

**ANNEXURE I**  
**CIVIL ENGINEERING**

**STRENGTH OF MATERIALS**

**UNIT:1** Simple stresses and strains-curves for ductile materials-Mechanical properties of materials-Hooke's law-lateral strain-Poisson's ratio-Elastic constants and the relation between them-Composite sections-Resilience-Strain energy-Gradual and sudden loading-Shear force and Bending Moment Diagrams for cantilever, Simply supported, fixed, continuous and overhanging beams subjected to Point loads and UDL

**UNIT:2** Theory of simple bending-assumptions-bending equation-bending stresses-Section Modulus-Shear stress distribution across various sections like rectangular, circular and I-sections-Torsion-solid and hollow circular shafts.

**THEORY OF STRUCTURES:**

**UNIT:3** Deflection of cantilevers and simply supported beams-Double Integration and Macaulay's methods-Mohr's theorems for slope and deflections-calculation for propped cantilevers subjected to simple loading-Analysis of Fixed and Continuous beams of uniform section for simple loading without sinking of supports. Columns and struts-types-slenderness ratio- Euler's and Rankine's formulae for axial loading. Determination of forces in members of statically determinate, plane and pin-jointed trusses for dead loads only. Dams and retaining walls-conditions for stability-middle third rule-Rankine's formula for active earth pressure.

**REINFORCED CONCRETE STRUCTURES:**

**UNIT:4** Grades of concrete, characteristic strength, Modulus of Elasticity-I.S. 456 -2000-Philosophy of Limit state design. Limit state of Strength and Serviceability, partial safety factor-design strength of materials and design loads-assumptions.

Analysis and Limit state design of rectangular beams-Singly, Doubly reinforced and T-beams. Shear in RCC beams, lintels and sunshades-Development length.

Slabs-analysis and limit state design of one-way and two-way slabs as per IS.456-2000. Torsion reinforcement. Design of continuous slabs and beams-Deflection check for Slabs and beams. Detailing of reinforcement in Singly reinforced and doubly reinforced simply supported beams of rectangular sections and lintels, one way and two way slabs.

**UNIT:5** Columns: Codal provisions of I.S 456-2000-short and long columns-different shapes-design of short columns by limit state method-long columns- concept, effective length for different end conditions. Footings-Isolated column footings-one way shear and two way shear. Stairs-types, loads on stairs.

Working stress method of design: Basic principles, neutral axis, lever arm-Design and analysis of Singly reinforced simply supported rectangular beams. Comparison of Limit state and Working stress methods.

**SURVEYING:**

**UNIT:6** Chain surveying- purpose and principle- errors and corrections- different operations in chain surveying- obstacles – methods of calculation of area. Compass Surveying- purpose and principle- bearings- traversing using prismatic compass- local attraction- errors. Levelling- definitions- component parts- errors- classification of levelling- contouring-characteristics and methods. Theodolite- principles and component parts- fundamental lines and relationship among them- adjustments of theodolite- measurement of horizontal and vertical angles- errors- traverse computations- bowditch and transit rule. Tacheometry-principle- stadia tacheometry- tangential tacheometry, Principle and uses of E.D.M, Electronic Theodolite, Total Station, Global positioning System – Importance, G.I.S – Use and applications in Civil Engineering

**HYDRAULICS.**

**UNIT:7** Fluid properties-specific weight –mass density-specific gravity-surface tension-capillarity-viscosity. Atmospheric pressure, gauge pressure and absolute pressure. Fluid pressure on plane surfaces-Centre of pressure, measurement of fluid pressure using

piezometer and manometers. Types of flows-uniform, non uniform, steady, un steady, laminar and turbulent flows. Energies of liquid in motion-continuity equation. Bernoulli's theorem-Pitot tube-Venturimeter. Flow thorough small and large orifices, free orifices, submerged orifices, co-efficients of orifices-Cc, Cv and Cd. Flow through internal, external, convergent and divergent mouthpieces. Types of Notches-rectangular and triangular, flow over notches. Types of Weirs-sharp crested and broad crested-mathematical formulae for discharge-Franci's and Bazin's.

**UNIT:8** Flow through pipes-major and minor losses-Chezy's and Darcy's formulae for loss of head due to friction-HGL & TEL- flow through siphon pipes. Reynold's number for laminar and turbulent flows. Flow through open channels-rectangular and trapezoidal-chezy's formula for discharge-Kutter's and Manning's equation for Chezy's constants-Most economical sections. Centrifugal pumps without problems. Classification of Turbines-Kaplan, Franci's and Pelton wheel without problems-use of Draft tube. Hydro-electrical installations-components and uses.

**IRRIGATION ENGINEERING:**

**UNIT:9** Necessity of Irrigations - Perinnial and inundation Irrigation , Flow and Lift Irrigation, Principal crops-kharif and rabi seasons-Duty, delta and base period. Methods of Irrigation-check flooding, basin flooding, contour bunding, furrow, sprinkler and drip Irrigations. Hydrology – Rainfall , types of Rain gauges, types of catchments-rainfall and runoff. Measurement of velocity of flow in streams-Ryve's and Dicken's formulae for computing maximum flood discharge. Classifications of Head works-component parts of diversion head works. Weirs and Barrages. Perculation and uplift pressures.Types of Reservoirs-dead storage, live storage and surcharge storage.

**UNIT: 10** Storage Head works-different types of dams-rigid and non rigid dams- gravity dams-low and high dams. Elementary profile of a dam. Failures of gravity dams-drainage galleries. Ogee and siphon spillways. Earth dams— types, failures and precautions. Phreatic lines and drainage arrangements in earthen dams. Distribution works-classifications and alignment of canals-typical cross section of a canal-berm and balanced depth of cutting- canal lining. Lacey's silt theory. Cross drainage works –types and functions.

**ANNEXURE II**  
**Number of Questions to be set**  
**CIVIL ENGINEERING**

UNIT NO	TOPICS	MARKS
I & II	Strength of Materials	20
III	Theory of Structures	20
IV & V	Reinforced Concrete Structures	20
VI	Surveying	15
VII & VIII	Hydraulics	15
IX & X	Irrigation Engineering	10
Total		100

**ANNEXURE III**  
**MODEL QUESTIONS FOR CIVIL ENGINEERING**

1. What is the Bending moment equation for a simply supported beam with uniformly distributed load, 'w' with a span of 'l'  
1)  $\frac{wl}{2}$                       2)  $\frac{wl^2}{8}$                       3)  $\frac{wl^2}{2}$                       4)  $\frac{wL^2}{4}$
  
2. What is a long column with load w and effective length l with span to effective depth ratio  
1)  $> \frac{l}{12}$                       2)  $= \frac{l}{12}$                       3)  $< \frac{l}{12}$                       4)  $\geq \frac{l}{10}$
  
3. The Reduced bearing with W.C.B =  $120^\circ$   
1) N  $30^\circ$  E                      2) S  $60^\circ$  E                      3) N  $30^\circ$  W                      4) S  $30^\circ$  W
  
4. What is the relation between  $c_d$ ,  $c_v$ ,  $c_c$  with orifices  
1)  $c_d = \frac{c_c}{c_v}$                       2)  $c_c = c_v \times c_d$                       3)  $c_d = c_c \times c_v$                       4)  $c_v = c_c \times c_d$