

**UNIVERSITY OF MUMBAI**



**Scheme of Instructions and Examination  
(RR-2007)**

**For**

**The Final Year  
(Semester VII & VIII)**

**of the**

**B.E. Degree Course  
In  
Civil Engineering**

**(With effect from 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
<b>Total</b>		<b>20</b>	<b>2</b>	<b>12</b>	<b>-</b>	<b>500</b>	<b>175</b>	<b>-</b>	<b>125</b>	<b>800</b>

\* 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
<b>Total</b>		<b>16</b>	<b>-</b>	<b>12</b>	<b>-</b>	<b>400</b>	<b>150</b>	<b>-</b>	<b>150</b>	<b>700</b>

\* Common to Construction Engineering

# Presentation on project & Oral

**UNIVERSITY OF MUMBAI  
(RR-2007)**

**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

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

### 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:

Assignments	:	15marks
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 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 , 7<sup>th</sup> Edition, John Wiley, 2007.
11. Reinforced Concrete Fundamentals: Ferguson, P.M., Breen J.E., and Jirsa J.O., 5<sup>th</sup> Edition, John Wiley & Sons, 1988.

<b>Class:-B E (Civil/Construction)</b>		<b>Semester VII</b>	
<b>Subject:- Quantity Survey, Estimation &amp; Valuation</b>			
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		<b>150</b>

### 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 iii) Cross drainage work iv) Factory shed including steel truss	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	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:-**

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. a ground plus three storied building (RCC)
  - b. a bridge with minimum 2 spans
  - c. a factory building
  - d. a road work
  - e. a cross drainage work
  - f. a load bearing structure
- iii. Preparation of valuation report in standard Government form.
- iv. Assignments on rate analysis, market survey, specifications and simple estimates.
- v. Detailed estimate of minor structure
- vi. Bar bending schedule

Use of quantity survey software and use of worksheets / databases for some of the above assignments is desirable.

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

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

### 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.	2
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.	6
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.

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

### Detailed Syllabus

Module	Topics	No. of Lectures
1	<p><b>Air Pollution:</b>  Definition of air pollution, major episodes, classification of air pollutants, units of quantification, sources of air pollution, natural &amp; 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.</p> <p><b>Noise Pollution:</b>  Basic concepts, measurement, standards, effects on human health, and various control methods.</p>	08
2	<p><b>Sewage:</b>  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.</p>	04
3	<p><b>Sewage</b>  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</p>	28

	and suitability, design values, disposal of treated effluent.	
4	<b>Plumbing:</b> 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.	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.

**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.

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

### 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. 6 Global Positioning System: Signals, Measurements, and Performance, Second Edition (2006): Pratap Misra and Per Enge
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.
9. A remote sensing perspective: Introductory Digital Image Processing:, John R. Jensen,Prentice Hall.
10. Imaging Radar for Resource Survey: Remote Sensing Applications: W Travelt, Chapman & Hall.

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

### 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. Diffulties 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 metal for 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

<b>Class:-BE(Civil)</b>		<b>Semester-VII</b>	
<b>Subject:- Elective-I: Applied Hydrology and Flood Control</b>			
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		<b>150</b>

### 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.

<b>Class:-B E (Civil)</b>		<b>Semester VII</b>	
<b>Subject:-Elective-I : Solid Waste Management</b>			
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		<b>150</b>

### 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

10	Municipal solid waste in Indian conditions, legal aspects of solid waste disposal.	04						
<p><b>Theory Examination:-</b></p> <ol style="list-style-type: none"> <li>1. Question paper will consist of total seven questions carrying 20 marks each.</li> <li>2. Only five questions need to be attempted.</li> <li>3. Question number 1 will be compulsory and based on maximum part of the syllabus.</li> <li>4. Remaining questions will be mixed in nature.</li> <li>5. In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.</li> </ol> <p><b>Oral Examination:-</b> Oral examination will be based on entire syllabus.</p> <p><b>Term work:-</b> 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:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 80%;">Report and assignments</td> <td style="width: 5%; text-align: center;">:</td> <td style="width: 15%;">15 marks</td> </tr> <tr> <td>Written test (at least one)</td> <td style="text-align: center;">:</td> <td>10 marks</td> </tr> </table> <p>The final certification and acceptance of term work ensures the satisfactory performance of tutorial work and at least passing in the term-work.</p> <p><b>Recommended Books:-</b></p> <ol style="list-style-type: none"> <li>1. Integrated Solid Waste Management: Techobanglous, Thisen and Vigil, McGraw Hill International.</li> <li>2. Hazardous Waste Management: Lagrega, Buckingham and Evans, McGraw Hill International.</li> <li>3. Solid Waste Management in Developing Countries: A.D. Bhide, Nagpur publications</li> <li>4. Environmental Pollution Control Engineering: C.S. Rao, Wiley Eastern, Manual of solid waste of management, CPHEEO</li> </ol>			Report and assignments	:	15 marks	Written test (at least one)	:	10 marks
Report and assignments	:	15 marks						
Written test (at least one)	:	10 marks						

<b>Class:-B E (Civil/Construction)</b>		<b>Semester VII</b>	
<b>Subject:-Elective-I : Systems Approach in Civil Engineering</b>			
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		<b>150</b>

### 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

<b>Class:-B E (Civil/Construction)</b>		<b>Semester VII</b>	
<b>Subject:-Elective-I : Risk and Value Management</b>			
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		<b>150</b>

### 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.

<b>Class:-B E (Civil)</b>		<b>Semester VII</b>	
<b>Subject:-Elective-I : Advanced Structural Analysis</b>			
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		<b>150</b>

### Detailed Syllabus

Module	Topics	No. of Lectures
1	<p>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.</p>	13
2	<p>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.</p>	07
3	<p>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.</p>	06
4	<p>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.</p>	08
5	<p>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.</p>	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.

<b>Class:-B E (Civil)</b>		<b>Semester VII</b>	
<b>Subject:-Elective-I : Structural Dynamics</b>			
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		<b>150</b>

### 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.

<b>Class:-B E (Civil)</b>		<b>Semester VII</b>	
<b>Subject:-Elective-I : Advanced Structural Mechanics</b>			
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		<b>150</b>

### 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 Jhonston 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, Preentice Hall, New Delhi.
8. Strength of Materials: Subramanian, Oxford University Press.

<b>Class:-B E (Civil)</b>		<b>Semester VII</b>	
<b>Subject:-Elective-I : Advanced Foundation Engineering</b>			
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		<b>150</b>

### 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

<b>Class:-B E (Civil)</b>		<b>Semester VII</b>	
<b>Subject:-Elective-I : Ground Water Hydrology</b>			
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		<b>150</b>

### 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.

<b>Class:-B E (Civil)</b>		<b>Semester VII</b>	
<b>Subject:-Elective-I : Pavement Subgrade and Materials</b>			
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		<b>150</b>

### 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	Grading requirements for aggregate, selection of bases and subbase material (including stabilized materials), selection of different grade of bitumen, types of bituminous surfaces, skid qualities, bituminous mix design, Marshall stability test, design aspect of paving concrete. Experimental characteristics of road aggregate.	06
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.	08
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

**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.

<b>Class:-B E (Civil)</b>		<b>Semester VII</b>	
<b>Subject:-Elective-I : Air Pollution</b>			
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		<b>150</b>

### 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.

<b>Class:-B E (Civil)</b>		<b>Semester VII</b>	
<b>Subject:-Elective-I : Prestressed Concrete</b>			
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		<b>150</b>

### 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 profiles.	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.

<b>Class:-B E (Civil)</b>		<b>Semester VII</b>	
<b>Subject:-Elective-I : Traffic Engineering and Control</b>			
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		<b>150</b>

### Detailed Syllabus

Module	Topics	No. of Lectures
1	<p>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.</p>	<p>08  03 04  07  03  02  03  04  04  02</p>
2	<p>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.</p>	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.

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

### 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. Shotcreting. 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

<b>Class:-BE(Civil)</b>		<b>Semester-VII</b>	
<b>Subject:- Elective-I: Advanced Computational Techniques</b>			
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		<b>150</b>

### 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 $\chi^2$ 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, $\chi^2$ 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	:	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. 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

<b>Class:-BE(Civil/Construction)</b>		<b>Semester-VII</b>	
<b>Subject:- Project A</b>			
Periods/week – each Period of 60 minutes duration	Lecture	-	
	Practical	-	
	Tutorial	04	
		<b>Hours</b>	<b>Marks</b>
Evaluation System	Theory Examination	-	-
	Seminar	-	25
	Oral	-	-
	Term Work	-	25
	Total		<b>50 (Internal)</b>
<p>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.</p> <p>The project work may include,</p> <ul style="list-style-type: none"> <li>- experimental analysis / verification,</li> <li>- development of design methods and verification,</li> <li>- design and fabrication of a model for a civil engineering project,</li> <li>- design for civil engineering structures and preparation of working drawings,</li> <li>- developing a software for analysis and / or design of decision making in civil engineering and management practice</li> <li>- technical and / or economic feasibility study</li> <li>- study on new materials / methodology for construction</li> </ul> <p>The students may be asked to work in groups with not more than four students in each group.</p> <p>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.</p>			