in road construction, earth work machinery, rock excavation machinery, aggregate	08

	transportation and watering equipment, wet mix WMM Plant, Asphalt plant, (computerized), drum mix, Continuous batch mix, compaction equipment, bituminous equipment, storage, heating and spraying equipment, hot mix plants, cold mix plants, paver, finisher, concrete road making machinery, equipment usage rates, factors affecting usage rate.	
9	Quality control (QC) and Quality assurance (QA) during construction of various pavements, importance, process control and end product control, statistical methods in quality control, control charts, frequency of testing etc.	03
10	Introduction to pavement management systems.	02

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least 10 assignments and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Principles and Practice of Highway Engineering: L.R.Kadiyali, Khanna publications.
2. Highway Engineering: Khanna S.K. and Justo C.E.G. Nem Chand.
3. The design and Performance of Road Pavements: Croney, David et al, McGraw Hill.
4. Pavement Design: Yoder and Witzech, McGraw-Hill, 1982.
5. Pavement Analysis and Design: Yang H. Huang, Prentice Hall, New Jersey, 1993

Class:-B E (Civil)		Semester VIII	
Subject:-Elective-II : Advanced Design of Steel Structures			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
Evaluation System		Hours	Marks
	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Moment Resistant Beam End Connections: Design of moment resistant bolted and welded beam end connections.	08
2	Round Tubular Structural Members Properties of steel tubes, design of tension and compression members, design of welded connections, design of flexural members, analysis and design of tubular trusses including purlins and supports.	10
3	Elevated Steel Tanks and Stacks: Loads acting on tanks including wind and earthquake, design of circular tanks with hemispherical and conical bottom, supporting ring beam, staging for circular tanks including design of columns and foundation, design of rectangular steel tanks including design of staging, columns and foundation.	12
4	Gantry Girder: Loads acting on gantry girder. Analysis and design of gantry girder.	05
5	Lattice Tower: Different configurations of lattice towers, loads acting on lattice towers, analysis and design of lattice tower including welded or riveted connections for members.	05
6	Steel Chimney: Forces acting on chimney, design of self supporting welded chimney and its components including design of foundation.	08

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral / Sketching examination will be based on entire syllabus.

Term work:-

The term work shall consist of a design report and detailed drawings on three projects as indicated below:

1. Design of tubular trusses
2. Design of elevated circular tank with conical bottom or rectangular steel tank
3. Design of lattice tower or steel chimney.

The drawings should be drawn with pencil only on minimum of A1 (Imperial) size drawing sheets. Each student has to appear for at least one written test during the term. Term work as mentioned above and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Design report and drawings	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Design of steel structures: Subramanian, Oxford Press.
2. Steel structures, Controlling behavior through design: R. Englekirk, Wiley
3. Design of steel structures: Negi L.S., Tata McGraw Hill
4. Design of steel structures: Kazimi S.M. A. & Jindal R.S., Prentice Hall of India.
5. Design of steel structures: Krishnamachar B.S, & Ajitha Sinha D.
6. Design of steel structures: Arya and Ajmani, New Chand & Bros.
7. Design of steel structures, Vol I & II: Ramchandran, Standard Book House, New Delhi.
8. Design of steel structures: Dayaratnam, Wheeler Publication, New Delhi
9. Design of steel structures: Breslar, Lin and Scalzi, John Willey, New York.
10. Structural steel work: Reynolds TJ., Kent L.E. & Lazenby, D.W., English University Press.
11. Comprehensive design of steel structures: Punamia, A.K. Jain & Arun Kumar Jain, Laxmi Publications Pvt. Ltd.
12. Design of steel structures: I C Sayal & Salinder Singh, Standard Publishers & Distributors.

Class:-B E (Civil)		Semester VIII	
Subject:-Elective-II : Earthquake Engineering			
Periods/week – each of 60 Period minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Definitions of basic problems in dynamics, static v/s dynamic loads, different types of dynamic loads, undamped vibration of SDOF system, natural frequency and periods of vibration, damping in structure. Response to periodic loads, response to general dynamic load, response of structure subject to ground motion, use of Fourier series for periodic forces.	12
2	MDOF systems: Direct determination of frequencies and mode shapes, orthogonality principle, approximate methods for determination of frequencies and mode shapes. Forced vibration of MDOF system, modal analysis, applications to multistoried rigid frames subject to lateral dynamic loads including ground motion	08
3	Seismological background: Seismicity of a region, earthquake faults and waves, structure of earth, plate tectonics, elastic-rebound theory of earthquake, intensity and magnitude of earthquake, measurement of ground motion, seismogram, earthquake frequency, local site effects, seismotectonics and Seismicity of India.	06
4	Characterization of ground motion: Earthquake response spectra, factors influencing response spectra, design response spectra for elastic systems, peak ground acceleration, response spectrum shapes, deformation, pseudo-velocity, pseudo-acceleration response spectra. peak structural response from the response spectrum, response spectrum characteristics, construction site specific response spectra.	06
5	Deterministic earthquake response: Types of earthquake excitation, lumped SDOF elastic systems. translational excitation, lumped MDOF elastic systems, translational excitation, time history analysis, multistoried buildings with symmetric plans, multi storied buildings with un symmetric plans, torsional response of symmetric plan building, distributed - parameter elastic systems, translational excitation, combining maximum modal responses using mean square response of a single mode, SRSS and CQC combination of modal responses.	06
6	I. S. code method of seismic analysis: Seismic co-efficient method and its limitation, response spectrum method, IS 1893-2002 provisions for seismic analysis of buildings and water towers,	06

	seismic evaluation and retrofitting, types of structural system used in building to resist earthquake loads.	
7	Review of damages during past earthquakes and remedial measures, seismic design considerations, allowable ductility demand, ductility capacity, reinforcement detailing for members and joints as per IS 13920	04

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least 20 (twenty) solved problems based on the above syllabus and the graded answer paper of term test shall be submitted as term work. Exposure to computer aided analysis using available software be considered.

The distribution of term work marks will be as follows:

Assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Structural Dynamics-An introduction to Computer Methods: Roy R. Craig.
2. Dynamics of Structures: Anil K. Chopra, Prentice Hall, India.
3. Dynamics of Structures: Cloguh & Penzien, Tata McGraw Hill
4. Structural Dynamics: John M. Biggs, Tata McGraw Hill
5. Fundamentals of Earthquake Engineering: N. M. Newmarks & E. Rosenblueth, Prentice Hall.
6. Earthquake Design Practice for Building: D. Key, Thomas Telford, London, 1988.
7. Earthquake Engineering: R. L. Wiegel, 2nd Edition, Prentice Hall, London, 1989
8. Design of Multistoried Buildings for Earthquake Ground Motions: J. A. Blume, Portland Cement Association, Chicago, 1961
9. Proceedings on World Conference on Earthquake Engineering: 1956-2000.
10. Earthquake Resistant Design of Structures: Pankaj Agarwal, Manish Shrikhande, Prentice Hall, India, 2006
11. I. S. codes No. 1893, 4326, 13920. (all latest codes)

Class:-B E (Civil)		Semester VIII	
Subject:-Elective-II : Soil Dynamics			
Periods/week – each of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
Evaluation System		Hours	Marks
	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Vibration of elementary system Degree of freedom Analysis of system with one degree of freedom , spring- mass system Harmonic vibration . uniform circular motion natural frequency, free and forced vibrations with and without damping Type of damping.	10
2	Wave propagation in elastic rods, in an elastic infinite medium, and in semi-elastic half space, wave generated by surface footing.	05
3	Liquefaction of soils , criterion and factors affecting liquefaction of soil, laboratory and field studies on liquefaction, liquefaction studies in oscillatory simple shear, evaluation of liquefaction potentials, liquefaction of clay.	10
4	Principles of machine foundation design, criteria for satisfactory machine foundation, degree of freedom of a block foundation analysis of vertical and sliding vibration of a machine foundation, mass of soil participating in vibration.	05
5	Vibration isolation and screening methods, improvement of distressed machine foundation.	06
6	Field and laboratory tests for evaluation of dynamic properties of soil under vertical vibration coefficient of elastic uniform compression, coefficient of elastic uniform shear, spring constant damping modulus of elasticity typical values of soils	06
7	Basics of dynamic earth pressure on retaining walls: conventional gravity type, reinforced soils, distribution of pressure, point of application of the resultant, simple examples.	06

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student shall prepare a project report covering the selection of design parameters, design analysis including drawing on any aspect of soil dynamics included in the syllabus. Each student has to appear for at least one written test during the term. The project report referred above, at least five examples and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments and report	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Soil Dynamics: Shamsheer Prakash, McGraw-Hill Book Company
2. Principles of Soil Dynamics: Braja M. Das, PWS-Kent Publishing Company
3. Dynamics of Bases and Foundations: D. D. Barkan, McGraw-Hill Book Company.
4. Relevant IS Codes

Class:- B E (Civil/Construction)		Semester VIII	
Subject:- Elective-II : Building Services			
Periods/week – each of 60 Period of minutes duration	Lecture		
	Practical	04	
	Tutorial	-	
		02	
Evaluation System		Hours	Marks
	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Machineries: Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors –DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity -Hot Water Boilers –Pumps	06
2	Plumbing Systems in Building: Plumbing services:-Water distribution system-Material for service pipes-Service connection-size of service pipe-Water meter-Valves-Storage tanks-Drainage system:-Pipe and traps-Sanitary fittings-system of plumbing-House drainage plans-Septic tank-Soak pit	09
3	Electrical Systems in Buildings Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations	06
4	Principles of Illumination & Design: Visual tasks – Factors affecting visual tasks – Modern theory of light and colour –Utilisation factor – Depreciation factor – MSCP – MHCP – Lamps of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.	08
5	Refrigeration Principles and Applications: Electric motors – Starters - Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire by A.C. Systems	05
6	Fire Safety Installation: Causes of fire in buildings – Safety regulations – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke	05

	detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers	
7	Rain Water Harvesting Water Audit of India, Concept of rain water harvesting, Methodologies for Percolation/ recharge bore pit, Percolation/ recharge bore well, Percolation/ recharge well cum bore pit, Harvesting rooftop rainwater, Harvesting driveway runoff. National water harvesters network (NWHN). Some case studies.	06
8	Introduction to Green Building: Need for a green building, planning and design of green buildings, obstacles, Materials used in green building technology, Rating System (According to LEED-INDIA)	03

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At last one site visit should be arranged to give an exposure to various construction techniques discussed in the above syllabus. A report on site, at least 10 assignments (including sketches) and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Report of site visit and assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Philips Lighting in Architectural Design, McGraw-Hill, New York, 1964.
2. The Lighting of buildings: R.G.Hopkinson and J.D.Kay, Faber and Faber, London, 1969.
3. Air-conditioning and Refrigeration: William H.Severns and Julian R.Fellows, John Wiley and Sons, London, 1988.
4. Air-conditioning and Energy Conservation: A.F.C. Sherratt, The Architectural Press, London, 1980.
5. National Building Code, BIS Publications New Delhi.
6. Building Construction: Dr. B.C. Punmia, Ashol K Jain, A.K Jain
7. Construction Engineering and Management: S. Seetharaman Umesh Publicatins, Delhi.
8. Water supply and Sanitary Installations: A. C. Panchdhari New age international publication, Delhi
9. Fire Safety in Building: V. K. Jain, New age international publication, Delhi
10. Green remodeling: David Johnston.
11. Green Building , Project Planning and Cost Estimation: R.S.Means
12. LEED – INDIA (Abridged Reference guide for Core and Shell, Version 1.0).

Class:-B E (Civil)		Semester VIII	
Subject:-Elective-II : Design of Hydraulic Structures			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Detailed Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Dams{General}: Introduction, classification, comparative study of different types of dams, selection of type of dam, selection of site of dam, preliminary and final investigations of dam sites, fixation of storage capacity, reservoir losses, sedimentation in reservoirs, density currents.	4
2	Gravity dams: Criteria for selection of dam site, construction material, forces acting on gravity dam, modes of failure, stability analysis, safety criteria, methods of design, stress analysis and stress contours, galleries, instrumentation, joints, keys, water seals, temperature control in concrete dams, foundation treatment. Spillways and other energy dissipating devices: types.	12
3	Arch and buttress dams: Types of arch dams, forces on an arch dam, design. Types of buttress dams.	4
4	Earth and rockfill dams: Advantages and limitations, foundation of earth dams, causes and failures of earth dams, design criteria, design considerations in earthquake regions, seepage line for different conditions, filters, upstream blankets, stability analysis, Swedish circle method with pore pressure, details of construction and maintenance, types of rockfill dams, stability analysis, advantages.	10
5	Spillways and flood control works: Factors affecting design of spillway, types of spillways, design principles of ogee spillway, chute spillway, siphon spillway and shaft spillway. Design of bucket type energy dissipater and stilling basin, flood mitigation reservoirs. Crest gates, types, advantages, choice, design of radial gate. Outlet works through dams, intake structures.	10
6	Miscellaneous topics: Design of small bridges and culverts, data collection, high flood discharge, linear waterway calculation, scour depth, causeways and culverts, principles of hydraulic design. Design details of surplus weir, flush escape, direct sluice, canal drop, canal regulator, cross drainage works. Vibration and cavitation in hydraulic structures. Design of air vent.	8

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. Assignments (on each module) consisting of theory and problems covering entire syllabus and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments	:	15 marks
Written test (at least one)	:	10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Irrigation and Water Power Engineering: Dr. B.C. Punmia and Dr. Pande B.B.Lal, Laxmi Publications Pvt. Ltd. New Delhi.
2. Irrigation Water Resources and Water Power Engineering: Dr. P.N. Modi, Standard Book House, Delhi.
3. Irrigation Engineering and Hydraulics Structures: S. K. Gerg, Khanna Publishers. Delhi.
4. Design of Irrigation Structures: S. K. Sharma, S. Chand and Co.
5. Theory and Design of Irrigation Structures: R. S. Varshney and R. C. Gupta, Nem Chand
6. Engineering for Dams, Vol. I to III: by Crager, Justin and Hinds, John Wiley
7. Design of Small Dams: USBR
8. Hydro Power Structures: R. S. Varshney, Nem Chand and Bross.
9. Concrete Dams: R. S. Varshney, Oxford and IBH Publishing Co.

Class:-B E (Civil)		Semester VIII	
Subject:-Elective-II : Industrial Waste Treatment			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Detailed Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	General: liquid wastes from industries – their volumes and characteristics, Effect of disposal into natural water courses, Municipal sewers and on land, River standards and effluent standards	06
2	Sampling and analysis of industrial wastes, Treatability study	06
3	Stream sanitation: Effects of industrial wastes on self-purification of streams and fish life, Statement and significance of the parameters of Streeter and Phelps's equation and BOD equations, Deoxygenating and reaeration , Oxygen sag	06
4	General treatment of industrial wastes: neutralization, equalization, segregation. Modification of conventional aerobic and anaerobic biological treatment methods. Dewatering and disposal of sludges – floatation, vacuum filtration, centrifugation, filter press	08
5	Detailed consideration of wastes produced from following industries: Processes normally followed , Volume and effects of raw and treated effluent on streams, sewers and land . Treatment methods , reuse-recovery 1) Textiles: cotton, wool, rayons. 2) Pulp & paper:- Sulphate process 3) Electroplating 4) Dairy 5) Sugar- sugarcane 6) Distilleries 7) Tanneries	14
6	Provision of various acts pertaining to industrial wastes / effluents, introduction to environmental impact assessment and environmental audit.	08

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student shall prepare a report comprising design criteria and flow sheet of the proposed treatment scheme including laboratory analysis for any one industrial waste. Demonstration of available software for design of effluent treatment plant is to be considered.

Each student has to appear for at least one written test during the term. The report mentioned above, at least 5 assignments and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments and report

: 15 marks

Written test (at least one)

: 10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Waste Water Treatment: Rao & Datta, Oxford & IBH Publishing Co.
2. Industrial Water Pollution Control: W W Eckenfelder Jr, Mc Graw Hill
3. Industrial Water Pollution Management: E F Gurnham, John Wiley
4. Biological Waste Treatment: Eckenfelder & Connor Pergamon Press
5. Theories and Practices of Industrial Waste Treatment: Addison Wesley
6. Pollution Control in Process Industries: S P Mahajan, Tata mcgraw Hill
7. Industrial Waste: W Rudolfs, (Ed), L E C Publishers Inc
8. The Treatment of Industrial Wastes: E D Besselièvre McGraw Hill
9. Industrial Waste Disposal: R D Ross, (Ed), Reinhold Book Corporation

Class:-B E (Civil)		Semester VIII	
Subject:-Elective-II : Transportation Planning and Economics			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150
Detailed Syllabus			

Detailed Syllabus

Module	Topics	No. of Lectures
1	Transportation Planning and management: General Travel Forecasting Principles and techniques, Generalized demand, price and capacity relationship applied to travel forecasting, Practical problems of forecasting travel. Introduction to the process of urban transport planning. Travel demand forecasting: Trip generation analysis, trip classification, multiple regression analysis, category analysis, trip distribution analysis: introduction, methods of trip distribution, uniform and average factor method, Fratar method, Furness method, the gravity model and its calibration, Intervening and competing opportunities model, linear programming approach to trip distribution. Modal split analysis: introduction, Modal split analysis: Probit analysis, Logit analysis and Discriminant analysis, modal split models with behavioral basis. Traffic Assignment: purpose of traffic assignment, traffic flow characteristics, Assignment techniques: All or nothing assignment, Multiple route assignment, Capacity restraint assignment, Diversion curves. Rout building algorithms. Land-use transport models: Introduction, selection of Land-use transport models, The Lowry model, Grain – Lowry model, Applications of Lowry model. Introduction to advanced/soft computational techniques for transportation planning like Expert Systems, Neural Networks, Fuzzy Logic, Genetic Algorithm, Simulated Annealing, Hybrid systems etc.	03 02 07 06 06
2	Transport Economics: Economic evaluation of highway schemes, need for economic evaluation, cost and benefits of transportation projects, basic principles of economic evaluation, Net present value method, benefit/cost ratio method, internal rate of return method. Vehicle operating costs, Value of travel time saving, Accident costs and road pricing.	08
3	Public Transportation Introduction to various mass transportation systems, Classification of mass transit modes: Street transit or surface transit, Semi rapid transit, Rapid transit or mass rapid transit System, Special transit systems: magnetic levitation, monorails, water borne transport, Automated Guided Transit,	02 05

Detailed capacity assessment of some selected technologies: Conventional bus on bus bays, Light rail transit, Rail Rapid Transit, Regional rail Transit or Suburban Railway,	04
Suitability of Transit Systems for different travel demand for Indian Cities, and forms, Influence of other factors in selection of Mass Transit Systems, Transit System Operations: Introduction, Route Development, Stop location and stopping policy, Schedule development, Capacity of transit systems.	04
Future of Public transportation.	02
	02

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. Project work based on transportation planning or on Public transportation system / Application of transport planning or transport economics software, assignment consisting of at least 15 problems and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments and project works : 15 marks

Written test (at least one) : 10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Traffic Engineering and Transport Planning: L.R. Kadiyali, Khanna publishers Delhi
2. Principles of Traffic Engineering: G.J. Pingnataro, Mc Graw-Hill, 1970.
3. Traffic System Analysis for Engineering and Planners: Wohl and Martin, Mc Graw Hill, 1983.
4. Introduction to Urban Transport Systems, Planning: B.G. Hutchinson, McGraw-Hill, 1970.
5. Economics of Transportation: Fair and Williams, Harperand Brothers, Publishers, New York.
6. Economic Analysis for Highway: Winfrey, Robley, International Textbook Co., Pennsylvania, USA, 1969.
7. Public Transportation Planning Operation and Management: Gray and Hoel, Prentice Hall Publication.
8. Principles of Transportation Engineering: Partha Chakroborty and Animesh Das, Prentice hall (India)

Class:-B E (Civil/Construction)		Semester VIII	
Subject:-Elective-II : Advanced Repair and Rehabilitation of Structures			
Periods/week – each Period of 60 minutes duration	Lecture	04	
	Practical	-	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	-	-
	Oral	-	25
	Term Work	-	25
	Total		150

Detailed Syllabus

Detailed Syllabus

Module	Topics	No. of Lectures
1	Introduction: Need for strengthening due to various reasons such as ageing, natural calamities, increase of load, change of function and design, construction errors	4
2	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, textile reinforced concrete	11
3	Specialized Repairs: Electro chemical repair using re-alkalization and chloride extraction techniques, Specialized repairs for chemical disruption, fire, marine exposure etc, Repair of damaged structures of water retaining structures, hydraulic structures, Pavements and Runways, Tunnels, Bridges, Piers and Flyovers, Parking Garages, Underwater repair, Masonary Repair, Repair and Restoration of Heritage Structures	11
4	Retrofitting by composite materials: Fiber reinforced concrete, Ultra-high performance fibre reinforced concrete (UHPFRC), Fiber reinforced composites, Carbon fibre reinforced polymer (CFRP), Fibre wrapping (Carbon, Aramide, Glass)	10
5	Seismic Retrofitting: Seismic strengthening of existing RC structures, Use of FRP for retrofitting of damaged structures	6
6	Post-Repair Maintenance of Structures: Protection & Maintenance schedule against environmental distress to all those structures	4
7	Special care in repair and rehabilitation of heritage structures	2

Theory Examination:-

1. Question paper will consist of total seven questions carrying 20 marks each.
2. Only five questions need to be attempted.
3. Question number 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature.
5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Oral Examination:-

Oral examination will be based on entire syllabus.

Term work:-

Each student has to appear for at least one written test during the term. At least 8 assignments and the graded answer paper of term test shall be submitted as term work.

The distribution of term work marks will be as follows:

Assignments : 15 marks

Written test (at least one) : 10 marks

The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.

Recommended Books:-

1. Concrete Repair and Maintenance: Peter H .Emmons and Gajanan M. Sabnis, Galgotia Publication.
2. Repairs and Rehabilitation-Compilation from Indian Concrete Journal-ACC Publication.
3. Guide to Concrete Repair and Protection, HB84-2006, A joint publication of Australia Concrete Repair Association, CSIRO and Standards Australia.
4. CPWD hand book on Repairs and Rehabilitation of RCC buildings published by DG(Works), CPWD, Government of India (Nirman Bhawan), <http://www.cpwd.gov.in/handbook.pdf>
5. Guide to Concrete Repair, Glenn Smoak, US Department of the Interior Bureau of Reclamation, Technical Service Center , <http://books.google.co.in>
6. Management of Deteriorating Concrete Structures: George Somerville, Taylor and Francis Publication
7. Concrete Building Pathology: Susan Macdonald, Blackwell Publishing.
8. Testing of Concrete in Structures: John H. Bungey, Stephen G. Millard & Michael G. Grantham, Taylor & Francis Publication.
9. Durability of concrete and cement composites: C.L.Page & M.M. Page, Woodhead Publishing
10. Concrete Repair, Rehabilitation and Retrofitting: M. Alexander, H. D. Beushausen, F. Dehn & P. Moyo, Taylor & Francis Publication
11. Concrete Repair Manual, Volume I & II, Published jointly by ACI, BRE, Concrete Society, ICRI

Class:-BE(Civil/Construction)		Semester-VIII	
Subject:- Project B			
Periods/week – each Period of 60 minutes duration	Lecture	-	
	Practical	-	
	Tutorial	04	
		Hours	Marks
Evaluation System	Theory Examination	-	-
	Seminar	-	-
	Presentation and Oral	-	50
	Term Work	-	50 (internal)
	Total		100

In continuation to semester VII work, the group of the students shall collect all necessary information pertaining to the project and analyse it. The group of the students shall prepare and submit a detailed report on the project.

The report shall be typewritten on A4 size papers and hard bound as per prescribed norms. Broadly the report shall include: Introduction, Literature Review, Problem definition, Data collection and analysis, Results (Numerical / Experimental), Conclusions and discussions.

Acquaintance with survey and research methods and their use in conducting systematic investigations, use of data analysis tools, computational methods and style of report, preparation and presentation shall form basis of evaluation. The group shall prepare and present a seminar based on this work before an external examiner.