

**B.E. III to VIII Semester
(Civil Engineering)**

Prospectus No. 10172

संत गाडगे बाबा अमरावती विद्यापीठ

SANT GADGE BABA AMRAVATI UNIVERSITY

(FACULTY OF ENGINEERING & TECHNOLOGY)

PROSPECTUS

**PRESCRIBED FOR
FOUR YEAR DEGREE COURSE
BACHELOR OF ENGINEERING
CIVIL ENGINEERING
III TO VIII SEMESTER
EXAMINATIONS, 2009-2010
SEMESTER PATTERN**



2009

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Price Rs. 12/-

PUBLISHED BY
Prof. J.S. Deshpande
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Sant Gadge Baba
Amravati University,
Amravati. 444 602

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**SYLLABUS
PRESCRIBED FOR
BACHELOR OF ENGINEERING
CIVIL ENGINEERING EXAMS.
SEMESTER PATTERN
THIRD SEMESTER**

Inplant Training & Industrial Visit in the faculty of Engineering & Technology

- 1)
 - a) the inplant training shall not be compulsory,
 - b) the inplant training shall be taken by students strictly during Summer vacation. after IVth or VIth Semester examination and / or during Winter vacation after Vth or VIIth Semester examinations,
 - c) the inplant training shall not be part of examination system, however, student shall prepare and submit report after completion of training to the concerned Head of Department alongwith certificate issued by the industry,
 - d) the inplant training shall be of minimum two weeks duration,
 - e) there shall not be any liability whatsoever on the Institution with respect to inplant training of the students,
 - f) students shall undertake inplant training on their own risk and cost. An undertaking in this regards signed by student and parents shall be submitted before proceeding for training to the concerned Head of Department/ Head of Institution.
 - g) the students shall complete inplant training under the supervision of concerned person in the industry,
 - h) Institutes shall help students to organise inplant training by way of correspondance,
- 2) Industrial Visit : Industrial visit may be organised for the students. Students should prepare & submit the report on Industrial visit to the concerned Head of Department/Head of Institution.

3SC1 MATHEMATICS-III

SECTION - A

Unit I : Ordinary Differential Equations.

Complete solution, Operator D, rules for finding the complementary function, the inverse operator, Rules for finding particular integral. Method of variation of parameters, Cauchy's and Legendre's Linear Differential equations. Simultaneous linear differential equations with constant coefficients Applications to civil engineering.

Unit II: Laplace transforms :

Definition and elementary properties, Inverse L.T. by various methods, Convolution theorem, Solution of ordinary and simultaneous differential equation using Laplace transform of periodic functions. Application to problems of beams.

Unit III Partial Differential Equations.

P.D.E. of first order and first degree of types i) $f(p,q) = 0$ ii) $f(p,q,z)=0$, iii) $f(p,q,x,y)=0$ iv) $f(p,q,x,y,z)=0$ i.e. (a) Lagrange's form $Pp + Qq = R$ (b) Clairaut's form $z=px+qy+f(p,q)$ v) Equations reducible to above standard types linear Homogeneous P.D.E. of nth order with constant co-efficients.

SECTION-B

Unit IV Numerical Methods :-

(a) i) Solution of Algebraic and transcendental Equations by Newton Raphson method and by method of False Position.
ii) Solution of system of linear equations by Grout's method, Gauss Seidal method and Relaxation Method.
(b) Numerical solution of differential equations by Picard's method, Taylor's series method, Euler's method, modified Euler's method and Rungekutta forth order method.

Unit V : Complex variable :

Analytic functions, C.R.conditions, Harmonic functions. harmonic conjugate functions, Milne's method, conformal mapping, Elementary conformal mapping $w=z+c$, $w=cz$, $w+$ Bilinear transformation.

Unit VI Statistics :

Probability : Axioms, conditional probability, Baye's theorem, Mathematical Expectation and probability distributions (Binomial, Poisson and Normal) Curve fitting by method of least square only for line and parabola, Corelation regression.

Books Recommended :

- 1) Text Book of Applied Mathematics by P.N.Wartikar and J.N.Wartikar.
- 2) Advance Mathematics for Engineers by Chandrika Prasad.
- 3) Method of Applied mathematics by F.B.Hildebran.
- 4) Introductory methods of Numerical Analysis by S.S.Sasby.
- 5) Computer Oriented Numerical Method by Raja Raman.

SECTION-A

- Unit-I
- Mechanical properties : Concept of direct, bearing and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, tor steel and concrete, Generalized Hook's law, factor of safety.
 - Uniaxial stresses and strains : Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.
- Unit-II
- Axial force, shear force & bending moment diagrams : Beams, loading and support conditions, bending moment, shear force and axial load diagrams for all types of loadings for simply supported beams, cantilevers and beams with overhangs, relation between shear force, bending moment and loading intensity.
- Unit-III
- Stresses in beams (Bending, Shear),
 - Bending: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section.
 - Shear : Distribution of shear stresses on beam cross sections,
 - Strain energy under uniaxial tension and compression, impact loads and instantaneous stresses.

SECTION - B

- Unit-IV
- Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load.
 - Thin cylinders subjected to internal pressures.
- Unit -V :
- Principal stresses : Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses, principal strains.
 - Combined direct & bending stresses : Combined direct and bending stresses, applications to short columns with eccentric loads, retaining walls with horizontal lateral force.
- Unit-VI
- Slope & deflection of beams : Slope & deflection in statically determinate beams subjected to point loads, uniformly

distributed loads, moments by a) Macauley's method b) Moment Area method c) Conjugate Beam method.

- Theory of long columns, Euler, Rankine formula.

PRACTICALS:

Minimum seven out of following:

- Tension test on metals.
- Compression test on metals.
- Shear test on metals.
- Impact test on metals.
- Hardness test on metals.
- Torsion test on metals.
- Deflection of beams.
- Modulus of rupture test.
- Buckling of columns.
- Deflection of springs.

A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

BOOKS RECOMMENDED:

- E.P.Popov, Mechanics of Materials, Prentice Hall of India, New Delhi.
- S. Timoshenko and O.H.Young, Elements of Strength of Materials, East West Press Private Ltd., New Delhi.
- Ferdinand L. Singer, Strength of Materials, Harper and Row, New York
- Shames, I. H., Introduction to solid mechanics, Prentice Hall of India, New Delhi
- Natarajan, Mahadeoappa, Strength of materials
- Junnarkar, S. B., Mechanics of materials
- Mubeen, A., Mechanics of solids, Pearson education (Singapore) Pte. Ltd.
- Beer and Johnston, Mechanics of materials, Mc-Graw Hill.

SECTION-A

- Unit-I
- Highway : Development And Planning, Road Transport characteristics, classification of Roads, Road development plans & Salient features, Road pattern, Alignment principles, Egg. Survey for highway. Material And Testing. Various properties of aggregates and bituminous materials and Test, IRC, IS Specifications, bituminous mix design.

- Unit-II Geometric Design : cross sectional elements, Right of way, Camber, Gradient, Typical Highway cross section in embankment and in cutting, PIEV Theory, stopping sight distance, Overtaking sight distance, Horizontal alignment - curves, superelevation, Extra widening, transition curves, vertical alignment, Design of summit and valley curves, IRC Standards for Geometric design.
- Unit-III Pavement Design : Components of Flexible and Rigid pavement, Design factors, ESWL, Flexible pavement design by C.B.R. Method. Westergaard's analysis for wheel load & Temperature stresses in rigid pavement, Rigid pavement by IRC method (As per IRC-37), Combination of stresses, Joints in Rigid Pavement, Construction And Maintenance – WBM Surface dressing, Bituminous roads, cement concrete Pavement, construction procedure, construction of roads in expansive soil.

SECTION-B

- Unit-IV Traffic Engineering : Traffic Characteristics, Traffic studies, road parking system, accident study, traffic control devices, marking, signs, signals, island its type, At grade intersections – clover leaf, diamond, rotary intersections & design elements, 3 E's of traffic, regulation for driving motor vehicle, motor vehicle Act & Rule.
- Unit-V Bridge Engineering – Component, classification and identification, data collection, site selection, economic span, different structural form – culverts, causeways, major and minor bridges, types of foundation, abutments, piers and wing wall, bearing their types and choices, Erection of bridge superstructure.
- Unit-VI Bridge Hydrology - Estimation of flood discharge, water way, scour depth, depth of foundation, Afflux, clearance and free board. Load, Forces, Stresses – Loads, forces, stresses acting on bridges. IRC Specification and code practices, critical combination. Rating And Maintenance – Methods and techniques of rating of existing bridges, repairs, maintenance, corrosion – causes and prevention, Strengthening of bridge superstructure.

PRACTICALS

Based on above syllabus, following practical are required to be performed and a laboratory report be submitted by every student. Practical examination will be viva based on above system.

List of Experiments (Any Eight)

1. Determination of Los Angeles value
2. Determination of Abrasion value of Aggregates by the use of devil machine
3. Determination of Aggregate Impact value
4. Determination of Aggregate Crushing value
5. Determination of Flakiness and Elongation Index of Aggregate.
6. Determination of perforation value of Bitumen
7. Determination of Viscosity of Bituminous material
8. Determination of softening point of bituminous material.
9. Determination of ductility of bitumen.
10. Determination of flash point and fire point of Bituminous material
11. Determination of marshal stability value

BOOKS RECOMMENDED :-

- 1) Khanna S.K. & Justo C.E. : Highway Engineering
- 2) Rao G.V. : Principles of Transportation & Highway Engg.
- 3) Dr.Kadiyali L.R. : Traffic Engg. & Transport Planning.
- 4) Sharma S.K. : Principles, Practice & Design of Highway Engg.
- 5) Bindra S.P. : Principles & Practice of Bridge Engg.
- 6) Bindra S.P. : A Course in Highway Engg.
- 7) Duggal A.K. & Puri V.P. : Laboratory Manual in Highway Engg.

3SC4 BUILDING CONSTRUCTION & MATERIALS SECTION - A

- Unit-I Introduction : Definition, types of buildings as per national building code, components of buildings and their functions, Types of structure – load bearing structure & framed structures, their relative advantages & disadvantages, load bearing walls and partition walls, HDPE Wall panel. Foundation :- Definition and necessity, loads of foundation, Bearing Capacity soil, SBC values based on IS code, field methods of improving bearing capacity. Types of foundation – shallow foundation & deep foundations for buildings, spread footings for walls & columns, Raft foundations, Foundations in black cotton soils, under-reamed pile foundation, precautions to be taken. Causes of failure of foundations. Setting out for foundation, excavation for foundation.
- Unit-II Stone Masonry – Technical terms, General principles to be observed during construction, random rubble masonry,

coursed and un-coursed rubble masonry, Selection of stone for masonry.

Brick Masonry – Classification of bricks, manufacturing of clay bricks, tests on bricks, properties of burnt bricks, new trends in brick manufacturing such as use of fly ash, stabilized mud blocks.

Brick masonry construction – Technical terms, general principles, commonly used types of bonds such as stretcher, header, English bond and Flemish bond, their suitability. Earthquake force, various features for making load bearing structure earthquake resistant.

- Unit-III Floors – Types of Floors – Basement floor, ground floor and upper floors, Types of upper floors – R.C.C. slab floor, R.C.C. slab & beam floor, R.C.C. ribbed floor, R.C.C. Grid floor, R.C.C. flat slab floor, Floor finishes – Types of flooring material, Sahabad, Kotta, Granite, Ceramic tiles, plain tiles, mosaic tiles, glazed tiles, different types of floor finishes, their suitability, method of construction, criteria for selection.
- Roofs – Flat & pitched roof, steel roof trusses – types and suitability, fixing details at supports, types of roof covering, AC & GI sheets, acrylic sheets, fixing details of roof covering.
- Formwork – Different types, their relative merits & demerits, period for removal of formwork for different members.

SECTION - B

- Unit-IV Doors & Windows – Different forms of commercial woods-plywood, particle-board, batten-board, block-board, novapan, sunmica, veneer sheets.
- Doors : Purpose, criteria for location, size of door, door frames & its types, methods of fixing, T Types of door shutters and their suitability, HDPE door shutter.
- Windows – Purpose, criteria for location, no. sizes & shapes of Windows, types of windows & their suitability.
- Ventilators – Types and their suitability. Fixtures & fastening for doors & windows.
- Glass – Types of glass & their suitability.
- Arches & lintels – Types & their suitability, details of R.C.C. lintels & chajja, precast lintels & arches.
- Unit-V Stairs – Function, technical terms, criteria for location, types of staircases, their suitability, principle of stair layout design.
- Lifts, ramps & escalators – suitability.
- Plastering & pointing- Necessity, types, processes of different types of plastering, defects in plastered work.

Painting & Colouring – Necessity, types, processes of painting & colouring to wall surfaces, wooden surface, iron & steel surfaces, types of paints and their uses.

Scaffolding – Purpose, types, suitability.

- Unit-VI Special Aspects of Construction –
- Damp proofing – causes of dampness, its effects, various methods of damp proofing, material used for damp proofing, details of cavity wall construction.
- Fire proof construction – Points to be observed during planning & construction. Fire protection requirements for a multistoried building.
- Sound proof Construction – Sound absorbants and their characteristic, factors affecting the acoustical design of an auditorium.
- Joints – Expansion & construction joints necessity, details of expansion joint at foundation level & roof level of load bearing structure and framed structure. Provision of construction joints in slabs, beams & columns.

PRACTICALS –

- Drawing of following building elements on A-2 size sheet.
 - Panelled door, flush door, glazed window.
 - Steel truss with details of joints, details & support, details of fixing of roof covering.
- Planning & drawing of a staircase for the given data. [On A-2 size sheet, Design calculations, plan & section.]
- Preparation of foundation plan from the given line plan of a two room building [On a A-2 size sheet.]
- Layout of the above, in field.
- Fields visits to building under construction and its report writing including material of construction, construction processes, Human recourses required, construction details.
- Sketch book containing Free hand sketches of following
 - Different types of foundations.
 - Bonds in brick masonry
 - Types of floors. [sections]
 - Types of stairs. [plans and side view]
 - Line sketches of different types of steel roof trusses.
 - Details of expansion joints.
 - Details of damp proofing for basement.
 - Fixtures & fastenings of doors & windows.

BOOKS RECOMMENDED :

- 1) Mackay W.B. : Building Construction, Vol. I, II, III, Longmans.
- 2) Sushilkumar : Building Construction, Standard Publishers Distributors.
- 3) Deshpande R.S. and Vartak C.V. : A Treatise on Building Construction.
- 4) Sharma S.K. Kaul B.K. : A. T.B. of Building Construction, S. Chand & Co.
- 5) Gurucharan Sing : Building Construction Engg., Standard Book House, Delhi-6
- 6) Sane L.S. : Construction Engg., Manak Talas, Mumbai.
- 7) Chudley R. : Construction Technology, Vol. I, II, III & IV, Longmans Group Ltd.
- 8) ISE National Building Code of India, 1970.
- 9) Punmia B.C. : Building Construction.
- 10) A Manual of Earthquake Resistant, Non-Engineered Construction Indian Society of Earthquake Tech.

3SC5**ENGINEERING GEOLOGY**

- Unit-I : Introduction - Different branches of Geology and importance of Geology in Civil Engineering.
Mineralogy - Study of common rock forming and ore minerals with reference to its physical properties.
Petrology - rock cycle, rock weathering and soil formation, origin, classification and textures of igneous sedimentary and metamorphic rocks, study of common rock types.
- Unit II : Structural Geology - outcrop, dip strike, elementary ideas about folds, faults, joints and unconformity, effect of these structures in foundation.
Earthquake Engineering - earthquake waves, causes and effects, magnitude and intensity, earthquake zones of India, seismic coefficient.
Geological investigation - surface and sub-surface investigation, direct and indirect.
- Unit-III : Rock as a material of construction. Study of engineering properties of rocks and soils. Geological studies related to site selection for dams and reservoirs, tunnel alignment, hydroelectric plants, bridges, roads, air fields etc. Case histories of some major projects of tunnels, dams and reservoirs.

LABORATORY WORK :-

- 1) Megascopic study of common rock forming and ore minerals.
- 2) Megascopic study of the common igneous, sedimentary and

metamorphic rocks.

- 3) Geological map reading and construction of sections from simple geological maps with engineering problems (about 8 maps)
A report/journal on above practical conducted shall be submitted by each student. Practical examination shall be based on practical and viva-voce conducted on the above syllabus.

BOOKS RECOMMENDED :-

- 1) Singh Parbin : General & Engineering Geology.
- 2) Mukharjee : A Text Book of Geology.
- 3) Tuyrell G.W. : The Principle of Petrology.
- 4) Wadia D.N. : Geology of India.
- 5) Krishan M.S. : Geology of India.
- 6) Date S.Y. & Mukharjee D.M. : Geological Maps.
- 7) Deshmukh D.N. & Mukharjee D.M. : Engineering Geological Maps.
- 8) Gupte R.B. : Geology of Engineering.
- 9) Reddy Venkata : Engineering Geology.

3 SC 6**COMMUNICATION SKILLS**

- Unit I : Word Study : synonym, antonym, meanings, matching words, adjectives, adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage.
Comprehension over an unseen passage.
Most commonly spoken sentences.
- Unit II : (a) Verbal communication, its significance, types of written communication, organization of a text (titles, summaries, headings, sequencing, signaling, cueing etc.), important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectivity and subject content.
(b) Non-verbal communication, types of graphics and pictorial devices, body language.
- Unit III : (a) Specific formats for written communication like business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day-to-day written communication like application, notices, minutes, quotations, orders, enquiries etc.
(b) Oral communications - important objectives of interpersonal skills, (verbal and non-verbal), face to face communications, group discussion and personal interviews.

Methodology of conduction of meetings, seminars, symposia, conferences and workshops.

BOOKS RECOMMENDED :

- 1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.
- 2) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Pub. House.
- 3) Curriculum Development Centre, TTTI WR, Bhopal : A Course in Technical English, Somaiya Pub. Pvt. Ltd.]
- 4) F. Frank Candlin : General English for Technical Students, University of London Press Ltd.

PRACTICALS :

- 1) Interactive Language Laboratory.
- 2) Group Discussion
- 3) Submission of Technical Report.
- 4) Mock Interview.

External Examination will be based on Group Discussion (5 Marks) & Viva-Voce on other practicals (10 Marks).

**SEMESTER : FOURTH
GEOTECHNICAL ENGINEERING – I**

4SC1

SECTION – A

- Unit-I History of development of soil mechanics , formation of soil, its significance to the field problems.
Soil properties and its classification, system: Definition of soil, soil as a three phase system, weight – volume relationship Density of Soil, relative density, in-situ density, specific gravity of soil solids, soil solids index and simple soil properties, void ratio, porosity, degree of saturation and functional relationship. Grain size analysis, Mechanical and Sedimentation analysis, consistency limits and their determination, liquidity idea, activity, sensitivity etc. Criteria of classification of fine grained and coarse grained soil IS soil classification
- Unit-II Concept of clay mineral, major soil minerals, Kaolonite, Illite, Montmorillonite, its structural formation and properties. Mechanics of compaction, factors affecting compaction, standard and modified Proctor test, OMC, their field determination, zero air-void line, concept of wet of optimum and dry of optimum, different structures of soil, field method

of compactions and quality control. Mechanical stabilization and CBR test & its application.

Unit-III

Absorbed water, surface tension, capillarity and its effect on soil properties permeability of soil, Darcy's law and validity, Discharge and seepage velocity, factors affection permeability, determination of oefficient of permeability laboratory and field methods. IS procedure for determination of coefficient of permeability for stratified deposits. Drainage and dewatering of soil, various methods, deciding different drainage system.

SECFION – B

Unit-IV

Laplace equation, its derivation in Cartesian co-ordinate system, its application for the computation of discharge seepage, seepage pressure, quick sand condition, concepts flow net, method to draw flow nets, characteristics and use of flow net, preliminary problem of discharge, estimation of discharge through homogenous earthen embankment, concept of effective neutral and total stress in soil mass, method of arresting seepage, design of graded filter, Terzagghi's criteria, protection filter, requirement of ideal filter material, concept of piping and criteria of stability against piping.

Unit-V

State of stress at a point, Mohrs stress circle, stress distribution in soil mass, Boussinesqs theory and its applications, point load, uniformly loaded rectangular and circular area New-marks chart, its preparation and use, equivalent point load to deleted.
Compression of laterally confined soil, e-p virgin compression curve, compression index, swelling index, coefficient compressibility, concept of consolidation spring analogy Terzaghi's theory of one imensional consolidation. Mathematical treatment). Consoledo meter-test, coefficient consolidation, time factor curve fitting methods, consolidation. Cassagrandes method for determination of pre-consolidation pressure.

Unit-VI

A physical concept of shear strength, Introduction of Mohr's stress diagram, Mohr's failure criterial, Mohr-Coulombs theory and development of failure envelopes, Laboratory measurement of shear strength for different drainage, coditions by direct shear test, Unconfined compression test, Triaxial and vane sheartest, concept of pore pressure coefficients and their significance on strength of soil,

overconsolidation ratio, shear characteristics of sand, NC and OC clays and partially saturated soil: Influence of soil structure and strain rate on shear strength, Merits and demerits of various shear strength tests.

PRACTICALS:-

Based on above syllabus, following ten practical are required to be formed and a laboratory report be submitted by every student. Practical-examination will be viva based on above syllabus.

EXPERIMENTS:-

1. Determination of specific gravity of soil solids by Pycnometer, density bottle.
2. Determination of moisture content by oven-drying method.
3. Determination of field density of the soil by sand replacement / core cutter method.
4. Determination of grain size distribution by mechanical sieve analysis.
5. Determination of Atterberg's limits (LL, PL and SL)
6. Determination of Compaction properties (Standard Proctor Test)
7. Determination of permeability of falling head test
8. Determination of shear strength parameters by direct shear test
9. Determination of unconfined compressive strength of soil.
10. Determination of shear strength parameters by Triaxial of UU type
11. C.B.R. test.
12. Consolidation test

BOOKS RECOMMENDED:

- 1) Craig R.F. : Soil Mechanics, ELBS, 1983.
- 2) Lambe T.W. & Whitman R.V. : Soil Mechanics, John Wiley and Sons, 1969.
- 3) Terzaghi K. & Peck R.B. : Soil Mechanics in Engg. Practice, John Wiley & Sons, 1967.
- 4) Gulhati S.K. : Engg. Properties of Soils, Tata McGraw Hill, New Delhi, 1978.
- 5) Singh A. : Soil Engg. in Theory and Practice, Asia Publishing House, Mumbai.
- 6) Venkategramiah C. : Soil Mechanics and Foundation Engg.

4SC2

FLUID MECHANICS – I SECTION - A

Unit I: Introduction: Definition of Fluid, physical properties of fluid mass density, unit weight, specific Gravity, dynamic viscosity, Kinematic Viscosity, Newton's law of viscosity, Rheological

classification of fluids. Adhesion, Cohesion, surface tension, capillarity, pressure inside droplet & jet of liquid.

Fluid Statics I : Pressure at a point, Pascal's law, Equation of fluid statics & its integration, Measurement of pressure, absolute & gauge, types of manometers.

Unit II: Fluid Statics II : Forces on immersed areas – plane and curved, Buoyancy, equilibrium of floating bodies, metacenter, metacentric height, its determination by analytical method only. Kinematics : types of Flow – Eulerian approach of describing fluid motion, streamline, stream tube, streak line, Path line, substantive, local, convective acceleration, velocity potential, stream function, continuity equation of 2D & 3D flow in Cartesian coordinates.

Unit III : Fluid Dynamics : Eulers equation of motion along a streamline and its integration to prove Bernoulli's equation, HGL, EGL, velocity distribution, Average velocity, Kinetic – Energy correction factor, momentum correction factor (Definition only) Momentum equation (Statement Only) Forces on pipe bends.

SECTION - B

Unit IV: Fluid Measurement – I : Venturimeter, Orificemeter, Pitot tube, Prandtl Pitot tube, circular orifices & mouthpieces, time of emptying rectangular tanks by orifices at bottom & sides.

Fluid Measurement – II: Notches & weirs, Definition, Types rectangular, triangular, trapezoidal, Cipolletti weir, end contractions, velocity of approach, Francis equation.

Unit V: Laminar flow through circular pipes, velocity distribution, Hagen Poiseuille equation with Proof. Reynold's number, Boundary layer, definition, development along a flat plate, Nominal thickness, energy thickness, Momentum thickness, displacement thickness.

Unit VI: Flow around immersed bodies, drag, lift, different forms of drag, calculations of drag & lift on cylindrical bodies only. Pipe flow Darcy – Weisbach equation $h_f = f l v^2 / 2 g d$ (no proof) major & minor losses, pipes in series, pipes in parallel, equivalent pipe, pipe Network (Hardy – Cross method only)

PRACTICALS :-

Minimum 8 practical out of the list given should be carried out. The practical examination shall consist of viva-voce based on theory &

practical. Graphs are to be drawn wherever necessary.

1. Verification of Bernoulli's theorem.
2. Reynolds experiment to determine type of flow.
3. Determination of coefficient of discharge for Venturimeter
4. Determination of coefficient of discharge for Orificemeter
5. Determination of hydraulic coefficients of orifice.
6. Determination of metacentric height.
7. Determination of friction factor for GI pipe
8. Determination of coefficient of discharge for rectangular notch .
9. Determination of coefficient of discharge for triangular notch.
10. Determination of coefficient of discharge for trapezoidal notch.
11. Determination of coefficient of discharge for mouthpiece.

Books Recommended :

- 1) Modi P.N. & Seth S.M. : Hydraulics & Fluid Mechanics, SI Edition.
- 2) Dr. Jain A.K. : Fluid Mechanics.
- 3) Subramanya K. : Fluid Mechanics.
- 4) Streeter : Fluid Mechanics.
- 5) Garde & Mirajgaonkar : Fluid Mechanics.

4SC3

**THEORY OF STRUCTURES – I
SECTION – A**

- | | |
|----------|---|
| Unit-I | <ol style="list-style-type: none"> 1. Classification of Structures, Concept of statically indeterminate beam and frame, Analysis of fixed beam and propped cantilever, Rotation and sinking of support. 2. Analysis of Continuous beam by theorem of three moments, sinking of support. |
| Unit-II | <ol style="list-style-type: none"> 1. Castigliano's theorem I, Unit load method, slope and deflection in determinate beams and portals. 2. Deflection in determinate trusses. |
| Unit-III | <ol style="list-style-type: none"> 1. Influence line diagrams for reactions, bending moment and shear force for determinate beams. 2. Rolling loads on simply supported beams, concentrated and uniformly distributed loads, maximum shear force and bending moment, focal length. |

SECTION B

- | | |
|---------|---|
| Unit-IV | <ol style="list-style-type: none"> 1. Rolling loads on trusses, Influence line diagrams for forces in members of simple trusses. 2. Three hinged arches subjected to static loads, Bending moment, radial shear and axial thrust. |
|---------|---|

Unit-V Slope deflection method:

1. Analysis of continuous beams with and without sinking of support.
2. Analysis of portal frames without side sway.

Unit-VI Moment Distribution method:

1. Analysis of continuous beams with and without sinking of support.
2. Analysis of portal frames without side sway.

BOOKS RECOMMENDED:

1. Junnarkar, S. B., Mechanics of Structure, Volume I and II
2. Jain and Arya, Theory and Analysis of Structures
3. Reddy. C. S., Basic Structural Analysis, Tata – McGraw hill
4. Wang, C. K., Elementary Analysis of Structures
5. Norris and Wilbur, Elementary Structural Analysis.

4SC4

**SURVEYING – I
SECTION-A**

- | | |
|--------|--|
| Unit-I | <ol style="list-style-type: none"> 1. Introduction Surveying – Necessity & purpose, Geodetic & plane surveying, classification of survey, principles of surveying. 2. Instruments for measurement of distance, linear measurements, corrections to field measurements, ranging out, direct and indirect ranging. Use of distomat. 3. Chain surveying: basic definition, principle, selection of survey stations, offsets for locating details, limiting length of offsets, degree of accuracy of offsets, use of cross staff, optical square, prism square, obstacles in chaining, plotting of chain survey work, cross staff survey. |
| UnitII | <ol style="list-style-type: none"> 1. Instruments for measurement of angles: Prismatic compass, surveyor's compass, their use and adjustments. Vernier and microscopic theodolite, their temporary adjustment. Permanent adjustment of vernier theodolite. Introduction and uses of Total Station. 2. Traversing with chain and compass, Reference meridians, bearing and azimuths. Local attraction, magnetic declination |

and its variation. Open & closed traverses. Adjustment of closed traverse - Bowditch's Graphical method.

- Unit-III
1. Instruments for measurement of elevation : Dumpy levels tilting and automatic levels. Details of their construction.
 2. Temporary and permanent adjustments of Dumpy and tilting levels.

SECTION - B

- Unit-IV:
1. Measurement. of Horizontal and Vertical angles with theodolite by different methods. Other uses of theodolite.
 2. Theodolite traverse, latitude and departure, Gale's traverse table.

- Unit-V
1. Leveling: Definition of terms, Principle, leveling methods, leveling staves, Booking and reduction of field notes, curvature and refraction.
 2. Contouring: Definition, Characteristics and uses of contour maps, methods of contouring. Refraction, reciprocal leveling plotting of profiles. Errors in leveling.

- Unit-VI:
1. Plane tabling : equipments, methods, two point and three point problems, Advantages & disadvantages of plane tabling, Lehman's rules.
 2. Construction and use of minor instruments such as Abney level, Box sextant, Plan i meter, Tangent clinometer, Ghat Tracer.

PRACTICALS–

5 practicals mentioned below shall be performed by each student, Observations, calculations and relevant work to be submitted in the form of field book and 4 drawing in A-1 size sheet as a sessional work.

1. Measurement of length – use Distomat.
2. Chain and Compass surveying.
3. L Section & C/section of road.
4. Plane table survey.
5. Theodolite traverse.
6. Study and use of minor instruments.
7. Measurement of area of a irregular figure by digital planimeter.

Practical examination shall consists of field exercise and vivavoce based on the above syllabus and practical work.

BOOKS RECOMMENDED:

1. D.Clark : Plane and Geodetic Surveying, Vol. I & II Aisa Publication

House.

2. P.B.Sahani : T.B. of Surveying, Vol. I & II, Oxford B.H.B.H.
3. T.P.Kanetkar & Kulkarni : Surveying and Leveling, Part I & II, Pune Vidharthi Griha Prakashan, Pune.
4. B.C.Punmia : Surveying I & II, Standard Book House Delhi.
5. R.C.Brinker and P.R.Wolf, Harper and Row : Elementary Surveying

4SC5 CONCRETE TECHNOLOGY AND REINFORCED CEMENT CONCRETE – I

SECTION – A

Unit-I Cement: Physical properties of Portland cement, laboratory tests, special types of cements.

Aggregate: Classification of aggregate, physical properties, bulking and moisture content, specific gravity, bulk density, laboratory tests.

Properties of fresh concrete: Workability of concrete, methods of measuring workability, nominal mix, mixing, centering & formwork, placing, compaction and curing of concrete

Unit II Properties of hardened concrete: Grades of concrete, properties of concrete, compressive, tensile, and shear strength, modulus of elasticity, creep, shrinkage and durability, laboratory tests on concrete.

Pozzolana and Admixtures: Plasticizer, retarders, accelerators, water proofing agents, mineral admixtures, IS code provisions.

Unit-III Special concrete: Light weight concrete, fibre reinforced concrete, Roller compacted concrete, self compacted concrete, high strength concrete, high performance concrete, high volume fly ash concrete.

Special concreting techniques: Guniting, grouting and shotcreting concrete, introduction & application of Ferrocement.

SECTION-B

Unit-IV Introduction of mix design, factors governing mix design, IS code method of mix design (IS: 10262 – 1982) and Indian Road Congress (IRC) – 44 methods.

Unit-V Basic elastic theory and concept of reinforced concrete, types of reinforcement.

Analysis of rectangular sections by working stress method, modes of failure, design of singly reinforced beams, one-way slabs (simply supported), lintels, and chajjas.

Unit-VI Analysis and design of doubly reinforced rectangular beam by working stress method section for simply supported span. Shear and Bond: Shear stress in reinforced concrete beam section, shear reinforcement, bent up bars and stirrups, bond stress, local and average bond stress, and development length.

Students must be shown video CD, slides, transparencies, and photograph of actual structures.

PRACTICALS:

- Compulsory site visit and submission of site visit report.
- Minimum seven out of following list:
 1. Fineness of cement:
 2. Soundness of cement
 3. Consistency and setting time of the cement
 4. Compressive strength of cement
 5. Sieve analysis of aggregate.
 6. Bulking of sand (fine aggregate).
 7. Silting of sand.
 8. Workability by slump cone test.
 9. Workability by compaction factor test.
 10. Workability by flow table method.
 11. Compressive strength of concrete.
 12. Mix Design (Compulsory) by IS method.

A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

BOOKS RECOMMENDED:

1. Lea, F. M. The Chemistry of Cement and Concrete, Edward Arnold (Publishers) Ltd.
2. Neville, A. M. : Properties of Concrete, Pitman Publishing Company.
3. Neville, Brooks : Concrete Technology, ELBS
4. Gambhir, M. L. : Concrete Technology, Dhanpat Rai and Sons
5. Orchard D. F. : Concrete Technology, Applied Science Pub Ltd.
6. Shetty, M. S. : Concrete Technology, S. Chand
7. Varshney, R. S. : Concrete Technology, Oxford Pub. house.
8. IS: 456–2000,
9. IS: 10262–1982,
10. Krishna Raju : Design of Concrete Mixes, Mc – Graw Hill.
11. Shah and Kale : Reinforced Cement Concrete Design,
12. Sushil Kumar : Treasure of Reinforced Cement Concrete

SEMESTER : FIFTH

**SSC1 REINFORCED CEMENT CONCRETE–II
SECTION –A**

(BY WORKING STRESS METHOD)

- Unit I :
1. Design of circular tanks with rigid and flexible base resting on firm ground.
 2. Design of rectangular water tanks resting on firm ground by using IS code method

(BY LIMIT STATE METHOD)

- Unit-II :
- 1) Introduction to limit state method, basic concept of singly, doubly reinforced and flanged beams, shear and comparison with working stress method.
 - 2) Analysis and design of one way single span and continuous slabs.
- Unit-III :
- 1) Analysis and design of two way slab, design problem on interior panel only.
 - 2) Staircased, Design of Dog legged type staircase only.

SECTION-B

- Unit-IV :
- Analysis and complete design of beams, rectangular and flanged sections for bending moment and shear.
- Unit-V :
- 1) Analysis and design of columns for axial load, uniaxial and biaxial bending.
 - 2) Design of isolated footings : square and rectangular subjected to axial load and bending moment, Design problem on footing with uniform depth only.
- Unit-VI :
- 1) Complete design of simple, small structures like canopies & Parking Shed.
 - 2) Detailing for earthquake resistant construction.
- Introduction, Cyclic behavior of concrete and reinforcement, significance of Ductility, Ductility of detailing for beams, coulmns, joints & shear walls.

Note : Students should use the latest I.S. codes.

PRACTICALS:

1. Design of corner or end panel of a two way slab system.
2. Design of column & footing (Sloped Footing)
3. Field visit on any RCC framed structure & report of the same.

BOOKS RECOMMENDED:

1. Jain A.K. : Plain & Reinforced Concrete, Vol. I & II.
2. Sinha S.K. & Roy S.K. : Fundamentals of RCC.
3. Pillai & Menon : RCC Design.
4. Dr.Shah V.L. & Karve S.R. : Limit State Design.

5SC2**FLUID MECHANICS-II****SECTION – A**

- Unit-I Turbulent flow through pipes ; Karman-Prandtl's equation (No Proof), Nikuradse's experiment, Velocity distribution laws & universal resistance laws, Hydraulically smooth & rough pipes, Colebrook - White equation (statement only), Moody's chart.
- Unit -II Uniform flow, Open channel flow, Types of flow, , geometric elements of rectangular & trapezoidal sections, Chezy's & Mannings equations, most efficient rectangular & trapezoidal section, Energy & momentum principles, Normal & critical depth, specific energy diagram, discharge diagram.
- Unit-III : Gradually varied flow, Dynamic equation of G.V.F. with proof, Analysis of Surface profiles, single step method. Rapidly varied flow; Hydraulic jump in horizontal rectangular channel, specific force diagram, elements of jump, relation between conjugate depth.

SECTION - B

- Unit-IV: Dimensional Analysis ; Buckingham's Pie theorem, it's application, similitude, Dimensionless numbers, Re, Fr, We, Predominant forces & their ratio, Model Analysis - Geometrically similar models, Reynolds law, Froudes law, Model study of spillways.
- UnitV: Impact of jet on stationary & moving plates, symmetrical, asymmetrical curved vanes; Moment of momentum equation (statement only), velocity diagrams.
- Elements of Hydroelectric Plant, Hydraulic turbines; classification of turbines, Description of Pelton wheel & Francis turbine, calculation of work done, power & efficiency, specific speed.
- UnitVI: Classification of pumps ; centriflial pumps, main parts & working, velocity diagrams, workdone, efficiency, priming of pumps, brief introduction of reciprocating pump, Jet pump, Submersible pump, Hydraulic Ram (No numericals).

PRACTICALS –

Minimum 8 practicals out of the list given below are to be performed:
The practical examination shall consist of viva-voce based on theory & practicals.

1. Verification of momentum equation.
2. Determination of Chezys coefficient.
3. Determination of coefficient of discharge of Venturiflume.
4. Study of Gradually Varied Flow.
5. Study of hydraulic jump, calculations of height of jump, length & energy loss.
6. Trial on Pelton wheel.
7. Trial on Francis turbine.
8. Trial on Reciprocating pump.
9. Trial on Centrifugal pump.
10. Trial on Hydraulic Ram.
11. Study of Hot wire Anemometer, Laser Doppler Anemometer.

BOOKS RECOMMENDED :

- 1) Modi P.N. & Seth S.M. : Hydraulics & Fluid Mechanics, SI Edition, Standard Book House, New Delhi-6
- 2) Ranga Raju : Open Channel Flow.
- 3) Dr. Jain A.K. : Fluid Mechanics.
- 4) Subramanya K. : Flow in Open Channel.
- 5) Chow V.T. : Open Channel Hydraulics.
- 6) Garde & Mirajgaonkar : Fluid Mechanics.

5SC3**ENVIRONMENTAL ENGINEERING – I****SECTION - A**

- Unit-I Quantity Estimation of water: Demand of water. Consumption for various purposes. Fire demand, Per capita demand. Factors affecting consumption. Fluctuation in demand. Design period, forecasting population, and design periods for water supply components.
- Sources: Surface sources, ground water sources, Infiltration Galleries, Relative merits of sources, assessment & suitability, selection.
- Intake works: Intakes, type, location, requirement & features.
- Unit-II 1. Distribution system: - Types of supply - Continuous, and intermittent,
- Types of system - Gravity; Pumping and combined gravity and pumping, Layouts of distributions system, Dead end, Grid iron, Circular system and Radial system. Maintenance

of distribution system. Equalising storage, Type of storage reservoirs, capacity

Types of conduits, Relative merits, selection, joints, hydraulic design. Pipe laying and testing/corrosions - theory & prevention.

Types of joints, Jointing and Valves.

Unit-III

Water quality:

Impurities in water, their effects and significance water borne diseases, collection of water samples. Water analysis-physical, chemical and bacteriological. Water quality standards: I.S. & WHO,

Flow diagrams and layouts of different water treatment works.

SECTION - B

Unit-IV

Aeration: Purpose, type of gravity, aerator & spray aerators. Sedimentation: Plain and with coagulation, different coagulants used, dose of coagulant, Jar test, coagulant, feeding and mixing devices. Flocculation, clarifloculator. Design criteria for sedimentation tanks, surface loading, simple problems of design of sedimentation tanks.

Unit-V

Filtration :- Rapid sand and slow sand filters, filter media, Rate of filtration, under drainage system and washing process. Control system, Negative head, operating difficulties, pressure filter; Simple design problems on rapid sand filters modifications of filters. (Dual media, multimedia, upflow, biflow, Diatomaceous earth).

Unit VI

Disinfection :- Requirement of good disinfectant, methods of disinfection.

Chlorination: Methods, prechlorination, post chlorination. Break point chlorination and super chlorination forms of chlorine.

Use of bleaching powder - Simple problems.

Introduction to tertiary treatments like Softening, Ion Exchange, Reverse Osmosis, Defloridation, Desalination.

PRACTICALS:

A. Analysis of water samples any eight of the following.

1) pH 2) Conductivity 3) Solids (Dissolved, Suspended, Total) 4) Turbidity 5) Acidity & Alkalinity 6) Hardness 7) Chloride 8) Fluoride 9) Iron & Manganese 10) Residual chlorine 11) MPN 12) Optimum dose of coagulant

B Report of field visit to water treatment plant is compulsory

BOOKS RECOMMENDED :

- 1) Steel E.W. : Water Supply and Sewerage, McGraw Hill, 5th edition, 1985.
- 2) Kshirsagar S.R. : Water Supply Engg., Roorkee Pub. House, Roorkee.
- 3) Birdie G.S. : Water Supply and Sanitary Engg., Dhanpat Rai & Sons, Delhi.
- 4) Peqvy & Technobiose : Environmental Engineers, McGraw Hill.
- 5) Dr. Punmia B.C. : Water Supply Engg.

5SC4

WATER RESOURCES ENGINEERING-I

SECTION - A

Unit-I

Engineering Hydrology: Definition and its importance., Hydrological Cycle, Hydrologic equation

Precipitation: Forms, Types, Factors affecting, Measurement, Rain gauge Network, Estimation of Missing data, Consistency of data, Mean Areal Precipitation, Brief introduction of Intensity-duration- Frequency relationship and Artificial rain.

Unit II :

Evaporation: Process, factors affecting, measurement, and estimation, control of evaporation.

Evapotranspiration: Factors affecting, measurement, and estimation

Infiltration: Process, factors affecting, measurement, Infiltration indices.

Run-off: Factors affecting, estimation of runoff, Rainfall-Runoff co-relation.

Unit-III

Floods: Flood classification, importance, estimation of flood, flood control techniques, Brief description of flood routing.

Hydrographs: Typical flood hydrograph, base flow separation, Unit hydrograph, S-curve hydrograph.

SECTION-B

Unit IV :

Irrigation Engineering: Necessity and advantages of irrigation, suitability of soils for different crops, standards for irrigation water.

Minor Irrigation Works: Necessity and general layout of Bandhara and percolation Tank.

Lift Irrigation: Necessity and general layout, main components

Unit-V

Crop Water Requirements: Principal Indian crop seasons and water requirements for different crops, Duty and Delta,

Consumptive use of water and its estimation, Irrigation efficiency.

Irrigation methods: Comparative study of different irrigation methods with special emphasis on sprinkler and drip irrigation.

Unit VI: Ground water: Aquifer parameters, Well hydraulics for steady flow condition, safe yield and yield tests.

Water Harvesting: Definition, Need for water harvesting, water harvesting potentially, elements of typical water harvesting system, Methods of water harvesting, cost of water harvesting,

BOOKS RECOMMENDED:

Hydrology

- 1) Sharma R.K. : Hydrology & Water Resources Engg.
- 2) Raghunath H.M. : Hydrology, Wiley Eastern Ltd., New Delhi.
- 3) Dr.Reddy Jayarami P. : Hydrology, Laxmi Pub., Delhi.
- 4) Subramanya S. : Hydrology, Tata McGraw Hill.

IRRIGATION ENGG

- 5) Punmia B.C. : Irrigation and Water Power Engg.
- 6) Garg S.K. : Irrigation and Water Power Engg.
- 7) Dahigaonkar J.G : T.B. of Irrigation Engg., Wheeler & Co.
- 8) Zimmerman J.D. : Irrigation, John Wiley & Sons, New York.

SSC5

SURVEYING-II SECTION-A

Unit-I Tacheometry: Stadia methods, fixed hair and movable hair and tangential method, formulae for distance and reduce level determination. Theory of anallatic lens, Beaman's stadia arc, Autoreduction tacheometer such as Jeffcot Hammer fennel.

Unit-II 1. Curves : Classification, degree of curve, elements of circular and compound curves, theory and methods of setting out simple curves, Instrumental method of setting out compound curves, vertical curves, their types, and setting out method of vertical curves.

2. Transition curves. : Ideal transition curves, characteristics methods of determination of length, Elements of different types and methods of setting out.

Unit-III 1. Triangulation : principles, classification of triangulation system, triangulation figures, their choice of station, phase

of signals, towers, satellite station, reduction to center, field work, Reconnaissance, Intervisibility, angular measurements.

2. Base line and its measurements. Basenet, extension of Basenet, corrections to base line measurement, adjustment of field observation, errors in observation, method of least square, weighted observations, figure adjustment (Triangle only).

SECTION B

Unit-IV 1. Hydrographic surveying: necessity, controls, shore line surveys, gauges, sounding equipments and procedure of taking soundings, methods of location of sounding, three point problem in hydrographic surveying, analytical and graphical methods. Station pointer.

2. Underground Surveying: surface alignment, correlation of surface and underground surveys; Weisbach triangle, transferring levels underground.

Unit-V 1. Elements of photogrammetry: Basic definitions, terrestrial and aerial photography, scale of vertical photograph, Relief and relief displacements, heights from parallel measurements, flight planning, photographs required.

2. Remote sensing : Introduction, definitions, remote sensing systems, advantages over conventional system, energy interaction in the atmosphere, Indian remote sensing satellite series and their characteristics.

Unit-VI 1. Field Astronomy : Elements of spherical trigonometry, Napier's rules of circular parts, celestial sphere, ecliptic, circumpolar stars, astronomical terms, Astronomical triangle, co-ordinate systems.

2. GIS & GPS : Components of geographical information system (GIS), advantages, function of GIS, Raster and vector data, advantages and disadvantages, global positioning system. (GPS), introduction, definitions, GPS receivers, antenna, advantages of GPS.

PRACTICALS -

Minimum 8 practicals from the list mentioned below shall be performed by each student and observations, calculation and relevant work shall be submitted as a sessional work.

Practical examination shall consist of field exercise and viva-voce examination based on the above syllabus & practicals.

LIST OF EXPERIMENTS :

2. Ranging circular curve by offsets from Long Chord.
3. Ranging circular curve by offset from tangents.
4. Ranging circular curve by offset from chord produced.
5. Ranging circular curve by single theodolite.
6. Ranging circular curve by double theodolite.
7. Ranging of transition curve.
8. Finding out tacheometric constants.
9. Finding out height & distances by tacheometry.
10. Practical on Stereoscope.
11. Location of true meridian at the given point.
12. Triangulation by satellite station.
13. Based line measurement.
14. Triangulation
15. Finding out Latitude and Longitude of a place.

BOOKS RECOMMENDED :

1. D.Clark. : Plane and Geodetic Surveying Vol II
2. T.P.Kanetkar & S.V.Kulkarni : Surveying and Levelling Part II
3. B.C.Punmia : Surveying Vol. II and III
4. Prof.Agor : Surveying
5. Prof. Shahane : Advanced Surveying.

5SC6**COMPUTERAIDED DRAFTING****PART I – AUTOCAD / FELIX CAD.**

1. INTRODUCTION & BASIC CONCEPTS –
Introduction to Auto CAD / Felix CAD, advantages over manual drawing, understanding basic concepts such as, Absolute, relative, polar & world co-ordinates, drawing units, drawing limits, extents, layers, line types, line thickness, object snapping, filters.
2. CREATING & EDITING DRAWING –
Drawing entities in Auto CAD / Felix CAD, various drawing commands, use of object snaps & filters, Editing the drawing – different editing commands, Dimensioning Commands, text commands, hatching commands.
Viewing the drawing – Different views, view ports, zooming in & out, panning,
Saving & Printing drawing in different scales.
3. CREATING THREE DIMENSIONAL OBJECTS –
Creating objects/images in three dimensions, editing in three

dimensions, Using 3-D image types, creating shaded images, creating rendered images, display options, setting the camera position.

PART II – M.S.EXCEL

Working with expressions – mathematical & relational operators.

Functions – Functions for simple mathematical calculations [SUM, AVERAGE, COUNT, MAX, MIN, SQRT] Rounding, logical operators [IF, SUMIF, AND, OR, NOT], Data lookup.

PRACTICAL CONTENTS –

1. Practicing the various drawing & editing commands in Auto CAD / Felix CAD.
2. Preparing drawings of following building elements in Auto CAD / Felix CAD and taking out printouts.
 - i) Any two types of door.
 - ii) Any two types of window.
 - iii) Plans of different types of stairs.
 - iv) Cross-section of dog-legged stair.
 - v) Line diagrams of different types of steel roof trusses.
 - vi) Spread footing for wall & column [plan & section]
 - vii) Bonds in brick masonry. [One brick thick wall in English bond & Flemish Bond].
3. Practising EXCEL and POWER POINT commands and any one assignment based on syllabus including printout.

SEMESTER : SIXTH**6SC1 NUMERICAL METHODS AND COMPUTER PROGRAMMING****SECTION A**

- | | |
|----------|---|
| Unit-I | <ol style="list-style-type: none"> 1. Basic grammar of FORTRAN, use of library functions 2. FORTRAN coding sheet, input output statements, format for input output statement, flowchart |
| Unit-II | <ol style="list-style-type: none"> 1. Control statements: GO TO, computed GO TO, Assigned GO TO, arithmetic, logical IF, block IF, DO statement, implied DO loop 2. Type declaration statement, DIMENSION statement, subscripted variables, EQUIVALENCE statement, DATA statement |
| Unit-III | <ol style="list-style-type: none"> 1. Sub – programs: Statement function, function sub – program, subroutine sub program. |

2. COMMON statement, labeled and blank COMMON, dummy and actual arguments.

SECTION-B

Computer Programs using FORTRAN FOX :

- Unit-IV
1. Matrix operations such as:
 - a. Addition and subtraction
 - b. Multiplication
 - c. Tranpose
 - d. Testing summary etc.
 2. Fourth order, Runge – Kutta method for solution of first order, second order differential equations and two simultaneous equations.
- Unit-V
1. Solution of quadratic equation
 2. Numerical integral using Trapezoidal and Simpson rule
 3. Finding root of equation $f(x) = 0$ by Newton – Raphson, Regula – Falsi and Bisection method.
- Unit VI
1. Centre of gravity, moment of inertia & radius of gyration of Tee section.
 2. Bending moment and shear force ordinates for simply supported beam subjected to point and uniformly distributed load only.
 3. Design of singly reinforced beam by limit state method.
 4. Determination of coefficient of permeability in parallel and perpendicular direction of bedding plane
 5. Reduce level by height of instrument method.
 6. Determination of Chezy's constant.

PRACTICALS:

Preparation and execution of at least eight computer programs using FORTRAN.

A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

BOOKS RECOMMENDED:

1. Rajaraman, Computer Programming in FORTRAN
2. Schaum Series, FORTRAN Programming.

6SC2

STRUCTURAL DESIGN – I SECTION A PRESTRESSED CONCRETE

- Unit-I
1. Introduction to prestressed concrete: Materials and their characteristics, type of prestressing, methods and various prestressing systems.
 2. Losses of prestress : Elastic loss, loss in creep, shrinkage, relaxation, anchorage frictional losses in prestress.
- Unit-II
1. Analysis of beams for flexure. under working load and Rectangular and flanged beams.
 2. Design of prestressed circular water tanks by IS code method.
- Unit-III
- Basic Design of rectangular sections for flexure under working load, Design for diagonal tension, Design of one way single span & continuous slabs.

SECTION-B

STEEL STRUCTURES BY WORKING STRESS METHOD

- Unit-IV
1. Analysis, Design of Roof trusses. Design of Tension and compression members, purlins.
- Unit-V
1. Design of beams, simple and compound beams.
 2. Design of welded and rivetted connections.
 - (a) Structural connections
 - (b) Framed connections
 - (c) Column splicing for axial load.
- Unit-VI
1. Design of simple and compound columns for axial load only, Design of lacing.
 2. Design of column bases subjected to axial load only, Gusseted base and solid slab base.

Students may be shown video CD, slides, transparencies, and photograph of actual structures.

PRACTICALS:

1. Candidates are required to prepare at least two designs based on theoretical course detailed workings are necessary. A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.
2. Field visit & report to be submitted.

BOOKS RECOMMENDED:

1. Dayaratnam, P., Prestressed Concrete Structures, Oxford and IBH Publishing Company Private Ltd.
2. Lin, T. Y. and Burns N. H., Design of Prestressed Concrete Structures, John Wiley and Sons.
3. Raju, N. K., Prestressed Concrete, Tata McGraw Hill Pub. Company Ltd.
4. Arya and Ajmani, Design of Steel Structures, Nem Chand Brothers, Roorkee
5. Duggal, S. K., Design of Steel Structures, Tata McGraw Hill Pub. Company Ltd.
6. Kazmi and Jindal, Design of Steel Structure, Prentice Hall of India Pvt. Ltd.
7. Negi, L. S. Design of Steel Structures, Tata McGraw Hill Pub. Company Ltd.
8. N. Subbramanyam, Design of Steel Structures, Oxford University Press, 2008.

6SC3 BUILDING PLANNING & DRAWING**SECTION - A**

- Unit-I Introduction : Importance of building drawing for Civil Engineering in construction & estimation, Method of drawing – Selection of scales for various drawings, types of line, methods of dimensioning in architectural drawing. Abbreviations & graphical symbols used in Civil Engineering Drawing as per IS : 962.
- Combined first angle & third angle method of projection. Layout of sheet for civil engineering drawing, Requirements of drawing as per plan sanctioning authorities.
- Unit-II Concept of line plan & working drawings of the building. Developing working drawings of the building from the given line plan Details to be incorporated in the working drawing. Necessity and use of working drawing. Concept of site plan, block plan and layout plan. Importance and details to be incorporated. Concept of foundation plan, importance and use.
- Developing working drawing and foundation plan for load bearing and framed structures.

SECTION - B

- Unit-III Planning of residential building.
- Introduction, general principles of planning viz. aspect, prospect, roominess, privacy, grouping, circulation, ventilation, furniture requirement. Climate and design consideration. Orientation of buildings, requirement of the owner, alternatives of building types viz. individual bungalows, semidetached houses, row houses, apartments. Provision of mezzanine floor, balconies and porches in the building. Common utilities such as parking, security, water supply, sanitation, etc. for apartments. Criteria for earthquake resistant planning of building.
- Unit-IV Building rules and by laws, for residential buildings, conversion of land to non-agricultural lands, layout for a housing project.
- Types of public building and their requirements, planning of public building. Preparing line plans of different public buildings such as schools, commercial market, primary health center, workshop, college building, post office.
- Free-hand sketching : Importance in Civil engineering. Free hand sketching of components of buildings and elevation features of building such as balconies, chajjas, etc.
- Perspective drawing, 1 Point and 2 Point perspective.

TERMWORK

Creating drawing of following, manually & by Auto CAD/Felix CAD and printouts to be submitted along with 10 free hand sketches on quarter of the imperial size sheet.

1. Developing working drawing of single storied residential building from the given line plan.
2. Preparing line plan of residential building from the given data. Developing submission drawing of the above as per requirement of the plan sanctioning authority. (Separate data should be given to every student).
3. Developing working drawing of storied framed structures (Apartment building) from given line plan.
4. Developing line plans of public building from the given data (minimum 2 line plans)
5. Free hand sketches : development of free hand sketches of components of building and elevation features of building such as balconies, chajjas, etc.

BOOKS RECOMMENDED:

- 1) Schaum Series : FORTRAN Programming.
- 2) McCracken D.D. and Dorn W.S. : Numerical Methods and FORTRAN Programming.
- 3) Hofman Davids : Computer Programming with FORTRAN.
- 4) Jain A.K., Rao M.N. : FORTRAN Programming.
- 5) Any standard CAD manuals.

6SC4 WATER RESOURCES ENGINEERING-II**SECTION-A**

Unit-I : Reservoir Planning : Investigation, selection of site, control levels, Reservoir Sedimentation, Reservoir Capacity, Calculation of life Reservoir.

Dams : Different types and their suitability-factors governing the selection of types of dam for project

Earth Dams : Types of dams, causes of failure seepage and drainage arrangement, phreatic line, stability analysis, seepage control measures

Unit II : Gravity Dams: Types of dams forces acting, modes of failure; principles of design of straight gravity dams, Elementary and practical profile, Galleries, Earthquake and its effect on dams.

Unit-III Diversion Head Works :- Selection of site and layout, components of diversion head works, design of weirs on permeable foundation, construction details of Kolhapur type weirs.

Spillways: Types of spillway, spillway capacity, Flood routing through spillways, types of crest gates.

Energy dissipaters: meaning, objectives, location. types hydraulic jump, jet diffusion and Bucket type,

SECTION-B

Unit-IV Canal Irrigation: Types of canals, Parts of Canal irrigation system, Canal alignment, Design of unlined and lined Canals, Balancing depth, cross section of canal, propose and types of canal lining

Unit-V Canal Masonry Works: Types and only design principles and description of

1. Regulation works: Canal fall's, Head Regulator, Cross regulator, Canal escapes and canal outlets.

2. Cross drainage works: Aqueduct, Syphon aqueducts, super passage, canal siphon, level crossing
3. Modules: Non modular modules, flexible modules, rigid modules.

Unit-VI Well Irrigation : open wells and tube wells, types of tube wells, duty of tube well water.

Water Management : Water management and distribution, co-operative water user's organization, warabandi, conjunctive use of water.

Water shed Management : Need of watershed management, importance of soil conservation measures, techniques ground water harvesting.

River Training Works : Need and types of river training works.

TERMWORK: Five problems from the following to be worked out by the students whenever necessary scale drawing on half empirical size must be drawn : Practical examination shall consist of viva – voce.

1. Fixing control levels of Reservoir from given data.
2. Cross section, plan, L-section of Earth dam showing all components; details of drainage of down stream casing.
3. Design and Drawing of elementary and practical profile of gravity dam.
4. Design and drawing of diversion weir on permeable foundation.
5. Design and Drawing of ogee spillway with energy dissipaters.
6. Computer Aided design of unlined and lined canal.
7. Drawing of any Four canal structure (No design)
8. Field visit

BOOKS RECOMMENDED :

- 1) Dr. Modi P.N. : Irrigation, Water Resources & Water Power Engg.
- 2) Punmia : Irrigation & Water Power Engg.
- 3) Garg S.K. : Irrigation & Water Power Engg.
- 4) Dahigaonkar J.G. : T.B. of Irrigation Engg., Wheeler & Co.
- 5) Varshaney R.S. : Theory of Irrigation Structures, Vol. I & II, Nemchand, Roorkee.
- 6) Birdie G.S., Das R.C. : Irrigation Engg., Dhanpatrai & Sons.
- 7) Michael A. M. : Irrigation (Theory & Practice)

**6SC5 TRANSPORTATION ENGINEERING-II
(RAILWAY, AIRPORT & TUNNEL)**

SECTION – A

- Unit-I RAILWAY : Railway transportation, classification Railway surveying, track standard terminology, track sections in embankment & cutting, high speed trains.
Traction and tractive resistance, hauling capacity and tractive effort of locomotives, different types of traction.
- Unit-II Permanent way: requirement, gauges, coning of wheels, components of permanent way, Railtypes and functions, defects in Rails, Rail joints, Sleeper density, Rail fixtures & fastening. Geometric design of railway track, gauge, gradients, speed, superelevation, cant deficiency, negative superelevation, grade compensation, curves, Railway accidents and causes.
- Unit-III Points and crossing Left & right hand turnouts, design calculations for turnout & cross over, types of Track junction, long welded rails.
Station and yards : types, function, facilities & equipment.
Railway signalling and interlocking: objects, classification & types of signals, control & movement of trains.

SECTION - B

- Unit-IV AIRPORT: Development of air transportation in India, Agencies controlling national & international aviation, Various survey to be conducted, airport site selection, Airport drainage, Aeroplane component parts, Aircraft characteristics.
Airport obstructions: Zoning laws, imaginary surfaces approach and turning zone
Runway and Taxiway design: orientation of runway, wind rose diagram, basic runway length and corrections, runway geometric design standards.
- Unit-V Airport layout, Terminal area, Terminal area, unit terminal concept, Apron, Apron layout, Aircraft parking & parking system. Visual aids,
Airport parking & lighting of runway, taxiway and other areas.
Airport traffic control, need of control aids, instrumental landing systems, accidents in the air.

- Unit-VI TUNNELS: Tunnels necessity, types, tunnel economics, tunnel alignment, tunneling methods in soft soil & hard rock. Needle beam method, drift method. Size and shape of tunnels, Tunnel lining, drainage, ventilation & lighting of tunnels.

BOOKS RECOMMENDED :

- 1) Saxena & Arora : Railway Engineering.
- 2) Agrawal M.M. : Railway Engineering.
- 3) Khanna S.K., Arora M.G., Jain S.S. : Airport Planning & Design,
- 4) Srinivasan : Tunnel Engineering.

6SC6 MINOR PROJECT

Any one Group Project in details.

- 1) Irrigation Project
- 2) Rehabilitation of Village / Town
- 3) Water Supply Project
- 4) Sewerage System
- 5) Bridge on River

Students should conduct a detailed survey in a seven day camp. Data Analysis , Design & Submit Report & Drawing sheets.

SEMESTER : SEVENTH

7SC1 THEORY OF STRUCTURE – II

SECTION - A

- Unit-I
1. Moment distribution method, application to portal frames with sway, multibay, multistorey symmetrical frames subjected to symmetric load only.
 2. Slope deflection method: Application to portal frames with side sway.
- Unit-II
1. Kani's method: Continuous beams and single bay single storey portal frames with side sway. Multi- bay, multi storeyed frames subjected to symmetric loads.
- Unit-III
1. Flexibility method, static redundancy, flexibility coefficients, compatibility condition application to beams.
 2. Stiffness method, kinematic redundancy, stiffness coefficients, direct stiffness approach, application to continuous beams and single - bay, single - storey portal.

SECTION - B

- Unit-IV 1. Maxwell's reciprocal theorem, Betty's theorem, Muller - Breslau's principle, Influence line diagrams for continuous beams, upto two span only.
2. Tension coefficient method & its applications to simple space trusses.
- Unit-V 1. Column analogy method, application to fixed beams, symmetric single - bay single - storey portals
2. Introduction to plastic analysis of steel structure, shape factor, plastic section modulus, redistribution of moment, upper and lower bound theorems, collapse loads for beams, single bay, single storey portals.
- Unit-VI 1. Castigliano's second theorem, principle of least work, Analysis of redundant frames (upto two degree redundancy),
2. Analysis of redundant trusses (up to second degree of redundancy), lack of fit, temperature effect.

PRACTICALS:

The laboratory work will be based on the following experiments (Any five experiments):

1. Influence line diagram for continuous beams.
2. Electrical resistance linear strain gauge for measuring static strains.
3. Application for moment indicator.
4. Horizontal reaction of two hinge arch.
5. Forces and displacements in redundant trusses and frames.
6. Study of polariscope.
7. Minimum two exercise based on theoretical course work.
8. Horizontal reaction of three hinge arch.
9. Verification of Betty theorem
10. Deflection in continuous beams upto two span.
11. Verification of Maxwell Reciprocal Theorem.

A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

BOOKS RECOMMENDED:

1. Junnarkar, S. B., Mechanics of Structure, Volume I and II
2. Jain and Arya, Theory and Analysis of Structures

3. Reddy. C. S., Basic Structural Analysis, Tata McGraw Hill
4. Wang, C. K., Elementary Analysis of Structures
5. Norris and Wilbur, Elementary Structural Analysis

7SC2**GEOTECHNICAL ENGINEERING-II****SECTION - A**

Unit I Exploratory Programme : Field exploration, objectives and methods of exploration planning of exploration programme, soil bring hand augers, percussion boring, rotary wash boring, collection of sample, split spoon sampler, area ratio, disturbed and undisturbed sample, SPT test, field vane shear test, geophysical methods, electrical resistivity and soil refraction methods. Soil log bore presentation and interpretation exploration data.

Stability analysis of infinite & finite slope, causes of failure of slope, stability analysis of infinite and finite slope in sand and clay; Taylor's stability number, friction circle method, Swedish circle method.

Unit II Bearing Capacity of Shallow foundation :- Different theories: Terzaghi's, Skempton's, Meyerhoff, BIS method for bearing capacity determination bearing capacity of granular soils based on SPT value.

In situ methods of evaluation of bearing capacity, plate load test, static cone penetrometer, pressuremeter test contact pressure distribution diagram below the base of footing.

Unit III Earth pressure at rest, general & local Stages of plastic equilibrium Rankine's and Coulomb's theory of active and passive earth pressure on retaining wall. Influence of surcharge, water table, wall friction, Rebhann's and Culmann's simple graphical methods

Ground Improvement : methods of soil stabilization use of admixture (lime, cement, flyash) in stabilization) Basic concept of reinforced soil, use of Geosynthetic material as a reinforcement, bioflotation, sand drain installation, preloading.

SECTION - B

Unit IV Pile foundation : Classification of piles and their uses, static analysis, formula for determination of pile capacity for driven and bored pile in sand and in clay, dynamic pile formula Negative skin friction, factors affecting it, piles in groups and

their capacity, group efficiency, factors affecting, group efficiency settlement ratio, behaviour of group efficiency settlement ratio, behaviour of group of pile in sandy and in clayey solids, pile load test, effect of pile cap. Criteria for spacing and depth of piles. IS design criterion for underreamed pile in clay and sands.

Computation of settlement : - total and differential related to single pile, group of piles in sandy and in clays soils.

Unit V Settlement :

Evaluation of soils settlement : immediate, primary and secondary settlement for footing resting on homogenous, isotropic, cohesive and cohesionless soils related to single footing, combined footing, raft foundation etc, standard for requirement of settlement, total as well as differential, concept of differential settlement, factors and causes for differential settlement, service loads, proportioning of footing for uniform settlement.

Unit VI: Well foundation : Component & their function, sinking of well, types of force system, and their computation, design criteria for various components of wells, tilting and shifting of wells, methods of correcting tilting and shifting. Bearing capacity of well as per IS. Cofferdam purpose, various types, their suitability.

Raft foundation : Its purpose, advantages, situation, classification of raft, criteria for rigid and flexible raft concept of floating foundation designed raft foundation.

LIST OF EXPERIMENTS (ANY 7 OUT OF 10)

1. To identify the subsoil strata by conducting soil resistivity / seismic reactivity method.
2. To determine the bearing capacity of soil by conducting standard penetration test.
3. To determine the soil characteristic by conducting standard penetration test.
4. To determine the soil properties by conducting the static cone penetration test.
5. Computation of bearing capacity by analytical approach to verify with field test.
6. To determine the C_u characteristic with respect to soil log bore presentation and interpretation of exploration.
7. To examine the soil characteristic with respect to soil log bore presentation and interpretation of exploration.

8. Determination of earth pressure by graphical method,
9. Determination of free swell index.
10. Slope stability analysis by graphical method
11. Design of rest foundation for a given data.

BOOKS RECOMMENDED :

- 1) Craig : Soil Mechanics.
- 2) Bowles J.E. : Foundation Design Analysis.
- 3) Hanson : Theoretical Soil Mechanics.
- 4) Peck and Hanson : Foundation Engineering.
- 5) Tomlinson : Foundation Engineering.
- 6) Leoner : Foundation Engineering.
- 7) Bramha : Foundation Engineering.
- 8) Prakash S. : Analysis and Design of Foundation and Retaining Structure.
- 9) Kasmalkar : Foundation Engineering.
- 10) Arora K.R. : Foundation Engineering.
- 11) Venkataramiah : Soil Mechanics and Foundation Engineering.
- 12) Rao G.V. : Engineering with Geosynthetics.

7SC3

STRUCTURAL DESIGN – II

(R.C.C. STRUCTURES BY LIMIT STATE METHOD)

SECTION-A

- Unit-I
1. Design of interior panel of flat slab by direct design method.
 2. Design of cantilever retaining wall and counterfort retaining walls.
- Unit II :
1. Design of combined footing.
 2. Design of Grid Slab.

SECTION-B

- Unit-III
1. Rivetted and welded connection subjected to eccentric loads.
 2. Welded plate girder curtailment of flange plates, design of stiffeners.
- Unit-IV
1. Compression member subjected to eccentric loading.
 2. Design of columns splicing for axial force moment and shear.
 3. Design of eccentrically loaded column base plate, gusset plate, anchor bolt and pedestal (Rivetted and welded)

Students must be shown video CD, slides, transparencies, and photograph of actual structures.

PRACTICALS :

- Candidates are required to prepare at least two designs of R. C. and two designs of steel based on theoretical course detailed workings are necessary.
- A compulsory site visit for studying the various aspect and prepare a report.
A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

BOOKS RECOMMENDED:

- Jain, A. K., Reinforced Concrete (Limit State Design)
- Jaikrishna and Jain, Plain and Reinforced Concrete, Volume I and II
- Sinham S. N., Reinforced Concrete (Limit State Design)
- Arya and Ajmani, Design of Steel Structures, Nem Chand Brothers, Roorkee
- Duggal, S. K., Design of Steel Structures, Tata McGraw Hill Pub. Company Ltd.
- Kazmi and Jindal, Design of Steel Structures, Prentice Hall of India Pvt. Ltd.
- Negi, L. S. Design of Steel Structures, Tata McGraw Hill Pub. Company Ltd.
- N. Subramanyam, Design of Steel Structures, Oxford University Press, 2008.

7SC4**ELECTIVE-I****(1) ADVANCED WATER TREATMENT****SECTION-A**

- Unit-I Requirements of water treatment facilities different unit operations and unit processes.
Coordination of unit operations. Common attributes of water affected by conventional unit operations and processes.
Aeration: rate of gas absorption and desorption, objectives of aeration, gravity aerators and spray aerators, governing factors, design of aerators, removal of methane, CO_2 , H_2S taste, design and odour.
- Unit-II Objectives of flocculation, chemical coagulation, concept of surface charge, coagulating effects of electrolytes, zeta potential, coagulants and coagulant aids, factors affecting coagulation.
Perikinetic and orthokinetic flocculation - mixing and stirring devices, flash mixing flocculators, construction and operation of flocculators, problems on design of flocculators. Pebbled

bed flocculator.

- Unit-III Sedimentation: objectives, theory of sedimentation discrete settling and hindered settling, settling of flocculant suspension. Ideal settling basin and its efficiency. Design, construction and operation of sedimentation tanks.
Inlet and outlet hydraulics, sludge, removal and disposal, tube and plate settlers. Problems on design of sedimentation tanks.

SECTION-B

- Unit-IV Filtration: objectives, design, construction and operation of rapid and slow sand filters, filtering sand, grain size and size distribution, preparation of filter sand, hydraulics of filtration. hydraulics of fluidized beds. Scour intensification, high rate, declined rate, upflow biflow, dual media, diatomaceous earth filters.
- Unit-V Disinfection : objectives, different disinfectants, chemical disinfection, theory, factors governing, and kinetics. disinfection by Ozone. Disinfection by chlorine; free available and combined. available chlorine, break point chlorination, chemical technology and other uses of chlorine, manageable variables
- Unit-VI Miscellaneous methods of treatment : Water softening: limesoda and zeolite process, split treatment problems on calculation of dose of lime and soda ash. Iron and Manganese Removal : Fluoridation and defluoridation. Desalination. Taste and Odour Removal.

PRACTICALS

- Design of aerator
- Design of flocculator
- Design of clarifier
- Design of rapid sand filter
- Calculation of requirement of disinfectant
- Report of field visit to any one Tertiary treatment/ Unconventional water treatment plant.

BOOKS RECOMMENDED :

- Fiar, Geyer & Okun : Water and Waste Water Engg., John Wiley & Sons.
- Mark J. Hammer : Water and Waste Water Technology, John Wiley & Sons.

3) Steel E.W. & Ghee M.C. : Water Supply & Sewerage, McGraw Hill Co.

7SC4**ELECTIVE-I****(2)ADVANCED GEOTECHNICAL ENGINEERING****SECTION - A**

- Unit-I Clay mineralogy : Introduction, atomic bonds, classification and nomenclature, structure of clay mineral, K Ionite. Illite and Montmorillonite groups, physical properties, clay-water relations, diffused double layer, thixotropy, base exchange capacity formation of different structure in soil deposits, electrical effects, electroosmosis, electrophoresis, stemming potential, zeta potential, clay mineral identification, DTA analysis, X ray diffraction method.
- Unit II Seepage : Flownet for anisotropic soil media, construction of flownet for hydraulic structure on non- homogenous soil, directional variation of permeability in anisotropic medium. Numerical analysis of seepage in layered soil computation of seepage force, seepage through earthen dam resting on confined and unconfined medium entrance discharge and Transfer condition of line of seepage through earth dam.
- Unit-III Three dimensional consolidation. Equation, solution of 3-dimensional consolidation equation, consolidation by vertical sand drain and its design aspect, free strain consolidation with no smear, effect of smear zone on radial consolidation. Calculation of the degree of consolidation with radial drains and solutions of problems based on this.

SECTION – B

- Unit IV Expansive soils: origin of soil, intensification of expansive soil, swelling potential, factors affecting the swelling, different systems of classification, concept of swelling pressure and its measurements in the laboratory, special constructional measures adopted for the construction on expansive soils, special foundations adopted for the construction in expansive soils, concept of cohesive nonswelling techniques and its effect on expansive soil.
- Unit-V Soil stabilization concept of mechanical stabilization, physical and chemical stabilization with organic and inorganic material like lime, cement, lime flyash and mechanisms, various factors affecting stabilization, determination of bearing capacity of stabilized soil, laboratory and field methods of stabilization. On various properties of soil.

Unit-VI Geotextile: types, specifications, functions and various application in the field of Geotechnical engineering. Reinforced earth, mechanism of reinforced earth, various constructional methods and its effect towards altering, the properties of soil, field situations for application of this techniques. Theory of Arching, effect of arching, design of yield strip, computation of vertical stresses.

PRACTICALS

1. Drawing Flownets for flow through body of dam and its foundations for different condition, text or graph paper.
2. One – dimensional consolidation test and determination of consolidation properties of soil
3. Practical on mechanical stabilization of soil to study important soil properties.
4. Practicals on cement / lime and flyash stabilization of soil.
5. Determination of swelling pressure of expansive soil.
6. Model plate load test on Geotextile reinforced soil.
7. Any two assignments based on syllabus.

BOOKS RECOMMENDED:

- 1) Scoth R.F. : Principles of Soil Mechanics.
- 2) Das B.M. : Advanced Soil Mechanics.
- 3) Terzaghi : Theoretical Soil Mechanics.
- 4) International Conference on Expansive Soils.
- 5) International Conference on Geotextiles.
- 6) Soil Mechanics for Road Engineers, AMSO Series.

7SC4**ELECTIVE-I****(3) WATER POWER ENGINEERING****SECTION -A**

- Unit-I Introduction, sources of energy, importance of water power, estimation of water power potential, primary and secondary power, load factor, pondage and pondage factor, load curve. Type of hydropower plants:- low and high head, run of river, valley dam, diversion canal, high head diversion, pumped storage underground, general description, layout, topographical requirements of each of above.
- Unit-II Penstocks: general classification, design criteria, economical dia, anchorages and accessories.
Water hammer :- meaning, rigid and elastic water column

- theory, Allievi's charts.
- Unit-III Surge tanks:
Necessity, types, function, location, effect of sudden load change, Hydraulic design of simple surge tanks, stability of surge tanks.

SECTION – B

- Unit-IV Intakes: types, locations, requirements, trashrack and other components, control gates, emergency gates.
- Unit-V Hydrel channel:- power canal and forebay, general principles of alignment and capacity, balancing tank.
Turbines:- types, hydraulic features, size, general description of components and layout, specific speed, choice, approximate costs.
- Unit-VI: Power house:- types, general layout and approximate dimensions.
Non conventional sources of energy: - tidal power, wind power, geothermal power, solar power, elementary principles and description, application of water power in drilling and blasting of rocks.

PRACTICALS –

Minimum 8 drawings on Half Empirical size Drawing Sheet is to be submitted.

- Drawings of run of river plant.
- Drawings of valley dam plant
- Drawings of diversion canal plant
- Drawings of High head diversion plant.
- Drawings of pumped storage plants.
- Design of penstock by analytical and graphical method.
- Design of simple cylindrical surge tank.
- Drawings of types of Intake.
- Drawings of surface power station.
- Drawings of underground power station.

BOOKS RECOMMENDED :

- Dandekar M.M. & Sharma : Water Power Engineering, Vikas Pub. House, Delhi.
- Brown J.G., Blackie and Practice : Hydro Electric Engg., Vol. I, II & III, W. Sons, London.

- Mosonyi E. : Water Power Development, Hungarian Academic Sciences, Budapest.
- Deshmukh M.M. : Water Power Engineering.
- Davin C. and Sorenson K.C. : Hand Book of Applied Hydraulics, McGraw Hill.

7 SC 4

ELECTIVE-I (4) PRESTRESSED CONCRETE SECTION-A

- Unit-I: a) Analysis and design of beams - Rectangular, flanged and I sections, for Limit State of flexure, ultimate flexural strength, recommendations of I.S. codes.
b) Analysis and design of end blocks in post tensional members - primary and secondary distribution zones, Bursting and spalling tensions.
- Unit II: a) Shear strength of prestressed concrete beams - mode of failure in beams, recommendations of I.S. code, ultimate shear strength of concrete, Design of shear reinforcement.
b) Deflection and bond in prestressed concrete.
- Unit-III: Analysis and design of continuous (upto two spans) and fixed beams. Elastic analysis, secondary moments, concordant cable, linear transformations.

SECTION – B

- Unit IV: Analysis and design of prestressed concrete structures such as concrete pipes, poles, sleepers, water tanks etc.
- Unit V: Analysis and design of portal frames, single storey and limited to two bays (fixed and hinged)
- Unit VI: Design of prestressed concrete bridges (simply supported) for I.R.C. loadings or equivalent uniformly distributed loads.

NOTE : Candidates should use the latest I.S. Codes.

PRACTICALS:

- Candidates are required to prepare at least two designs based on theoretical course, detailed workings are necessary.
- Site visit for studying the various aspects of prestressed concrete and preparation of report is recommended.

BOOKS RECOMMENDED:

- Guyon Y. : Prestressed Concrete, Vol. I & II, John Wiley and Sons, New York.

- 2 Krishna Raju, N. : Prestressed Concrete, Tata McGraw Hill Pub. Company, New Delhi.
- 3 Lin, T. Y. : Prestressed Concrete, Tata McGraw Hill, New Delhi.
- 4 Dayaratnam, P. : Prestressed Concrete Structures, Oxford and IBH Publishing Company Pvt. Ltd., New Delhi.

7SC4 ELECTIVE – I
(5)ARTIFICIAL NEURAL NETWORK & FUZZY LOGIC
SECTION-A

Unit-I Artificial intelligence, introduction, classification of artificial intelligence, tools of artificial intelligence, applications of A. I. in Civil Engineering.

Unit-II Expert systems, introduction, classification, tools, applications of expert system in Civil Engineering.

SECTION – B

Unit-III Neural network, introduction, classification, tools, applications of neural network in Civil Engineering.

Unit-IV Fuzzy logic, introduction, classification, tools, applications of expert system in Civil Engineering.

PRACTICAL:

§ Candidates are required to prepare at least two term works based on above theoretical course.

A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

BOOKS RECOMMENDED:

1. Rolston D.W. : Principles of Artificial Intelligence and Expert System, McGraw Hill International Edition, 1988.
2. Waterman D.A. : A Guide to Expert Systems, Addison-Wesley Pub. Co., 1985.
3. Koestem C.N. and Maher : Expert System in Civil Engineering, ASCE, 1986.
4. ASCE's Journal of Computing in Civil Engineering.

7SC4 ELECTIVE – I
(6)ADVANCED CONCRETE TECHNOLOGY
SECTION -A

Unit-I: Admixtures and construction chemicals: Introduction, admixtures, plasticizers (Water reducers), action of plasticizers, dispersion, retarding effect, superplasticizers

(High range water reducers), site problems in the use of plasticizers, retarders, accelerators, air-entraining admixtures, pozzolanic or mineral admixtures, fly ash, silica fume, rice husk ash, metakaolin, ground granulated blast furnace slag (GGBFS), damp and water proofing admixtures, IS code provisions for admixtures.

Unit-II Durability of concrete: Introduction, strength and durability relationship, volume change in concrete, significance of durability, impact of water cement ratio on durability, factors affecting durability, methods of predicting durability, IS code provisions for durability of concrete.

Unit-III Deformation in concrete: Introduction, deformation of concrete in Indian climate, permeability, factors contributing cracks in concrete, sulphate attack, alkali aggregate reaction, corrosion of embedded steel, controlling measures.

SECTION – B

Unit-IV Special concrete and concreting techniques: Introduction to special concrete, Lightweight, aerated, no-fines, high density, fibre reinforced, polymer, prepacked, self-compacted (self leveled), and high volume fly ash (HVFA) concrete.

Introduction to special concreting techniques, Guniting or shotcrete, ferrocement, roller compacted concrete, and ready mix concrete casting and applications.

Unit-V: Repairs and rehabilitations: Introduction, need for repairs, crack width, interaction between permeability, volume change and cracking, polymer modified mortar, bond aid for plasters, guniting aid, silicon based water repellent materials, protective and decorative coatings, injection grout for cracks, coatings to embedded reinforcement, concrete repair systems, stages of repair works.

Unit-VI Non-destructive testing of concrete: Introduction, rebound hammer, limitations, rebound number and strength of concrete, penetration technique, pullout test, resonant frequency, pulse velocity method, corrosion analyser, rebar locators.

Students must be shown video CD, slides, transparencies and photograph of actual structures.

PRACTICAL:

Only three out of the following list :-

- 1) Air entrained in fresh concrete.

- 2) Determination of workability of concrete by adding admixture and super plasticizers.
- 3) To measure amount of sodium and potassium ions in freshly mixed concrete.
- 4) Determination of 7 days compressive strength of concrete by adding super plasticizers / mineral admixture / pozzolana.
- 5) Rapid chloride ion permeability test.
- 6) Volume changes in set concrete / length comparator.
- 7) Bond test, to measure strength bond strength at site between a repair overlay and substrata.
- 8) Permeability test of concrete with and without super plasticizers / mineral admixture / pozzolana.
- 9) Rebound hammer.
- 10) Ultrasonic pulse velocity.
- 11) Determination of corrosion of reinforcing steel by pH / carbonation / automatic corrosion analyser / Half - cell potentiometer.
12. To measure location of reinforcing steel in existing structures by NDT means (Rebar locator / cover meter.)

Each student shall submit a journal / report on above experiments. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

BOOKS RECOMMENDED:

1. Lea, F. M.: The Chemistry of Cement and Concrete, Edward Arnold (Publishers) Ltd.
2. Neville, A. M. : Properties of Concrete, Pitman Publishing Company.
3. Neville, Brooks : Concrete Technology, ELBS
4. Orchard, D. F. : Concrete Technology, Applied Science Pub Ltd.
5. Shetty, M. S. : Concrete Technology, S. Chand
6. Varshney, R. S. : Concrete Technology, Oxford Pub. House.
7. Krishna Raju : Design of Concrete Mixes, McGraw Hill.
8. Shah and Kale : Reinforced Cement Concrete Design,
9. Sushil Kumar :Treasure of Reinforced Cement Concrete

**7SC4 ELECTIVE-I
(7) ENVIRONMENTAL POLLUTION & RURAL SANITATION
SECTION-A**

- | | |
|----------|--|
| Unit-I | General components of environment. Nature and scope of Environmental pollution, population growth, Degradation due to human activity. Episodes of Environmental pollution. |
| Unit-II | Water pollution-sources of water pollution, effects on water bodies, D.O. sag curve, pollution control measures, water pollution act

Noise pollution: sources of noise pollution, human tolerance levels, levels of exposure due to various sources, preventive and curative methods. |
| Unit-III | Report of field visit to municipal waste water treatment plant/ Industrial Effluent treatment plant. |

SECTION-B

- | | |
|----------|--|
| Unit-IV | Land pollution: solids its effect on the environment, various methods of collection, treatment and disposal of solid waste, Hazardous waste and risk analysis. |
| Unit-V | Environmental Impact assessment : Need for EIA, elements of EIA, Environmental attributes, Nature of Impact - Primary, Secondary, Tertiary, Short Term & Long terms, Local & Regional. |
| Unit-VI: | 1) Rural Sanitation – Collection & disposal of night soil, Sanitary Latrines.
2) Biogas plant - Capacity & Design. |

PRACTICALS

- 1) Case study of environmental pollutions.
- 2) Design of DO sag curve.
- 3) Measurement of noise
- 4) Design of solid waste disposal system (any one)
- 5) Case study of EIA.
- 6) Field visit to solid waste disposal system / rural sanitation projects

BOOKS RECOMMENDED :

- 1) Mishra P.C. : Fundamentals of Air & Water Pollution.
- 2) Mohan I. : Environmental Pollution & Management, Ashish Pub. House, New Delhi-110026
- 3) Gilbert M. Masters : Introduction to Environmental Engg. & Science.

7SC4

ELECTIVE-I**(8)ADVANCEDEARTHQUAKEENGINEERING**

- Unit I: Behaviour of structures in past earthquakes : lessons learnt with regards to weak / strong aspects of structural systems.
Ground motion characteristics : choice of ground motion for a major project site.
- Unit II : Detailed study of IS : 1893 - 2002 : seismic analysis of buildings using codal provisions, design considerations.
- Unit III: Introduction to seismic design : Considerations for bridges, dams, chimneys.
- Unit IV: Vulnerability of buildings : use of Vulnerability Atlas and understanding techno legal issues with regard to buildings.
- Unit V : Concepts in repair, restoration and seismic strengthening : retrofitting weakness in existing buildings, aging, weathering, development of cracks, material and equipment for repairs of masonry and concrete structures, study of IS : 13935.
- Unit VI: Methodologies for repairs : for walls, roofs, slabs, columns and foundations of buildings in stone, brick or reinforced concrete.

PRACTICALS :**PROJECT :**

Students to prepare minimum one complete design of a building or retrofitting of a building with full details. Tutorials based on above syllabus.

BOOKS :

- 1) Anil K. Chopra : Dynamics of Structures, Prentice Hall of India Pvt. Ltd.
- 2) James L. Stratta : Manual of Seismic Design, Pearson Education.
- 3) Jaikrishna, Chandrashekhar, Brajesh Chandra : Element of Earthquake Engineering, Sarita Pub., Meerat.

7SC5

INDUSTRIAL TRAINING & SEMINAR**Industrial Training:-**

Students shall undertake at least 2 weeks training in the summer vacation after Sixth Semester under any Contractor/ Architect/ Designer/ Industry and submit a detailed report.

Seminar based on Project shall be delivered in Seventh

Semester only. 25 marks shall be given through the internal evaluation done by three member committee one of them will be guide.

Seminar shall be delivered with POWER POINT presentation.

**EIGHTHSEMESTER
ESTIMATINGAND COSTING****SECTION –A**

8SC1

- Unit-I General : Importance of the subject, purpose of quantity estimates, Modes of measurement and units of measurement as IS1200. Methods of cost estimates in general, various methods of stage-I (approximate) estimates.

Specification: Purpose and principles of specification writing, types of specification writing and developing detailed specification of a few items related to building, Irrigation Work, Road work.

- Unit -II Cost Buildingup: purpose and principles, importance of Schedule of Rates in cost estimates, factors affecting analysis of rates. Fixed, variable prime and supplementary cost, overhead costs and its allocation.

Recommendations from N.B.O. for Task work, No. of workman etc., Schedule of rates, market rate analysis of some specific items including transportation cost.

- Unit-III Cost & Quantity Estimate: Methods of detailed estimates, forms used, detailed estimates of Civil Engineering works, Building, Quantity estimates : Working out quantities of various materials required for construction, such as cement, steel, bricks, aggregates, timber.

SECTION – B

- Unit-IV Earth work estimates in Roads including hill road.

Cost Accounting, Various methods, classification of cost , direct & indirect charges, distribution of overheads, MAS account, issue rate of store accounts.

- Unit-V Valuation - Purpose of valuation, value and cost, market value, potential value, sentimental value, scrap value, etc. Real estate, Guilt edged security. Net & gross return, Tenure of land, free hold & lease hold property.

Sinking f Depreciation, capitalized value, annualized value,

methods of valuation, rent fixation, valuation tables. Valuation of a old building.

- Unit-VI Organisation for construction industry specific to Govt. organisation. P.W.D.Organisation Site administration, Labour contracts, BOT.
- Role of Govt.deptt. as a construction agency, Arranging Works: Methods of carrying out works, Arranging contract work, Tender Notices, acceptance of tender, essentials of contracts, types of contracts, contract documents, Indian contract law and Engineering contracts, land acquisition, Act, Legal aspects of various contract provision.

PRACTICALS–

The candidates submit the following :

- 1) i) Detailed estimate of a building, single stories with minimum four room with a flat roof (Given problem.)
- ii) Detailed estimate of road of minimum 1 KM length,. With Hot mix cote.
- iii) Detailed estimate of any two of the following.
 - a) R.C.C. Frame structure Residential building.
 - b) Culvert
 - c) Septic tank for a colony.
2. Specification for 10 items as below.
Building works 6 Items.
Road Work 2 Items.
Irrigation work 2 Items.
3. Analysis of 8 Items.
4. Valuation of building, existing Building should be taken for valuation work.
5. Submission of one working drawing by actual (field visit) visit to the construction site & its estimate.
6. Tender documents for the Building in problem No. 1
a) Tender Notice. b) Tender. c) Schedule A and Schedule B. d) Conditions of contracts regarding time, labour payment, damages.
7. Use of Computer software for detailed estimate of building.

NOTE :- Practical Examination shall consists of viva-voce and a test based on syllabus and sessional work.

BOOKS RECOMMENDED :

1. R.H.Namavati. : Estimating and Valuation
2. D.N.Datta : Estimating & Dosting – Datta Lucknow.

3. Vazirani : C.E.Estimating & Costing, Chandola Khanna Publisher Delhi.
4. B.S.Patil : Estimating Costing – Orient Longmans.
5. P.W. & H.Deptt. Govt. of Maharashtra : Standard Specification
6. Namavati : Valuation
7. Rangawala : Valuation Charotar Book Stall
8. Dhanpat Rai : Text book of Estimates Costing – Anand & Sons, Delhi.
9. B.C.Chakraborty : Principles of Estimation & Costing.
10. Indian Contract Act.

8SC2 ENVIRONMENTAL ENGINEERING–II SECTION–A

- Unit-I Quantity of storm water, DWF, variation of sewage, flow systems of sewerage - separate combined and partially combined, layouts of sewerage system, capacity of sewers, design of sewers.

Laying out of circular sewers-Boning rod and sight rail method, Testing & maintenance of sewers.

- Unit-II Waste water characteristic, sampling of sewage, physical, chemical and biological examinations, B.O.D. and C.O.D.,B.O.D. equation, problems on B.O.D.

Population equivalent, Nitrogen cycle. Pollution due to domestic and industrial waste. Industrial effluent standards for disposal on land, into stream and into sewers. MINAS.

Treatment of sewage - purpose of treatment, preliminary treatment, primary treatment and secondary treatment. Flow diagram for conventional sewage treatment plant. Preliminary Treatment:- Screening, Grit chamber, detritus tank. Primary Treatment:- Sedimentation of sewage.

- Unit-III Biological treatment: Trickling filters, low rate & high rate trickling filters, construction details, Re- circulation, Modification of trickling filters.

Activated sludge process - Process description, Methods of aeration, loading rates, Different modified forms of A.S.P.,MLSS & SVI,F/M.

SECTION–B

- Unit-IV Low cost waste treatments - Oxidation ponds, Aerated Lagoon, Treatment and Disposal of sludge - Digestion of sludge, sludge disposal.

Septic tank, working and design, Disposal of septic tank effluent Disposal of sewage on land and in stream. Self

purification capacity of stream.

- Unit-V Characteristics of solid waste:- Physical, chemical, biological Analysis
- Collection of solid waste:- Types of collection system and services, frequency of collection, methodology involved in setting up collection bins.
- Disposal of solid wastes:- Different methods, sanitary land fill, composting, incineration.
- Unit-VI Air pollution: Introduction to air pollution, various pollutants, their sources and their effects on man and material, prevention or air pollution at sources, introduction to control devices, electrostatic precipitator & cyclones only.
- Noise pollution: Nature, sources, effects, control measures, human tolerance level.
- Introduction to EIA, Environmental Acts Water Acts 1974, 1988 Air Acts 1981, 1988 EPA 1986 MVA 1988 Environmental Audit and objectives.

PRACTICALS

- 1) Analysis of waste water (any four) – BOD (for domestic waste), COD (for industrial waste), Solids (Volatile), SVI, Nitrogen, Chlorides.
- 2) Air sampling & Analysis of SPM.
- 3) Physical characteristic of solid waste.
- 4) Sketches of sewers appurtenances – Manholes – different types, storm water inlets, overflows, inverted siphons, automatic flushing tanks, ventilation in sewers.
- 5) Report of Field visit to Municipal wastewater treatment plant/Industrial Effluent treatment

BOOKS RECOMMENDED :

- 1) Kshirsagar S.R. : Sewerage and Sewage Treatment, Roorkee Pub House, Roorkee.
- 2) Steel E.W. Steel : Water Supply & Sewerage, McGraw Hill Book Co.
- 3) Birdie G.S. : Water Supply and Sanitary Engineering, Dhanpat Rai & Son's.
- 4) Garg S.K. : Waste Water Engineering.
- 5) Dr. Bhide A.D., Sunderson B.B. : Solid Waste Management in Developing Countries.
- 6) Rao H.V.N. : Air Pollution.
- 7) Stern, Wohlers, Boobel, Lowry : Fundamentals of Air Pollution, Academic Press, 1973.

8SC3 PROJECT PLANNING & MANAGEMENT

SECTION-A

- Unit-I Construction, industry & National economy, The Engineer, Contractor & Construction economy.
- Bar Charts, Advantages, Limitations, preparation of bar Charts, Gantt charts, advantages, critical path method, basic concept, activity, event, Fulkerson's rule for numbering event, Network- construction & scheduling, advantages of CPM, dummy activity, Floats, activity times, project duration, critical path.
- Unit-II PERT, advantages, three times estimates, average time, slacks, probability, probability factor, S.D., variance, critical path
- Crash programming, Normal & crash costs, Normal time, Crash time, cost slope, simple compression of Network.
- Unit-III Resource planning, resource levelling of skilled & unskilled labours, allocation, scheduling resources.
- Project control, control with CPM techniques, necessity & review, updating of network

SECTION-B

- Unit-IV Safety, construction hazards, in multistage buildings, during blasting, deep excavation, material handling, methods of prevention of accidents, injury rate; injury severity rate, injury index, National Safety Council, its role, recommendation, organisation definition, types, line, Line and Staff, Functional organization, quality control, ISO.
- Unit-V Management: Fayol's principles of management, functions of management, personnel management, importance, functions.
- Materials management, objectives, functions, inventory, need for inventory, ABC, EOQ analysis.
- Unit-VI Excavating equipments
- (a) power shovel : construction, working, output, factors affecting output, cycle time, problems on output.
 - (b) Dragline:- Construction, working, output, factors affecting output, cycle time, problems on output.
 - (c) Concrete mixers, Tilting & non-tilting type construction working.

- (d) Compacting equipments ; tamping rollers, smoothwheel rollers, pneumatic tired rollars, Working, Construction, selection of equipments, cost of owning & operating, replacement analysis, downtime cost, obsolence cost.

BOOKS RECOMMENDED:

- 1) Peurifoy R.L. : Construction Planning, Equipment & Method.
- 2) Srinath L.S. : PERT & CPM.
- 3) Punmia & Khandelwal : PERT & CPM.
- 4) Khanna S.K. : Industrial Organization & Management.
- 5) Satyanarayan : Operations Reserach.

8 SC4

ELECTIVE – II

(1) ADVANCED DESIGN OF STEEL STRUCTURES

SECTION-A

- Unit-I (a) Design of foot bridge(N-Truss or Pratt)
(b) Analysis and design for transmission tower lines
- Unit-II (a) Design of self supporting steel chimney and its foundation.
(b) Design of through type truss bridge member for dead load and equivalent live load including top, bottom bracings and portal bracing.

SECTION - B

- Unit-III Design of industrial buildings including gantry girder, gantry column, Design of knee braces.
- Unit-IV a) Design of north light trusses and lattic girder.
b) Design of elevated rectangular, square pressed steel tanks and staging

PRACTICAL:

§ Candidates are required to prepare at least two designs of steel structure based on theoretical course detailed workings are necessary. Field Visit.

A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

Students must be shown video CD, slides, transparencies and photograph of actual structures.

BOOKS RECOMMENDED:

1. Ramchandra, Design of Steel Structure, Volume – I and II

2. Arya, Ajmani, Design of Steel Structures
3. Duggal, Design of Steel Structures
4. N. Subramanyam, Design of Steel Structures, Oxford University Press, 2008.

8SC4

ELECTIVE -II

(2) ADVANCED WASTE WATER & INDUSTRIAL WASTE TREATMENT

SECTION - A

- Unit-I 1. Physical unit process: screening, mixing, flocculation, sedimentation, floatation.
2. Design of Grit Chambers and Screens.
3. Chemical Unit Processes: precipitation, gas transfer, adsorption
- Unit-II Biological Unit Process: fundamentals of biological treatment. Design of trickling filter & activated sludge process.
- Unit-III 1. Low cost waste water treatment: design of oxidation pond and aerated lagoon
2. Oxidation ditch. Design of Secondary Settling Tank.
3. Methods of disposal of industrial wastes. Equalization tank, Neutralization.

SECTION – B

Unit-IV General : Effect of discharge of industrial wastewaters on streams, land and environment. Importance and scope. Problems involved in treatment. Variation in quality and quantity of industrial wastewaters. Standards & Criteria

Indian standards for discharge of treated waste water on land, into municipal sewers and natural water courses.

Sampling of Waste Water :

Representative sampling. Grab and composite samples.

Unit-V General Approaches to Planning of Industrial Wastewater Treatment and disposal. Equalization and proportioning Neutralization.

Treating different effluent streams separately. Including/ excluding domestic wastewater along with the industrial waste.

Treating industrial wastewater along with town waste.

Unit-VI Process flow diagram, characteristics and treatment of various industrial wastes.

Industrial wastes of pulp and paper, textiles, tannery, food, canning, sugar mills, distillery, dairy, Pharmaceutical, Electroplating etc. Case study of any one industry.

PRACTICALS

- 1) Design and computerize drawing of municipal wastewater treatment plant.
- 2) Design and computerize drawing of effluent treatment plant for any one industry.
- 3) Report of field visit to any industrial waste water treatment./municipal wastewater treatment.

BOOKS RECOMMENDED :

- 1) Matcalf and Eddy : Waste Water Treatment, Disposal and Reuse, McGraw Hill Pub. Co., New Delhi.
- 2) Rao and Datta : Waste Water Treatment, Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi.

8SC4

ELECTIVE-II

(3) FINITE ELEMENT METHOD

SECTION - A

- Unit-I Continuum structures, discretisation, finite elements, nodes, variational principle, minimum potential theorem, relation to Rayleigh-Ritz method.
- Unit-II Interpolation, Lagrangian, Hermitian shape functions, natural coordinates, area and volume coordinates, coordinate and derivative transformations.
- Unit-III 2-D plane stress and plane strain analysis, constant strain triangle, rectangle. 3D analysis, tetrahedron & parallelepiped elements.

SECTION - B

- Unit-IV Isoparametric elements, plane stress, plane strain and solids, numerical integration.
- Unit-V Beam straight with C and C continuity, numerical integration to cater for membranes, bending and torsion combination.
- Unit-VI Programming aspects, geometry, connectivity, code numbers alternate data types, half band data preparation, flow charts, typical subroutine for assembly, shape functions, solution of equations, stiffness matrix.

PRACTICAL:

Candidate are required to prepare two problems based on syllabi.

BOOKS RECOMMENDED:

1. Desai, C. S., Abel, Introduction to Finite Element Method
2. Cook, Concept and application of Finite Element Method
3. Patwardhan, N. R. Illustrated Finite Element Method
4. Krishnamurthi, C. S., Finite Element Analysis – Theory and Programming

8SC4

ELECTIVE-II

(4) DAM ENGINEERING

SECTION - A

- Unit-I Introduction to Dam Engineering : Different classification for dams, relative advantages and disadvantages of various dam selection or types of dam, Investigation of dam sites, Engineering surveys, geological investigation, subsurface exploration programme, economic height of dam, Construction machinery, material, money, inventory.
- Unit-II Rockfill dam : Introduction, general characteristics, materials and testing of rockfill material, foundation of rockfill dam, design, rockfill placement, examples.
- Unit-III Arch dam :- components, types, methods for design.
Buttress dam : components, types, forces acting, Buttress spacing, Master curve for economic spacing, preliminary design
Solid Gravity dams : Analysis & Design of gravity dam.

SECTION - B

- Unit-IV Spillways: choice of types, crest gates, hydraulic design, comparison, approach and tail channel, J.H.C. & tail water rating curve
Energy Dissipaters: types, components, design of hydraulic jump type, basins, ski-bucket type, roller bucket.
- Unit-V Head Regulators : requirements, types, foundation treatment including uplift consideration, Bank connection, energy dissipation, hydraulic design of opening and barrel, ventilation, types of gates.
Approach Channel, case study for one on rock foundation

and one on permeable foundation.

Model Studies: scales design principles, materials, scale effects for model of dams spillways.

Unit-VI Instrumentation : In earth dam and solid gravity dams, piezo meters, settlement, gauges, (surface monuments, base plate, cross arm) strain meters joint meters, thermometers, stress meters, pore pressure cells, plumb-bob Seismograph. water level gauges (description, object, location, working, installation of each, design not expected)

Special problems: increasing height of masonry and concrete dams, strengthening, repairs and maintenance, leakage, evaporation controls. evaporation controls.

PRACTICALS :

Any four drawing sheet from the following :-

Compulsory field visit to dam site and report writing.

- 1) Analysis, design and drawing of Gravity dam based on the given data.
- 2) Design and drawing of spillway and stilling basin.
- 3) Layout of arch dam plan, section at middle, flank, types of arch dams.
- 4) Drawing of atleast four instruments (two earth dam and two gravity dam)
- 5) Design and drawing of head regulator for earth dam.

BOOKS RECOMMENDED :

- 1) Sharma H.D : Concrete Dams, Metropolitan Book Co, Delhi.
- 2) Varshney R.S. : Concrete Dam, Ox IBH, Mumbai.
- 3) Sherard et al : Earth and Rockfill Dam, John Wiley, New York.
- 4) USBR : Design of Small Dams.
- 5) USBR : Design of Large Dams.
- 6) Peurifoy R.L. : Construction, Planning and Equipments, McGraw Hill Book Co.
- 7) Satyanarayanan : Construction, Planning & Equipment, Standard Pub.
- 8) USBR : Design of Gravity Dam.

ELECTIVE-II

8 SC4

(5)ADVANCEDENGINEERINGGEOLOGY

Unit I: A) Geology & engineering characters of Basalts & other rock formations : study of rock formations of Maharashtra older than Deccantrap from Civil engineering point of view, field characters of basalt flows and older formations which are significant from dam foundation, tunnelling work, watershed development including percolation tanks and construction material.

(B) Geology of dam & reservoir's : bearing capacity & water tightness of different types of rocks occruing in Maharashtra from construction of gravity dam with important case histories of different dam sites in Maharashtra whose geological problems were encountered and remedial measures were adopted. Set of geological conditions which lead to tail channel erosion with case histories of different dam sites.

(C) Geology of tunnel alignment : geological factors responsible for overbreaks & percolation of water, various geological structures which affects the tunnelling works. Case histories of tunnels & hydro-electric projects, roads, railways & canals driven through different types of Basalts & other r o c k s occur in Maharashtra.

Unit II: (A) Seismological studies : factors to be to safeguard gravity dams. Detailed studies of active & dead faults. Type & design aspect of the dam to be constructed in seismic zone with cace histories.

(B) Percolation tanks : importance of geological studies for the selection of sites for percolation tanks, geological studies of watershed development projects in Maharashtra including Raleganshindi & Vidarbha region.

(C) Ground water studies : water bearing characters of different types of Basalts. Soil & water preservation techniques of civil engineering significance and under ground bandhara. Exploration of tubewells n alluvium and sandy - alluvium substrata for drinking water oses procedures and need thereof. Deciding acquifers for tubewell exploration & development of tubewells conducting yield tests of tubewell.

Unit III: (A) Geology of soil formation : geological factors which govern the engineering characters of soils. Soil derived from different types of rocks which can be used for casing & hearting of

earthen dams. Nature of river alluvium in Maharashtra. Problem water logging & its remedial measures.

(B) Construction material : properties of different types of rocks that can be used as rubble for masonry, road metal, railway ballast, concrete aggregates etc. Problem of alkali aggregate reaction. Scarcity of sand in Deccan trap region, suitability of compact & gabbroic basalt as a substitute of sand after crushing.

(C) Geology of cut-off trench : geological logging and mapping of cut off trench of irrigation projects. Applicability of grouting in irrigation projects & different grouting techniques.

Unit IV: (A) Drilling and logging : different methods of drilling. Precautions to be taken during drilling, preservation of cores. Recording of drilling data. Geological logging of the drill & its interpretation. Methods of water intake tests.

(B) Aerial photo interpretation : interpretation of aerial photos from the point of view of rock types, geological structures, selection of dam sites and alignment of roads, railways & ghat interpretation of lineaments for groundwater.

(C) Town planning : role of geology in town planning. Important case histories of the old town planning.

Unit V : Geophysical principle of electrical resistivity survey, its utility in determining the depth of overburden, foundation grade rocks, gullies & other geological structures by having case histories of dams & tunnels, significance of electrical resistivity survey in ground water studies, brief introductory ideas regarding seismic, magnetic and gravity surveys and their applications in various fields.

Unit VI: (A) Rock Mechanics : Engineering properties of rocks, general properties, strength of rocks, elasticity of rocks. Residual stresses in rock masses, classification system in rock engineering - Terzaghi's load classification, Lauffer-Pacher classification. Rock quality designation (RQD), rock structure rating (RSR), concept of Wickham et.al (1972)

(B) Environmental Geology : role of geology in environmental engineering, geo-environmental : soils as resources, wind erosion, erosion by moving water, predicting & controlling erosion, soil erosion & land use decisions, problem soils. Reactivation of pre faults, earthquakes in Peninsular India, intensity & magnitude, assessment, Himalayan earthquakes,

landslides - characterisation, landslide analysis, dimensions of landslide hazard, landslide potential, case histories, subsidence, response to subsidence prediction, costs of subsidence, case histories.

PRACTICALS :

- 1) Construction of sub surface geology on L-section from the drill-hole data, interpretation of the plotted data from the stand point of depth of foundation grade rock, leaky zones, case of dam sites and major zones of overbreaks, roof collapse and percolation of water in case of tunnels and stability of hill slopes up to nine problems.
- 2) Geophysical survey in the field, interpretation of geophysical data by using curve matching technique & inverse slope method.
- 3) Interpretation of aerial photographs for locating type of rocks, lineaments, dam sites, roads, railway routes, ghat roads and ground water studies.
- 4) Geological logging of drill cores for dam foundation, bridge foundation up to two problems of any dam or bridge sites in the geological field visit for study of basalt flows, dykes, fractures & on different project sites.

BOOKS RECOMMENDED :

- 1) P.W.D. Hand Book, Chapter No. 6.
- 2) Geological Survey of India - Engineering Geology Case Histories, Parts I & II.
- 3) Auden J.B. : Indian Society of Engineering Geology, Commemoration Volume.
- 4) Wahlstrom E.E. : Tunnelling in Rocks.
- 5) Wahlstrom E.E. : Dams, Dam Foundations and Reservoir Sites.
- 6) Goodman R.E. : Introduction to Rock Mechanics.
- 7) Bieniawski Z.T. : Rock Mechanics Design in Mining and Tunnelling.
- 8) Lama R.D. & Vutukuri V.S. : Hand Book of Mechanical Properties.
- 9) Gupta R.B. : A Text Book of Engineering Geology, Pune Griha Prakashan.
- 10) Miller : Principles of Remote Sensing.
- 11) Pandey S.N. : Text Book of Photo Geology.
- 12) Lundgren L. : Environmental Geology, Prentice Hall Pvt. Ltd.
- 13) Patwardhan A.M. : The Dynamic Earth System, Prentice Hall Pvt. Ltd.

(6) MATRIX COMPUTER ANALYSIS OF STRUCTURES**SECTION-A**

- Unit-I Solution of simultaneous algebraic equations, Gaussian elimination method, Half-band matrices, computer programme.
- Unit-II Finite difference method, application to plate deflection problems for fixed and simply support conditions.
- Unit-III Flexibility method, static redundancy, flexibility coefficients, compatibility conditions, application to continuous beams, single-bay single story portals, pin joined plane trusses.

SECTION-B

- Unit-IV Stiffness method, kinematic redundancy, equilibrium equations, member stiffness matrix and structure stiffness matrix, assembly procedure, application to continuous beams, pin jointed plane truss, numerical examples upto three unknowns.
- Unit-V Stiffness matrix of plane frame member with axial deformation (6x6), Grid member (6x6), transformation of forces and displacements, member and global coordinate system.
- Unit-VI Data and program organization for stiffness method, various coding systems, member-joint and joint-coordinate relations, member-displacement relations, code number approach, methods of introducing boundary conditions for restrained displacements.

PRACTICAL:

- § Detailed formulation of any one structure. Preparation of program and data file.

BOOKS RECOMMENDED:

1. Gere, Weaver, Analysis of framed structures
2. Rubinstein, M. F., Matrix computer analysis of structures
3. Matrin, M. C., Introduction to matrix methods of structural analysis

(7) ADVANCED STRUCTURAL ANALYSIS**SECTION-A**

- Unit-I 1. Approximate methods of analysis of multi-bay multi-storey Frames by -
(a) Cantilever method,
(b) Portal method &

(c) Factor method.

2. Shear centre for thin walled beam section.

Unit-II 1. Elastic centre method, application to fixed & hinged symmetric portals, arches.

2. Analysis of beams circular in plan.

Unit-III 1. Cantilever moment distribution method, application to rigid jointed plane frames.

2. Vierndeel girders - analysis for vertical sway cases only.

SECTION-B

Unit-IV 1. Finite difference method, application to beam deflection problems

2. Minimum potential principle, Rayleigh & Rayleigh-Ritz approach to continuous problems, application to simply supported and cantilever beams using power series and trigonometric series.

Unit-V 1. Introduction to theory of elasticity - (treatment in cartesian co-ordinates), state of stress at a point, stress -equilibrium equations, strain-components, stress -strain relations, generalized Hooke's law, strain plane stress and plane conditions, stress and compatibility for 2D.

Unit-VI 1. Analysis of columns loaded laterally.
2. Structural response to earthquake, analysis of multistoried frames by I.S. code provisions.

PRACTICALS:

1. Candidates are required to prepare at least two solution of the analysis based on theoretical course.
A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

BOOKS RECOMMENDED:

1. S. B. Junnarkar, Mechanics of Structures – III
2. Norris, Wilbur, Elementary Structural Analysis
3. Timoshenko & Goodier, Theory of Elasticity
4. Jaikrishna, Chandrashekhara, Element of Earthquake Engineering, Sarita Publication, Meerut (U.P.)
5. MalikaSelvam, Introduction to Earthquake Engineering
6. Vazirani & Ratwani : Advanced Theory of Structures.
7. Ross C.T.F. : Advanced Stress Analysis.

(8) ROCK MECHANICS**SECTION-A**

- Unit I: Introduction, properties and testing. Introduction to Rock Mechanics and its field applications, identification of common rocks, physical & mechanical characteristics of rock material. Field & Laboratory testing of rocks. Classification of rock masses for engineering purpose.
- Unit II: Rock excavation : Blasting - objectives, blasting materials, blasting methods, open cut blasting. control blasting operation, precautions.
Drilling, braking & cutting.
Machines used for rock excavation.
- Unit III: Rock reinforcement & Grouting : Rock bolting - bolting - methods & materials.
High capacity of rock anchors - types of rock anchors, anchor grouting, civil engineering applications. Bolted & anchor supports. Rock grouting - objectives, types of treatment, grouting material, grouting methods, quality control & monitoring of grouting.

SECTION-B

- Unit IV: Rock strength & deformability : modes of rock failure, stress-strain behaviour in compression, Mohr- Coloumb failure criteria, Griffiths crack theory, empirical criteria for failure, effect of size on strength. Plane of weakness in rocks, joint orientation & roughness. Deformability of rocks - elastic & non- elastic behaviour, influence of time on rock deformation, viscous behaviour & creep.
- Unit V : Rock foundation & slope stability : rock foundation - allowable bearing pressures, stress & deflection in rock under footing, failure mechanisms, subsiding & swelling rocks, base heave & remedies, foundation anchoring. Rock slopes - modes of failure, factors affecting, analysis of slopes.
- Unit VI: Underground opening : types of boring machine, cutting tools, muck handling. Opening in competent rock, horizontally layered rocks & rock with inclined layers, plastic behaviour around tunnels, time dependent behaviour of tunnels, underground opening in blocky rocks - Block theory. Review of design methods of tunnels - Empirical & semi-empirical methods. Support & stabilisation.

PRACTICALS :

Any eight experiments/assignments of the following :-

- 1) Unconfined compression test on rock.
- 2) Large direct shear test on jointed rock mass / rock material.
- 3) Triaxial test on rock.
- 4) Point load strength test on rock.
- 5) Brazillian strength test on rock.
- 6) Slake durability test on rock.
- 7) Flat Jack test.
- 8) Beam bending test on rock.
- 9) Fracture toughness test on rock.
- 10) Till test on rock samples.
- 11) Study of field shear test on rock.

BOOKS RECOMMENDED :

- 1) Goodman R.E. : Introduction to Rock Mecanics.
- 2) Franklin J.A., Dusseault M.B. : Rock Engineering.
- 3) Franklin J.A., Dusseault M.B. : Rock Engineering Applications.
- 4) Stagg K.G, Zienkiewicz O.C. : Rock Mechanics in Engineering Practice.

(9) ADVANCED R. C. C. DESIGN**SECTION-A**

[BY LIMIT STATE METHOD]

- Unit-I
- 1) Design of Portal frame up to two bay two storied symmetrical frame for symmetrical loading.
 - 2) Design of circular slab for uniformly distributed load only, Introduction to grid floor slab.
- Unit-II
- 1) Design of a footbridge and simply supported slab deck bridge for I.R.C.class A loading.
 - 2) Design of RCC girder (T beam) bridge for I.R.C.class A loading.

SECTION-B

- Unit-III
- 1) Structural response to earth quake, Analysis of multistoried frame by seismic coefficient method.
 - 2) Design of square bunkers using Rankine theory. Design of Silos.
- Unit-IV
- 1) Design of R.C.C. Intze tanks.
 - 2) Design of staging for Intze tanks with raft foundation.

PRACTICALS:

1. Candidates are required to prepare at least two designs based on theoretical course detailed workings are necessary.

A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

BOOKS RECOMMENDED:

1. Suhil Kumar, Treasure of R. C. C. Design
2. Jain, A. K., Reinforced Concrete (Limit State Method)
3. Shah, Karve, Design of R. C. C. Structures
4. N. Krishna Raju, Advanced R. C. C. Design
5. Rajgopalan, K., Storage Structures.

8SC5 COMPUTER AIDED DESIGN OF STRUCTURES

Software: Anyone of the following software

STAAD, SAP, NASTRAN, ANSYS, BUILD MASTER, SCADDS & STRUDS and any other reputed software

Solutions to minimum two for the following problems.-

1. Analysis and design of minimum three storied building
2. Cantilever or counterfort retaining wall
3. Analysis and design of steel structure
4. Any other RCC or steel structure

PRACTICALS:

Candidates are required to prepare at least two designs based on above course.

A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

8SC6 PROJECT

Complete Project Report in a group of Maximum 9 students shall be submitted.

Out of 75, 25 marks shall be given through the internal viva by three member committee one of them will be guide.

@ REGULATION NO. 11 OF 2002

Examinations leading to the Degree of Bachelor of Engineering (Civil Engineering) (Four Year Degree Course.... Semester Pattern) Regulation, 2002.

Whereas it is expedient to frame the Regulation in respect of Examinations leading to the Degree of Bachelor of Engineering (Civil Engineering) (Four Year Degree Course.....Semester Pattern) for the purposes hereinafter appearing the Management Council is hereby pleased to make a following Regulation.

1. This regulation may be called "Examinations leading to the Degree of Bachelor of Engineering (Civil Engineering) (Four Year Degree Course....Semester Pattern) Regulation, 2002.
2. This Regulation shall come into force w.e.f. from the Academic session-
 - i) 2000-01 for Ist & IInd Semester B.E.,
 - ii) 2005-06 for IIIrd & IVth Semester B.E.,
 - iii) 2006-07 for Vth & VIth Semester B.E., and
 - iv) 2007-08 for VIIth & VIIIth Semester B.E.
3. The Schemes of Teachings and Examinations for Ist & IInd, IIIrd & IVth, Vth & VIth, and VIIth & VIIIth Semester in respect of Bachelor of Engineering (Civil Engineering) (Four Year Degree Course.... Semester Pattern) shall be as per Appendices A, B, C, and D appended with this Regulation respectively.

@ Latest amended vide Regulation No. 27 of 2005, 14 of 2007 & 40 of 2007.

Examination in Environmental Studies leading to Bachelor Degree, Ordinance, 2005

Whereas it is expedient to frame an Ordinance relating to Examination in Environmental Studies leading to Bachelor Degree level, hereinafter appearing, the Management Council is hereby pleased to make the following Ordinance.

1. This Ordinance may be called "Examination in Environmental Studies leading to Bachelor Degree, Ordinance, 2005."
2. This Ordinance shall come into force from the Academic session 2005-06.
3. In this Ordinance and in other ordinances relating to the examination, unless there is anything repugnant in the subject or context :-
 - (i) "Academic session" means a session commencing on such date and ending with such date of the year following as may be appointed by the Management Council.
 - (ii) "Admission to an examination" means the issuance of an admission card to a candidate in token of his having complied with all the conditions laid down in the relevant ordinance, by a competent officer of the University.
 - (iii) "Applicant" means a person who has submitted an application to the University in the form prescribed for admission to an examination.
 - (iv) "Candidate" means a person who has been admitted to an examination by the University.
 - (v) "Regular Candidate" means an applicant who has applied for admission to a University examination through an affiliated college, Department or Institute in which he/she has prosecuted a regular course of study.
 - (vi) "Examinee" means a person who presents himself/herself for an examination to which he/she has been admitted.
 - (vii) "Examination" means an examination prescribed by the University under the relevant Ordinance.
 - (viii) "External Candidate" means a candidate who is allowed to take a University examination in accordance with the provision of Original Ordinance No. 151.
 - (ix) "Non-Collegiate Candidate" means a candidate who is not a collegiate candidate.

* As amended vide Ordinance Nos. 7 of 2006 & 10 of 2007.

- (x) An "Ex-student" is a person who having once been admitted to an examination of this University, is again required to take the same examination by reason of his failure or absence thereat and shall include a student who may have joined a college, Department or Institute again in the same class.
 - (xi) "Bachelor Degree Examination" means an examination leading to Bachelor Degree of the University.
 - (xii) "Previous Year" means a year following by final year of Bachelor Degree.
4. Save as otherwise specifically provided, the conditions prescribed for admission to the examination under this Ordinance shall apply to all persons who wish to take the examination to the Degrees of the University mentioned in para 5 below.
 5. The conditions prescribed for admission to examination under this Ordinance shall apply to following degrees of the University :-
 - 1) Bachelor of Arts
 - 2) Bachelor of Performing Arts
 - 3) Bachelor of Fine Arts
 - 4) Bachelor of Mass Communication
 - 5) Bachelor of Social Work
 - 6) Bachelor of Commerce
 - 7) Bachelor of Business Administration
 - 8) Bachelor of Science
 - 9) Bachelor of Computer Science
 - 10) Bachelor of Computer Applications
 - 11) Bachelor of Pharmacy
 - 12) Bachelor of Science (Home Science)
 - 13) Bachelor of Technology (Cosmetics)
 - 14) Bachelor of Engineering
 - 15) Bachelor of Engineering (Part Time) (Civil)
 - 16) Bachelor of Textile
 - 17) Bachelor of Technology (Chemical Technology)
 - 18) Bachelor of Technology (Chemical Engg.)
 - 19) Bachelor of Architecture, and
 - 20) Bachelor of Laws (Five Year Course)
 6. i) Environmental Studies shall be a compulsory subject for a previous year examination of the following Bachelor Degrees of the University,
 - 1) Bachelor of Arts
 - 2) Bachelor of Performing Arts
 - 3) Bachelor of Fine Arts
 - 4) Bachelor of Mass Communication

- 5) Bachelor of Social Work
 - 6) Bachelor of Commerce
 - 7) Bachelor of Business Administration
 - 8) Bachelor of Science
 - 9) Bachelor of Computer Science
 - 10) Bachelor of Computer Applications
 - 11) Bachelor of Pharmacy
 - 12) Bachelor of Science (Home Science)
 - 13) Bachelor of Technology (Cosmetics)
 - 14) Bachelor of Engineering (Part Time) (Civil)
- ii) Environmental Studies shall be a compulsory subject for IIIrd & IVth Semester of the following Bachelor Degrees of the University,
- 1) Bachelor of Engineering
 - 2) Bachelor of Textile
 - 3) Bachelor of Technology (Chemical Technology)
 - 4) Bachelor of Technology (Chemical Engineering)
 - 5) Bachelor of Architecture, and
- iii) Environmental Studies shall be a compulsory subject for Vth & VIth Semester of the Degree of Bachelor of Laws (Five Year Course)
- iv) Students admitted to Second Year/Third Year/IVth Semester/ VIth Semester of various degree examination courses in different Faculties in the academic session 2005-06 or thereafter shall have to appear for examination in the subject Environmental Studies.
7. The main examination leading to Environmental Studies shall be held in Summer and supplementary examination in Winter every year, at such places and on such dates as may be appointed by Board of Examinations.
Explanation:- Examination shall be conducted on the basis of one common question paper for all Bachelor Degree Examination courses irrespective of annual or semester pattern.
8. Scope of the subject for annual pattern examination and or semester pattern examination shall be as provided under the syllabus.
9. Common question paper for all courses covered under this Ordinance alongwith answer books shall be supplied by the University to the Colleges, Departments and Institutes for conducting the examination of the subject.
10. Valuation of the answer books relating to this subject shall be done at College/Department/Institution level only. Remuneration for valuation of answer books shall not be paid by the University.
Provided that prescribed evaluation fee for evaluation of each answer

book/s of an external examinee/s appeared from the examination centre shall be paid to each examination centre.

11. It shall be obligatory on the part of the College/Department/Institute to submit candidate wise following information to the University on or before the date as may be prescribed by the University :-

Sr. No.	Grade/Category	Marks secured
1.	“A”	- 60 and above
2.	“B”	- 45 to 59
3.	“C”	- 35 to 44
4.	“D”	- 25 to 34
5.	“Fail”	- 24 and below
6.	“Absent”	

12. For the purposes of teaching, learning and examination, the Committee consisting of three teachers shall be appointed by the Principal/ Head of the Department/Head of the Institution under his/her Chairmanship/ Chairpersonship. While appointing three teachers on the said committee, the Principal shall take care that the teachers to be appointed on the committee, if necessary, shall be from different faculty.
13. i) Duration of theory examination of this subject shall be three hour.
ii) For all Bachelor Degree examinations, common question paper of 100 marks shall be provided by the University.
iii) Distribution of these 100 marks shall be as follows :-
- | | | |
|---|---|----------|
| a) Part-A, Short Answer Pattern | - | 25 Marks |
| b) Part-B, Essay type with inbuilt choice | - | 50 Marks |
| c) Part-C, Essay on Field Work | - | 25 Marks |
14. Medium of instruction shall be English or Marathi or Hindi. Question paper shall be supplied in English and Marathi and Hindi. A candidate shall have option to write answers in English or Marathi or Hindi.
15. Examination for the subject Environmental Studies shall be compulsory for external candidates appearing as a fresh candidate at Winter and/or summer examination.
16. For teaching of the subject, there shall be atleast two hour per week. For teaching the subject to the regular candidates, a full time approved teacher of the University and or a person having Postgraduate Degree in any faculty with second class shall be considered eligible.

17. For teaching of the subject, additional fee to be charged to regular candidate shall be as prescribed by the University.
18. Every College/ University Teaching Department shall charge additional fee of Rs. 100/- to every Student of the subject Environmental studies. Out of this Rs. 100/-, the College/University Teaching Department shall have to pay Rs. 25/- to the University as an examination fee of each candidate for the subject environmental studies.
19. The Grade secured by an examinee in the examination of this subject shall not be considered for providing the facility of A.T.K.T. in next higher class.
20. The provisions of Ordinance No. 18/2001 shall not be applicable for securing a grade or higher grade in the examination of this subject.
21. Result of the Final Year of the respective Degree shall not be declared of an examinee unless he/she secures any one of the grade in the examination of subject.

Provided an examinee admitted to Five Year LL.B. course desiring not to continue his/her education beyond Sixth Semester of the said course shall have to secure any one of the grade in the examination of the subject otherwise his/her result of Sixth Semester for awarding B.A. degree shall not be declared.

22. Certificate shall be issued, to the successful examinees in the subject Environmental Studies, after the examination.

ENVIRONMENTAL STUDIES

PART-A

SHORT ANSWER PATTERN

Total Marks : 100

25 Marks

1. The Multidisciplinary nature of environmental studies

- . Definition, scope and importance.
- . Need for public awareness.

(2 lecture hours)

2. Social Issues and the Environment

- . From Unsustainable to Sustainable development
- . Urban problems related to energy
- . Water conservation, rain water harvesting, watershed management
- . Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- . Environmental ethics : Issues and possible solutions.
- . Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- . Wasteland reclamation.
- . Consumerism and waste products.
- . Environment Protection Act.
- . Air (Prevention and Control of Pollution) Act.
- . Water (Prevention and Control of Pollution) Act.
- . Wildlife Protection Act.
- . Forest Conservation Act.
- . Issues involved in enforcement of environmental legislation.
- . Public awareness. (7 lecture hours)

3. Human Population and the Environment

- . Population growth, variation among nations.
- . Population explosion - Family Welfare Programme.
- . Environment and human health.
- . Human Rights.
- . Value Education.
- . HIV / AIDS.
- . Women and Child Welfare.
- . Role of Information Technology in Environment and human health.
- . Case Studies. (6 lecture hours)

PART-B

ESSAY TYPE WITH INBUILT CHOICE

50 Marks

4. Natural resources :**Renewable and non-renewable resources :**

- . Natural resources and associated problems.
 - Forest resources : Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
 - Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
 - Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
 - Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity, case studies.
 - Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.
 - Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- . Role of an individual in conservation of natural resources.
- . Equitable use of resources for sustainable lifestyles.

(8 lecture hours)

5. Ecosystems

- . Concept of an ecosystem.
- . Structure and function of an ecosystem.
- . Producers, consumers and decomposers.
- . Energy flow in the ecosystem.
- . Ecological succession.
- . Food chains, food webs and ecological pyramids.
- . Introduction, types, characteristic features, structure and function of the following ecosystem :-
 - Forest ecosystem
 - Grassland ecosystem
 - Desert ecosystem
 - Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

(6 lecture hours)

6. Biodiversity and its conservation

- . Introduction - Definition : genetic, species and ecosystem diversity.
- . Biogeographical classification of India.
- . Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
- . Biodiversity at global, National and local levels.
- . India as a mega-diversity nation.
- . Hot-spots of biodiversity.

- . Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- . Endangered and endemic species of India.
 - . Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity. (8 lecture hours)

7. Environmental Pollution

- . Definition
 - . Causes, effects and control measures of :-
 - Air pollution
 - Water pollution
 - Soil pollution
 - Marine pollution
 - Noise pollution
 - Thermal pollution
 - Nuclear hazards
- . Solid Waste Management : Causes, effects and control measures of
 - . Role of an individual in prevention of pollution.
 - . Pollution case studies.
 - . Disaster management : floods, earthquake, cyclone and landslides. (8 lecture hours)

PART-C ESSAY ON FIELD WORK

25 Marks

8. Field work

- . Visit to a local area to document environmental assets - river / forest / grass land / hill / mountain
- . Visit to a local polluted site - Urban / Rural / Industrial / Agricultural
- . Study of common plants, insects, birds.
- . Study of simple ecosystems - pond, river, hill slopes, etc. (5 lecture hours)

- (Notes :**
- i) Contents of the syllabys mentioned under paras 1 to 8 shall be for teaching for the examination based on Annual Pattern.
 - ii) Contents of the syllabys mentioned under paras 1 to 4 shall be for teaching to the Semester commencing first, and
 - iii) Contents of the syllabys mentioned under paras 5 to 8 shall be for teaching to the Semester commencing later.

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(M) Magazine
(R) Reference
(TB) Textbook

APPENDIX-B
FOUR YEAR B.E. DEGREE COURSE
CIVIL ENGINEERING
(SEMESTER PATTERN)
SEMESTER : THIRD

BRANCH ABBRIVATIONS :-
C - CIVIL
S - SEMESTER PATTERN

L : Theory Lecture (Hourly)
T : Tutorial
P : Practical
D : Drawing / Design Works

Sr. No.	Sub. Code	SUBJECT	Teaching Scheme			Examination Scheme									
			L	T	P/D	Theory					Practical				
						Total Hours/Week	Duration of Papers (Hrs)	Max. Marks Theory Papers	Maximum Marks College Assessment	Total	Min. Pass Marks	Max. Marks College Assessment	Max. Marks External	Total	Minimum Pass Marks
1.	3SC1	Mathematics-III	4	-	-	4	3	80	20	100	40	—	—	—	—
2.	3SC2	Strength of Materials	4	-	2	6	3	80	20	100	40	10	15	25	12
3.	3SC3	Transportation Engineering-I	4	-	2	6	3	80	20	100	40	10	15	25	12
4.	3SC4	Building Construction & Materials	4	-	2	6	3	80	20	100	40	10	15	25	12
5.	3SC5	Engineering Geology	2	-	2	4	2	40	10	50	20	25	25	50	25
6.	3SC6	Communication Skills	2	-	2	4	2	40	10	50	20	10	15	25	12
TOTAL			20	-	10	30				500				150	

GRAND TOTAL : 650

SEMESTER : FOURTH

1.	4SC1	Geotechnical Engineering-I	4	-	2	6	3	80	20	100	40	10	15	25	12
2.	4SC2	Fluid Mechanics-I	4	1	2	7	3	80	20	100	40	10	15	25	12
3.	4SC3	Theory of Structures-I	4	1	-	5	3	80	20	100	40	—	—	—	—
4.	4SC4	Surveying-I	4	-	2	6	3	80	20	100	40	25	25	50	25
5.	4SC5	Concrete Technology & Reinforced Cement Concrete-I	4	-	2	6	3	80	20	100	40	25	25	50	25
TOTAL			20	2	8	30				500				150	

GRAND TOTAL : 650

APPENDIX-C
FOUR YEAR B.E. DEGREE COURSE
CIVIL ENGINEERING
(SEMESTER PATTERN)
SEMESTER : FIFTH

BRANCH ABBRIVATIONS :-
C - CIVIL
S - SEMESTER PATTERN

L : Theory Lecture (Hourly)
T : Tutorial
P : Practical
D : Drawing / Design Works

Sr. No.	Sub. Code	SUBJECT	Teaching Scheme			Examination Scheme									
			L	T	P/D	Theory				Practical					
						Total Hours/Week	Duration of Papers (Hrs)	Max. Marks Theory Papers	Maximum Marks College Assessment	Total	Min. Pass Marks	Max. Marks External	Max. Marks College Assessment	Total	Minimum Pass Marks
1.	5SC1	Reinforced Cement Concrete-II	4	-	2	6	4	80	20	100	40	15	10	25	12
2.	5SC2	Fluid Mechanics-II	4	-	2	6	3	80	20	100	40	15	10	25	12
3.	5SC3	Environmental Engineering-I	4	-	2	6	3	80	20	100	40	15	10	25	12
4.	5SC4	Water Resources Engineering-I	4	-	-	4	3	80	20	100	40	—	—	—	—
5.	5SC5	Surveying-II	4	-	2	6	3	80	20	100	40	15	10	25	12
6.	5SC6	Computer Aided Drafting	1	-	2	3	-	--	--	---	--	25	25	50	25
TOTAL			21	-	10	31				500				150	

GRAND TOTAL : 650

SEMESTER : SIXTH

1.	6SC1	Numerical Methods & Computer Programming	4	-	2	6	3	80	20	100	40	15	10	25	12
2.	6SC2	Structural Design-I	4	-	2	6	4	80	20	100	40	15	10	25	12
3.	6SC3	Building Planning & Drawing	2	-	4	6	4	80	20	100	40	15	10	25	12
4.	6SC4	Water Resources Engineering-II	4	-	2	6	3	80	20	100	40	15	10	25	12
5.	6SC5	Transportation Engineering-II	4	-	-	4	3	80	20	100	40	--	--	--	--
6.	6SC6	Minor Project	-	-	2	2	-	--	--	---	--	25	25	50	25
TOTAL			18	-	12	30				500				150	

GRAND TOTAL : 650

APPENDIX-D
FOUR YEAR B.E. DEGREE COURSE
CIVIL ENGINEERING
(SEMESTER PATTERN)
SEMESTER : SEVENTH

BRANCH ABBRIVATIONS :-
C - CIVIL
S - SEMESTER PATTERN

L : Theory Lecture (Hourly)
T : Tutorial
P : Practical
D : Drawing / Design Works

Sr. No.	Sub. Code	SUBJECT	Teaching Scheme			Examination Scheme									
			L	T	P/D	Theory					Practical				
						Total Hours/Week	Duration of Papers (Hrs)	Max. Marks Theory Papers	Maximum Marks College Assessment	Total	Min. Pass Marks	Max. Marks External	Max. Marks College Assessment	Total	Minimum Pass Marks
1.	7SC1	Theory of Structures-II	4	1	2	7	4	80	20	100	40	25	25	50	25
2.	7SC2	Geotechnical Engineering-II	4	-	2	6	3	80	20	100	40	25	25	50	25
3.	7SC3	Structural Design-II	4	-	4	8	4	80	20	100	40	25	25	50	25
4.	7SC4	Elective-I	4	-	2	6	3	80	20	100	40	15	10	25	12
5.	7SC5	Industrial Training & Seminar } Project }	-	-	-	-	-	--	--	---	--	50	25	75	37
6.	8SC6		-	-	2	2	-	--	--	---	--	--	--	--	--
TOTAL			16	1	12	29				400				250	

GRAND TOTAL : 650

7 SC 4 Elective - I	1)	Advanced Water Treatment	2)	Advanced Geotechnical Engineering	3)	Water Power Engineering		
	4)	Pre Stressed Concrete		5)		Artificial Neural Network & Fuzzy Logic	6)	Advanced Concrete Technology
	7)	Environmental Pollution & Rural Sanitation		8)		Advanced Earthquake Engineering		

SEMESTER : EIGHTH

1.	8SC1	Estimating & Costing	4	-	2	6	4	80	20	100	40	15	10	25	12
2.	8SC2	Environmental Engineering-II	4	-	2	6	3	80	20	100	40	15	10	25	12
3.	8SC3	Project Planning & Management	4	-	-	4	3	80	20	100	40	--	--	--	--
4.	8SC4	Elective-II	4	-	2	6	3	80	20	100	40	15	10	25	12
5.	8SC5	Computer Aided Designs of Structures	-	-	2	2	-	--	--	---	--	25	25	50	25
6.	8SC6	Project	-	-	6	6	-	--	--	---	--	75	50	•125	62
TOTAL			16	-	14	30				400				250	

GRAND TOTAL : 650

8 SC 4 Elective-II	* 1)	Advanced Design of Steel Structures	2)	Advanced Waste Water & Industrial Waste Treatment	3)	Finite Element Method		
	4)	Dam Engineering		5)		Advanced Engineering Geology	6)	Matrix Computer Analysis of Structures
	7)	Advanced Structural Analysis		8)		Rock Mechanics	*9)	Advanced Design of RCC Structures

* Paper of 4 hours duration

Project • 1. College Assessment 50 2. Uni.Oral Exam. 75

The Department of Civil and Environmental Engineering's (CEE) undergraduate program offers opportunities for rigorous academic learning, fellowship, hands-on experience, and leadership. Classes are relatively small, so students get to know both the faculty and fellow students. The program in civil and environmental engineering, which is top-ranked nationally, provides students with a strong fundamental background in engineering science, design, and practice. CEE's four-year curriculum leads to an ABET-accredited Bachelor of Science (BS) degree in Civil Engineering. Undergraduates at Berkeley have opportunities for professional interactions and community service. Most engineers don't start core engineering classes until late in the 2nd year, however, once you start those classes, each individual class is usually only offered once per year and is a prerequisite for the next semester's classes. If you have zero credits to start, starting in the spring shouldn't hold you back as long as you ensure that you will have the prerequisites complete by the time the engineering classes start. One thing that may actually help you is that you may be able to put off the humanities classes until later in the degree. This will be helpful because many students end up b