

(Time : 3 Hours)

(80 marks)

N.B:

1. Question No:1 is compulsory
2. Attempt any three questions from the remaining five questions.
3. Figures to the right indicate full marks.

Q. 1. Attempt any four. (20)

- a. Explain mud jacking and grouting for the foundation.
- b. Illustrate the construction sequence of a diaphragm wall using a neat sketch.
- c. Define dredging. State the purposes for which it is carried out
- d. What is seismic retrofitting? How is it achieved?
- e. Write a note on Smart Road Technology
- f. Explain launching techniques for heavy decks.

Q. 2
a. Write an explanatory note on the construction sequence and methods of construction of domes (10)

- b. Write an explanatory note on coastal construction techniques for making them soundproof as well as air and moisture-resistant. (10)

Q. 3
a. What are pre-engineered buildings? State their merits and demerits. Give some examples (10)

- b. Explain the procedure for underwater drilling and blasting (10)

Q.4
a. Explain the construction sequence in the cooling tower of a thermal power plant (10)

- b. Describe the stepwise procedure of strengthening a beam using RC Jacketing. (10)

Q. 5 (10)

- a. Write an explanatory note on the trailing suction hopper dredger. (10)
 - b. Describe the process of constructing concrete roads using pavers (10)
- Q. 6**
- a. Explain in detail various methods and techniques of ground improvement for soft soil. (10)
 - b. Explain the stepwise procedure for the erection of large-span structures. (10)

Duration: 3hrs

[Max Marks: 80]

- N.B. :** (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

- 1 Attempt any FOUR [20]**
- a Differentiate between cybercrime and cyber fraud.
 - b Explain various threats associated with cloud computing.
 - c Explain methods of password cracking
 - d Explain E-contracts and its different types.
 - e Explain different attack vectors in cyber security
- 2 a Explain the classification of cybercrimes with examples. [10]**
b Explain various types of credit card frauds [10]
- 3 a Explain different buffer overflow attacks also explain how to mitigate buffer overflow attack [10]**
b Explain electronic banking in India and what are laws related to electronic banking in India [10]
- 4 a What do you understand by DOS and DDOS attack? Explain in detail. [10]**
b Write a note on Intellectual Property Aspects in cyber law. [10]
- 5 a Explain the objectives and features of IT Act 2000 [10]**
b What are Botnets? How it is exploit by attacker to cause cyber attack? [10]
- 6 a Explain SQL injection attack. State different countermeasure to prevent the attack. [10]**
b Explain what is Information Security Standard and Explain HIPAA act in detail [10]

(3 Hours)

Total Marks: 80

Note:

1. **Question No. 1 is compulsory.**
2. Attempt any **THREE** out of the remaining **FIVE** questions.
3. Assume suitable data if necessary.

- 1 Answer the following (any 4) (20)
- a) Define the terms: Hazard, Vulnerability, Risk 5
 - b) Discuss the Direct and indirect effects of disasters 5
 - c) What is Disaster Scenario of India? 5
 - d) Explain types of Manmade disasters. 5
 - e) What is Climate Change? What are the effects of Global Warming? 5
- 2
- a) What are different types of flood? Enlist structural mitigation measures for flood. 10
 - b) Explain the types of landslide and factors affecting them. Give a case study for the same. 10
- 3
- a) What are different government agencies responsible for various types of disasters? 10
 - b) Explain roles and responsibilities of NDMA in detail. 10
- 4
- a) Discuss the role of GIS and Remote Sensing in disaster management. 10
 - b) Describe the institutional mechanism setup in India. 10
- 5
- a) What is role of NGOs in disaster management? Enlist major NGOs working on disaster management. 10
 - b) Explain Bio shield and Sea wall in detail with schematic diagram. 10
- 6
- a) What is Community Base Disaster Management (CBDM)? Discuss how it is useful in Indian scenario. 10
 - b) What are Do's and don'ts in Earthquake, Tsunami and Cyclone? 10

Duration : 3 Hours

[Max Marks : 80]

- N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

- | | | |
|---|--|------|
| 1 | Attempt any FOUR | [20] |
| a | Write short note on green roof retrofits. | 5 |
| b | Explain any 5 goals of sustainable development | 5 |
| c | Name any 5 green buildings India with the ratings. | 5 |
| d | Discuss in detail about platinum , gold, silver and certification ratings followed in existing green buildings. | 5 |
| e | Discuss the comparison between conventional building and green building | 5 |
| 2 | a Explain about the site selection criteria in green building | [10] |
| b | Explain the concept of rainwater harvesting along with its components. | [10] |
| 3 | a Explain in detail about the energy efficient measures in green building. | [10] |
| b | What is commissioning? Explain in detail commissioning plan for building equipment and system and post installation. | [10] |
| 4 | a Explain about water efficient plumbing system along with its components. | [10] |
| b | Explain the IGBC green building rating system and explain its features | [10] |
| 5 | a Explain indoor air quality management. | [10] |
| b | What is daylighting? Explain in detail. | [10] |
| 6 | a Explain in detail different types of sustainable green building materials | [10] |
| b | Discuss about the effective waste management for reducing the carbon footprint in the green building construction. | [10] |

(3 Hours)

[Total Marks: 80]

- (1) Question No. 1 is compulsory.
- (2) Attempt any three questions from remaining five questions.
- (3) Draw neat sketches wherever necessary.
- (4) Figures to the right indicate full marks.
- (5) Answer each and every question combined manner in order.

- Q 1** Attempt any Four out of Six **5**
- a.** What is meant by 'consideration' in contract law? Name and explain any four exceptions for the rule of consideration.
 - b.** Write in detail about various aspects of Arbitration like Necessity and advantages.
 - c.** Write in brief the need for laws and legislature in construction industry.
 - d.** Distinguish between 'security deposit' and 'earnest money deposit'
 - e.** What are the essentials of a valid contract?
 - f.** In what ways can the construction industry harm the environment?
- Q 2**
- a.** With the help of a flow chart show the responsibilities of work in civil engineering for a Builder, an Engineer, an Architect and a Contractor in sequence. **7**
 - b.** Prepare a tender notice (advertisement) for inviting tenders for construction work of a government building as a lump sum contract. the site is in Colaba Mumbai. Tender amount is 5,00,00,000/- and opening of tender date will be on 31st of December 2022. Use the above data along and **assume every other data required.** **7**
 - c.** What are the changes that are made in the 2020 draft of Environmental impact assessment? According to you how will these changes affect our cause to protect the environment? **6**
- Q 3**
- a.** A submitted his tender in competition with others for a public construction project. On opening of the tenders, it was realized by him that he had committed an error. He wants to revoke his tender. Can he do so without any liability under each of the following circumstances? (i)- Before tenders are scrutinized and a decision is taken by the department. (ii)- Tenders are scrutinized and the department has decided to accept his tender but the letter of acceptance has not been posted. (iii)- On receipt of the letter of acceptance of his tender. Give reasons for your answer. **6**

- b. Explain in detail the three envelopes system used in tendering. 7
- c. Write in detail about various aspects of Dispute Resolution Board like Necessity, Formation, Functioning and advantages. 7

Q 4

- a. Explain in detail lump sum contracts, item rate contracts types of cost plus contracts, labor contract. Explain the merits and demerits of each contract. 7
- b. Describe the process of preparing Environment Impact assessment report In detail. 7
- c. Mention various ways in which disputes can arise in Construction Industry. Name and describe in short various dispute resolution methods in Construction industry. 6

Q 5

- a. Explain in detail types of breach in contracts. Explain liquidated and unliquidated damages. 7
- b. What are the roles and power of an arbitrator? Write in detail about publication of an award in Arbitration. 7
- c. What is the need of an advisory board in minimum wage act? Write about the formation of advisory board for both state and center. 6

Q 6

- a. Define the terms in the context of construction industry- Builder, Engineer, Architect, Contractor. Describe the role of each in short. 6
- b. Write about the two ways in which the government can revise the minimum wage of the workers. 7
- c. What are the various safety regulations to be followed on site? 7
-

Duration: 4 Hours

[Max Marks:80]

Instructions:

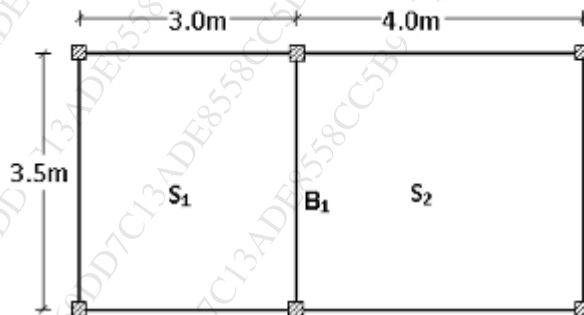
- (1) Question No 1 is **compulsory**.
- (2) Attempt any **three** questions out of the **remaining five**.
- (3) All questions carry equal marks.
- (4) Use of **relevant IS codes** permitted
- (5) Assume suitable data, if required and state it clearly.

1 Attempt any FOUR

- a Explain the importance of ductile detailing in earthquake resistant design of structures **05 M**
- b Differentiate between static and dynamic loads. Explain different types of dynamic loads **05 M**
- c Explain the structural behaviour of different components of a counterfort retaining wall **05 M**
- d Distinguish between a rigid base and flexible base circular water tank based on their structural behaviour **05 M**
- e What are the functions of longitudinal and transverse reinforcement in columns? **05 M**

2 a Design a circular water tank resting on ground for a capacity of 3 lakh litres. The water tank has a flexible base, walls and base slab are not monolithic with each other. Use M25 grade concrete and Fe 500 grade steel. Adopt WSM. Draw reinforcement details **12 M**

- b Figure shows a slab beam system. The slabs S1 and S2 are having a thickness of 140mm, live load of 3 kN/m^2 and floor finish load of 1 kN/m^2 . The beam B1 is 250mm wide and 400mm deep. The beam is supporting a masonry wall of thickness 250mm and height 3m. Unit weight of masonry wall is 12 kN/m^3 . Calculate the **total load** carried by beam **B₁** including its self-weight. **08 M**



- 3 a A prestressed concrete beam 250mm wide and 400mm deep is prestressed with steel wires of area 350mm^2 . The wires are provided at a uniform eccentricity of 50mm with an initial prestress of 1250N/mm^2 . The beam has a span of 10m. Determine the final stress (after losses) and percentage loss of stress in the steel wires for the following cases **10 M**

(i) The beam is pre-tensioned

(ii) The beam is post-tensioned

Take $E_s = 210\text{kN/mm}^2$, $E_c = 35\text{kN/mm}^2$

Shrinkage of concrete = 300×10^{-6} for pretensioned beam

= 215×10^{-6} for post tensioned beam

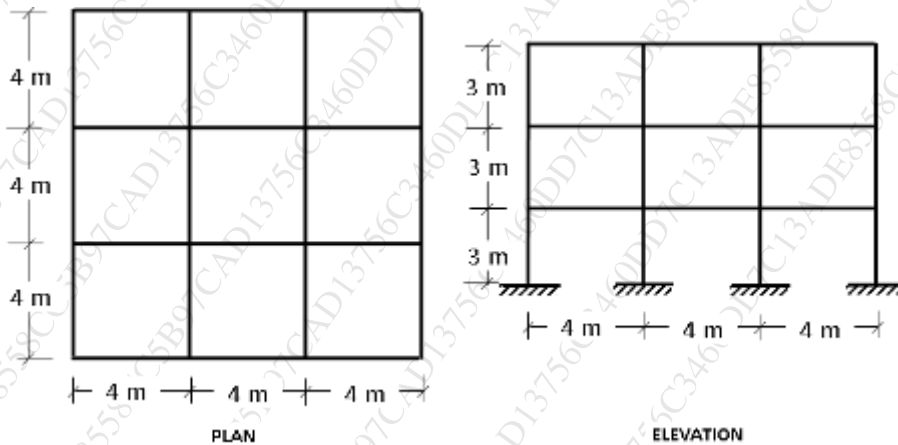
Relaxation of steel stress = 5% of initial stress

Creep coefficient = 1.6

Anchorage slip = 1.25 mm

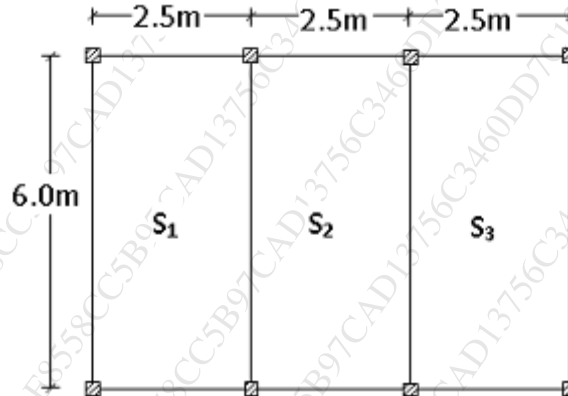
Friction coefficient for wave effect = 0.0015 per m

- b It is proposed to construct a 3-storied railway station building as shown in the figures given, in Pune as a special moment resisting frame. Intensity of dead load on each floor = 12kN/m^2 . Intensity of live load = 4kN/m^2 . Type of soil: Hard. Determine the total design base shear on the structure using seismic coefficient method as per IS 1893(Part 1): 2016. Also show the distribution of base shear at different floor levels **10 M**

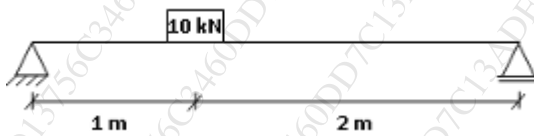


- 4 Design a suitable dog legged staircase for a room size of $3.5\text{m} \times 5\text{m}$ and floor to floor height of 3.3m. Take live load as 3kN/m^2 and floor finish load as 1kN/m^2 . Design both the flights and carry out the necessary serviceability checks. Draw functional plan showing dimensions of flights and midlanding **20 M**
- Draw reinforcement details of both the flights. M20 grade concrete and Fe415 grade steel

- 5 a Figure shows the typical plan of an office building. live load on the slabs is 4 kN/m^2 and floor finish load 1 kN/m^2 . The slabs are supported on 230 mm thick beams on all sides. Design the continuous slabs S1-S2-S3 using IS Code coefficients. Adopt M20 concrete and Fe 500 steel. Carry out all serviceability checks. **14 M**



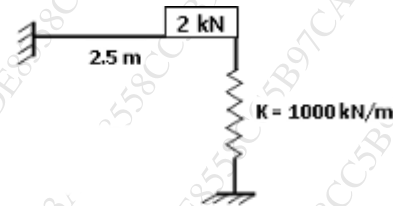
- b Determine the natural frequency of following beams **06 M**



(a)

$$E = 2.5 \times 10^4 \text{ MPa}$$

$$I = 675 \times 10^6 \text{ mm}^4$$



(b)

$$E = 3.2 \times 10^4 \text{ MPa}$$

$$I = 520 \times 10^6 \text{ mm}^4$$

- 6 A reinforced concrete cantilever retaining wall is supporting a levelled backfill of height 4.2m above GL. Depth of foundation is 1m below GL. Unit weight of backfill is 17 kN/m^3 . Angle of repose of soil is 28° , SBC of soil is 180 kN/m^2 . Coefficient of friction between concrete and soil is 0.55. Design the stem and toe slab of the retaining wall. Carry out all stability checks. Draw reinforcement details of the retaining wall. Adopt M20 grade concrete and Fe 500 grade steel. **20 M**

Duration: 3 Hours

Total Marks: 80

N. B: 1. Q1 is compulsory. Attempt any three out of remaining five questions.

2. Assume suitable data if required and mention it clearly.
3. Support answers and solutions with suitable sketches.
4. IS 1343:2012 is permitted in examination.

Q1

- A** Why high strength steel and high grade concrete is used in prestressed concrete structures? **04**
- B** Develop the equations for minimum sectional modulus required for section to be safe in limit state of serviceability maximum compression in flexure and cracking. **04**
- C** Differentiate between the losses of stresses in steel in pre-tensioned and post-tensioned elements. What are different factors influences the loss of stresses in steel due to shrinkage in concrete? **04**
- D** How different factors influence deflection of the beam? Calculate permissible limits of deflection of an 8 m long beam corresponding to different stages. **04**
- E** Steel with ultimate tensile strength 1600 MPa is used for prestressing. Determine the following. **04**
- (i) Maximum permissible initial stress in steel
 - (ii) Maximum possible stress in steel at failure of section in limit state of collapse flexure
 - (iii) Minimum stresses effectively available after all losses
 - (iv) Loss of stress in steel due to relaxation, if initial stress in steel is 1200 MPa. Consider normal relaxation.

Q2

- A** A 5 m long simply supported beam 200 mm x 450 mm is prestressed by a parabolic cable carrying an effective force of 600 kN. Cable is located at 150 mm below centroid at mid span and concentric at supports. The beam supports a factored load of 90 kN/m (inclusive of self weight). Calculate the principal tensile stresses at support section at following mentioned fibers and compare with limiting value. Use M40 concrete. **10**
- (i) 100 mm above centroidal axis
 - (ii) 100 mm below centroidal axis
- B** Define kern points and derive equation for top & bottom kern point. Also determine the efficiency of rectangular section of dimensions 'b x d' and circular section of diameter 'd'. **05**
- C** Explain the concept of load balancing. Sketch a load balancing cable for a concrete beam with a single overhang. Beam is simply supported at A & B over a span of 8 m and the overhang BC is 2 m. The beam supports uniformly distributed load over the entire span. **05**

Q3

- A** A posttensioned beam of rectangular section 200 mm x 450 mm is prestressed by a cable made up of 12 - 8 mm ϕ wires. Cable is linear with maximum eccentricity at mid span. It is located at 100 mm from soffit of the beam at mid span and concentric at supports. The wires are initially stressed to 1100 MPa. Jacking force is applied from one end only. **15**
- Take $\mu = 0.15$, $K = 0.0066 / \text{m}$, anchorage slip = 2 mm, span = 6 m simply supported, $E_s = 210 \text{ kN/mm}^2$, $E_c = 35 \text{ kN/mm}^2$, shrinkage strain in concrete ($\epsilon_{ca} + \epsilon_{cd}$) = 300×10^{-6} , creep coefficient = 1.6, consider 6 % relaxation loss.
- Estimate loss of stress, loss of strain, percentage loss of stress and percentage loss of strain in steel.

- B** A prestressed concrete beam 150 mm wide and 400 mm deep of span 10 m is simply supported. **05**
It is subjected to a live load of 10 kN/m at service. Initially a prestressing force of 400 kN is applied at a constant eccentricity of 50 mm. Take unit weight of concrete and characteristic strength of concrete as 24 kN/m³ and 40 MPa respectively. Assume loss ratio as 0.85. Determine shear strength of the section and comment on requirement of shear reinforcement.

Q4

- A** A concrete beam of 10 m simply supported span has 300 mm wide and 500 mm deep rectangular section. It is prestressed by 2 post-tensioned cables of area 600 mm² each. They are initially stressed to 1600 N/mm². The cables are located at 150 mm below neutral axis throughout the length. Take $E_c = 38 \text{ kN/mm}^2$ and $\gamma_c = 24 \text{ kN/m}^3$. **10**
- (i) Neglect all losses, find the deflection at the center of the span at transfer stage.
 - (ii) Allowing 20 % loss in prestress, find the deflection at the center of the span when it carries an imposed load of 25 kN/m.

- B** A posttensioned concrete beam of simply supported span 16 m is of rectangular section 400 mm wide and 1200 mm deep. A tendon consists of 3300 mm² area is made of steel having characteristic strength 1700 N/mm². The tendon is located at 870 mm from the top face of the beam. If $f_{ck} = 60 \text{ N/mm}^2$, estimate the ultimate flexural strength of the section and corresponding safe uniformly distributed load on the beam. Take $\gamma_c = 25 \text{ kN/m}^3$. **10**

Q5

- A post-tensioned unsymmetrical I-section having the following properties is used as a 30 m long simply supported bridge girder. **20**
Overall depth = 1000 mm, position of the centroid from top edge = 440 mm, area of C/s = 345000 mm², $Z_t = 95 \times 10^6 \text{ mm}^3$, $Z_b = 75 \times 10^6 \text{ mm}^3$
Consider type-1 element and M55 concrete with $f_{ci} = 38.5 \text{ MPa}$, imposed load 3 kN/m, $\eta = 0.75$, $\gamma_c = 25 \text{ kN/m}^3$
The girder is safe in limit state of serviceability maximum compression in flexure and cracking. Determine prestressing force and corresponding eccentricity. Ensure that CGS is at minimum 100 mm from soffit. Also locate safe cable zone.

Q6

- A** A 6 m long simply supported beam has rectangular C/s 200 mm x 450 mm. It is prestressed by a cable consisting of 20 H T wires of 4 mm ϕ each having $f_i = 1000 \text{ MPa}$. Beam carries 8 kN/m impose load. Consider 20 percent loss in prestress at service. Cable is parabolic and placed with zero eccentricity at supports and maximum 125 mm towards soffit at mid span. Determine stresses at mid span, quarter span and support section at transfer and service stage. **15**
- B** Explain concept of thrust line? Sketch expected thrust line at transfer stage and service stage for a simply supported beam subjected to uniformly distributed load. Beam is prestressed by a parabolic cable, located below neutral axis at mid span and concentric at supports. **05**

Time 4 Hours

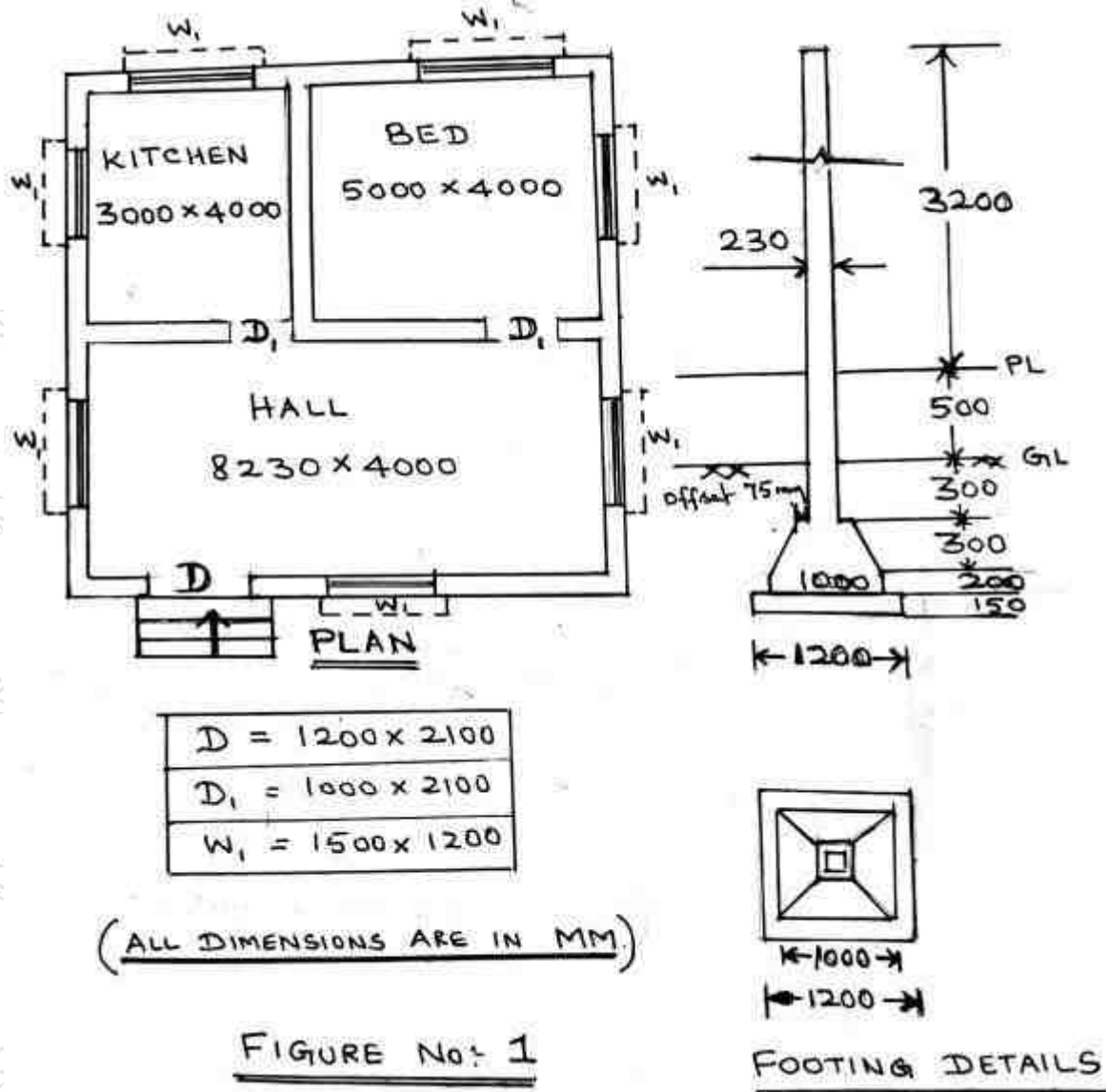
Marks: 80

- N.B. :
- (1) Question No.1 is compulsory
 - (2) Attempt any **THREE** questions from the remaining 5 Questions
 - (3) Figures to the right indicate full marks
 - (4) Assume suitable data if necessary

Q1 Figure No 1 shows the plan and sectional details of a Framed Structure.
Work out the quantities of the following items of work from **Figure No -1**

20

- a) Total volume of Concrete in all footings
- b) Flooring Quantity
- c) Damp Proof Course
- d) 1stClass Brick Work in Super Structure.



- Q2** (a) Prepare an Abstract of cost for all items in Question Number 1 **8**
- (b) Prepare the Bar bending schedule of a simply supported R.C.C. Lintel from the following **12**
specification:
Size of lintel 300 mm wide 200 mm depth.
Main bars in tension zone of Fe 250 (grade I) 3 bars of 16 mm dia., one bar is cranked through 450 at 170 mm from each end 2 No. anchor bars at top 8 mm dia.
Two legged stirrups@150mm c/c of 6mm dia. throughout.
Clear span of the lintel is 1150 mm. Bearing on either side is 150 mm.

- Q3** (a) What are the points to be observed while framing the specification of the items? Draft the detailed specification for three coat internal plastering with synthetic enamel paint **8**
- (b) Estimate the quantity of earthwork for a portion of a road to be constructed by **Mid Sectional Area Method** from the following data. **12**
Formation width = 10 m. Side slope in banking = 2:1, and in cutting 1:1.
Downward gradient 1 in 120 from chainage 0 to 120 while it remains in same formation level from 120 to 180 chainage and have again upward gradient 1 in 90 from 180 to 300 chainage.
Formation level at zero chainage is 210.5 m.
Chainage and corresponding ground levels are given below.

0	30	60	90	120	150
210.5	200.85	199.9	198.65	196.4	199.3
180	210	240	270	300	
198.1	196.33	197.26	196.55	197.28	

- Q4** (a) Prepare an Approximate Estimate for Residential Building in western suburbs of Mumbai (RCC framed structure). **10**
- Plot Area- 60 m x 30 m
 - FSI- 1.5
 - Building is G + 6
 - Consider foundation cost as 20 % of superstructure cost.
 - Allow 20% of building cost for all services.
 - Allow 2.5% of overall cost for consultant fees.
 - Consider 5 % provision for contingencies.

b) i) Draft a tender notice for a construction of a library building by CIDCO, Navi Mumbai with an estimated cost of Rs. 12,54,67,475 and duration of project is 12 months. **5**

ii) Write short notes on Mass Haul Diagram **5**

Q5 (a) Prepare Rate Analysis for **12**

- a) RCC Work 1:1.5:3 for beam with 2% steel
- b) 1st Class Brickwork in Superstructure with CM 1:6

(b) A person has purchased a plot of land costing of Rs. 120000 and has constructed a building there on at a cost of Rs. 500000 including w/s. Sanitary and Electrical installations. Allowing a net return @ 7% cost of construction and 5 % net return on cost of land. Work out the standard rent of the property with the following data. **8**

- i) Sinking Fund on 4% basis for the future life of 70 years = 0.0022
- ii) Annual maintenance @ 0.5% cost of construction
- iii) Municipal taxes and other outgoings 28% of Gross rent.

Q6 Write short notes on any **FOUR** of the following: **20**

- a) IS 1200
 - b) Price Escalation clause of Contract
 - c) Earnest Money Deposit
 - d) Easement Rights
 - e) Factors affecting Rate Analysis
 - f) Valid, Void and Voidable Contracts
-

Duration- 3 Hrs

Marks- 80

N.B.:

- 1) Question **number one** is **compulsory**.
- 2) Attempt **any three** of **remaining five** questions.
- 3) Assume **suitable data if required**.
- 4) Draw **neat sketches** wherever **necessary**.

Q.1. Solve any four of the following:

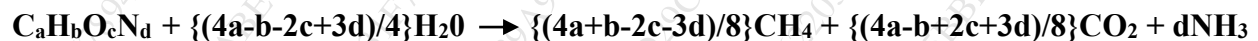
(20)

- A. Volume reduction of solid waste.
- B. Explain factors affecting the generation rate of solid waste.
- C. State & explain characteristics of hazardous waste.
- D. Write a short note on Life Cycle Assessment in SWM
- E. What are the factors to be considered for selecting the landfill site.

Q.2. A) Estimate the volume of methane produce by anaerobic digestion of one tone of

Waste having chemical composition $C_{55} H_{110} O_{35} N_2$

(10)



B) Explain with a neat sketch working of municipal incinerator.

(10)

Q.3 A) Explain Hauled container system and stationary container system with neat sketches.

(10)

B) What is composting? Explain various types of composting with advantages & disadvantages of each.

(10)

Q.4 A) Explain Physical , chemical and biological transformation of solid waste.

(10)

B) Explain the EPA identification of toxic and hazardous waste. Explain methods of disposal of hazardous waste

(10)

Q.5 A) Estimate the moisture content of MSW sample with following Composition (05)

Component	% by mass	Moisture content %
Food waste	20	70
Paper	40	6
Cardboard	10	5
Plastic	10	2
Garden trimings	10	60
Wood	5	20
Tin cans	5	3

B) Calculate the energy content of solid waste having the following composition (05)

using modified Dulong's formula. Figures in bracket are % by mass.

1) Carbon (36.3) 2) Hydrogen (7.3) 3) Oxygen (51.1) 4) Ash (4.7)

5) Nitrogen (0.5) 6) Sulphur (0.1)

C) Define Biomedical Waste. Give sources of generation of Biomedical Waste. Enlist (10)

different methods of disposal of Biomedical waste and explain any one in detail.

Q.6 Write short note on (any four) (20)

A) Pyrolysis

B) Transfer station

C) Legal aspects of solid waste disposal

D) 7' R' in SWM

E) Need of IOT in SWM

Duration: 3 Hours

[Max Marks:80]

Instructions:

- (1) Question No 1 is **Compulsory**.
- (2) Attempt any **three** questions out of the remaining five.
- (3) All questions carry equal marks.
- (4) Use of **relevant IS codes** permitted
- (5) Assume suitable data, if required and state it clearly.

1 Attempt any FOUR

- a Distinguish between working stress method and limit state method. **05 M**
- b Differentiate between one-way slab and two-way slab. **05 M**
- c For a singly reinforced beam, calculate all the fundamental design constants using working stress method. Adopt M30 concrete and Fe415 steel. **05 M**
- d Discuss about primary torsion and secondary torsion, with neat sketches. **05 M**
- e Write a note on two-way shear consideration in footing. **05 M**

- 2 a** A simply supported beam has a width of 240 mm and an overall depth of 600 mm. It is reinforced with four bars of 12 mm diameter at the bottom. Find the safe UDL on the beam, in addition to its self weight, on a span of 4.5 m. Assume clear cover to the steel as 25 mm. Use M25 concrete and Fe415 steel. Adopt working stress method. **10 M**
- b** A doubly reinforced beam has a width of 235 mm and an effective depth of 500 mm. Tension steel consists of 4 bars of 20 mm diameter and compression steel has 2 bars of 20 mm diameter. Effective cover to compression reinforcement is 35 mm. Determine the moment of resistance of the section. Use M20 concrete and Fe415 steel. Adopt working stress method. **10 M**

- 3 a** A rectangular beam has a width of 230 mm and an effective depth of 510 mm. It is subjected to a factored moment of 210 kNm. Determine the area of flexural steel. Use M20 concrete and Fe415 steel. Adopt limit state method. **10 M**
- b** A singly reinforced beam with 230 mm width is to be provided. It is subjected to a design moment of 130 kNm. Design the beam using limit state method. Adopt M20 concrete and Fe415 steel. Draw the steel details. **10 M**

- 4 a** A rectangular beam section is 355 mm wide and has an overall depth of 730 mm. It is subjected to a factored bending moment of 200 kNm, factored torsion of 90 kNm and factored shear force of 140 kN. Use effective cover of 45 mm on all the 4 sides. Using limit state method, provide the suitable reinforcement. Adopt M20 concrete and Fe415 steel. **10M**
- b** A T-beam floor system has 135 mm thick slab supported on beams. Web width is 290 mm and effective depth is 585 mm. Tension steel consists of 4 bars of 25 mm diameter. The beams are spaced at 3.1 m C/C. The beam has an effective length of 3.5 m. Determine the moment of resistance. Adopt M20 concrete and Fe415 steel. Use limit state method. **10 M**

- 5 a A rectangular beam has a support section having 285 mm width and 565 mm effective depth. **08 M**
It is reinforced with 4 bars of 16 mm diameter. Near the support section, 2-legged-10 mm diameter stirrups are provided at 160 mm C/C. Determine the shear resistance developed at the support section, using M20 concrete and Fe415 steel. Adopt limit state method.
- b A slab having a clear size of (4.2 m X 5.2 m) is simply supported on all four sides on 300 mm wide wall. Live load is 3 kN/m^2 and floor finish is 1.1 kN/m^2 . The slab is restrained at the corners. Design the slab using limit state method. Carry out the necessary serviceability checks. Draw reinforcement details. **12 M**
- 6 a Design a rectangular column to carry an axial ultimate load of 2450 kN. Unsupported length of the column is 3.2 m. Ends of the column are effectively held in position and also restrained against rotation. Adopt M20 concrete and Fe415 steel. Use limit state method. **08 M**
- b Design a square footing for a short axially loaded column of size (320 mm X 320 mm), carrying 680 kN working load. SBC of soil is 200 kN/m^2 . Adopt M20 concrete and Fe415 steel. Sketch the steel details. Use limit state method. **12 M**
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(3 Hours)

Max Marks=80

Question 1 is compulsory**Attempt any three from remaining****Assume suitable data if required, mention it clearly and draw the diagrams wherever necessary.****Figures to the right indicate full marks.****Attempt sub questions in order.**

- Q.1 Attempt any four**
- Discuss merits and demerits of canal lining. **05**
 - Compare head regulator and cross regulator. **05**
 - Compare low high gravity dam and gravity dam. **05**
 - Sketches detailed cross section of earthen dam showing various components and state the function of turbing and pitching. **05**
 - Calculate the length of spillway for maximum discharge of $2000 \text{ m}^3/\text{sec}$ with a head of 4m. Assume coefficient of discharge $C= 1.9$ **05**
- Q.2**
- Write exhaustive note on comparison of theoretical and practical profile of gravity dam. **05**
 - Sketch and explain Aqueduct. **05**
 - Design the practical profile of a gravity dam from the following data: **10**
 RL of base of dam 1198.5m
 RL of FRL = 1220m
 Specific gravity of masonry = 2.4
 Safe compressive stress of masonry = 1.5 N/mm^2
 Height of waves = 1200mm. Take free board = 1.25m
- Q.3**
- Sketch and explain level crossing cross drainage work.. **05**
 - Design an irrigation channel to carry 50 cumecs of discharge. The channel is to be laid at a slope of 1 in 4000. The critical velocity ratio for the soil is 1.1. Use Kutter's rugosity coefficient as 0.025. **10**
 - Discuss causes and failures of earthen dams and its remedial measures. **05**
- Q.4**
- Compare Kennedy's theory and Lacey's theory. Write drawbacks of Lacey's theory **10**
 - Design an ogee spillway for a concrete gravity dam for the following data(only downstream): **10**
 Average river bed level = 200m
 Spillway crest RL = 300m
 Side slope of downstream = 0.75H:1V, upstream face is vertical
 Design discharge $5000 \text{ m}^3/\text{sec}$
 Spillway length is 8m with clear length of 10m each
 Pier thickness = 2.5m, Assume coefficient of discharge $C= 1.9$

- Q.5**
- a.** What are energy dissipaters? Discuss the various methods used for energy dissipation below spillway **10**
 - b.** Discuss seepage control through embankment and foundations of earth dams in detail **10**

Q.6 Attempt any four

- a.** Discuss advantages and disadvantages of arch dams. **05**
- b.** Write short note on canal losses **05**
- c.** Write short note on radial gate. **05**
- d.** Discuss various types of joints in gravity dams. **05**
- e.** Discuss various type of factors important in selecting the site for dam. **05**
