CIVIL ENGINEERING

Time : 3 hours

Full marks : 100

Instructions : (i) *Attempt all the questions.*
(ii) *Marks are indicated in the right-hand side against each question.*

1. Answer any *ten* questions : 2×10 = 20

(a) Enumerate the characteristics of good timber as building materials.

(b) What is reciprocal leveling ? Explain.

(c) Explain the latitude and departure of a survey line.

(d) What are the gauge and pitch distance of a rivet line?

(e) Write the Bernoulli's equations and mention its assumptions.

(f) Explain the doubly reinforced and over reinforced sections.

(g) Explain the method of construction of a WBM road.

(h) What is the quicksand condition in foundation engineering?

(i) Classify the types of river training works.

(j) Enumerate the detailed specifications for plastering work in 1 : 3 cement mortar.

(k) What are the different systems of plumbing?

(l) Explain self-cleaning and non-scouring velocity with reference to sewer design.

2. Answer the following questions : 5×6=30

(a) A trapezoidal notch has a base width of 0.75 m and a side slope of 1 horizontal : 2 vertical. Calculate the discharge over the notch for a head of 0.50 m by assuming C_d= 0.63.

(b) Explain how will determine the depth of well foundation.

(c) The following consecutive readings were taken with a dumpy level and 5 m levelling staff on continuously sloping ground at a common interval of 15 m. The first point is having an elevation of 185.275 m. Rule out a page of level book and enter the readings. Calculate *(i)* the reduced levels of the points by rise and fall method and *(ii)* the gradient of the line joining the first and the last points :

0.415, 1.025, 2.085, 2.925, 3.620, 4.595, 0.715, 2.115, 3.090, 4.405

(d) Explain the sedimentation process used in a water treatment plant. Draw a neat sketch of sedimentation tank in which coagulant is used. Compute the dimensions of continuous flow rectangular settling tank for a population of 20,000 persons with a daily per capita water allowance of 120 litres. Assume detention period of 6 hours.

(e) Explain how will you determine the length of a bridge over a river and the economic span of a bridge.

(f) Calculate the quantity of cement concrete and prepare a bar bending schedule for an RCC slab roof provided over a room with the following data :

Size of the room 4.8 m x 4.20 m ;

Bearing of slab on each side 15 cm and thickness of slab 15 cm ;

Provide 10 mm diametre bars cranked from one side 8 cm c/c both ways, end bars will be straight bars.

3. Answer the following questions : 10×5=50

(a) A 300 mm diameter sewer is to flow at 0.3 m depth on a grade ensuring a degree of self-cleaning equivalent to that obtained at full depth at a velocity of 0.90 m/s. Find the required grade and the associated velocity and rate of discharge at this depth. Assume Manning's rugosity coefficient n as 0.013. The variations of n with depth may be neglected. What is the corresponding value of Chezy's coefficient?

(b) A reinforced concrete beam is 20 cm wide and 40 cm depth from the compression edge to the center of tension steel. The compression reinforcement consists of 2 bars of 20 mm diametre and tensile reinforcement 3 bars of 20 mm diametre. The center of compression steel is at a distance of 4 cm from the top edge of the beam. If m = 18 and bending moment at the section is 40 kNm, calculate the compressive stress in concrete and stresses in both compressive and tensile stress.

(c) A natural soil sample has bulk density of 2.0 g/cc with 6% water content. Calculate the amount of water required to be added to one cubic meter of soil to raise the water content to 15% while the void ratio remains constant. What is then the degree of saturation? G = 2.67.

(d) The speed of the overtaking and overtaken vehicles are 60 kmph and 30 kmph respectively on a two-way traffic road. If the acceleration of the overtaking vehicle is 3.6 km per hour per second, then __

(i) calculate the safe overtaking sight distance;

(ii) determine the minimum length of overtaking zone;

(iii) draw a neat sketch of the overtaking zone and show the position of sign posts.

(e) A beam ABC 16 m long is simply supported at A and B, AB = 12 m and the overhanging portion (BC) of 4 m length. The beam carries two point loads of 18 tones at 4 m from A and 8 tones at C. The beam also carries a uniformly distributed load of 1.5 tones/m from A to C. Draw the shear force and bending moment diagram for the beam.

***