

**Final Year B.E.  
(Part-Time)  
Civil Engineering**

**Prospectus No. 091730**

**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 (PART-TIME)  
FINAL YEAR  
EXAMINATION, WINTER 2009  
(ANNUAL PATTERN)**



**2009**

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**SYLLABUS  
PRESCRIBED FOR  
BACHELOR OF ENGINEERING  
(PART-TIME)  
CIVIL ENGINEERING  
ANNUAL PATTERN  
FINAL YEAR**

**4PTC1 / 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.

**4PTC2/8SC3 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: Feyol'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, obsolescence 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.

**4PTC3 / 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 :**

1. 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.
2. 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:

1. Jain, A. K., Reinforced Concrete (Limit State Design)
2. Jaikrishna and Jain, Plain and Reinforced Concrete, Volume I and II
3. Sinham S. N., Reinforced Concrete (Limit State Design)
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 Structures, Prentice Hall of India Pvt. Ltd.
7. Negi, L. S. Design of Steel Structures, Tata McGraw Hill Pub. Company Ltd.
8. N. Subramanyam, Design of Steel Structures, Oxford University Press, 2008.

#### 4PTC 4 / 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; tailors 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, Rankine's and Coulomb'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 Geotextiles 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, factor 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 soils, 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 homogeneous, 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- 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.

**4 PTC 5 / 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<sub>2</sub>, H<sub>2</sub>S 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**

- 1) Design of aerator

- 2) Design of flocculator
- 3) Design of clarifier
- 4) Design of rapid sand filter
- 5) Calculation of requirement of disinfectant
- 6) Report of field visit to any one Tertiary treatment/ Unconventional water treatment plant.

**BOOKS RECOMMENDED :**

- 1) Fiar, Geyer & Okun : Water and Waste Water Engg., John Wiley & Sons.
- 2) Mark J. Hammer : Water and Waste Water Technology, John Wiley & Sons.
- 3) Steel E.W. & Ghee M.C. : Water Supply & Sewerage, McGraw Hill Co.

**4 PTC 5 / 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.

**(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.

**(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, conorant 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:**

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

**BOOKS RECOMMENDED:**

1. 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.

**4 PTC 5 / 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.

**4 PTC 5 / 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

#### 4 PTC 5 / 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.

**4 PTC 5 / 7SC4****ELECTIVE-I****(8)ADVANCED EARTHQUAKE ENGINEERING**

- 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.

**4 PTC 6 / 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 latic 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.

**4 PTC 6 / 8SC 4****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.

### 4 PTC 6 /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

### 4 PTC 6 / 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, flunk, 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.

### 4 PTC 6 /8 SC4

### ELECTIVE-II

### (5) ADVANCED ENGINEERING GEOLOGY

- 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 in alluvium and sandy - alluvium substrata for drinking water uses procedures and need thereof. Deciding aquifers 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 classification (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) Gupte 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.

**4 PTC 6 / 8 SC4****ELECTIVE-II****(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

**4 PTC 6 / 8SC4****ELECTIVE-II****(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. Malikeselvam, Introduction to Earthquake Engineering
6. Vazirani & Ratwani : Advanced Theory of Structures.
7. Ross C.T.F. : Advanced Stress Analysis.

**4 PTC 6 / 8SC4**

**ELECTIVE – II**

**(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.

**4 PTC 7 / 8 SC 5 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.

**4 PTC 7 / 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.

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## APPENDIX - D

FOUR YEAR B.E DEGREE COURSE IN  
CIVIL ENGINEERING (PART-TIME)

YEAR : FINAL

ANNUAL PATTERN

L: Theory Lecture  
T : Tutorials  
P : Practicals  
D : Drawing/Design WorkBranch abbreviation  
PTC : Part Time Civil Engg.

| Sr. No. | Sub. Code | Equivalent Subject Code | S U B J E C T                       | TEACHING SCHEME |   |     |                  | EXAMINATION             |            |                             |             | SCHEME     |                             |             |      |    |
|---------|-----------|-------------------------|-------------------------------------|-----------------|---|-----|------------------|-------------------------|------------|-----------------------------|-------------|------------|-----------------------------|-------------|------|----|
|         |           |                         |                                     | L               | T | P/D | Total Hrs./ week | Duration of Paper (HRS) | THEORY     |                             |             | PRACTICAL  |                             |             |      |    |
|         |           |                         |                                     |                 |   |     |                  |                         | Max. Marks | Max. Coll- ege Asses- sment | T O T Marks | Max. Marks | Max. Coll- ege Asses- sment | T O T Marks |      |    |
| 1.      | 4PTC1     | 8SC2                    | Environmental Engineering-II        | 2               | - | 1   | 3                | 3                       | 8          | 20                          | 100         | 40         | 15                          | 10          | 25   | 12 |
| 2.      | 4PTC2     | 8SC3                    | Project Planning & Management       | 2               | - | -   | 2                | 3                       | 80         | 20                          | 100         | 40         | -                           | -           | -    | -  |
| 3.      | 4PTC3     | 7SC3                    | Structural Design-II                | 2               | - | 2   | 4                | 4                       | 80         | 20                          | 100         | 40         | 15                          | 10          | 25   | 12 |
| 4.      | 4PTC4     | 7SC2                    | Geotechnical Engineering-II         | 2               | - | 1   | 3                | 3                       | 80         | 20                          | 100         | 40         | 25                          | 25          | 50   | 25 |
| 5.      | 4PTC5     | 7SC4                    | Elective-I                          | 2               | - | 1   | 3                | 3                       | 80         | 20                          | 100         | 40         | 15                          | 10          | 25   | 12 |
| 6.      | 4PTC6     | 8SC4                    | Elective-II                         | 2               | - | 1   | 3                | 4                       | 80         | 20                          | 100         | 40         | 15                          | 10          | 25   | 12 |
| 7.      | 4PTC7     | 8SC5                    | Computer Aided Design of Structures | -               | - | 1   | 1                | -                       | --         | --                          | --          | --         | 25                          | 25          | 50   | 25 |
| 8.      | 4PTC8     | 8SC6                    | Project                             | -               | - | 4   | 4                | -                       | --         | --                          | --          | --         | 75                          | 50          | *125 | 62 |
| TOTAL   |           |                         |                                     | 12              | - | 11  | 23               |                         |            |                             | 600         |            |                             |             | 325  |    |

GRAND TOTAL : 925

## 4PTC5 / 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

## 4PTC6/ 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

**SANT GADGE BABA AMRAVATI UNIVERSITY**

**\* ORDINANCE NO. 1 OF 1987**

**Examinations leading to the Degree of Bachelor of Engineering (Four Year Part Time Degree Course) Ordinance, 1986**

Whereas it is expedient to make an Ordinance in respect of Examinations leading to the Degree of Bachelor of Engineering (Four Year Part Time Degree Course) for the purpose hereinafter appearing, the Executive Council is hereby pleased to make the following Ordinance.

1. This Ordinance may be called Ordinance relating to Examinations leading to the Degree of Bachelor of Engineering (Four Year Part Time Degree Course) Ordinance, 1986.
2. This Ordinance shall come into force w.e.f. the session 1986-87.
3. Subject to compliance with the provisions of this Ordinance and of other Ordinances in force from time to time an applicant for admission to the Degree of Bachelor of Engineering (Four Year Part Time Degree Course) shall have,
  - i) Passed the Diploma Examination of the Board of Technical Education, Bombay, Maharashtra State or any other examination recognised by the University equivalent thereto, securing not less than 50% marks at the qualifying examination;
  - ii) Passed the qualifying examination in respective branch or any other branch recognised by the University equivalent thereto.
4. The Degree of Bachelor of Engineering (Part-Time) shall be awarded to an examinee who in accordance with the provisions of this Ordinance qualifies himself/herself for the award in any of the following branches of Engineering viz. (i) Civil (ii) Electrical (iii) Mechanical.
5. University shall hold Main Examinations of the Part-Time Course in Winter every year for First B.E., Second B.E., Third B.E., and Final B.E. and Supplementary Examinations in Summer every year at such places and on such dates as may be notified by the University.
6. For the purposes of instructions and examinations, students shall study sequentially.
7. Academic Session shall be of one year and shall begin after the Winter Vacation.

\* As approved by the Executive Council, dated 24-4-1987.

8. Subject to his/her compliance with this Ordinance & other Ordinances (Pertaining to Examinations in General) in force from time to time, the applicant for admission to an Examination at the end of the course of study of a particular session shall be eligible to appear at it, if :

- i) he/she satisfies with the conditions in the table and the provisions thereunder.

**TABLE**

| Sr. No. | Name of Exam. | The student should have completed the session satisfactorily. | The student should have passed in all the subjects of the Examination of |
|---------|---------------|---|--|
| 1.      | 2.            | 3.  | 4.   |
| 1.      | First B.E.    | First B.E.  | ----   |
| 2.      | Second B.E.   | Second B.E.   | ----   |
| 3.      | Third B.E.    | Third B.E.  | First B.E.   |
| 4.      | Final B.E.    | Final B.E.  | Second B.E.  |

(Notes :- Subjects prescribed and numbered in the scheme of Examinations shall be treated as separate subjects, however, the theory and practical, if any, of the subject shall be treated as separate Head of Passing)

- (ii) He/She has complied with provisions of Ordinance pertaining to Examinations in general.
- (iii) He/She has prosecuted a regular course of study in College affiliated to the University.
- (iv) He/She has in the opinion of the Principal, shown satisfactory progress in his/her studies.
9. Papers and the Practicals in which an examinee is to be examined, maximum marks for these and the minimum pass marks which an examinee must obtain in order to pass in the subjects and the examination are detailed in the Examination Scheme.
10. Examination fees for each B.E. examination and also the practical examination shall be as prescribed by the University from time to time.
11. An examinee who is successful at any of the first, second, third and final B.E. Examinations under this Ordinance and who obtains 75% or more marks in that examination shall be placed in First Division with Distinction, those obtaining 60 % or more but less

than 75 % shall be placed in the First Division and all other successful examinees shall be placed in the second division.

12. (i) Scope of the subject shall be as indicated in the syllabus.  
(ii) Medium of instruction and examination shall be English.
13. Provisions of Ordinance No.7-A relating to condonation of deficiency of marks for passing an examination shall apply to the examinations under this Ordinance.
14. An examinee who does not pass or who fails to present himself/herself for the examination shall be eligible for readmission to the same examination, on payment of a fresh fees and such other fees as may be prescribed.
15. As soon as possible after the examination, the Executive Council shall publish a result of the examinees. The result of all the examinations shall be classified and the branchwise merit list shall be notified as per Ordinance No.6
16. Notwithstanding anything to the contrary in this Ordinance no one shall be admitted to an examination under this Ordinance, if he/she has already passed the same examination or an equivalent examination of any Statutory University.
17. (i) Examinees who have passed in all the subjects prescribed for all the examinations of the particular branch shall be eligible for award of the Degree of Bachelor of Engineering in the branch concerned.  
(ii) The Degree Certificate in the prescribed form, shall be signed by the Vice-Chancellor.

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**\* Regulation No. 15 of 2004**

**Examination leading to the Degree of Bachelor of Engineering (Civil) (Four Year Part Time Degree Course) Regulation 2004.**

Whereas it is expedient to frame the Regulation in respect of Examination leading to the Degree of Bachelor of Engineering (Civil) (Four Year Part Time Degree Course) Regulation, 2004, for the purposes hereinafter, appearing the Management Council is hereby pleased to make the following Regulation.

1. This Regulation may be called "Examination leading to the Degree of Bachelor of Engineering (Civil) (Four Year Part Time Degree Course) Regulation, 2004".
2. This Regulation shall come into force w.e.f. the examinations :-
  - i) Winter-2006 exam. for First Year B.E. (Civil) (Part Time)
  - ii) Winter-2007 exam. for Second Year B.E. (Civil) (Part Time)
  - iii) Winter-2008 exam. for Third Year B.E. (Civil) (Part Time)
  - i) Winter-2009 exam. for Final Year B.E. (Civil) (Part Time)
3. Appendices A, B, C & D in respect of Bachelor of Engineering (Civil) (Four Year-Part Time Degree Course) Regulation 2004, shall be as appended with this Regulation.

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\* Latest Amended vide Regulation No. 12 of 2007

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**SANT GADGE BABA AMRAVATI UNIVERSITY.**  
**SPECIAL NOTE FOR INFORMATION OF THE STUDENTS**

- (1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.
- (2) Be it known to all the students desirous to take examinations for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinances Booklet the various conditions/provisions pertaining to examination as prescribed in the following Ordinances.

|                       |   |  |
|-----------------------|---|--|
| Ordinance No. 1       | : | Enrolment of Students.   |
| Ordinance No. 2       | : | Admission of Students  |
| Ordinance No. 4       | : | National cadet corps   |
| Ordinance No. 6       | : | Examinations in General (relevant extracts)  |
| Ordinance No. 18/2001 | : | An Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of deficiency of marks in a subject in all the faculties prescribed by the Statute, No.18, Ordinance, 2001. |
| Ordinance No. 9       | : | Conduct of Examinations (relevant extracts)  |
| Ordinance No. 10      | : | Providing for Exemptions and Compartments  |
| Ordinance No. 19      | : | Admission of Candidates to Degrees.  |

|                       |   |  |
|-----------------------|---|--|
| Ordinance No. 109     | : | Recording of a change of name of a University student in the records of the University.  |
| Ordinance No. 6/2008  | : | For improvement of Division/Grade.   |
| Ordinance No. 19/2001 | : | An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001. |

**Prof. J.S.Deshpande**  
Registrar  
Sant Gadge Baba  
Amravati University.

**PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM**

The pattern of question paper as per unit system will be broadly based on the following pattern.

- (1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.
- (2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.
- (3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.
- (4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60.
- (5) Each short answer type question shall Contain 4 to 8 short sub question with no internal choice.