006062

2007

CIVIL ENGINEERING (Paper I)

Time allowed : 3 Hours } **{ Maximum Marks : 200**

Note :
(i) Solve one question from each section.
(ii) If more than one questions are attempted in a section, the excess will be ignored.
(iii) Figures to the right indicate the number of marks for the question / sub-question.
(iv) Make suitable assumptions, if necessary and state the same.
(v) Use of log-tables, non-programmable calculators is permitted.
(vi) Use of any kind of I.S. Codes and Steel Table Codes is NOT permitted.
(vii) Candidate should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he will be penalised.

SECTION - A

1. (A) A uniform rod AB (length 1.6m and wt. 150N) rests in equilibrium. On the inner surface of a smooth semicircular channel, 1m in radius, when carrying two point loads, 100N and 400N as in Figure 1.A. **16**

Determine its configuration as defined by angle ϕ.

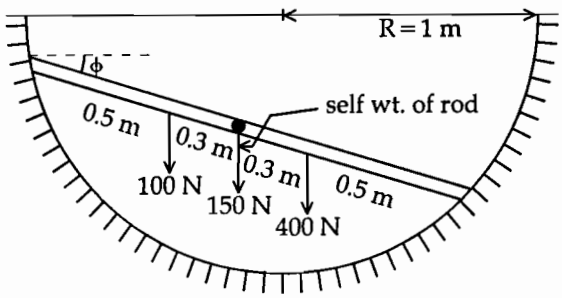

Figure 1. A

(B) A tensile load of 40KN is acting on a rod of diameter 40mm and of length 4m. A bore of diameter 20mm is made centrally on the rod. To what length the rod should be bored so that the total extension will increase by 30% under the same tensile load. **09**

Take $E = 2 \times 10^5$ N/mm^2.

P.T.O.

(C) The steel truss shown in Figure 1.C is anchored at A and supported on rollers at B. If the truss is so designed that, under the given loading, all tension members are stressed to 100 N/mm^2 and all compression members, to 80 N/mm^2, find vertical deflection of point C. **09**
Take E = 2×10^5 N/mm^2.
Also find the lateral displacement of end B.

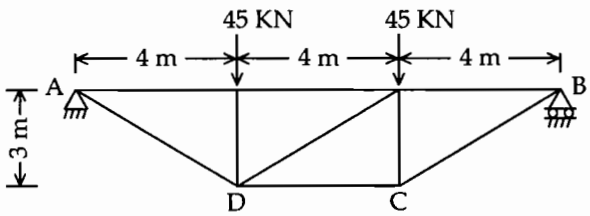

Figure 1. C

2. (A) A system of three identical, homogeneous cylinders (equal in wt.) as shown in Figure 2.A is in equilibrium. If coefficient of friction 'μ' is same for all surfaces where sliding is possible, what should be its minimum value ? **16**

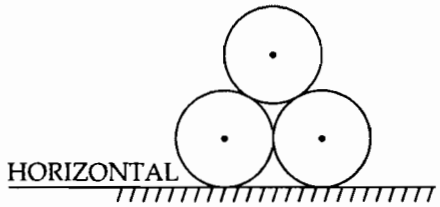

Figure 2. A

(B) The bar shown in Figure 2.B is subjected to a tensile force of 160KN. If the stress in the middle portion is limited to 150 N/mm^2, determine the diameter of the middle portion. Find also length of middle portion if the total elongation of bar is to be 0.2mm. **09**
Given : E = 2.1×10^5 N/mm^2.

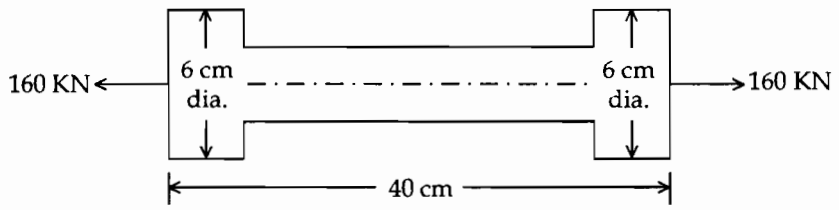

Figure 2. B

(C) At a point in a strained material, the principal stresses are 100 N/mm^2 tensile and 40 N/mm^2 compressive. Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of major principal stress. What is the maximum intensity of shear stress in the material at that point ? **09**

SECTION - B

3. (A) Analyse the frame shown in Figure 3.A using moment distribution method. Draw bending moment diagram. **16**

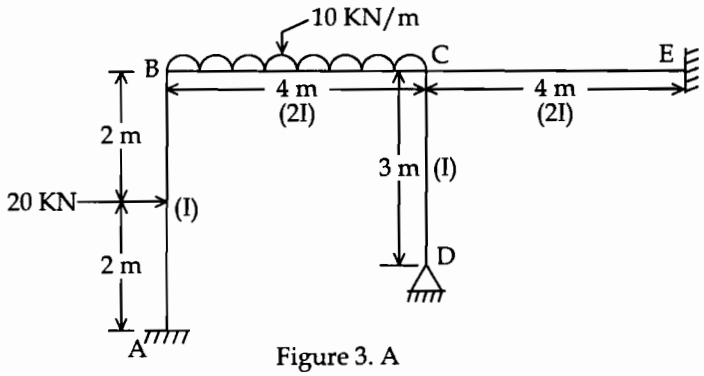

Figure 3. A

(B) For the pratt truss shown in Figure 3.B construct the influence line diagrams for forces in members L_0U_1, L_0L_1, L_1U_1, U_1L_2 and U_1U_2. **10**

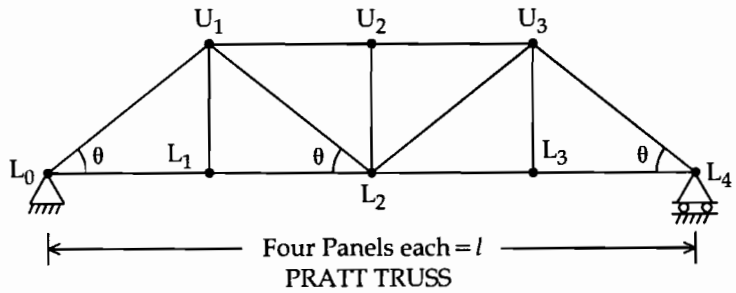

Figure 3. B

(C) Determine the horizontal thrust and the bending moment at the crown in parabolic two hinged arch shown in Figure 3.C assuming that $I = I_C \sec\theta$. The outward horizontal displacements at A and B due to yielding of supports are $40/EI_C$ and $60/EI_C$ respectively. **08**

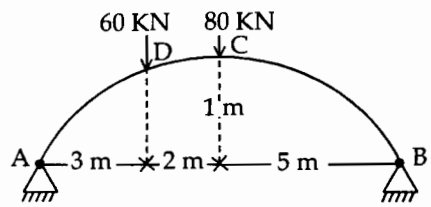

Figure 3. C

P.T.O.

4. (A) Analyse the continuous beam with a spring at the joint C as shown in Figure 4.A by slope deflection method. **16**

Draw bending moment diagram.

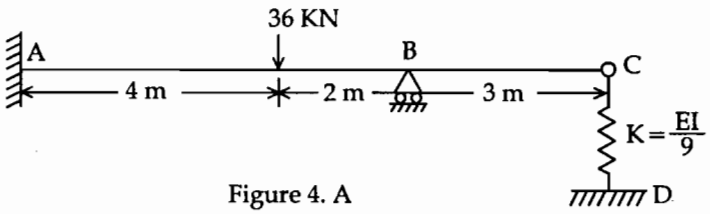

Figure 4. A

(B) Using flexibility method, find out reactions at the supports for a continuous beam ABCD with spans AB = BC = CD subjected to uniformly distributed load of intensity ω KN/m over entire span. **10**

Assume EI uniform.

(C) A cable is suspended between two points A and B located at 60m apart horizontally. B is lower than A by 15m. At the point G located at a horizontal distance of 15m from A, the cable is 12.875m below the point A. The cable carries a uniform load of 24 KN/m of span. **08**

Determine the position and sag of the lowest point and the horizontal tension 'H' in the cable.

Also determine the curved length of the cable.

SECTION - C

5. (A) A 200mm × 150mm × 10mm angle, carrying a load of 200 KN is to be welded to a steel plate by fillet welds as shown in Figure 5.A. Find the length of the weld at the top and bottom if the allowable shear stress in the weld is 102.5 N/mm^2. **08**

Given : Distances between the neutral axis and the edges of the angle section from top and bottom are 144.7mm and 55.3mm respectively.

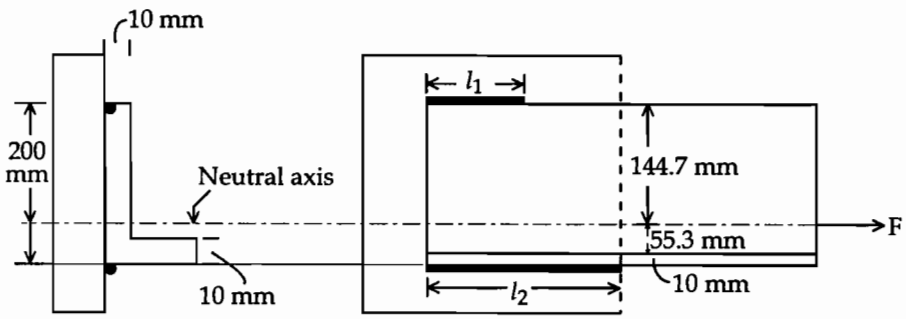

Figure 5. A

OVERALL DIMENSION OF ANGLE = 200 × 150 × 10 mm

(B) With the help of neat sketches explain : **10**

(i) Design of stiffners used in plate girder.

(ii) Design of splicing used in plate girder.

(C) An isolated T beam simply supported over a span of 6m has a flange width of 1500mm. The thickness of the flange is 80mm and the beam has an effective depth of 500mm upto the centre of tensile reinforcement. Which consists of 4 Nos. of 25mm diameter bars. **15**

Calculate the moment of resistance of the section neglecting compressive resistance of the area of web above the neutral axis. The width of web is 250mm. Use M20 grade concrete and HYSD steel of grade Fe415.

6. (A) Plates have been connected with flanges of 'I' section by applying 8mm fillet weld as shown in Figure 6.A. Compute the maximum load which may be placed at a distance of 100mm from the flanges. **15**

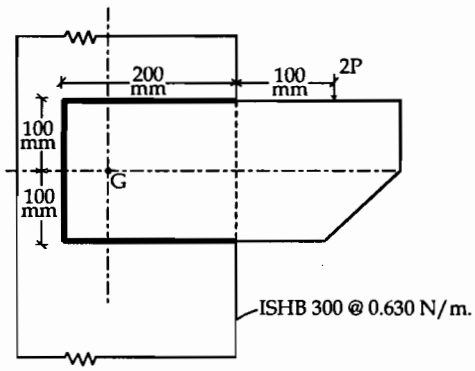

Figure 6. A

(B) Design a reinforced concrete column section to support an axial load of 500KN at the service state. One side of the column section is restricted to 250mm. The effective length of the column is 4.0m. The materials used are M15 grade concrete and HYSD steel of grade Fe415. **08**

Given : $\sigma cc = 4$ N/mm^2 and $\sigma sc = 190$ N/mm^2.

(C) Explain with the help of neat sketches : **10**

(i) Limit state of collapse : Flexure, for singly reinforced rectangular beam.

(ii) Wind load calculations for the design of steel roof truss.

P.T.O.

SECTION - D

7. (A) Design a circular water tank of 2,00,000 litres capacity. The joint between base slab and side wall is to be rigid. Good foundation for the tank is available at a depth of 0.6m below the ground level. σcbc for concrete = 7 N/mm^2, σst for steel = 115 N/mm^2, m = 13. **17**

(B) With the help of neat sketches explain : **08**

(i) Designing of cantilever retaining wall and counterfort retaining wall showing reinforcement details in each part.

(ii) Different forms of shear reinforcement and their share in resisting shear force.

(C) Write notes on : **08**

(i) Methods of concrete mix design.

(ii) Effects of materials, mix proportions, time and temperature on workability of concrete.

8. (A) Design the dog legged reinforced concrete stair case for a multistorey building in which the storey height (floor to floor distance) is 3.0m. The stair hall measures 2.8m × 4.3m (internal). The width of the stair is 1.25m. The staircase is not liable for overcrowding. The weight of finishes may be considered as 0.125 KN/m^2 of the finished surface of the step. **17**

Concrete MIS grade and HYSD steel of grade Fe415 is to be used.

(B) Design a concrete mix from following data : **10**

(i) Characteristic strength at 28 days = 25 N/mm^2.

(ii) Type of cement = rapid hardening, port-land cement.

(iii) Slump required = 30−60mm; exposure−moderate.

(iv) Aggregate available = Gravel 20mm to 40mm (max.)

(v) Fine aggregate = Natural sand is available.

(vi) Specific gravity of coarse aggregate = 2.7

(vii) Specific gravity of fine aggregate = 2.65

(viii) The fine aggregate corresponds to grading zone II giving fine aggregate percentage between 29% to 37%.

(ix) Water cement ratio corresponding to 28 days strength = 0.56

(x) Water cement ratio corresponding to durability consideration = 0.55

(xi) Approximate water contents corresponding to given type of aggregate and workability = 160 kg/m^3.

(xii) Wet density of concrete = 2480 kg/m^3.

(C) Write notes on : 06

(i) Factors affecting strength of concrete.

(ii) Admixtures used in concrete.

(iii) Tests on workability of concrete.

SECTION - E

9. (A) A rectangular beam 175mm × 350mm has an effective span of 10m. The prestressing cable has a triangular profile with zero eccentricity at ends and 60mm at the mid span. The effective prestress is 750 KN after all losses. 08

Determine the point load the beam can carry at mid span, if the pressure line passes through the upper kern of the section.

(B) The end block of a post tensioned beam is 100mm × 150mm. A prestressing cable consists of 7 wires of 6mm dia. strand and stressed to 800 MPa has to be anchored at the centre of the end block. 17

The anchorage plate is 75mm × 75mm having permissible bending stress = 165 MPa.

Using M45 grade concrete, design thickness of anchorage plate.

(C) Write notes on : 08

(i) Erection techniques adopted in modern days, with reference to precast construction.

(ii) Design considerations for transportation and erection of precast units.

10. (A) A prestressed concrete beam 150mm × 300mm in cross section supports a live load of 5 KN/m over a simply supported span of 8m. It has parabolic cable having an eccentricity of 75mm at the mid span and zero at the ends. 08

Determine the force of prestress if the net resultant stress at the bottom fibre at mid span is zero under the action of dead load, live load and prestress force.

(B) A section of a prestressed concrete beam 150mm × 300mm carries a factored shear force of 110 KN and a factored bending moment of 25KNm. The prestressing steel index is 0.4 and the effective prestress after all losses is 600 MPa. Compressive stress at centroidal axis due to prestress is 6.5 N/mm^2. 17

Design suitable shear reinforcement assuming $\sigma ck = 35\ N/mm^2$, $\sigma p = 1600 N/mm^2$, $Ap = 150mm^2$ and cover to reinforcement = 60mm.

(C) Write notes on : 08

(i) Precast and cast at site advantages and disadvantages for concrete structures.

(ii) Modern techniques used in precast construction.

P.T.O.

SECTION - F

11. (A) Write algorithm and flow chart for finding roots of the equation by Newton Raphson Method. **18**

(B) Find smallest positive root of $x^3-5x+3=0$ using Newton Raphson Method. **08**

(C) For the system of equations : **07**

$$6x_1-x_2-x_3=11.33$$
$$-x_1+6x_2-x_3=32$$
$$-x_1-x_2+6x_3=42$$

Approximate values of $x_1=4.67$, $x_2=7.62$ and $x_3=9.05$, use Gaussian method to find values upto three decimal.

12. (A) Write algorithm and flow chart for finding roots of the equation by Bi-section method. **18**

(B) Find the roots correct to two decimals using Bi-section method for equation $x^3-x-4=0$. How many iterations are required if permissible error is 0.02. **09**

(C) Apply Newton Raphson Method to solve the equation $x^3+2x-5=0$ for finding out real root at the end of fifth iteration. **06**

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PDT

2007

CIVIL ENGINEERING (Paper II)

006312

Time allowed : 3 Hours] **[Maximum Marks : 200**

Note :
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SECTION - A

1. (a) The following are the lengths and bearings of the sides of a closed traverse ABCD. Compute the length and bearing of line DA : **15**

Line	Length in meter	Bearings
AB	76.80	140° 12′
BC	195.60	36° 24′
CD	37.20	338° 48′
DA	?	?

(b) Explain clearly the two point problem and how it is solved ? **11**

(c) What are the characteristics of contour lines ? **8**

P.T.O.

2. (a) The following is the data relative to observations made on a vertically held staff with a tachometer fitted with an anallatic lens. The constant of the instrument was 100. Calculate the distance 'AB' and the reduced levels of 'A' and 'B' : **12**

Instrument Station	Height of axis	Staff Station	WCB	Vertical Angle	Hair Readings	Remark
O	1.56	A	12° 25 ′	0° 0 ′	1.88, 2.25, 2.62	R.L. of "O" 130.25
		B	60° 45 ′	+15° 10 ′	1.83, 2.15, 2.47	

(b) What is transition curve ? Why it is used ? Define shift of a curve. **10**

(c) What is meant by a satellite station and reduction to centre ? How would you correct the observation when made upon an eccentric signal ? **12**

SECTION - B

3. (a) What are the common defects in paintings, their causes and remedial measures ? **10**

(b) What are the methods of Artificial seasoning ? **10**

(c) Explain setting time test of cement and its importance. **14**

4. (a) Describe various types of fire protection systems. **12**

(b) What are the factors affecting ventilation of building ? **10**

(c) Mention the various aspects and prospects to be considered under Regulations and Byelaws, by the Architect while planning and designing the layout of a building. **12**

SECTION - C

5. (a) What is meant by safe bearing capacity of soil ? Explain plate loading test for determination of bearing capacity ? **10**

(b) What are the general principles in bricks masonry construction ? What are the rules for bricks bonding ? **11**

(c) What are the advantages of constructing steel roof trusses over timber trusses ? Explain any one method of Damp proofing of flat RCC roofs. **12**

(b) Define the following terms with reference to CPM/PERT network. **10**

(i) Dummy activity

(ii) Critical Path

(iii) Float

(iv) Dangling Error

(v) Event

(c) Enumerate the factors in selecting the pump. Differentiate clearly between a reciprocating pump and a centrifugal pump. **11**

SECTION - F

11. (a) Describe 'Needle beam method' of tunnelling and state the soil condition suitable for this. **12**

(b) Explain the different methods of ventilation during construction of tunnels. **10**

(c) What are the factors influencing the shape of tunnels ? **11**

12. (a) What are faults ? How are faults recognized in the field ? **10**

(b) What are the main geological problems associated with Dam sites ? Explain **11**

(c) What is Sedimentary Rock ? Classify Sedimentary rocks into various classes and give a brief description of each class. **12**

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SECTION - D

7. (a) Compute the intensity of active and passive earth pressure at depth 8 meter in dry cohesionless sand with an angle of internal friction of 30° and unit weight of 18 kN/m^3. Also calculate the total earth pressure and its line of action. What will be the intensity of active pressure if the water level rises to the ground level ? Take saturated unit weight of sand as 22 kN/m^3. **11**

(b) Define : **12**

(i) Shear strength

(ii) Cohesion

(iii) Angle of internal friction of soil

(iv) Optimum moisture content

(c) What is Coffer dam ? Explain its type with sketches. **10**

8. (a) What are the different methods of soil stabilization ? **11**

(b) What is a flow net ? What are its uses ? **10**

(c) What are the different types of shallow foundation ? Discuss with sketches. **12**

SECTION - E

9. (a) What is A-B-C control policy of inventory ? What are the objectives and functions of store management ? **11**

(b) What is control chart ? Explain any two control charts of sampling plan. **12**

(c) What is scientific management ? Explain principles of scientific management. **10**

10. (a) What safety measures will you adopt in the following situations : **12**

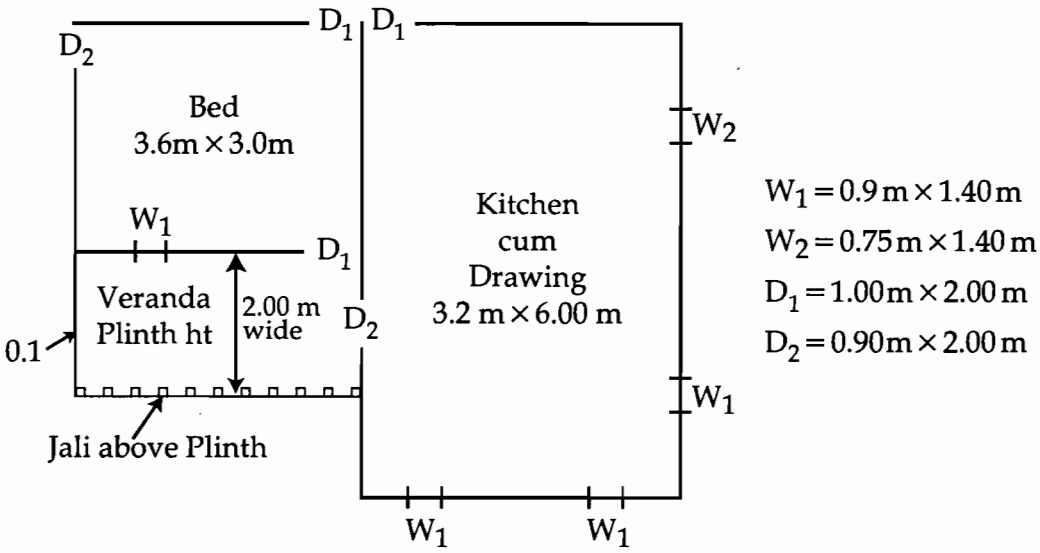
(i) Storage and handling of building materials.

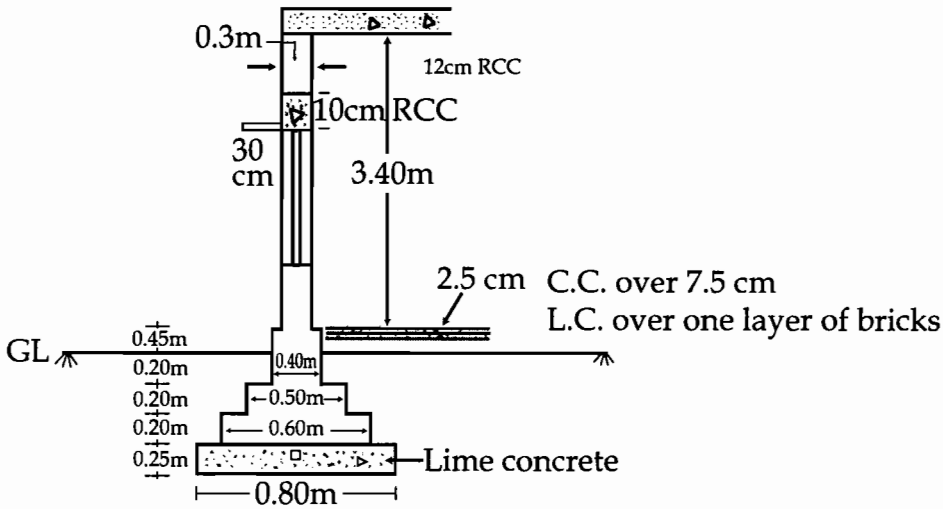
(ii) Demolition of a building

P.T.O.

6. (a) The line plan of a residential building is given in figure No. 1. **20**

Figure 1. Not to scale.





Section of Main Wall

Estimate the quantities of the following items of work in measurement sheet.

(i) Excavation

(ii) 2.5 cm. thick D.P.C. at plinth

(iii) Ist class brick work in foundation and plinth in lime mortar

(iv) Inside plastering

(b) What is unbalanced tender ? Explain with example. **8**

(c) What are the factors to be considered in Rate analysis ? **5**

PET

2007

CIVIL ENGINEERING (Paper III) 006532

Time allowed : 3 Hours } **{ Maximum Marks : 200**

Note :

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SECTION - A

1. (a) Define 'Viscosity' of fluid. A cylindrical shaft of 90 mm diameter rotates about a vertical axis inside a fixed cylindrical tube of length 50 cm. and 92 mm internal diameter. If the space between the tube and the shaft is filled by an oil of dynamic viscosity 1.8 poise, calculate the power required to overcome the viscous resistance when the shaft is rotated at a speed of 240 rpm. **12**

(b) A solid cone of diameter 24 cm and height 20 cm floats with its vertex downwards in water. Find the metacentric height of the cone and comment on its equilibrium. Assume the specific gravity of cone = 0.80. **11**

(c) Define streamline and equipotential line. A closed tank, kept on ground level, containing water is partly filled with water and the air space above it is under pressure. A 5 cm hose, connected to the tank, discharges water to atmosphere on to the roof of a building 3m above the level of water in the tank. If frictional losses are 1.5 m of water, what air pressure must be maintained in the tank to deliver 15 *l/s* to the roof ? Neglect minor losses except the velocity head at exit. Assume specific weight of water as 9.79 kN/m^3. **11**

P.T.O.

2. (a) In an open channel flow define the specific energy of flow. In a hydraulic jump occuring in a horizontal, rectangular, frictionless channel the energy loss and Froude number after the jump are 9.0m and 0.12 respectively. Calculate the discharge intensity and initial depth of the jump. **12**

(b) A straight 25cm diameter pipeline, 5km long, is laid between two reservoirs having a difference in water levels of 40m. To increase the capacity of the system, an additional 25cm diameter pipe, 2.5km long, is laid parallel from the first reservoir to the midpoint of the original pipeline. Assuming $f = 0.025$ for both the pipes find the increase in discharge due to installation of the new pipe. Assume $hf = flv^2/2gD$. **11**

(c) State Buckingham *pi* theorem. A pipe of diameter 1.5m is required to transport an oil of relative density 0.9 and kinematic viscosity 0.03 stoke at a rate of 3.0 m^3/s. If a 15cm diameter pipe with water having kinematic viscosity of 0.01 stoke is used to model the above flow, calculate the velocity and discharge in the model. **11**

SECTION - B

3. (a) What is hydrologic cycle ? Describe, briefly, with a neat sketch, the different processes involved in it. Explain briefly the man's interference in various parts of this cycle. **12**

(b) A catchment has six raingauge stations. In a year, the annual rainfall recorded by the gauges are as follows :

Station	A	B	C	D	E	F
Rainfall (cm)	82.6	102.9	180.3	110.3	98.8	136.7

For a 10% error in the estimation of the mean rainfall, calculate the optimum number of stations in the catchment. **11**

(c) Discuss the importance of evaporation control of reservoirs and possible methods of achieving the same. **11**

SECTION - D

7. (a) Explain with sketches any five factors controlling the alignment of roads. **11**

(b) What is the need of providing superelevation on horizontal curves ? **11**

Under the mixed traffic condition a highway horizontal curve has a radius of 250 m. in plain terrain. Design the superelevation with the design speed of 100 km/h. Calculate the restricted speed, if any.

(c) State four objects of carrying out traffic volume studies. Briefly explain the methods of traffic volume counts. **11**

8. (a) Explain the relationship between speed, travel time, volume, density and capacity. Support your answer with sketches. **11**

(b) Define stopping sight distance as per IRC norms. **11**

Calculate the stopping sight distance for a design speed of 60 km/h for :

(i) Two way traffic on a two lane road,

(ii) Two way traffic on a single lane road.

(c) Draw a sketch of flexible pavement cross section and show the component parts. Briefly explain the functions and importance of any four important components of the pavement. **11**

SECTION - E

9. (a) State five ideal characteristics of a bridge site. **11**

Define the following :

(i) Effective linear waterway

(ii) Afflux

(iii) Economic span

(iv) Scour

(b) Explain briefly the rational method for the determination of flood discharge. **11**

Calculate the peak runoff from following data :

Catchment area : Sandy soil with thick vegetation cover and area is 12000 ha. Length and fall : Length of catchment = 23 km

Fall = 175 m.

Severmost storm recovered : 24 cm in 3 hrs.

(c) Enumerate the various forces, loads and stresses considered in the design of bridges. Explain in brief the forces due to water currents. **11**

P.T.O.

(c) Details of a non-overflow section of a concrete gravity dam are given below : **11**

(i) R.L. of deepest foundation level = 100 m.

(ii) R.L. of roadway at top of dam = 160 m.

(iii) Maximum water level = 157 m.

(iv) Roadway width at top = 8 m.

(v) Downstream face vertical upto R.L. = 152 m.

(vi) Upstream face vertical upto R.L. = 140 m.

(vii) Slope of downstream face = 0.85 H : 1 V

(viii) Slope of upstream face = 0.1 H : 1 V

(ix) Horizontal seismic coefficient, αH = 0.15

Calculate the hydrodynamic pressure force due to earthquake and its moment about toe of dam. There is no tail water.

6. (a) Design an Ogee spillway (downstream profile of crest of spillway only) of a gravity dam by USWES method using following data : **11**

(i) Maximum discharge = 3500 m^3/s

(ii) Net length of spillway = 170 m.

(iii) R.L. of maximum water level = 526 m.

(iv) R.L. of bed of river at spillway = 465 m.

(v) Slope of downstream face = 0.75 H : 1V

(vi) Upstream face is vertical

(vii) Coefficient of discharge of spillway, C = 2.21

Neglect end contractions and velocity of approach. Also state the crest level of spillway. Spillway is ungated spillway.

(b) Design a trapezoidal shaped concrete lined channel to carry a discharge of 200 cumec at a slope of 30 cm/km. Assume side slope of 1.5 H : 1 V, Manning's $n = 0.017$, limiting velocity in the channel as 2.0 m/s. **11**

(c) What is meant by river training ? What are the objectives of river training ? State the various methods adopted for river training. **11**

P.T.O.

4. (a) The peak of a flood hydrograph due to a 3-hour duration isolated storm in a catchment is 270m^3/s . The total depth of rainfall is 5.9cm. Assuming an average infiltration loss of 0.3cm/h and a constant baseflow of 20 m^3/s estimate the peak flow of the 3-hour unit hydrograph of this catchment. If the area of the catchment is 567 km^2, determine the base width of the 3-hour unit hydrograph by assuming it to be triangular in shape. **12**

(b) Give the detailed list of various methods of estimating flood peak from a catchment and explain the rational method and its use. **11**

(c) A 30cm diameter well completely penetrates an unconfined aquifer of saturated depth 40m. After a long period of pumping at a steady rate of 500 *lpm*, the drawdown in two observation wells, 25m and 75m from the pumping well were found to be 3.5m and 2m respectively. Determine the transmissivity of the aquifer. Also calculate the drawdown at the pumping well. **11**

SECTION - C

5. (a) Following table gives the necessary data about the crops, duty and area under each crop commanded by a canal taking off from a storage reservoir. Assuming a time factor for the canal to be (12/20), calculate the discharge required at the head of the canal. If the capacity factor is 0.80, determine the design discharge. **11**

	Crop	Base period (days)	Area (ha.)	Duty of water at the head of the canal (ha/cumec)
(1)	Sugarcane	320	900	580
(2)	Overlap for sugarcane in hot weather	90	150	580
(3)	Wheat (Rabi)	120	750	1600
(4)	Bajra (Kharif)	120	600	2000
(5)	Vegetables (Hot weather)	120	320	600

(b) Define duty of irrigation water and mention any six methods of improving duty. **11**

10. (a) Explain the various techniques adopted to strengthen the bridge substructure and superstructure. **11**

(b) Write short notes on the following : **11**

(i) Classification of bridges.

(ii) Erection of supension bridges.

(c) Discuss in brief any four methods of erection of steel bridges. State the conditions under which each type is used. **11**

SECTION - F

11. (a) State the various types of water demands of a city. **11**

Compute the population of the year 2010 and 2016 for a city whose population in the year 1940 was 25,000, and in the year 1980 was 47,000. Use geometric increase method.

(b) The BOD_5 of a waste is 600 mg/l. The deoxygenation constant, $K_1 = 0.23$/day(base e.). Find the ultimate BOD_4 of the waste. What proportion of the BOD_4 would remain unoxidised after 20 days ? **11**

(c) Define ecosystem. Give an account of the structure and function of an ecosystem. **11**

12. (a) A settling basin is designed to have a surface overflow rate of 32.6 m/day. Find the overall removal obtained for a suspension with size distribution given below. **11**

Particle size(mm)	:	0.10	0.08	0.07	0.06	0.04	0.02	0.01
Weight fraction greater than size (percent)	:	10	15	40	70	93	99	100

The specific gravity of particles is 1.2 and the water temperature is 20°C at which, the dynamic viscosity is 1.027 centipoise and density is 0.997 gm/cm^3.

(b) What is meant by activated sludge ? **11**

Explain briefly the activated sludge process. Describe briefly the types of aeration systems in an activated sludge process.

(c) Define air pollution. What are the sources of air pollutants ? State any ten pollutants generally found in air. **11**

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