2018-2019
B.TECH./B.ARCH.(AUTUMN SEMESTER) EXAMINATION
DESIGN OF CONCRETE STRUCTURES - II
(CE - 411)

Max. Marks: 60
Duration: Two Hours

Note: (i) Answer all the questions.
    (ii) Assume suitable data, if not given.
    (iii) Use of IS codes 456, 3370 and IRC loading charts are allowed.

Q.No. | Question | M.M.
--- | --- | ---
1. | Calculate the reinforcement in a three span continuous beam of a typical interior idealized plane frame of a building. The frames are spaced 5.5m apart and in the typical floor 140mm thick continuous slab is cast monolithically with beams. The thickness of floor finish is 40mm. The beam has three equal spans of length 6.1m. The floor is to support imposed load of 5 KN/m² at the service state. The unit weight of the finishing material is 20KN/m². The materials to be used are M-20 grade concrete mix and HYSD steel of grade Fe-415 for moderate exposure conditions. Use bending moment and shear force coefficients for the continuous beam given in IS-456. | (15)

1'(a) | Explain the Redistribution of Moment with suitable example? Also discuss the advantages of Redistribution of Moment. | (03)

1'(b) | Determine the design moments at support and in the mid span region, before and after redistribution of moments of 30%, for a beam AB of span L, carrying a uniformly distributed load, when (i) it is fixed at both ends A and B; (ii) it is fixed at end A and simply supported at B. Draw the bending moment diagrams in each case, and show the points of contra flexures and points of maximum bending moments. | (12)

2. | Design the top ring beam and cylindrical wall of an Intz type water tank of 750,000 litres capacity, supported on an elevated tower comprising of 8 columns. The base of the tank is 16 m above the ground level. Depth of foundation is 1.5 m below the ground level. Adopt M-25 grade concrete and Fe-500 grade TMT steel. The design of the tank should conform to the stresses specified in IS:3370 and IS:456. | (15)

2' | Design the waist slab of a staircase shown in Fig.1. The stairs are simply supported on beams provided at the first riser and at the edge of the upper landing. Assume a finish load of 0.8 KN/m² and a live load of 5.0 KN/m². Use M20 grade concrete and Fe415 grade steel. Assume mild exposure conditions. Take Tread T = 300 mm and Riser R=150 mm. | (15)

3. | Design the deck of a slab culvert (section and steel reinforcement) for a clear span of 4.5 m having a clear roadway of 10 m between the kerbs for I.R.C. Class AA tracked vehicle. Sketch the outlines for IRC Class AA tracked vehicle on the deck. Use M-20 grade concrete and Fe-500 TMT bars. | (15)

Contd...
4(a) Discuss the merits and demerits of prestressed concrete over conventional reinforced concrete.

4(b) In prestressed concrete beam of cross-section 200mm x 300mm and span 6m, an initial prestressing force of 400kN is applied at constant eccentricity of 70mm by tendons of area 400mm$^2$. Assuming $E_s = 2 \times 10^5$ N/mm$^2$; $E_c = 0.333 \times 10^5$ N/mm$^2$; anchor slip = 1.5mm; creep coefficient in concrete $C_c = 2.0$; shrinkage coefficient of concrete = 0.0002 and creep in steel = 3.0%. Find the total percentage loss of prestress in the tendons.

**FIGURES**

![Diagram of the beam](image)

Fig. 1

Note: All dimensions are in mm
B.TECH. (AUTUMN SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
FOUNDATION ENGINEERING
(CE-413)

Maximum Marks: 60
Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

1(a) What are the major differences between Rankine's and Coulomb's theories of lateral earth pressure on retaining wall? Derive relations of depth of tensile crack for c=\phi soil and e-soil.

1(b) A 8.5 m high retaining wall has smooth vertical backside and retains two different layers of cohesionless soils. If an overhead tank having surcharge intensity of 15 kN/m² is constructed at the surface of backfill, then determine the percentage increase in lateral active thrust and position of line of action from top of the retaining wall. The properties of soils in two layers are given below:
(i) I\textsuperscript{st} Layer: Thickness = 4.0 m, \phi = 30° and \gamma = 17 kN/m³
(ii) II\textsuperscript{nd} Layer: Thickness = 4.5 m, \phi = 20° and \gamma = 19 kN/m³

(OR)

1'(b) Determine the safe depth of embedment and total height of cantilever sheet pile wall for depth of excavation of 5.0m in cohesionless soil having unit weight of 18 kN/m³ and angle of shearing resistance of 30°. Neglect the friction between the soil and the surface of sheet pile wall.

2(a) With the help of a neat sketch, explain the “Friction Circle Method” used for analysing the stability of finite slopes.

2(b) Is the slope shown in the Figure 1 is stable? If not, how much above the rock surface will the slip occur?

3(a) Explain the Standard Penetration Test (SPT) method for determining the allowable bearing capacity of soil in the field.

3(b) Define total and differential settlements of foundation and mention their permissible values for isolated, raft and machine foundations resting on sand and clay beds. In a machine foundation system, the machine has a weight of 100 kN, spring constant of 11000 kN/m and damping coefficient of 125 kNs/m.

Determine:
(i) Logarithmic decrement
(ii) Damping factor
(iii) Check whether the vibrating system is over damped, under damped or critically damped

(OR)

3'(a) Briefly describe the general requirements of a foundation for its satisfactory performance.
3(b) Calculate the net ultimate bearing capacity of a rectangular footing 2.5 m × 4 m in plan, founded at a depth of 1.8 m below the ground surface. Natural water table is 0.5 m below the ground surface. The properties of the soil are $\gamma_{sat} = 22.5$ kN/m$^3$, $\gamma = 18$ kN/m$^3$, $c = 15$ kN/m$^2$ and $\phi = 25^\circ$. Use Terzaghi’s theory of local shear failure.

4(a) Write down the various conditions under which pile foundation is provided.

4(b) Determine the allowable pile load capacity of the 400 mm diameter driven concrete pile as shown in Figure 2. Take the value of factor of safety as 2.5.

Table 1: Terzaghi’s Bearing Capacity Factors

<table>
<thead>
<tr>
<th>$\phi$</th>
<th>$N_c$</th>
<th>$N_q$</th>
<th>$N_\gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5.7</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>5</td>
<td>7.3</td>
<td>1.6</td>
<td>0.5</td>
</tr>
<tr>
<td>10</td>
<td>9.6</td>
<td>2.7</td>
<td>1.2</td>
</tr>
<tr>
<td>15</td>
<td>12.9</td>
<td>4.4</td>
<td>2.5</td>
</tr>
<tr>
<td>20</td>
<td>17.7</td>
<td>7.4</td>
<td>5.0</td>
</tr>
<tr>
<td>25</td>
<td>25.1</td>
<td>12.7</td>
<td>9.7</td>
</tr>
<tr>
<td>30</td>
<td>37.2</td>
<td>22.5</td>
<td>19.7</td>
</tr>
<tr>
<td>35</td>
<td>57.8</td>
<td>41.4</td>
<td>42.4</td>
</tr>
<tr>
<td>40</td>
<td>95.7</td>
<td>81.3</td>
<td>100.4</td>
</tr>
<tr>
<td>45</td>
<td>172.3</td>
<td>173.3</td>
<td>297.5</td>
</tr>
<tr>
<td>50</td>
<td>347.5</td>
<td>415.1</td>
<td>1153.2</td>
</tr>
</tbody>
</table>

Table 2. Values of $K$ and $\delta$

<table>
<thead>
<tr>
<th>Pile Material</th>
<th>$\delta$</th>
<th>$K$ (Loose Sand)</th>
<th>$K$ (Dense Sand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>20°</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Concrete</td>
<td>0.75$\phi$</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Timber</td>
<td>0.67$\phi$</td>
<td>1.5</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Figure 1

Figure 2

Figure 3 Values of $N_q$ for driven piles

Figure 4 Adhesion factor for driven piles
2018-19
B. Tech. (VII SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
IRRIGATION ENGINEERING
(CE-415)

Maximum Marks: 60 Credits: 04 Duration: Two Hours

Answer All Questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q. No. Question M.M.

1 (a) Discuss the variation of duty of water with the place of its measurement within the canal system. Calculate the discharge required at the head of canal head regulator if the duty of water at field is 1800 ha/cumec. The total conveyance losses in the canal network are 33%.

1 (b) A distributary canal has a culturable commanded area (CCA) of 2500 acres. The intensity of irrigation for crop A is 40% and for B is 60%, both the crops being rabi crops. Crop A has a base period of 65 days and crop B has a base period of 85 days. Calculate the average discharge in the distributary canal if the depth of water requirements for crop A and crop B are 45 cm and 60 cm respectively. Consider time factor for the canal to be 18/25 and capacity factor as 0.85.

OR

1' (a) Explain the following irrigation efficiencies: (i) water storage efficiency and (ii) water distribution efficiency. The readily available moisture content in the soil for daily consumptive use by crop as well as other need is 16.2 cm. If water application efficiency is 80% and water conveyance efficiency is 75%, calculate the Gross Irrigation Requirement (GIR) for the crop.

1' (b) A loam soil has field capacity of 27% and permanent wilting percentage as 12%. The dry unit weight of soil is 14.72 kN/m³. If the depth of root zone is 0.9 m, determine the storage capacity of the soil. Irrigation water is applied when moisture content drops to 17%. If water application efficiency is 80%, determine the water depth required to be applied to the field.

2 (a) Design a lined canal to carry a discharge of 18 cumec. Assume bed slope as 1 in 4400, N=0.015 and side slopes 1.25:1.
2 (b) Design an irrigation canal using Lacey’s method. The relevant data for the design are given as under:

i) Full supply discharge = 50 cumec
ii) Side slopes = \( \frac{1}{2}(H):1(V) \)
iii) Average size of silt particle = 0.28 mm

OR

2' (a) Discuss merits and demerits of Kennedy’s and Lacey’s silt theories. Also discuss the concept of Initial and final regime. Comment on adverse impact of silting of canal.

2' (b) Design a channel section by Kennedy’s theory for data given below:

i) Discharge = 28 cumec
ii) Kutter’s \( N = 0.0225 \)
iii) Critical velocity ratio = 1.0
iv) Side slopes = \( \frac{1}{2}:1 \)
v) \( B/D \) ratio = 8

3 (a) Explain why the correction is taken as additive for point in the rear or backwater and subtractive for the points forward in the direction of flow in the case of mutual interference of sheet piles. Using Khosla’s method of independent variables following corrected values of percent pressures (\( \phi \)) were obtained for a barrage constructed on a permeable foundation:

<table>
<thead>
<tr>
<th>Pile description</th>
<th>% Pressures (( \phi )) at key points</th>
</tr>
</thead>
<tbody>
<tr>
<td>( u/s )</td>
<td>E</td>
</tr>
<tr>
<td>Intermediate</td>
<td>68</td>
</tr>
<tr>
<td>( d/s )</td>
<td>40</td>
</tr>
</tbody>
</table>

Assuming impervious floor to be horizontal having total span of 72 m with intermediate pile at a distance of 18 m from \( u/s \) sheet pile. For 4 m head of water, draw hydraulic gradient line for the subsoil flow and calculate the thickness of the floor at a distance of 54 m from the \( u/s \) end of the floor.

3 (b) The following hydraulic data pertains to a bridge site of the river.

i) Maximum discharge \( Q = 15,000 \) cumec
ii) Highest flood level HFL = 186 m
iii) River bed level = 191 m
iv) Average diameter of river sand = 0.25 mm

Design the suitable launching apron accompanied by a neat sketch to train the river along proposed bridge structure.

... Continued
3 (c) What is meant by river training? State any three objectives of river training. The meander width ($M_0$) for an alluvial stream is estimated to be 2800 m. calculate the maximum discharge in the river.

4 (a) Design the crest of Sarda fall. The relevant data for the design are given below:

i) Full supply discharge = 9 cumec
ii) Full supply level u.s/d.s = 101.0/100.0m
iii) Full supply depth u.s/d.s = 1.2/1.2m
iv) Bed width of canal = 10 m
v) Side slopes of canal = 1(H):1(V)
vi) Bligh’s coefficient = 8

4 (b) Design contraction transition for an aqueduct with the following data

**Canal Data**
- Discharge = 30 cumec
- Bed width = 20 m
- Depth of water = 1.50 m
- F.S.L. = 251.50 m

**Drain Data**
- High flood discharge = 250 cumecs
- High flood level = 247.50 m
- High flood depth = 2.50 m
2018-19  
B.TECH. EXAMINATION  
CIVIL ENGINEERING  
CONCRETE TECHNOLOGY  
CE - 421

Maximum Marks: 60  
Credits: 04  
Duration: Two Hours

*Answer all the questions.*  
*Assume suitable data if missing.*  
*Notations used have their usual meaning.*

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1(a)</td>
<td>In the absence of any laboratory support, how will you judge the quality of cement, fine aggregate and coarse aggregate? Explain briefly all the possible field tests.</td>
<td>[05]</td>
</tr>
<tr>
<td>Q1'(a)</td>
<td>Discuss in brief various types of tests that are conducted for determining the tensile strength of concrete</td>
<td>[05]</td>
</tr>
<tr>
<td>Q1(b)</td>
<td>What are the various non-destructive tests for assessing the quality of hardened concrete? Explain briefly the principle involved, testing procedure, and the correlation of test results with the strength of concrete for any two methods.</td>
<td>[10]</td>
</tr>
<tr>
<td>Q2(a)</td>
<td>What is Secondary Hydration? Explain it with the help of equation.</td>
<td>[05]</td>
</tr>
<tr>
<td></td>
<td>(a) What is meant by Ready Mix Concrete and what are its benefits?</td>
<td>[05]</td>
</tr>
<tr>
<td></td>
<td>(c) Discuss the causes of Alkali aggregate reaction.</td>
<td>[05]</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2'(a)</td>
<td>Briefly describe Autogenous Shrinkage and Carbonation Shrinkage.</td>
<td>[07]</td>
</tr>
<tr>
<td>(b)</td>
<td>Discuss the steps required to reduce the Alkali Aggregate Reaction.</td>
<td>[08]</td>
</tr>
<tr>
<td>3</td>
<td>What is meant by Durability of Concrete and what are the factors that affects it?</td>
<td>[15]</td>
</tr>
<tr>
<td>4(a)</td>
<td>What are the main categories of lightweight concrete? Discuss any one of them in detail</td>
<td>[08]</td>
</tr>
<tr>
<td>(b)</td>
<td>Explain what is meant by Ferrocement? List the advantages and uses of Ferrocement.</td>
<td>[07]</td>
</tr>
</tbody>
</table>
2018-19
B.TECH.(AUTUMN SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
DAM ENGINEERING
(CE-428)
Maximum Marks: 60
Credits: 04
Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.    Question                                                                 M.M.
1(a)    What are the major forces acting on a gravity dam? Enumerate various studies to be [05]
carried out in the preparation of D.P.R. (detailed project report) for a gravity dam.
1(b)    List various modes of failure of gravity dams. Give step-wise procedure of [10]
calculating height of wave as per T. Savelli approach IS 6512: 1984

OR

1'(b)   Calculate distance of resultant force from heel of a gravity dam profile as shown in [10]
Fig.1 under the influence of following forces.

Weight of dam \( (\gamma_m = 24 \text{ kN/m}^2) \); Water and silt pressure (as per IS 6512: 1984) and
Uplift force (\( C = 0.7 \))

2(a)    Differentiate between low and a high gravity dams. [05]
2(b) What is the significance of elementary profile of a gravity dam? Derive the relations for its base width.

OR

2'(b) Calculate the forces and moments due to horizontal earthquake acceleration \((a = 0.15)\) for the dam section shown in Fig 1.

3(a) Define the buttress dam and suggest its suitability. What are different types of buttress dam?

OR

3'(a) Derive the value of the most economical central angle for arch dam.

3(b) Design and sketch a constant angle arch dam from the data given below.

- Top width of the valley = 200 m
- Bottom width of the valley = 100 m
- Depth of the valley = 110 m
- Minimum top arch thickness = 1.5 m
- Central angle for top arch = 130°
- The permissible compressive of dam material = 500 t/m²

Give your calculations in tabular form.

4(a) Name and any two non rigid dams of India. Draw a neat sketch of an embankment showing its important components.

OR

4'(a) List various causes of earthen dam failures. Discuss in brief hydraulic failures.

4(b) Discuss significance of jump height curve and tail water curve. Give the hydraulic design of a ski-jump bucket for an ogee spillway with the help of given data:

- Design discharge = 7000 Cusec
- Height of spillway crest = 100m
- No. of span = 8
- Length of each span = 10m
- Spillway coefficient = 2.10
- Thickness of pier = 3.0m
- Pier contraction coefficient = 0.02
- Abutment contraction coefficient = 0.10
2018-2019
B.Tech EXAMINATION (Civil Engineering)
Industrial Pollution Control
CE-429

Duration 2 hours
Maximum Marks : 60

Instructions:
 i. Attempt all the questions
 ii. Assume suitable data/value, if not given or missing.
 iii. Notations used have their usual meanings.
 iv. Answer the questions in order of sequence.

Q.No.1a What do you mean by segregation and equalization in context with an ETP? Write steps in the design of equalization tank based on the flow proportion. [05]

Q.No.1b What do you mean by composite and grab sampling? Discuss their significances from planning point of view for an ETP. [05]

Q.No.1c What are the significances of COD and BOD tests? Five samples were collected from different points in an industrial drain. Correspondingly, initial and final DO of each sample was found to be 7.4, 7.5, 7.3, 7.6, 7.2 and 3.1, 3.2, 3.4, 3.6, and 3.3 mg/l respectively. The volume of sample taken in each BOD bottle was 7ml, before diluting it three times. Determine the average BOD in mg/l of this industrial drain. [05]

Or

Q.No.1'c What are the major characterization of effluent from industries like fertilizer, sugar, paper & pulp, iron & steel and tanneries? [05]

Q.No.2a What is DO deficit in the stream? What are the effects of DO deficit in any water stream and discuss your views as to how DO deficit can be controlled. [7.5]

Q.No.2b List technologies each that are based on aerobic and anaerobic principles. Prepare neat sketch showing flow diagrams of any two technological schemes based on aerobic and anaerobic processes. [7.5]

Q.No.3a What are the attached and suspended growth culture system? List some of the wastewater treatment methods based on this classification. [05]

Q.No.3b Design an activated sludge process wastewater treatment plant for a sugar industry using the data as follows:
Flow Rate = 800m3/day
Initial BOD5 = 1250 mg/l
TSS = 900 mg/l
Outlet BOD < 30 mg/l
Outlet TSS < 50 mg/l [10]

Contd....
Your design should include:
  i. Primary Sedimentation  
  ii. Aeration Tank  
  iii. Secondary Clarifier  
  iv. Recirculation Ratio

Q.No.3'b  
Using the above data, design an effluent treatment plant comprising UASB reactor, aeration tank, and sludge drying beds

Q.No.4a  
Describe the principles of sampling and analysis for gaseous pollutants in an industry.

Q.No.4b.  
Identify various outdoor air pollutants and describe potential control measures to reduce them.

Q.No.4c  
A plate type ESP use in a cement plant for the removal of dust particles consist of 12 equal channels. The spacing between the plates is 20cm, height 3m and length 3m. The unit handles 20000m³/h of gas.

  i. What is the efficiency of collection plates?  
  ii. What is the collection rate of particles having density 9.2gm/m³?  
  iii. What should be the length of the plate for achieving efficiency of 99% keeping other parameters same?
2018-19
DEPARTMENT OF CIVIL ENGINEERING
B. TECH VII SEMESTER EXAMINATION
STRUCTURAL ANALYSIS-II
CE-430 (Backlog)

Maximum Marks: 60

Duration: Two Hours

Note: Answer all the questions.
Assume suitable data, if required.
Notations used have their usual meaning.

Q1(a) Evaluate the support moments in the continuous beam shown in Fig.1, using Kani’s [15]
Method.

OR

Q1(a)’ Analyse the frame shown in Fig. 2 using Portal method and determine the following. [15]
i. Bending moment in interior columns EF & FG.
ii. Bending moment and shear force in beams FJ & GK.

Q 2(a) Derive the relationship between Flexibility matrix and Stiffness matrix. [3]

Q2(b) Analyse the portal frame ABCD shown in Fig.3 using Force method. [12]

Q 3(a) Draw the influence line diagrams for the support reactions developed in a propped cantilever beam. [8]

Q 3(b) Define Müller-Breslau principle. Use the Müller-Breslau principle to sketch the [1+6]
influence lines for the vertical reaction at A, the shear just to the left of the roller support at E, and the moment at A in beam given in Fig. 4.

Q 4(a) Determine the maximum positive moment created at point B in the simply supported overhang beam ABC shown in Fig. 5, due to the wheel loads of the crane. [3]

Q 4(b) Draw the influence line diagrams for the forces in members \( L_1U_2, U_2L_3, U_3L_4 \) and \( L_2L_3 \), of a bridge truss given in Fig. 6, when a unit load is moving from \( L_1 \) to \( L_7 \). [12]

OR

Q 4(b)’ Draw the influence line diagrams for horizontal thrust developed at A and B in a three-hinged arch given in Fig. 7. Also, draw influence line diagrams for the internal normal and shear forces, and moment developed at cross-section D. [12]
Fig. 1

Fig. 2

Fig. 3

Fig. 4

contd....
Maximum Marks: 60

Duration: Two Hours

Note: Answer all the questions. Assume suitable data, if required. Notations used have their usual meaning.

Q1(a) Evaluate the support moments in the continuous beam shown in Fig.1, using Kani’s Method.

OR

Q1(a)' Analyse the frame shown in Fig. 2 using Portal method and determine the following.
   i. Bending moment in interior columns EF & FG.
   ii. Bending moment and shear force in beams FJ & GK.

Q 2(a) Derive the relationship between Flexibility matrix and Stiffness matrix.

Q2(b) Analyse the portal frame ABCD shown in Fig.3 using Force method.

Q 3(a) Draw the influence line diagrams for the support reactions developed in a propped cantilever beam.

Q 3(b) Define Müller-Breslau principle. Use the Müller-Breslau principle to sketch the influence lines for the vertical reaction at A, the shear just to the left of the roller support at E, and the moment at A in beam given in Fig. 4.

Q 4(a) Determine the maximum positive moment created at point B in the simply supported overhang beam ABC shown in Fig. 5, due to the wheel loads of the crane.

Q 4(b) Draw the influence line diagrams for the forces in members $L_1U_2$, $U_2L_3$, $U_3L_4$ and $L_2L_3$, of a bridge truss given in Fig. 6, when a unit load is moving from $L_1$ to $L_7$.

OR

Q 4(b)' Draw the influence line diagrams for horizontal thrust developed at A and B in a three-hinged arch given in Fig. 7. Also, draw influence line diagrams for the internal normal and shear forces, and moment developed at cross-section D.
Fig. 5

Fig. 6

Fig. 7
2018-19
B.TECH. VII SEMESTER (CIVIL ENGINEERING) EXAMINATION
CE 437 PRESTRESSED CONCRETE

Maximum Marks: 60 Credits: 04 Duration: Two Hours

Note:
1. Answer all the questions.
2. Assume suitable data if missing.
3. Notations used have their usual meaning.
4. Use of IS: 1343 (2012) is permissible.

Q.No. Question M.M.
1. (a) Discuss the load balancing concept for a simply supported prestressed concrete beam subjected to uniformly distributed load over the entire span. [03]
1. (b) A beam of 200 mm × 450 mm is prestressed by a force of 400 kN by steel cables located at an eccentricity of 150 mm. Determine the percentage loss of prestress due to creep of concrete for the following data:
Concrete grade = 45 MPa; Prestressing cable = 7 numbers of 7 mm diameter; creep coefficient = 2. [05]
1. (c) A prestressed concrete beam of 200 mm × 450 mm subjected to live load of 5 kN/m over a simple span of 10 m. The beam has parabolic cable having an eccentricity of 150 mm at the mid-span and zero at the ends. Determine the force of prestress, if the net resultant stress at the bottom fibre at mid-span is zero due to dead load, live load and prestress force. [07]

2. (a) Determine the flexural strength of a post-tensioned bonded beam of 300 mm × 600 mm is prestressed with 20 numbers of 9 mm diameter high tensile steel wires located at 150 mm eccentricity. Use M45 concrete and 1600 MPa characteristics strength of prestressing steel. [05]
2. (b) A box section girder has an overall depth of 1100 mm and breath of 600 mm. The walls are 150 mm thick on all the four sides. It is pre-tensioned with 12 numbers of 9 mm diameter prestressing wires at an effective cover of 100 mm from the bottom edge. Determine its moment of resistance, use M45 grade of concrete and 1500 MPa characteristics strength of prestressing steel. [10]

OR

2'. (b) Determine the preliminary cross section dimensions of a post-tensioned bonded beam of rectangular section subjected to a moment of 900 kNm. Use M45 grade of concrete and 1600 MPa characteristics strength of prestressing steel. [10]

3. (a) Define the following:
(i) Effect of stress corrosion in post-tensioned prestressed concrete beam. [05]
(ii) Factors influencing the transmission length in pre-tensioned prestressed concrete...
3. (b) A section of prestressed concrete beam 200 mm × 450 mm carries a factored shear force of 175 kN and factored moment of 45 kNm. The effective prestress after all losses is 900 MPa. Compressive stress at centroidal axis due to prestress is 6.5 MPa. Design suitable shear reinforcement by using the following data:
Grade of concrete = M40; characteristics strength of prestressing steel = 1600 MPa; area of prestressing steel = 150 mm²; cover to the steel wires = 75 mm.

OR

3'. (b) The end block of a post-tensioned beam 300-400 mm has 125 mm square bearing plate subjected to 1600 kN force. Design the transverse reinforcement to contain the bursting force. Use Fe415 grade of steel. Also show the reinforcement in end zone.

4. (a) Derive an expression for the area of concrete section and the factor of safety of a pre-stressed concrete ring beam subjected to water pressure.

4. (b) Design a prestressed concrete column subjected to 1000 kN load acting at 20 mm eccentricity with the column axis. Also determine the factor of safety. Use M50 grade of concrete and 1600 MPa characteristics strength of prestressing steel.
Maximum Marks: 60
Duration: Two Hours

Note: Answer all the questions.
Assume suitable data, if required.
Notations used have their usual meanings.
Use of IS 1893 and IS 875(Part-3) are allowed.

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>What evidence did Wegener gave in favour of his theory?</td>
<td>02</td>
</tr>
<tr>
<td>1(b)</td>
<td>What is the necessity of tripartite plot in earthquake engineering?</td>
<td>02</td>
</tr>
<tr>
<td>1(c)</td>
<td>Describe the procedure of determining the focus of an earthquake.</td>
<td>03</td>
</tr>
<tr>
<td>1(d)</td>
<td>What do you mean by intensity of an earthquake? How it is measured? How intensity is correlated with peak ground velocity and peak ground acceleration?</td>
<td>08</td>
</tr>
</tbody>
</table>

**OR**

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1' (a)</td>
<td>Why earthquake epicentres are not uniformly distributed around the globe?</td>
<td>02</td>
</tr>
<tr>
<td>1' (b)</td>
<td>Define response spectrum. Write its uses.</td>
<td>02</td>
</tr>
<tr>
<td>1' (c)</td>
<td>Calculate the moment magnitude of an earthquake with the rupture area dimensions of length 35km, width 15km and slip 1 meter. Assume modulus of rigidity, ( \mu = 3.5 \times 10^{10} \text{N/m}^2 )</td>
<td>03</td>
</tr>
<tr>
<td>1' (d)</td>
<td>Name various types of plate boundaries. Discuss any two of them with suitable sketches</td>
<td>08</td>
</tr>
</tbody>
</table>

2(a)  In an experiment on a certain structure modelled as an SDOF system, the amplitude of free vibration decreases from 10 mm to 4 mm. If the logarithmic decrement was 0.1018 and undamped natural frequency is 40 rad/sec., determine the damping ratio, damped frequency and number of cycles completed.

2(b)  Derive the equation of motion of a single degree of freedom system under free vibration with damping. Also derive the expression for its amplitude.
3(a) Discuss the causes of failure of the RC structures under past Earthquakes.

OR

3'(a) Discuss and sketch the ductile detaining of reinforcement in Beam, Beam-column Joint and Footing as per IS 13920.

3(b) The plan and elevation of a three storey RCC hospital building is shown in figure below. The building is located in seismic zone IV. The type of soil encountered is Rocky and it is proposed to design the building with a special moment resisting frame. The intensity of dead load is 15.0 kN/m² and floors are to cater to an imposed load 4.0 kN/m². Determine the seismic forces at different floor levels.

4(a) Describe the various Earthquake resistant features that can be introduced in a masonry building to make it Earthquake resistant.

OR

4'(a) Define bands with neat sketches. At what levels in a masonry building would you provide them? Give justifications for each of them.

4(b) A multi-storeyed building shown in figure below having 20m x 30m plan dimensions and an overall height of 30m is to be designed at Agra in developed out-skirt area with scattered buildings of its height. Determine the design wind pressures acting on the building and draw the pressure diagram.