Time: 3 Hours **Total Marks-80**

N.B. (1) **Question no. 1 is compulsory**
(2) Attempt **any THREE** questions out of remaining five

Q.1 Attempt any FOUR **[20]**

a) Differentiate between lifts and escalators.
b) Explain in detail types of pipes.
c) Define Visual task and explain factors affecting visual task.
d) Explain Drainage system. Draw and explain the systems of plumbing for drainage in residential buildings.
e) What is grouting? Write its application in repair.
f) Write short notes on Septic tank.

Q.2 a) Explain the different types of wires and wiring systems. What points will you consider while making choice of wires and wiring systems? **[10]**
b) What is Condition Survey? Explain the stages of conducting Condition Survey of a RCC structure. **[10]**

Q.3. a) Prepare a list of semi destructive and nondestructive methods. Explain any TWO in detail. **[10]**
b) Write note on moisture barrier system. **[5]**
c) What are the safety measures to be taken on the construction sites? **[5]**

Q.4. a) Explain in detail about the tendering process for construction projects. **[5]**
b) Explain Column Jacketing with neat sketch. **[5]**
c) Explain in detail HVAC system with its working principle, types and application. **[10]**

Q.5. a) Explain the common repair materials used for repair or rehabilitation or strengthening of the concrete structures and also the selection criteria of repair materials. **[10]**
b) Explain Fire protective systems. **[5]**
c) What is Ferro concrete? Explain applications of Ferro concrete. **[5]**

Q. 6. Attempt any FOUR **[20]**

a) Enlist and explain protective devices in electrical installation.
b) Discuss the properties of Water Proofing materials and explain any one water proofing method in detail.
c) Write note on Corrosion protection of structures.
d) Explain the temporary support structures.
e) What are the causes of seepage in concrete structures?

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3 Hours **Total Marks: 80**

1) **Question No. 1 is compulsory**
2) **Solve any 3 from Q.no. 2 to Q. No.5**

Q.1. Solve any Four out of Five **5 Marks. Each**

1 Explain the importance of the water/cement ratio of concrete.
2 What is the permeability of concrete? Explain the factors affecting it.
3 Explain high-performance concrete.
4 List out any five types of cement. And explain where it is used.
5 Why is curing required for fresh concrete? List out various methods of curing concrete.

Q.2. Solve any Four out of Six **5 Marks. Each**

1 Explain Vaccum concrete.
2 Explain how seawater attacks the life span of marine structures.
3 What is FRC? List various metallic and non-metallic fibres used in concrete.
4 What is self-compacted concrete? Explain the advantages of SCC.
5 What are the advantages of FRC?
6 Write a short note on the ACI Method of Concrete Mix Design.

Q.3. Solve any Four out of Five **5 Marks Each**

1 Explain the step-by-step procedure for concrete mix design using the IS 10262 method.
2 Explain the difference between Nominal Mix & Design Mix.
3 What is no fines concrete? Where is it used?
4 Explain the difference between Accelerators and Retarders.
5 Prepare a checklist for quality control of concrete during concreting.

Q.4. Solve any Five out of Six **4 Marks Each**

1 What is the NDT of concrete? What are the pull-out methods of NDT?
2 Explain the USPV test of NDT.
3 Explain the Ground penetration Radar test of NDT.
4 What is quality control of concrete?
5 Explain the acceptance criteria of concrete cubes for compressive strength.
6 Explain how Industrial Waste material is used in concrete.

Q.5. Solve any two out of three **10 Marks. Each**

1 Explain Hot weather concreting and precautions taken during Hot weather concreting
2 Explain Cold weather concreting and precautions taken during Cold weather concreting
3 Explain the difference between the IS 10262 and the ACI methods of concrete mix design. Which will you prefer? Why?

(Time: 3 Hours) **(Total Marks: 80)**

Note: 1. Q.No.1 is compulsory.
2. Attempt any three questions out of remaining five questions.
3. Assume any data if required stating clearly.

Q.1 Attempt **ANY FOUR**

a.	Derive the equation of impact of jets on flat stationary vanes.	**05**
b.	Derive conditions for most economical trapezoidal channel section	**05**
c.	Define specific speed of centrifugal pump and derive its expression.	**05**
d.	Draw the neat sketch of layout of hydroelectric power plant.	**05**
e.	Classify the jumps based on Froud's number.	**05**

Q.2

a. Derive the expression for torque exerted on a series of radial curved plate. **10**

b. A jet of water discharge 140 m^3/s at 40 m/s in the direction making 30^0 to the direction of series of curved vanes moving at 17.5 m/s. If outlet angle of vane is 20^0 determine **10**

a) The inlet vane angle, so that there is no shock at entry.
b) Direction of flow at outlet.
c) Work done per second.

Q.3

a. Obtain an expression for unit speed, unit discharge and unit power of turbine. **10**

b. An outward flow reaction turbine has internal and external diameter of runner as 0.6 and 1.2m respectively. The guide blade angles is 15^0 and velocity of flow through runner is constant and equal to 4 m/s. If the speed of the turbine is 200 rpm, head on the turbine is 10m and discharge at outlet is radial determine **10**

a) Runner vane angle at inlet and outlet
b) Work done by water on runner
c) Hydraulic efficiency.

Q.4

a. Explain construction and working of centrifugal pump with diagram. **10**

b. Three stage centrifugal pump has impellers 40 cm diameter and 2 cm wide at outlet. The vane is curved back at the outlet at 45 degree and reduce the circumferential area by 10%. Its manometric efficiency is 90% and overall efficiency is 80%. Determine the head generated by the pump when running at 1000 rpm. Delivering 50 LPS. What should be the shaft power and specific speed? **10**

Q.5

a.	Draw and explain in detail Hydraulic ram	**05**
b.	Differentiate between flow through pipe and open channel flow.	**05**
c.	The rate of flow through a trapezoidal open channel is 20 m^3/s and the mean velocity of flow is 1 m/s. The side slope is 1:1 and the bed slope is 1 in 5000. Take C=60. Determine the bottom width and depth of water in the channel.	**10**

Q.6

a. Derive expression for critical depth of rectangular channel section. **10**

b. A rectangular channel section has a width of 3m and carries a discharge of 3 m^3/s with a depth of 0.3 m Calculate: **10**

a) Specific energy.
b) Critical depth.
c) Critical velocity
d) Minimum Energy

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Time: 3 hours **Total marks: 80**

Note: Q.1. is compulsory.
Answer any 3 out of the remaining 5 questions.
Assume suitable data (if necessary).
Numbers on the right indicate full marks.

1. Answer any four:

a) Explain the scope of geotechnical engineering. 5

b) Determine the shrinkage limit & specific gravity of a soil sample whose volume and mass reduced from 19.5 cc and 31 gm to 10 cc and 18 gm respectively upon over drying. 5

c) Explain the corrections applied in hydrometer analysis. 5

d) Derive the expression for average coefficient of permeability of soil when flow is parallel to the bedding planes. Draw a neat sketch. 5

e) Explain quick sand condition. Draw a neat sketch. 5

f) Explain the factors affecting compaction. 5

2. a) Derive the relation between voids ratio and degree of saturation using three phase diagram. 5

b) An embankment having a total volume of 2000 m^3 is to be constructed having a bulk density of 1.98 gm/cm^3 and a placement water content of 18%. The soil is to be obtained either from borrow area A or B which has voids ratio of 0.78 and 0.69 respectively. Taking specific gravity of both the soil samples as 2.66, determine the volume of soil required to be excavated from each of the areas. If the cost of excavation is Rs. 35/m^3, but the cost of transportation is Rs 32/m^3 and Rs. 36/m^3 respectively, which of the borrow areas is more economical? If one truck can carry 130 m^3 of soil, how many trucks will be required for the transportation? 10

c) Explain activity of clays. 5

3. a) The following observations were recorded in a liquid limit test in the lab: 10

Observation	1	2	3
Weight of (wet soil + container) in gm.	30.7	32.25	31.5
Weight of (dry soil + container) in gm.	22.43	23.15	22.3
No. of blows	43	32	22

If the weight of the empty container is 8 gm, determine the liquid limit and flow index.

b) Explain the plasticity chart for the IS soil classification system with a neat sketch. 5

c) State Darcy's law and explain its validity. 5

4. a) Sieve analysis was carried out on 500 gm of soil and the following information were obtained: 10

Size of sieve (mm)	4.75	2	1	0.425	0.212	0.15	0.075
Weight retained (gm)	10	165	100	85	40	30	50

Draw the particle size distribution curve and determine its IS classification.

b) Explain how in-situ permeability is determined in case of confined aquifers by pumping out test. Draw a neat sketch. 5

c) Explain the uses of flow nets. 5

5. a) A sand sample of 35 cm^2 cross-sectional area and 20 cm long was tested in a constant head permeameter under a head of 60 cm, the discharge was 120 ml in 6 minutes. The dry weight of sand used for the test was 1120 gm, and G = 2.68. Determine the coefficient of permeability in cm/sec, the discharge velocity and seepage velocity 10

b) A granular soil deposit is 7 m deep over an impermeable layer. The groundwater table is 4 m below the ground surface. The deposit has a zone of capillary rise of 1 m. The unit weights of the soil in the dry zone, zone of capillary rise and saturated zone are 16.248 kN/m^3, 18.087 kN/m^3 and 19.927 kN/m^3. Plot the variation of total stress, pore water pressure and effective stress with the depth of the deposit. 10

6. a) The results of an IS Standard Proctor Test are as follows: 10

Trial No.	1	2	3	4	5
Moisture content (%)	10	12	14.3	16.1	18.2
Mass of (mould + wet soil) (g)	2925	3095	3150	3125	3070

Take volume of mould=1000ml, mass of mould=1000g and specific gravity of the soil particle = 2.65. Plot the following: a) moisture content - dry density curve, b) zero air voids curve and c) 80% saturation line. Determine the optimum moisture content and the corresponding maximum dry density.

b) Write a short note on depth and spacing of boreholes. 5

c) Explain borehole logs. 5

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Time: 3 Hours **Maximum Marks-80**

Note: (1) All questions carry equal marks.

(2) Question No. 1 is compulsory, attempt any three out of the remaining five questions.

(3) Use of IS 456:2000 is permitted

(4) Assume suitable data if required and state it clearly.

Q1 **Attempt any four** **20**

(a) What are the assumptions in Limit State Method? Draw stress strain block diagram for doubly reinforced section in Limit State Method.

(b) Draw reinforcement detailing of Two-Way Slab 4m x 3m clear span the following details: Ast in shorter direction = 304.25 mm2 and Ast in longer direction = 260.93 mm2. Assume diameter of bar and also show bent up bars in the directions.

(c) Explain the condition when the beam shall be designed as doubly reinforced beam.

(d) Why the minimum (or nominal) shear reinforcement is needed even though the nominal shear stress (τv) < shear strength of concrete (τc).

(e) Explain the Design Interaction curves? Explain the applicability of Interaction curves.

(f) What do you mean by side reinforcement? Where and when it is preferred. Draw reinforcement details.

Q2 **(a)** The simply supported rectangular beam is 400 x 650 mm, Area of steel used is 6 nos of 25 mm bar. Calculate the Moment of Resistance. Effective cover is 50mm. Find the uniformly distributed load on beam in addition to its self-weight on a span 4.5m. Use M30 and Fe415. Using Working Stress Method. **10**

(b) Design shear reinforcement for beam 280mm x 500mm effective depth carry factored load of 150kN. It is reinforced with 5 nos. of bars of 16 mm diameter. Use M20 & Fe 415. Use Limit State Method. **10**

Q3 **(a)** A T beam RCC floor system consist of 125mm thick slab supported by beams at 3.5 m center to center. The effective width and depth of web respectively is 320 mm x 420 mm. Width of support is 300mm. The T beam is reinforced with 4 nos. of bars of 25 mm on tension side of beam. Use M20 and Fe 415. Calculate the Moment of Resistance using Limit State Method. **07**

(b) Design a rectangular beam 300mm wide and 550mm effective depth. The center of steel are 50mm from the respective edges. The beam is simply supported beam span of 4.5m subjected to bending moment of 90kN-m. Use Working Stress Method. **08**

(c) Calculate the reinforcement in central band for the total area of reinforcement 2800 mm2, size of footing 4 m x 2.75 m **05**

Q4 **(a)** Design RCC slab for hall of size 7.5m x 3.5m clear span. The slab is simply supported on 230mm wall on all four side. Live load of 4 kN/m2 and floor finish of 1kN/m2. M20 & Fe415. Apply checks and draw reinforcement details (plan and section) Use Limit State Method. **10**

(b) A rectangular R.C beam 320mm x 450 mm deep is subjected to an ultimate torsional moment of 8.5 kN-m, ultimate BM of 55 kN-m and ultimate shear force of 80 kN. Design the torsion reinforcement if the grades of concrete and steel are M 20 and Fe 415 respectively. Assume effective cover to reinforcement as 40mm. Use Limit State Method. **10**

Q5 **(a)** Design a simply supported slab for 4 m x 5.75m (clear span). The slab is simply supported on 230mm wall. Consider live load of 4 kN/m2 and floor finish of 1 kN/m2. Grade of concrete and steel is M20 & Fe415. **12**

(b) A short column of size (350 mm X 600 mm) is subjected to an axial working load of 850 kN & factored moment of 300 kNm about major axis. Determine the reinforcement in the column if the moment due to minimum eccentricity is less than the applied moment. Adopt M20 concrete & Fe415 steel. Use effective cover to the main steel as 60 mm. Provide the necessary lateral ties. Draw a neat sketch showing the details. Use Limit State Method. **08**

Q6 **(a)** A rectangular column of dimension 300 mm x 450 mm is subjected to an axial working load of 950 kN. Design Isolated footing for column resting on soil with Safe Bearing Capacity of 210 kN/m2. Use M20 & Fe415 Draw reinforcement details (plan & section) **12**

(b) What are partial safety factors for load and material strength? What is their significance in limit state method of design? Explain the concept of probability and reliability in Limit State Method. **06**

(c) A beam has M25 concrete & Fe415 steel. Its width is 250 mm & effective depth is restricted to 500 mm. The factored bending moment is 355 kN-m. Prove that doubly reinforced section needs to be provided. If the depth is not restricted, find the effective depth to be provided to make it singly reinforced section. **02**

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