Q1. Design a continuous reinforced concrete beam of rectangular section to support a dead load of 10kN/m and a service live load of 15 kN/m over three simply supported spans of 8m each. 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.

OR

Q1'(a). 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.

Q1'(b). The plan and elevation of a three storey RCC school building is shown in Fig.1(a-b). The building is located in seismic zone V. The type of soil encountered is medium stiff and it is proposed to design the building with a special moment resisting frame. The intensity of dead load is 10.0 kN/m² and floors are to cater to an imposed load 3.0 kN/m². Calculate the design seismic load at the top story level.

Q2. Design the top ring beam and cylindrical wall of an Intz type water tank of 1 million 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-415 grade tor steel. The design of the tank should conform to the stresses specified in IS:3370 and IS:456.

OR

Contd......2...
Q2'. Design the long wall of a rectangular water tank of capacity 70,000 litres. The tank rests on firm ground. Use M-25 grade concrete and Fe-415 grade steel. The design of the tank should conform to the stresses specified in IS:3370 and IS:456. (12)

Q3. Design a slab culvert (section and steel reinforcement) for a clear span of 5m having a clear roadway of 10 m between kerbs for I.R.C. Class AA single wheeled vehicle. Use M-20 grade concrete and Fe-415 grade steel. (12)

Q4 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. (12)

Q5. Design a waist slab type of a dog-legged staircase for an office building for the following data: (12)

Height between the floor = 3.2 m
Tread $T = 270$ mm
Riser $R = 160$ mm
Width of flight = landing width = 1.25 m
Live load = 5.0 kN/m$^2$
Finished load = 0.6 kN/m$^2$

Assume the stairs to be supported on 230 mm thick masonry walls at the outer edges of the landing, parallel to the risers. Use M20 grade concrete and Fe415 grade steel.

OR

Q5'. Design the vertical stem of a T-shaped retaining wall for a height of 3 m above the ground level. The top of the earth retained is surcharged at an angle of 10° with the horizontal. The angle of repose of earth is 29° and its density is 17kN/m$^3$. The safe bearing pressure is 100 kN/m$^2$. Use M-20 grade concrete and Fe- 500 grade TMT bars. (12)
Fig 1(a): Plan  Fig 1(b): Elevation
1(a) Differentiate between Rankine’s and Coulomb’s theory of earth pressure? Derive expressions for the critical height of unsupported vertical cut for pure clay, dry sand and c=φ soil.

1(b) Explain Rosal and Bell theory of earth pressure. Determine the magnitude and point of application of resultant lateral earth pressure acting on the vertical face of a retaining wall of height 8.5 m when wall is moving away from the backfill. Use the following data:

(i) Surcharge over layer I: Uniform surcharge intensity, q = 16 kN/m²
(ii) Layer I: Thickness = 5.0 m, c = 30 kN/m², φ = 18° and γ = 19 kN/m³
(iii) Layer II: Thickness = 3.5 m, c = 0.0 kN/m², φ = 32° and γ = 17 kN/m³

OR

1(a) The pressure surface of the retaining wall is inclined with vertical at an angle of 12°. The backfill is non-cohesive soil with unit weight of 19 kN/m³ and angle of internal friction of 33°. The angle of inclination of ground level is 10°, the angle of wall friction is estimated to be 20° and the vertical height of the wall is 10 m. Using Rebhann’s graphical construction method, compute the maximum active thrust on the wall and find the position of critical slip plane.

1(b) Differentiate between cantilever and anchored sheet pile walls. Find out horizontal earth pressures on both sides of anchored pile, tension in tie rod and safe depth of embedment (Fig. 1).

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

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

3(a) Discuss the limitations of the plate load test method. What is standard penetration resistance value ‘N’? Explain the various corrections to SPT-N value for saturated fines and over burden pressure?

3(b) Determine the allowable gross load and the net allowable load for a circular footing of 2.5 m diameter and with a depth of foundation of 1 m. Use Terzaghi’s theory and assume local shear failure. The values of bearing capacity factors are Nq′ = 25.2, Nq = 12.6 and Nγ = 10.1. Take a factor of safety of 2. The soil at the site has γ = 18 kN/m³, c′ = 15 kN/m² and φ′ = 25°.
4(a) Write down the conditions under which pile foundation is provided. [3]
4(b) Write a short note on group action of piles. [3]
4(c) A pile group of 25 piles has to be proportioned in a uniform pattern in soft clay with equal spacing in all directions. Assuming the value of $c_u$ to be constant throughout the depth of the piles, determine the optimum value of spacing of piles in the group. Assume $\alpha = 0.6$. Neglect end bearing effect, and assume the piles to be circular.

OR

4(a) With the help of a neat sketch, describe how the skin resistance and base resistance are separated for any particular pile settlement during the pile load test. [4]
4(b) Determine the allowable pile load carrying capacity of a 300 mm diameter driven concrete pile as shown in the Figure 3. Take the value of factor of safety as 2.5. [8]

5(a) Briefly explain Barkan's method of machine foundation design. How would you determine the natural frequency, damping coefficient and dynamic magnification factor of a machine foundation soil system? [5]
5(b) What do you understand by vibration isolation technique? The equation of motion in SI units for a machine foundation-soil system is given

$$(5.5 \times 10^3) \frac{d^2 z}{dt^2} + (1.8 \times 10^5) \frac{dz}{dt} + (1.1 \times 10^7) z = 0$$

Determine:

(i) Undamped and damped natural frequency
(ii) Logarithmic decrement
(iii) Whether the system is under damped, over damped or critically damped
(iv) Number of cycles elapsed for 75% reduction in amplitude.
Fig. 1

Fig. 2

Fig. 3

Table: Values of $K$ and $\delta$

<table>
<thead>
<tr>
<th>Pile Material</th>
<th>$\delta$</th>
<th>Value of $K$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Loose Sand</td>
</tr>
<tr>
<td>Steel</td>
<td>20</td>
<td>0.5</td>
</tr>
<tr>
<td>Concrete</td>
<td>0.75</td>
<td>1.0</td>
</tr>
<tr>
<td>Timber</td>
<td>0.67</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Values of $N_q$ for driven piles
(IS: 2911 Part I-1979)
2015-16  
B.TECH. EXAMINATION  
CIVIL ENGINEERING  
CONCRETE TECHNOLOGY  
CE - 421  

Maximum Marks: 60  
Credits: 04  
Duration: Three 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>1(a)</td>
<td>Compare the contributions of C₃S and C₅S to the early strength of concrete.</td>
<td>[06]</td>
</tr>
<tr>
<td>1(b)</td>
<td>What is meant by Ready Mix Concrete and what are its benefits?</td>
<td>[06]</td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td>1: With the help of a neat sketch discuss the various stages required for the manufacture of Portland Cement.</td>
<td>[12]</td>
</tr>
<tr>
<td>2(a)</td>
<td>Briefly describe Autogenous Shrinkage and Carbonation Shrinkage.</td>
<td>[06]</td>
</tr>
<tr>
<td>2(b)</td>
<td>Discuss the effect of temperature on the strength of concrete.</td>
<td>[06]</td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td>2: What do you understand by workability of concrete? Discuss in detail factors affecting the workability of concrete.</td>
<td>[12]</td>
</tr>
<tr>
<td>3(a)</td>
<td>What is meant by Durability of Concrete and what are the causes that affects it?</td>
<td>[06]</td>
</tr>
<tr>
<td>3(b)</td>
<td>Discuss the mechanism of acid attack on concrete.</td>
<td>[06]</td>
</tr>
<tr>
<td>4.</td>
<td>In the absence of any Laboratory Support how will you judge the qualities of cement, sand, and coarse aggregate? Explain briefly all the possible field tests.</td>
<td>[12]</td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td>4: What are the various Non-Destructive Tests for assessing the quality of hardened concrete? Explain briefly the principle involved, method of tests and the tests result correlation with the strength of the concrete.</td>
<td>[12]</td>
</tr>
<tr>
<td>5(a)</td>
<td>What are the main categories of lightweight concrete? Discuss any one of them in detail.</td>
<td>[06]</td>
</tr>
</tbody>
</table>
| 5(b)  | Write short notes on any two of the following:  
(a) Self Compacting Concrete  
(b) Concrete for Radiation Shielding  
(c) Pre-Placed Aggregate Concrete | [06] |
Answer all the questions. Assume suitable data if missing. Notations used have their usual meaning.

1(a) What do you understand by traffic demand modeling? Briefly describe the sequence and functions of all four stages. [8]

1(b) Explain Regression method for Trip Generation

The following data of trip generation versus the household size is extracted from a survey of a traffic zone. Assuming that the trip generation rate is dependent on the household size, develop a model to compute trip rate based on household size.

<table>
<thead>
<tr>
<th>Household Size (x)</th>
<th>Trips generated per day (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

2(a) Explain the various physical characteristics of road users. [7]

2(b) Describe the various engineering, enforcement and educational measures to reduce accident rates. [8]

OR

2'(a) Define delay and enlist the various types of delays. Also write the various uses of carrying out travel time and delay studies. [5]

2'(b) Vehicle A is approaching from west and vehicle B from south. After collision, vehicle A skids 60° north of east and vehicle B skids 40° south of east. Skid distance before collision for A is 16 m and B is 25 m. The skid distances after collision are 28 m and 14 m respectively. Weight of A and B is 4600 and 5800 kN respectively. Skid resistance of pavement is 0.55. Determine the pre-collision speeds. [10]

3(a) With the help of neat sketches, describe channelized and un-channelized intersections. [5]

3(b) Figure 1 shows the traffic in terms of PCU at a rotary intersection. If the average entry width of rotary = 10 m, width of rotary carriageway = 13.5 m and weaving length = 54 m, then find out the traffic capacity of the intersection. Support your answer with a neat sketch. [10]

4(a) Define the concept of Phase in traffic signal design. Explain the factors that influence the choice and number of phases for an intersection. [8]

In a signal design project for a four-legged intersection, draw three potential options of four-phase signal system and mention the traffic condition in which each option is suitable.

Contd.....2.
4(b) The signal cycle time of an intersection is given as 80 seconds, the green time for a phase is 40 seconds, and the corresponding yellow time is 4 seconds. If the saturation headway is 2.4 seconds per vehicle, the start-up lost time is 2 seconds per phase, and the clearance lost time is 1 second per phase. Find the lane capacity of the movement.

OR

4'(a) Explain any FOUR of the following terms:

i) Startup Lost Time  
ii) Effective Green Time

iii) Clearance Interval  
iv) Lane Capacity

v) Saturation Headway  
vi) Critical Lane

4'(b) Explain with examples the different types of traffic signs. Write the classification of regulatory signs and draw the shape and color scheme of three important regulatory signs.

Figure 1
Maximum Marks: 60
Credits: 04
Duration: Three Hours

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

Q.No. Question M.M.
1(a) Discuss the role of dams in the development of our country? Discuss merits of gravity dams. [05]
1(b) Enumerate various forces acting on a gravity dam. Discuss Molitor model for wave pressure. [10]

OR

1(b) Design zone 1st, IIInd and I st block of zone IIIrd of a 55m high concrete dam by the method of zoning. Take unit weight of dam material as 24 kN/m³, coefficient of uplift pressure as 0.75, fetch of reservoir 15km and wind speed 88 km/h. [10]

2(a) Differentiate between low and a high gravity dams. [05]
2(b) (i) Write short note on galleries in dam. [04]
(ii) Calculate the forces and moments due to horizontal earth quake acceleration \( (\alpha = 0.12) \) for the dam section shown in Fig 1. [06]

OR

2(b) Derive the expressions for base width, normal, principal and shear stresses in an elementary profile of a gravity dam. [10]

3(a) Design a 110 m high constant radius arch dam by thin cylinder theory for a valley 50 m wide at the base and 250 m wide at a height of 110 m. The permissible compressive stress, \( f_c = 500 \text{t/m}^2 \). [10]

3(b) What is a the buttress dam? Suggest its suitability. Draw cross-section of a buttress [05]

Contd.....2.
3'(b) Show that the optimal central angle for an arch dam on the basis of thin cylinder theory is $133^\circ 34'$.

4(a) Draw the neat sketch of a zoned embankment resting on a shallow pervious strata. Briefly explain the function of each component.

4(b) What do you mean by Rolled fill and hydraulic fill type of embankment construction.

OR

4'(b) Discuss the causes of seepage failure of an earthen dam.

---

Fig. 1

[Note: All dimensions are in meter]
Q.No.1a Write general steps involved in conducting an industrial survey with respect to the development of an environmental management plan including setting-up of an effluent treatment facility.

Q.No.1b What are the major categories of industrial pollution? Briefly explain the importance from environment point of view to address these categories of pollution.

Q.No.1c During the field investigation, the boron concentration of an upstream water stream and effluent was found to be 0.0672 and 7.82 mg/l respectively. A nearby power plant pumps 45883 litres per minute from this stream, having a flow of 38960 m3/hr. The discharge of the plant's ash pond is 365 m3/hr. Compute the boron concentration in the stream after completely mixing.

OR

Q.No.1c Write the basic chemical equations of transformation of organic matter decomposition under aerobic and anaerobic processes.

Q.No.2a Dissolved oxygen (DO) and water temperature are the most commonly used in-situ monitored parameters for water quality of the rivers, ponds, oceans etc. The DO in water has an important impact on aquatic life of the water body. Excessive growth of algae can provide very high concentration of DO. On the other hand, DO depletion due to discharge of organic waste may kill the aquatic animals like fish. Factors affecting DO in water is given in diagram.
What do you infer from the above diagram?

Q.No.2b  What do you mean by the coagulation and flocculation processes for wastewater treatment? Briefly explain the procedure of a test which is conducted in a lab to find out the optimum dose of a coagulant?

Q.No.2c  What do you mean by segregation and equalization of wastes? Discuss the methodology to deal with the segregated stream in a leather industry.

Q.No.3a  Neatly prepare flow diagrams of wastewater treatment plants from inlet to final point based on any aerobic and anaerobic processes separately and explain the function of each unit in brief.

Q.No.3b  Find out the volume of an equalization tank required to equalize the flow variation for an effluent treatment plant with the help of the following data. Also determine the actual residence time required for the equalization tank.

<table>
<thead>
<tr>
<th>Time, Litres/Min</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>227</td>
<td>340</td>
<td>945</td>
<td>1229</td>
<td>1119</td>
<td>567</td>
<td>359</td>
<td>473</td>
<td>340</td>
<td>624</td>
<td>926</td>
<td>1172</td>
<td>1550</td>
<td>839</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>11</td>
<td>12</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>5</td>
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<td>7</td>
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<td></td>
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<tr>
<td>340</td>
<td>265</td>
<td>392</td>
<td>246</td>
<td>170</td>
<td>318</td>
<td>325</td>
<td>208</td>
<td>231</td>
<td>159</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q.No.4a  Sulphur dioxide is emitted at a rate of 150 g/s from a stack with an effective height of 55.5 m. The wind speed at stack height is 5 m/s and the atmospheric stability class is D for the overcast day. Determine the ground level and crosswind concentrations along the centre line at a distance of 525 m from the stack and 50 m respectively in micrograms per cubic meter. ($\alpha_y = 36 m$, $\alpha_z = 18.5 m$)

Contd.....3.
Q.No.4b In a steel manufacturing plant, two furnace discharges into one stack, which is 115 m high. Each furnace stack having dia of 1.45 m is fired with coal at the rate of 230 tons every 24 hrs. The combustion air is supplied at the rate of 4.53 kg for each kg of coal. The gases exit from the stack with a velocity of 609 cm/sec at 127°C. The atm. temperature is 16°C. The wind velocity is 10 miles/hr. Calculate plume rise in meters. (1 Barometric pressure = 1000 mbar)

OR

Q.No.4'b Show with the help of an example the reaction of primary pollutants with secondary air pollutants and its impact on the environment. Also explain different behaviors of plumes in the atmosphere.

Q.No.5 Write notes on any industry of your choice discussing any four of the following:
   a. Manufacturing operations
   b. Sources of Pollution
   c. Treatment method and units
   d. Standards and Disposal
   e. Resource Recovery / Reuse of Treated Effluent (if any)
   f. Also prepare its sketch (flow diagram).

Q.No. 6a What do you mean by Adsorption? Explain the models and their limitations that are used in the design of Adsorption process?

Q.No.6b Given the following data for the adsorption of Phenolic compound on GAC:

<table>
<thead>
<tr>
<th>Carbon dose mg/l</th>
<th>Effluent mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>9.94</td>
</tr>
<tr>
<td>11.2</td>
<td>5.3</td>
</tr>
<tr>
<td>22.3</td>
<td>3.0</td>
</tr>
<tr>
<td>56.1</td>
<td>0.71</td>
</tr>
<tr>
<td>168.3</td>
<td>0.17</td>
</tr>
<tr>
<td>224.4</td>
<td>0.06</td>
</tr>
</tbody>
</table>

i. What is the adsorption capacity at an initial concentration of 10 mg/l?
ii. What is the carbon dose required to reduce the concentration from 1 to 0.01 mg/l?
1. Analyze the frame shown in Fig. 1 using Kani's method. The variation in the geometrical moment of inertia is shown in figure; $E$ is same for all the members.

![Fig. 1](image)

1' Analyze the continuous beam shown in Fig. 2 using Kani's method. Also draw the BMD for the beam.

![Fig. 2](image)

2. Use flexibility method to analyse the frame shown in Fig. 3. Flexural rigidity, $EI$, of the members is constant throughout.
3. Use Stiffness method to analyse the frame shown in Fig. 4. Flexural rigidity, $EI$, of the members is constant throughout. Also draw BMD.

4 (a) A beam ACB $7 \, m$ long is fixed at A and simply supported at B. The beam is provided with an internal hinge at C, $4 \, m$ from A. Draw the influence line diagram for

(i) Vertical reaction at A
(ii) Vertical reaction at B
(iii) Bending moment at A
(iv) Bending moment at D, the middle point of AC

4 (b) A girder $24 \, m$ long has supports $20 \, m$ apart with an overhang of $1 \, m$ over the left support and $3 \, m$ over the right support. Find the maximum positive and negative bending moment at a section $8 \, m$ from the left support due to a live load of $20 \, kN/m$. 

OR

Contd.....3.
4. For the continuous beam shown in Fig. 5, draw I.L. Diagram for (i) vertical reaction at A, (ii) vertical reaction at B, (iii) bending moment at B, (iv) shear force at G and (v) bending moment at G.

```

Hinge

A  Δ  E  Δ  B  C  Δ  F  Δ  D

3 m  2 m  2 m 4 m  2 m  3 m
```

Fig. 5

5. A Pratt truss with parallel top and bottom chords, having a hinge supported at left end and roller support at right end has 6 panels of 5m length each and is of 5m height. Draw IL - Diagrams for the forces in the members connected at the second joint of the top chord from the extreme left joint and calculate maximum forces in the members by using these diagrams due to the dead load of 20kN/m covering the entire span and a moving load of 30kN/m longer than span passing over the truss from one end to another.

OR

5'. A suspension bridge cable hangs between two points A and B separated horizontally by 250m and with B 40m above A. The lowest point in the cable is 10m below A. The cable supports a stiffening girder, weighing 2kN/m run which is hinged vertically below A, B and the lowest point of the cable. Find the position and the magnitude of the largest bending moment, which a single point load of 300kN can induce in the girder together with the position of the load. Also calculate the maximum tension in the cable which will develop due to this load.
B.TECH. (AUTUMN SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
ADVANCED HIGHWAY ENGINEERING
(CE-433)

Maximum Marks: 60  Credits: 04  Duration: Three Hours

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

Q.No.  Questions  M.M.

1(a)  Explain the various wheel load factors for the design of highway pavement. Discuss the advantages and limitations of CBR method for design of flexible pavement.  06

1(b)  What are the modified Westergaard's concepts and assumptions for design of highway pavement? Calculate the stresses at interior, edge and corner of a cement concrete pavement by modified Westergaard's stress equations

Modulus of elasticity of concrete = 3.0 \times 10^5 \text{ kg/cm}^2

Poisson's ratio of concrete = 0.15

Thickness of concrete = 18 \text{ cm}

Modulus of subgrade reaction = 8.5 \text{ kg/cm}^2

Wheel load = 5100 \text{ kg}

Radius of loaded area = 15 \text{ cm}

OR

1'(a)  Discuss California resistance value method and McLeod method for design of highway pavements  06

1'(b)  Explain any three of the following:

(i) Stabilometer Method  (ii) Design of dowel and tie bar  (iii) Burmister's method
(iv) Equivalent single wheel load method

2(a)  Write short notes on any three of the following:

(a) Resisting length  (b) Hair pin bend  (c) Precipice work  (d) Scupper
(e) Prevention of land slide

2(b)  Explain why design, construction and maintenance of hill roads need special considerations. Design all geometric elements of horizontal and vertical alignment of a hill road for a design speed of 50 kmph at

(a) horizontal curve of minimum radius 90 m

(b) vertical summit and valley curves formed due to change in gradient equal to 9%

Contd.....2.
3(a) What are the methods of achieving good highway drainage? Specify the design approach for surface drainage system of a highway.

3(b) Discuss how the problem of road construction in water logged areas may be solved. Explain how the surface water is collected and disposed off in rural and urban roads (OR)

3'(b) The maximum quantity of water expected in one of the open longitudinal drains on clayey soil is 0.9 m³/sec. Design the cross section and longitudinal slope of trapezoidal drain, assuming the bottom width of the trapezoidal section to be 1.0 m and cross slope to be 1.0 vertical to 1.5 horizontal. The allowable velocity of flow in the drain is 1.2 m/sec and Manning's roughness coefficient is 0.02.

4(a) What are the various types of failure in flexible and cement concrete pavements? Show the general pattern of failure of pavements of alligator cracking, reflection cracking, mud pumping and frost cracking.

4(b) Discuss briefly why highway maintenance is needed. Explain how the maintenance of the bituminous surfaces and cement concrete pavements are carried out.

OR

4'(b) What is the current practice for periodic renewal of surfaces of National Highway? Explain the principle and uses of Benkelman Beam test.
Maximum Marks: 60  
Credits: 04  
Duration: Three Hours

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

1(a) What is an earthquake? Discuss body waves and surface waves with sketches. Explain main characteristics of seismic waves. [04]

1(b) How the epicentre of an earthquake is located? Discuss briefly the need of seismic zoning. How moment magnitude a better measure of earthquake size than other magnitude? [04]

1(c) Find the natural period for the system shown below assume that the beam and spring are mass less. Take L=1m, EI= unity and K=48units

\[
\text{Diagram:}
\begin{array}{c}
\text{L, EI} \\
\text{L, EI} \\
\text{K=48units} \\
\text{L/2, L/2}
\end{array}
\]

OR

1'(a) Derive the relation for response of a single degree damped free vibration system. [04]

1'(b) An empty elevated water tank is pulled by a steel cable by applying a 30kN force. The tank is pulled horizontally by 10cm. The cable is suddenly cut and the resulting free vibration is recorded. At the end of five complete cycles, the time is 3.0seconds and the amplitude is 3cm. Determine the damping ratio, natural period of undamped free vibration, effective stiffness, effective weight and damping coefficient for the given data. [04]

1'(c) The properties mass m, stiffness K and natural frequency $\omega_n$ of an undamped SDOF system are to be determined by a harmonic excitation test. At an excitation frequency 4Hz, the response tends to increase without bound (resonance occurs). Then a weight W of 22N is attached to the mass m, the resonance occurs at 3Hz. Determine the dynamic properties of the system. [04]

2  Answer any three of the followings:
(a) Find out storey lateral force in a three storey RCC school building situated in seismic zone V as shown below using equivalent lateral force procedure as per IS 1893:2002. Zone Factor=0.36; Importance Factor=1.5; Response

Contd......2
(b) A building should exhibit ductile behaviour in earthquake prone regions. Give the measures and provisions as per IS1893:2002 to make a building resistant in earthquake prone regions.

(c) Describe the advantages of using concrete over brick masonry for buildings in seismic areas. What are the possible damages to RC building in earthquake prone areas?

(d) Answer the following:

(i) Different Terrain Category, (ii) Design wind force for individual panel and (iii) Design wind speed at 80m height above ground level in terrain category IV where basic wind speed at reference height is 50m/s

(e) Discuss with the help of sketches, the Do’s and Don’ts, in cyclone prone areas for disaster mitigation.

3 Give a short account of disaster management concept. Discuss the roles of the organisations involved in the disaster management in India? [09]

4 Give a detailed classification of landslides. Discuss various aspects of landslide mitigation techniques and management. [09]

5(a) Write notes on any two of the followings:

(i) Methods for raising the levee height in emergencies
(ii) Location of levee (iii) Flood walls (iv) Flood bypass

5(b) Five alternative flood projects are under construction. The estimated annual benefits and cost of the projects are tabulated below. Which of these projects would you select? Give reasons also. [08]

<table>
<thead>
<tr>
<th>Project</th>
<th>Annual benefits ($)</th>
<th>Annual cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1,50,000</td>
<td>1,28,104</td>
</tr>
<tr>
<td>II</td>
<td>2,10,000</td>
<td>1,56,048</td>
</tr>
<tr>
<td>III</td>
<td>2,75,000</td>
<td>2,08,064</td>
</tr>
<tr>
<td>IV</td>
<td>3,00,000</td>
<td>2,84,152</td>
</tr>
<tr>
<td>V</td>
<td>3,40,000</td>
<td>3,36,158</td>
</tr>
</tbody>
</table>
2015-2016
B.TECH. (AUTUMN SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
ELEMENTS OF EARTHQUAKE AND WIND ENGINEERING
(CE-445N)

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Note: (i) Answer all the questions.
(ii) Assume suitable data, if not given.
(iii) IS 875(Part-III) and IS 1893 are allowed.

Q1(a) What is the Mohorovicic discontinuity?

Q1(b) What evidence did Wegener gave in favour of his theory?

Q1(c) Why are earthquake epicenters not uniformly distributed around the globe?

Q1(d) Name different types of Faults.

Q1(e) Define Ritcher scale of magnitude of earthquake.

2(a). Derive differential equation of motion for a two degree damped system shown in figure below. Also find the natural frequencies and mode shapes assuming undamped free vibration system and assuming \( m_1 = m_2 = m \) and \( k_1 = k_2 = k_3 = k \).

Q2(b) Find the damped natural frequency, frequency ratio, steady state response amplitude of a single-degree-of-freedom system with \( m = 10 \) kg, \( c = 20 \) N-s/m, \( k = 4000 \) N/m, when an external force \( F(t) = F_0 \cos(\omega t) \) acts on the system with \( F_0 = 100 \) N and \( \omega = 10 \) rad/sec.

OR

Contd…..2.
2. Find Natural Frequencies and Mode Shapes for the three storeys shear frame placed below. If \( a_0 = 0.918 \) and \( a_1 = 0.0021 \) and damping ratio in first and third mode is 5%, what will be damping in second mode.

\[
\text{(20)}
\]

Q3(a) Define bands with neat sketches. At what levels in a masonry building would you provide them? Give justifications for each of them.

\[
\text{(8)}
\]

Q3(b) Discuss the causes of failure of the RC structures under past Earthquakes.

\[
\text{(7)}
\]

Q4(a) Sketch the ductile detaining of reinforcement in Beam-column Joint and Footing as per IS 13920.

\[
\text{(5)}
\]

Q4(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 medium stiff and it is proposed to design the building with a special moment resisting frame. The intensity of dead load is 15.0 kN/m^2 and floors are to cater to an imposed load 3.0 kN/m^2. Determine the seismic forces at different floor levels.

\[
\text{(10)}
\]
Q4(a) Describe the various Earthquake resistant features that can be introduced in a masonry building to make it Earthquake resistant.

Q4(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.