SYLLABUS

SCHOOL OF DISTANCE EDUCATION

ANDHRA UNIVERSITY, VISAKHAPATNAM.

B.E./B.TECH. - CIVIL ENGINEERING

IIIrd Year

DMCIV-301: STRENGTH OF MATERIALS & THEORY OF STRUCTURES – III

UNIT - I:

Analysis of statically Indeterminate frames (single storey, single bay portal frames only) using (i) Slope – deflection method (ii) Moment – distribution method

(i) Kani's method (iv) Column analogy method.

UNIT – II:

Arches: Normal thrust, Radial shear and bending moment in three hinged and two hinged parabolic and segmental arches. Effects of rib – shortening and temperature change. Tied arches and spandrel – braced arches. Influence lines for 3 hinged and 2 hinged arches.

UNIT – III:

Suspension Bridges: Stresses in loaded cables with supports at the same level and at different levels. Length of cable two-hinged stiffering girders – temperature effects. Influence lines for stiffering girders.

UNIT – IV:

Introduction to matrix methods of structural analysis (very elementary treatment only) flexibility and stiffness matrix force method and displacement method for two span continuous beams and 6 membered and 4 jointed trusses only.

UNIT – V:

Shear centre and unsymmetrical bending -Bending axis and shear centre shear centre for sections having one axis of symmetry. Shear centre for any unsymmetrical section, stresses in beams subjected unsymmetrical bending.

References:

(i) Statically Indeterminate structures-C.K.Wang

(ii) Theory of structures by S. Ramamrutham

(iii) Theory of structures vol II- S.P. Gupta. G.S. Pandit, R. Gupta

(iv) Advanced topics in strength of materials- Prof L.B. Shah and Dr. R.T. Shah.

REFERENCES:

(i) Statically Indeterminate structures - C.K. Wang

(ii) Theory of structures - S. Ramamrutham

(iii) Theory of structures vol II- S.P. Gupta. G.S. Pandit, R. Gupta

DMCIV-302 – FLUID MECHANICS-II

Unit I – Viscous Effects on Fluid Motion

A) Laminar Flow and N.S.Equations : Equation of Motion for Real Fluids, Stress-strain Relationships, Tangential Stress Terms, Introduction to Navier-Stokes Equations, Solution of N.S.equations for standard cases of Plane Two Dimensional and Axi-symmetric Flows; Plane Two dimensional Flows – Steady Flow between Parallel Plates – Couette and Poiseuille Flows; Axi-symmetric Flows – Laminar Flow through pipe, Hagen-Poiseuille Equation, Laminar Flow through annulus of concentric circular tubes; Stokes Law.

B) Turbulent Flow & its Characteristics: Transition from Laminar to Turbulent Flow, Critical Reynolds Number, Characteristics

of Turbulent Flow, Mean and Fluctuating Components of Velocity, Quantitative Description of Turbulence, Statistical Nature of Turbulent Flow, Isotropic and Homogeneous Turbulence; Analysis of Turbulent Flows – Turbulence Modeling, Semi-empirical Theories, Boussinesq Eddy Viscosity Model, Prandtl Mixing Length Concept; Introduction to Continuity Equation and Reynolds Equations for Turbulent Flows, Reynolds stress Tensor

Unit II – Boundary Layer Theory and Flow Past Submerged Bodies

A) Boundary Layer Theory – Introduction, Characteristics of Laminar Boundary Layer, Boundary Layer Growth over a Flat Plate (without pressure gradient), Laminar and Turbulent Boundary Layers, Boundary Layer Thickness and its Characteristics, Displacement, Momentum and Energy Thickness; Karman Momentum Integral Equation; Viscous drag, Boundary Layer Separation, Mechanism of Separation, Control of Boundary Layer Separation, Hydro dynamically smooth and Rough Boundaries, Velocity of Distributions for Turbulent Flow in Pipes – velocity defect Law, von Karman's Universal Law for Mean Velocity near Smooth and Rough Boundaries; Friction factor for Pipe Flows – dependence on Reynolds Number and Relative Roughness, Moody's Diagrams, Simple Pipeline Design Problems.

B) Flow Past Submerged Bodies: Drag and Lift – Deformation Drag, Friction Drag, Form Drag – Drag Coefficient; Distribution of Fluid Pressure on immersed bodies – Pressure Distribution for flow past a circular disk, sphere; Effects of eddy pattern in two dimensional flow – distribution of pressure for two dimensional flow past a cylinder, von Karman vortex trail – Variation of Drag Coefficient with Reynolds Number; Drag on Cylinder – Resistance diagram for bodies of revolution – Drag Coefficient of Practical Bodies; Lift & Propulsion – Effect of Circulation in Irrotational Flow, Generation of Lift around a cylinder – Magnus Effect, Computation of Lift Force; Lift on Airfoil – Lift Coefficient and its Variation with Angle of Attack, Joukowsky Profile, Polar Diagram, Stall, Induced Drag.

Unit III – Open Channel Flows – Uniform Flow and Flow in Open Channel transitions

A) Uniform Flow : Introduction, Classification of Open Channels, Classification of Flow, Wide open Channel, Velocity Distribution in a channel Section, Measurement of Velocity, Pressure Distribution in a Channel Section, Effect of Slope on Pressure Distribution. Uniform Flow Computation – Conveyance, section, Effect of Slope on Pressure Distribution. Uniform Flow Computation – Conveyance, Section Modulus and Hydraulic Exponents; Basic Equations – Chezy's Equation, Manning's Equation, Determination of Normal Depth and Velocity, Design of Rigid Bed Channels – Best Hydraulic Section, Determination of most Economical Section Dimensions for Uniform Flow in Rectangular, Trapezoidal, Circular and Triangular Channels.

B) Channel Transitions – Introduction, Definition of Specific Energy, Froude Number, Critical Flow – Computation of Critical depth, Conjugate or Alternate Depths – Sub-critical, Critical and super-critical Flows – Froude Number – Specific Energy Diagram, Relationship between Critical depth and Specific Energy for Rectangular, Trapezoidal Sections – Channel Transitions – Change of Depth in Rectangular Channels with change in Cross – section and Hump in the Bed; Control Sections.

UNIT IV – Open Channel Flows - Non-Uniform Flow

A) Steady Non-uniform Flow: Gradually Varied Flow : Derivation of Governing Equation – Mild, Steep, Critical, Horizontal and Adverse Slopes; Classification of G.V.F. Profiles – Backwater and Drawdown Curves, G.V.F. Profiles for Channels with Changing Slopes; Computation of G.V.F. Profiles – Direct Step and Standard Step Methods – Computation of G.V.F. Profiles in rectangular channels using Direct and Single Step methods (Simple cases only); Rapidly Varied Flow: Hydraulic jump – Types of jump, Impulse Momentum Application to Hydraulic jump in horizontal rectangular Channels, Specific Force.

B) **Unsteady Flow:** Unsteady gradually Varied Flow – Dynamic Equation for Unsteady flow, Monoclinical Rising Wave, Dynamic Equation for Uniformly Progressive Flow; Unsteady Rapidly Varied Flow – Uniformly Progressive Flow, Moving Hydraulic jump – Positive and Negative Surges.

Unit V – Hydraulic Machinery

A) **Hydraulic Turbines:** Function of Prime movers and Pumps, Hydraulic Turbines, Classification Based on Head, Discharge, Hydraulic Action – Impulse and Reaction Turbines, Differences between Impulse and reaction Turbines , choice of Type of Turbine – Specific Speed. Working and Design Principles of Impulse Turbines – Component parts & working Principles of a Pelton Turbine – Recapitulation of Work Done by series of vanes mounted on Wheel – Velocity triangles, Simplified Form of Velocity Triangles for a Pelton Turbine Bucket; Hydraulic and Overall Efficiency – Design Principles of Pelton Turbine; working and design Principles of Reaction Turbines – Component Parts & Working Principles of a Francis Turbine – design Principles of Francis Turbine – Arriving at Vane Angles – Governing Mechanism for Francis Turbine. Draft Tube Theory – Functions and Types of Draft Tubes in Reaction Turbines – Efficiency of Draft Tube.

B) **Pumps :** Functions of a Pump – Types of Pumps – Selection Criterion – Rotodynamic and Positive displacement Pumps – Comparison between Centrifugal & Reciprocating Pumps. Centrifugal Pumps/Impellers based on Shape and Type of Casing – Pump with Volute Casing, Pump with Vortex Chamber & Pump with Guide vanes, Closed, Semi-closed & Open Impellers, Axial, Radial & Mixed Flow Impellers; Shape and Number of Vanes; Working Head and Number of Stages, Single & Double Suction. Pressure Change in a Pump, Manometric and Static Head – Velocity Vector Diagrams – Effect of Vane Shape. Work done – Pump Losses and efficiency – Pressure Rise in the Impeller – Minimum Starting Speed of pump – multi Stage Pumps; Pumps in Parallel and Series; Cavitation – maximum Suction Lift – NPSH and its importance in Selection of pumps, Similarity

relations and Specific Speed – Performance Characteristics of Pumps; Reciprocating Pumps – Component Parts – Operation of Single Acting and Double Acting Reciprocating Pumps – Discharge Co-efficient, Volumetric Efficiency and Slip – Work done and power Input – Indicator Diagram, Effect of Acceleration and Friction on Indicator Diagram, Maximum Speed of Rotation of Crank. Air Vessels, Modified Indicator diagram in the presence of Air Vessels, Work Saved due to Presence of Air Vessel – Flow into and from Air Vessel.

C) **Performance characteristics of Hydraulic Machines:** Unit Quantities – Specific Speed and its importance – Model Relationships; Performance characteristics of Turbines – Operating Characteristics – Iso-efficiency Curves. Similarity Relations and specific speed of pumps – performance characteristics of Centrifugal pump – Dimensionless characteristics – constant efficiency curves of Centrifugal Pumps.

Textbooks:

(1) Fluid Mechanics by A.K.Jain
(2) Elementary Mechanics of Fluids by Huntur Rouse
(3) Fluid Mechanics and Hydraulic Machinery by P.N.Modi & S.M.Seth
(4) Flow through open channels by K.Ranga Raju
(5) Fluid Mechanics and Fluid Power Engineering by D.S.Kumar.

DMCIV-303:FOUNDATION ENGINEERING

UNIT I:

Earth pressure; Rankine's active and passive earth pressure, smooth vertical wall with Horizontal backfill (dry granular material), extension to soil coulumb's wedge theory, Rebhana's construction.

UNIT II:

Site investigation; Principles of exploration, sampling methods, transportation and storage of samples, boring and drilling methods log of boreholes, sampling tubes and samplers, sampling records.

UNIT III:

Bearing capacity of soils; Terzaghi's equation for bearing capac-ity in soils, its modification for continuous, square, rectangular and circular footings, general and local shear failure conditions. Plate load test as per IS specification. Allowable bearing capacity. Standard penetration test and use of N Values for estimating soil conditions and bearing capacity. Proportioning of footings and rafts; Settlement analysis; Computation of pressures before load-ing and after loading, estimation of settlement; ultimate and after any given period correction for construction period.

UNIT IV:

Pile Foundations; Types of piles-timber, steel, concrete, caste in situ piles, precast piles, bearing piles, friction piles, compaction piles, large diameter piles. Pile capacity-static formulae, dynamic formulae pile load test, determination of point resistance and skin friction as per IS code. Bearing capacity of pile groups, negative skin friction.

UNIT V:

Bulkheads; Classification, cantilever sheet piles in sandy soil and clay soil anchored bulkheads; free earth support, Anchored bulkheads fixed earth support equivalent beam method.

Remarks to be mentioned to Candidate :

1. The question paper consists of 2 parts.
2. Part A is for 30 marks, each question carrying 2 marks.
3. All the questions in Part A to be answered in one place in the sequential order.
4. Part B is for 70 marks, each question carries 14 marks.

Remarks to Paper Setter/Examiner: 1,2 questions from each unit are to be set with the instruction that not more than one question from each UNIT Is to be attempted. 2. All units must be covered in setting the question paper.

Reference Books:

1. Foundation Design-Teng,

2. Analysis and Design of Foundations-Shasnsear Prakash et. al,
3. Foundation Analysis and Design J.E. Bowels
4. Soil Mechanics &Foundation Engineering - B.C. Punmia.

DMCIV-304:WATER RESOURCES ENGG – I

UNIT I :

Introduction and Hydrological Aspects: a) Water Resources in India-Hydrology in water Resources Planning-Hydrologic Cycle-Percipiration-Types. Measurement of Rainfall-Average depth of rainfall over an area v Mean annual rainfall-Consistency of rainfall record-Double made.curve-Mean.annual rainfall-Infilteration-Factors affecting & its determination Evaporation & Evapotranspriration.(b)Runoff-Factors-affecting-run-off-methods-of-determinati-on of run-off Hydrograph analysis-Base flow separation-Unit Hydrographs-Hydrograph, Applications of Unit Hydrograph.

UNIT-II:

Ground Water Flow: a) Mechanics of Interstitial flow-Definitions-Subsurface distribution of water-Ground water movement-Darcy's law ermeability-Intrinsic permeability - well Hydraulics - Steady flow in to different types of aquifers and wells - Determination of Hydraulic properties of Aquifer - Well losses, specific capacity of well and well efficiency - Pumping test and Recovery test methods for determination of well yield, b) Methods of construction of open wells - yield of an open well - Methods of construction of tube wells- well shrouding and well development. Spacing of tube wells - Design of tube wells - Pumpimg arrangements, centrifugal and Bore hole type pumps - Collector wells.

UNIT III :

Reservoir Planning : a) Types of reservoir - Investigations for reservoir planning - Selection of site for a reservoir-Zones of storage in a reservoir-Purpose of reservoir design studies. Purposes of reservoir regulation-Reservoir yield-Mass curve and demand curve-Determination of reservoir capacity yield from a reservoir of given

capacity-Operating schedules -Guide curve for reservoir operation-Apportioment of total cost of a multi purpose project- Benefit-Cost Studies, b) Reservoir losses-Measures to reduce evoporation loss in reservoirs Reservoir sedimentation - Control of reservoir sedimentation.

UNIT IV:

Irrigation: a) Definition of Irrigation-Types of Irrigation systems-Direct and Indirect lift and Inundation Irrigation systems-Methods of Irrigation- Surface, Sub-surface and sprinkler methods-Drip irrigation. Soil-water-Flant relationship-Soil moisture tension-Soil moisture constants - Depth of wafter held by soil in root zone-water extraction quality of Irrigation water.; b) Water requirements of drops-Duty and Delta-Their relationship crops, Seasons, Base and drop period, Factors affecting Duty and methods of improving duty-Consumptive use of water-Determination or canal capacities for different scrooping pattern-wize of reservoir. Assessment of irrigation water charges.

UNIT-V:

Canal Systems: a) Classification of Irrigation canals-Canal alignment-Design of Unlined canals-Regime theories-Renneys and Lacsy's theories-Design problems-Design of unlined canals according to IS: 7112 -1975 Design procedure-L S of a channel-Balancing depth-Losses-Schedule of areas statistics-Cross section of an irrigation channel maintenance of irrigation channels.; b) Regulation of channel system-Canal outlets-Requirements of a good outlet-Types of outlet-Non-modular, Semi-Modular and Modular outlets Water loosing-Its control-Land drainage canal lining-Methods-Design of lined canals-Canal Navigation- Requirements-Canal avigation works.

Reference Books*:*

1) Water resources Engineering, B.C.Punmia.
2) Water resources Engineering, 'S.K. Garg.
3) Water power Engineering, 'H.K. Barrows'.;
4) Hand book of Applied Hydrology, Ventechow.;
5) Hydro-electrical Handbook, 'Greager, Justin and Hinds.

DMCIV-305: RC STRUCTURES II

UNIT I : Design of bored cast in situ piles and pile caps.

UNIT II : Retaining Walls - Type of Retaining Walls, Forces on Retaining Walls, Ranking and Coulomb earth pressure theories, passive earth pressure, Drainage of retaining walls, stability requirements, preliminary proportioning of cantilever walls,Design of cantilever retaining wall.

UNIT-III: Water Tanks-Introduction, stresses in concrete &steel modular ratio. Impermeability requirements; Container portion; Design of reinforced concrete domes. Circular and rectangular shapes of container. Analysis and Design of side wall and bottom slabs of circular tanks as per IS Code co-efficient; Analysis and Design of rectangular tanks, side wall and bottom slab for various geometrical proportions on ground. Sections subjected to bending; Wind load analysis of staging of rectangular tanks only.

UNIT IV:

Bridges-Components of a bridge, classification of bridges, load types, footway Keros, railings and parapet loading ampact, wind, longitudrnal forces, centrifigul forces; General design requirements: Design of solid slab bridges, Effect of concentrated load on deck slab, Effective width method, Disperson of load along the span. Stiffening unsupported edges of slabs; Design of solid slab bridge; Design of T-beam bridge-Design of longitudinal beams and cross beams; Courbons method.

UNIT V:

Prestressed concrete: A. Reinforced concrete versus pre-stressed concrete. Prestressing systems, Prestressing losses. Steel and concrete for Prestressing. Momogeneous beam concept, limiting escentricities, pressure line load balancing concept. Sheer and principal stresses B. Structural drawings with detailing of steel reinforcement on the above topics (Min-5 drawings)

Ref. Books :

1) Design of Reinforced concrete structures by P. Dayaratnam;

2) Fundamentals of reinforce concrete by N.C. Sinha & S.K. Roy;
3) Prestressed Concrete by N. Krishna Raju:
4) Reinforced concrete (Limit state Design) byAshok K. Jain;
5) Design of Reinforced concrete structures By S. Ramamruthem & R. Narayan;
6) Limit State theory & Design of Reinforced concrete by S.R.Karve&V.L.Shah;
7) Limit State Design by Ramchandra.

DMCIV-306: STEEL STRUCTURES 1I

UNIT I:

Plate Girders: Components of plate Girder, Economical depth, Design of Flanges (flange area method, moment of inertial method), curtailment of flange plates, connection of flange angles to web and flenge angles to flange plates.

UNIT II:

Web stiffners: Vertical stiffners, horizontal stiffners. Bearing stiffner; Web Splices, Rational splice, shear splice and moment splice, splices of slange angles and flange plates.

UNIT III:

Bridges: Loadings, Deck types and through type bridges; plate girder bridges, design of stringers, cross girders, wind bracings. Design of truss girder bridges, tension & compression members, joints, windbracings; Bearings, functions, type of bearings, plate bearing; Rocker bearing, roller bearing, knuckle pin bearing. Bearings adopted by Railway Board, Blastomer bearing.

UNIT IV :

Water Tanks: Introduction: Design of elevated circular and rectangular water tanks; Design of pressed steel tanks, design of staging.

UNIT V:

Plastic Analysis: Introduction, upper and lower bound theorems, uniqueness theorem, shape factor, load factor (a) Beams: Collapse

load for standard case of Beams, continuous beams, design of beams(b) Frames: Combined Mechanism, Collapsable load for a frame of single bay single bay single storey.

NOTE: Structural drawings on the above topics (with min. 5 drawings) sessional work only.

Ref*:*

1. Design of Steel Structures-P.Dayaratnam
2. Design of Steel Structures -Arya andAzmani,
3. Design of Steel Structures-Ramchandra, Vols. I and II,
4. Analysis and Design of Structures II -Vazirani & Ratwani,
5. Design of Steel structures- Kazmi & Zindal.

DMCIV-307: ENVIRONMENTAL ENGINEERING

UNIT-I:

Water Supply Engineering: Introduction-objectives of water supply-various uses and demands of water-fluctuations in demand-population forecasting-estimation of quantity of water required-sources of water for the water supply-classification, choice of source of water with regard to quantity and quality-wells classification-yield from wells-well yield test.

Intakes for collecting surface water-conduits for conveyance of water-joints, laying, and testing-leakage detection and prevention-pumps for lifting of water-head, power, and efficiency of pumps-pumping mains.

Unit-II: Quality of water-impurities in water-physical; chemical and bacteriological sampling and analysis of water- Standards for drinking water. Water Treatment: general sequence of treatment-sedimentation-coagulation-flocculationfiltration-disinfection of water-water softening-removal of fluorides. iron and manganese-Taste and odour control. Water distribution system-storage capacity of distribution reservoirs-layout of distribution systems-Appurtenaiices in distribution system

UNIT-III:

Wastewater Engineering: Introduction-systems of sanitation-classification of sewerage systems-merits and demerits- quantity of sewage-fluctuations-planning, design, and laying of sewerage systems-sewer appurtenances.

Characteristics of sewage - physical, chemical and bacteriological sampling and analysis-derivation of expression to compute the ultimate BOD, BOD exerted, and BOD consumed from first order reaction rate assumption for BOD removal.

Unit-IV:

Treatment of wastewater; General treatment flow - screens-grit chamber-grease traps skimmers-sedimentation- Activated Sludge Process- Trickling filters-aerobic lagoons anaerobic lagoons- oxidation ponds- oxidation ditches-septic tanks-Imhoff tanks-anaerobic digestion -sludge handling and treatment.

Sewage disposal: objectives of disposal- methods of disposal-sewage farming -recycling and reuse

House plumbing: general layout of sanitary fittings to house drainage-sanitary fittings-plumbing system of drainage- single and double stack system - of building drainage

UNIT-V:

E.I.A: Basic Copncepts of EIA- EIA methodologies – Adhoc methods, Matrix methods, Network methods- Environmental media Quality index method, Overlay methods – Cost / Benefit Analysis - General methodologies for EIA for (i) Developmental activities & land use, (ii) surface water environment, (iii) Biological Environment,, (iv) Air Environment, (v) Noise Environment and (vi) Assessment of Socio-Economic Impacts.

TEXT BOOKS:

1. Environmental Engg. by Peavy
2. Water Supply & Waste Water Engg. by B.S.N. Raju
3. Water Supply Engg. by P.N. Modi.
4. Environmental Impact Assessment Methodologies by Y. Anjaneyulu

DMCIV-308: FLUID MECHANICS LABORATORY

List of Experiments :

1. Calibration and study of small orifice
2. Calibration and study of Cylindrical mouth piece
3. Calibration and study of Rectangular & Triangular notches
6. Calibration & study of Venturimeter, Flow nozzlemeter and Orificemeter
9. Determination of friction factor for a given pipe,
10. Characteristic curves of centrifugal pump,
11. Characteristic curves of Impulse turbine,
12. Characteristic curves of Reaction turbine
13. Characteristic curves of Reciprocating pump
15. Determination roughness coefficients for a Channel,
16. Determination Conjugate depths in a hydraulic jump,
17. Determination of alternate depths in channel transitions (Spe.energy)
18. Verification of momentum principle using a flat plate & hemispherical vane,
19. Measurement of pressure distribution around a cylinder
20. Measurement of pressure distribution around a bluff body

DMCIV-309: Structures Laboratory

(2) Tension test on mild / HYSD bars
(3) Compression test on wood (parallel and perpendicular to grains)
(4) Tests on springs for the determination of rigidity modulus and spring constant
(5) Brinell's and Rockwell hardness test.
(6) Double shear test on mild steel specimen.
(7) Bending test.: Load deflection test for the determination of you modulus on simply supported and cantilever beam for wood and steel.
(8) Study of forces in coplanar force system.
(9) Specific gravity and unit weight of cement, coarse and fine aggrigates.

(10) Determination of normal consistency of cement
(11) Determination of initial and final setting time
(12) Fineness of cement.
(13) Bulking characteristics of sand.
(14) Sieve analysis of coarse and fine aggregates and classification as per IS 383.
(15) Determination of compressive strength of cement (for different grades of cement). (Demonstration Only)
(16) Workability tests on green concrete by using Slump cone, Compaction factor apparatus, Flow table Vee-Bee consistometer.(Demonstration Only)
(17) Tests on Hardened concrete - Compressive Strength Split tensile strength Modulus of rupture(Demonstration Only)
(18) Design of concrete mix by using IS code method (for class work only)

DMCIV-310: ENVIRONMENTAL ENGINEERING LABORATORY

(1) Turbidity,
(2) Determination of dissolved solids, fixed solids, volatile solids, settlable solids,
(3) Odour Taste, temperature; B. Chemical Parameters:
(4) ph,
(5) Residual chlorine,
(6) Determination of Chlorides.
(7) Determination of hardness (Total),
(8) Determination of-Iron(Total-Iron),
(9) Determination-of-Acidity,Determination-of-lkalinity,
(10) Determination of Residual Chlorine,
(11) Determination of calcium,
(12) Determination of Optimum dose of Coagulant(Jar test);C.Bacteriological Examination of Water&Waste Water:*
(13) Demonstration of M.P.N. and plate count tests

*These are Optional