(3HOURS)   [Total Marks 80]

PLEASE NOTE:
1. **Question no 1 is compulsory.**
2. Attempt **any three questions** out of remaining question.
3. Figures to the right indicate full marks.
4. Illustrate answer with proper sketches.

Q1		Attempt any **four of the following**	20
	a)	Explain the working principle of lifts	
	b)	Write a note on Water meter.	
	c)	What is a Three-Phase Power and Its Features?	
	d)	Explain Rapid Chloride Penetration Test (RCPT).	
	e)	What is Polymer modified mortar? Explain its application in repair.	
	f)	What are the safety measure to be taken on the construction sites?	

Q2 a) Explain in detail HVAC system with its working principle, types and applications **10**

b) Explain in detail Earthing with its working principle, types and applications. **10**

Q3 a) Explain with neat sketches: **i)** Septic Tank **ii)** Column jacketing **10**

b) Explain in detail causes of deterioration of concrete. **10**

Q4 a) Write a note on: **i)** Moisture barrier systems **ii)** Manhole **10**

b) Explain in detail temporary support structures with respect to their types and applications. **10**

Q5		Attempt **any four** of the following	20
	a)	Differentiate between Lifts and Elevators.	
	b)	Explain in detail types of wires.	
	c)	Explain in detail types of pipes	
	d)	What is grouting? Write its application in repair.	
	e)	Write a note on UPV Test	

Q6	a)	Explain the procedure to conduct condition survey of a building.	**5**
	b)	Explain in detail Tendering process for construction projects.	**5**
	c)	What are the measures to protect reinforcement from corrosion?	**5**
	d)	Define visual task and explain factors affecting visual task	**5**

***********END***********

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Time: 3Hrs

Max. Marks: 80

N.B.:
(1) Question No.1 is compulsory
(2) Attempt any three from the remaining
(3) Draw neat sketches wherever essential
(4) Write answers in legible handwriting
(5) Assume suitable data if required

Q.1.	**Solve any four out of five**	**5 Marks Each**

A Explain importance of water/cement ratio of concrete.

B What is workability of concrete? Explain any four factors affecting workability.

C Explain light weight concrete.

D List out laboratory tests of cement. Explain any one of them.

E Why curing is required for fresh concrete? List out various methods of curing.

Q.2.	**Solve any four out of six**	**5 Marks Each**

A Explain Vacuum concrete.

B Explain what sea water attack on concrete is.

C What is Fiber Reinforcement concrete? List out any 4 types of fibers used in concrete.

D What is self-compacted concrete? Explain advantages of SCC.

E What are advantages of FRC?

F Write short note on ACI Method of Concrete Mix Design.

Q.3.A	**Solve any two out of three**	**10 Marks Each**

1 Explain step wise procedure of Concrete Mix Design by IS 10262 Method.

2 Write note on Types their uses of cement. (any 6)

3 Explain difference between Nominal Mix & Design Mix.

Q.3.B	**Solve any two out of three**	**10 Marks Each**

1 What is durability? Explain factors affecting on durability of concrete.

2 Explain difference between Accelerators and Retarders.

3 Explain Difference between Grouting admixtures and Bonding Admixtures.

Q.4.	**Solve any four out of six**	**5 Marks Each**

A What is NDT of concrete? What are the various methods of NDT?

B Explain Windsor probe test of NDT.

C Explain Ground penetration Radar test of NDT.

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D   What is quality control of concrete?

E   Explain acceptance criteria of concrete cubes for compressive strength.

F   Explain concrete from Industrial Waste material.

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

A   Explain Hot weather concreting and precautions taken during Hot weather concreting

B   Explain Cold weather concreting and precautions taken during Cold weather concreting

C   Design concrete mix of M25 grade by using IS 10262 -2009, following data.

1. Type of cement - OPC
2. Max. Nominal size of C.A. -20 mm (Angular)
3. Min. Cement content- 320 Kg/Cum
4. Max. cement content - 450Kg/Cum
5. Max. W/C Ratio - 0.55
6. Workability -75 mm slump. & 0.8 C.F.
7. Exposure condition - Mild
8. Admixture - Not recommended
9. Sp. Gravity of cement - 3.15
10. Sp. Gravity of C.A. - 2.68
11. Sp. Gravity of F.A. - 2.70
12. Fine aggregates confirming from Zone -I (IS :383)
13. Standard Deviation for M- 25 is 4.0
14. Ratio of fine aggregate to total aggregates is 0.40

Q. 6.   Solve any two out of three   10 Marks Each

A   Explain procedure and importance to determine soundness of cement. Draw neat and labeled sketches of apparatus used to measure soundness.

B   Explain zones of fine aggregate and their importance in mix design. Write a note on gradation of aggregate with relevant curves

C   Write a note on high performance concrete w r t requirements, characteristics, merits etc.

Table 2 Maximum Water Content per Cubic Metre of Concrete for Nominal Maximum Size of Aggregate
(Clauses 4.2, A-5 and B-5)

Sl No.	Nominal Maximum Size of Aggregate mm	Maximum Water Content [1] kg
(1)	(2)	(3)
i)	10	208
ii)	20	186
iii)	40	165

NOTE — These quantities of mixing water are for use in computing cementitious material contents for trial batches.

[1] Water content corresponding to saturated surface dry aggregate.

Table 3 Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate
(Clauses 4.4, A-7 and B-7)

Sl No.	Nominal Maximum Size of Aggregate mm	Volume of Coarse Aggregate[1] per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate			
		Zone IV	Zone III	Zone II	Zone I
(1)	(2)	(3)	(4)	(5)	(6)
i)	10	0.50	0.48	0.46	0.44
ii)	20	0.66	0.64	0.62	0.60
iii)	40	0.75	0.73	0.71	0.69

[1] Volumes are based on aggregates in saturated surface dry condition.

Table 5 Minimum Cement Content, Maximum Water-Cement Ratio and Minimum Grade of Concrete for Different Exposures with Normal Weight Aggregates of 20 mm Nominal Maximum Size

(Clauses 6.1.2, 8.2.4.1 and 9.1.2)

Sl No.	Exposure	Plain Concrete			Reinforced Concrete		
		Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete	Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete
1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Mild	220	0.60	–	300	0.55	M 20
ii)	Moderate	240	0.60	M 15	300	0.50	M 25
iii)	Severe	250	0.50	M 20	320	0.45	M 30
iv)	Very severe	260	0.45	M 20	340	0.45	M 35
v)	Extreme	280	0.40	M 25	360	0.40	M 40

NOTES

1 Cement content prescribed in this table is irrespective of the grades of cement and it is inclusive of additions mentioned in 5.2. The additions such as fly ash or ground granulated blast furnace slag may be taken into account in the concrete composition with respect to the cement content and water-cement ratio if the suitability is established and as long as the maximum amounts taken into account do not exceed the limit of pozzolona and slag specified in IS 1489 (Part 1) and IS 455 respectively.

2 Minimum grade for plain concrete under mild exposure condition is not specified.

(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.No.1 Solve any four questions out of following **20**
(a) What is Impulse momentum principle. Show that the force exerted by the **[5]**
jet on a stationary vertical plate in the direction of jet is $\rho a V^2$
(b) Draw the neat sketch of layout of hydroelectric power plant. **[5]**
(c) Define various efficiencies of Centrifugal Pump. **[5]**
(d) Differentiate between (i) Uniform flow and Non Uniform flow (ii) **[5]**
Steady flow and Unsteady flow (iii) Sub critical, critical and super critical
flow.
(e) Explain briefly Specific Energy Curve **[5]**

Q.No.2 (a) A jet of water of 30 mm diameter strikes a hinged square plate at its **[10]**
centre with a velocity of 20 m/s. The plate is deflected through an angle of
20^0. Find the weight of plate. If the plate is not allowed to swing, what will
be the force at the lower edge of the plate to keep plate in vertical position.
(b) Derive the expression for force exerted by a jet on stationary curved **[10]**
plate, when the jet strikes the curved plate at the centre.

Q.No.3 (a) A Pelton wheel is to be designed for the head of 58 mt when running at **[10]**
190 r.p.m.. The Pelton wheel develops 95 kW shaft power. The velocity of
the buckets is equal to 0.5 times the velocity of the jet. Overall efficiency is
85%. Take $C_v = 0.97$
(b) A Kaplan turbine develops 24000 kW power at an average head of 40 **[10]**
meters. Assuming a speed ratio of 2, flow ratio of 0.6, diameter of boss equal
to 0.32 times the diameter of runner and overall efficiency of 90%. Calculate
the diameter, speed of the turbine

Q.No.4 (a) A centrifugal pump having outer diameter equal to two times inner **[10]**
diameter and running at 1000 r.p.m.. Pumps works against a total head of 40
meter. The velocity of flow through the impeller is constant and equal to 2.4
m/s. The vanes are set back at an angle of 40^0 at outlet. If the outer diameter
of the impeller is 500 mm and width at outlet is 50 mm, determine (i) Vane
angle at inlet (ii) Work done by impeller on water per second (iii)
manometric efficiency

(b) Explain briefly multistage centrifugal pump **[05]**
(c) Explain Hydraulic Press **[05]**

Q.No.5   (a) Derive the conditions for most economical trapezoidal channel section.   **[10]**

(b) Determine the diameter of circular sewer pipe which is laid at a slope of   **[10]**
1 in 8100 and carries a discharge of 0.8 m^3/sec when flowing half full. Take
Manning's N as 0.020

Q.No.6.   (a) Derive the expression for Gradually Varied Flow.   **[10]**

(b) Explain various type of bed slope in open channel.   **[5]**

(c) The discharge of water through a rectangular channel of width 6 mt is 12   **[5]**
m^3/sec when depth of flow is 1.0 mt, Calculate : (i) Specific Energy (ii)
Critical Depth and Critical velocity.

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N.B:
1. **Question No.1 is compulsory**
2. **Attempt any three questions from remaining five questions.**
3. **Assume suitable data wherever required.**
4. **Figures to the right indicate full marks.**

Q1		Attempt **any four** of the following	
	A	Write various terms associated with odour measurement.	(5)
	B	Write preventive measures for Green House Effect.	(5)
	C	Explain air sampling methods for particulate pollution.	(5)
	D	Explain cyclonic winds.	(5)
	E	Write functions of CPCB	(5)

Q2	A	What is air pollution? Explain in detail various types of primary pollutants and secondary pollutants with respect to sources, effects and controls.	(10)
	B	Calculate resultant noise level in workshop having 15 machines and each machine produces a noise of 75 dB.	(10)

Q3	A	Enlist air pollution controlling devices. Explain any two with neat sketch.	(10)
	B	Explain the relation between ELR and ALR for ELR >ALR, ELR < ALR, ELR = ALR, Negative lapse rate and inversion of temperature.	(10)

Q4	A	Explain working of high volume sampler with neat sketch.	(10)
	B	Explain any five types of plume patterns.	(5)
	C	Enlist various noise controlling techniques. Explain anyone noise control techniquein detail.	(5)

Q5	A	Convert the following sound pressures into dB units: i) P = 0.4 microbar ii)P = 40000 microbar iii)P = 0.0004 microbar iv)P = 40 microbar v)P = 0.04 microbar	(10)
	B	Explain primary and secondary meteorological factors. What is depletion of Ozone layer.	(10)

Q6		Write short note on following.(Any Four)	(10)
	A	Air Quality Index (AQI)	(5)
	B	Effect of air pollution on visibility	(5)
	C	Wind roses diagram	(5)
	D	Acid rain	(5)
	E	Sources of indoor pollutants	(5)
	F	Noise rating systems	(5)

<div align="center">(3 Hours)</div>   **[Total Marks: 80**

Note:
    i.   Q. No. 1 is **compulsory.**
    ii. Attempt **any 3** out of remaining 5.
    iii. Support with neat sketch wherever possible.

1.   Solve **any four**   **(20 M)**
   - A. Explain the role of infrastructure in development of nation.
   - B. Discuss what steps should be taken to achieve uninterrupted traffic system in urban areas.
   - C. Discuss on guided transit system.
   - D. Write a note on ATC.
   - E. Explain the advantages and disadvantages of water transportation system.
   - F. Write a note on slip forms.

2. A. Compare modes of transportation available in India on the basis of construction cost, maintenance cost, operation cost, fuel consumption and suitability.   **(10 M)**
   - B. Explain the use of GPS in Civil Engineering.   **(05 M)**
   - C. Write a note on types of EDM.   **(05 M)**

3. A. Discuss on methods of tunneling in hard rocks.   **(10 M)**
   - B. Explain zoning near airports.   **(05 M)**
   - C. Discuss on advantages and disadvantages of drone survey.   **(05 M)**

4. A. Discuss on factors affecting site selection of airport and also explain various corrections applied to basic runway length.   **(10 M)**
   - B. Discuss on types of bridges along with their suitability and unsuitability.   **(05 M)**
   - C. Discuss on types of Aprons.   **(05 M)**

5. A. Write a note on earth excavating equipments.   **(10 M)**
   - B. Enlist benefits of public transportation.   **(05 M)**
   - C. Compare LRTS and BRTS.   **(05 M)**

6. A. Discuss on pile driving methods.   **(10 M)**
   - B. Compare docks and harbor.   **(05 M)**
   - C. Explain types of harbors based on utility.   **(05 M)**

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3 Hours	**Total marks: 80**

NOTE:
i)   Question No. 1 is compulsory.
ii)   Attempt any three out of the remaining five questions.
iii)   Figure to the right indicates full marks.

Q.1   Write notes on **any four** of the following questions.   **20**
       i.- Carbon cycle.
       ii.- Global warming and construction industry
       iii.- Alternatives building blocks for walls
       iv.- Selection of mortar.
       v.- Agro wastes used in construction industry.

Q.2   A) What do you mean by sustainable development? What are the measures of sustainable   **10**
       development? Mention the challenges to such developments.

       B) What are the raw materials used for stabilized mud block? Discuss the process and   **10**
       advantages of SMB.

Q.3   A) Explain types, properties and requirements of mortar.   **10**

       B) What are the advantages of green building? Discuss about the green materials and the **10**
       different certification of green building.

Q.4   A) Discuss about different types of curing methods used in construction.   **10**

       B) Explain the matrix materials, types of polymers used and application of Fibre   **10**
       reinforced polymer composites.

Q.5   A) Explain the materials used, construction methods and application of ferrocement.   **10**

       B) Explain the various roof alternatives available in construction and its application. **10**

Q.6   A) What are the various industrial waste materials used in construction industry with its **10**
       merits and demerits.

       B) Write a detailed note on Composite and alkali activated cements and its types.   **10**

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Time: 3-hour   **Max. Marks: 80**

Please Note:

1. All questions carry **equal** marks
2. Question **one** is **compulsory**
3. Attempt any **three** out of remaining questions
4. Use of **IS codes** is permitted
5. **Assume** suitable data if required and **state** if clearly.

Q1   Attempt any **4 out of 6 questions**. Each question carry 5 marks.   **20**
   a) What are the assumptions in working stress method. Draw the stress strain diagram for the singly reinforced beam in working stress method.
   b) Explain characteristic strength of material, characteristic load, and partial safety factors.
   c) Explain the condition when the beam shall be designed as a doubly reinforced beam.
   d) Differentiate one way slab and two way slab.
   e) Explain Pu – Mu Interaction Curve.
   f) Explain different types of footing with neat sketch.

Q2 a) A simply supported beam of width 250 mm and overall depth 550 mm   **08**
           is reinforced with 4 bars of 16 mm diameter on tension side. Clear cover
           to steel is 25mm.Find the safe UDL it can carry in addition to its self-
           weight on a span of 4m. Use M20 grade of concrete and Fe 415 steel.
           Adopt Working Stress Method.
       b) A reinforced concrete beam 250mmX600 mm overall depth reinforced   **08**
           with 5 bars of 16mm diameter is used as a simply supported beam over
           an effective span of 6m. Determine the maximum UDL the beam can
           carry safely including self-weight. Use M20 concrete and Fe 415 steel.
           Adopt Limit State Method.
       c) Explain Limit State of Collapse and Limit State of Serviceability   **04**

Q3 a) A doubly reinforced rectangular beam 250mmx 600mm overall depth is   **10**
           reinforced with 3 bars of 16 mm diameter in compression and 4 bars of
           20 mm diameter in tension side. Determine the moment of resistance of
           the section. Use M20 grade concrete & Fe 415 grade of steel. Adopt
           Working Stress Method
       b) Find out the ultimate moment of resistance of a flanged section with   **07**
           flange width = 1050mm,
           depth of flange = 120mm
           Area of steel = 5 nos of 20mm diameter
           Effective depth = 600mm
           Width of rib = 280mm
       c) What are the advantages of T beams over rectangular beams.   **03**

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Q4 a) Design shear reinforcement for a beam of 280mmX 450mm effective depth carrying a factored load of 30kN/m over a span of 6m. It is reinforced with 1256mm² steel. Use M20grade of concrete and Fe 415 steel. Adopt Limit State Method. **10**

b) Design a slab for a hall of size 7m X 3m clear span. The slab is simply supported on 230mm wall on all the four sides. Consider live load as 4kN/m² and floor finish as 1kN/m². Assume M20 grade of concrete and Fe 415 steel. Draw Reinforcement details. Adopt Limit State Method. **10**

Q5 a) Design a short circular column with helical reinforcement to carry an ultimate load of 2100kN. Use M20grade of concrete and Fe 415 steel. Draw Reinforcement details. Adopt Limit State Method **10**

b) Explain the need of transverse reinforcement in columns. How can you differentiate short column and long column. **5**

c) Write a note on one way shear and two way shear in footing. **5**

Q6 a) Design a short square column to carry an ultimate load of 1800kN. The column is 4m long effectively held in position but not restrained against rotation. Use M20 grade of concrete and Fe 415 steel. Draw Reinforcement details. Adopt Limit State Method **08**

b) Design a square footing for a short axially loaded column of size 350mmX350mm, carrying working load of 700kN. Use M20 grade of concrete and Fe 415 steel. Safe bearing capacity of soil is 180kN/m². Draw reinforcement details. Adopt Limit State Method **12**

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Time: 3 Hours   Max Marks: 80

Note 1. Question **1** is compulsory
　　　2. Attempt any **4** out of six questions
　　　3. Assume any suitable data where ever required

Q.1　　Attempt any **four**

a. A saturated sample of undisturbed clay has a volume of 19.2cc and weight as 32.5gm. After oven drying the soil sample, the weight reduces to 20.2gm. Determine saturated unit weight of the clay sample. Draw a phase diagram.　　**05**

b. Explain a method of determining the gran size distribution of cohesionless soils.　　**05**

c. Calculate the value of permeability of a sample of 6cm height and 50cm2 cross-sectional area, if a quantity of water of 430cc flows down in 10min under an effective constant head of 40cm. On oven drying the test specimen weighed 498gm. Assuming $G = 2.65$, calculate the seepage velocity of water during the test.　　**05**

d. A sample of clay has a void ratio of 0.70 in the undisturbed state and of 0.50 in a remoulded state. If the specific gravity of solids is 2.65, determine shrinkage limit in each case.　　**05**

e. Compute the area ratio of a sampling tube given the outside diameter = 100mm and inside diameter = 94mm. In what types of soil can this tube be used for sampling.　　**05**

Q.2　**a.** Explain factors affecting compaction　　**05**

b. Write a note on methods of boring.　　**05**

c. The following are the results of standard compaction test performed on a sample of soil:　　**10**

Water content, %	5	10	14	20	25
Bulk density, gm/cc	1.77	1.98	2.1	2.18	2.16

Plot compaction curve and obtain maximum dry density and optimum moisture content. Calculate the water content necessary to completely saturate the sample at its maximum density, assuming no change in the volume. Take $G = 2.7$.

Q.3　**a.** What are different types of soil structures which can occur in nature? Describe in brief.　　**05**

b. How would you determine the average permeability of a soil deposit consisting of number of layers. Discuss in detail with neat diagram.　　**05**

c. The water table in a certain deposit of soil is at a depth of 2m below the ground surface. The soil strata consist of clay up to a depth of 4m from the ground surface and below which lies sand. The clay stratum is saturated above the water table. Given Clay stratum: $w = 30\%$, $G = 2.72$; Sandy stratum: $w = 26\%$, $G = 2.64$. Determine and construct pressure distribution diagram of total pressure, pore water pressure and effective pressure at a depth of 8m below the ground surface. Also determine change in the effective pressure if the water table is brought down to a level of 4m below the ground surface by pumping.　　**10**

Q.4 **a.** What are the various factors that affect coefficient of permeability? Discuss. **05**

b. The minimum and maximum dry density of a sand were found to be 1.50 and **05** 1.70gm/cc. Calculate the dry density corresponding to relative densities of 50% and 75%.

c. A pumping test was carried out in an unconfined aquifer out to determine the **10** coefficient of permeability of soil at a site which was selected for the construction of an earth dam. The observation wells were established at distance of 3 and 6 m from the test well. The following data were obtained:

Depth of water table = 16m, discharge under steady condition = 2.3m3/min, draw down at outer well = 0.5m, draw down at inner well = 1.5m. Draw a neat diagram and determine the coefficient of permeability of the soil.

Q.5 **a.** Define Seepage and Discharge velocity. Determine the coefficient of permeability (in **10** m/day) of a soil sample 6cm in diameter and 15cm in height. The diameter of stand pipe is 2cm. The test results show head of water before the start of test as 45cm and final head after 2minutes of commencement of test as 30cm.

b. A sand deposit consists of two layers. The top layer is 2.5m thick with bulk density **10** 1.71 gm/cc and the bottom layer is 3.5m thick with saturated density 2.06 gm/cc. The water table is 3.5m from the surface and the zone of capillary saturation is 1m above the water table. Draw the diagram showing the variation of total stress, neutral stress and effective stress.

Q.6 **a.** What are the purposes of site investigation. A sample of clay has liquid limit of 62% **10** and plasticity index 32%. (a) What is the state of consistency of the soil if the soil has its natural water content of 34%. (b) Calculate the shrinkage limit if the void ratio of the sample at the shrinkage limit is 0.70. Assume G = 2.70

b. An air-dried soil sample weighing 25 kg was sieved in a laboratory. The results are **10** given below.

IS sieve size	2.0	1.0	600μ	425μ	212μ	150μ	75μ	Pan
Mass retained, gm	0	2020	3510	7530	8150	2810	900	80

Draw the grain size distribution curve and determine coefficient of curvature and coefficient of uniformity.

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