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.

Q1'(a). Obtain the maximum elastic moment diagram (BM envelop) for ultimate limit state before redistribution of moments, and design moment envelop after 30% redistribution of moments for a two span continuous beam ABC, 8m-long, freely supported at A and C, and continuous over the central support B, 4m from A. The beam carries dead load (inclusive of self weight) of 20 kN/m and a uniformly distributed live load of 28 kN/m.

Q1'(b). A special reinforced concrete moment resisting frame building with infill panels is situated in Delhi. Height of the building is 10m. The building is resting on medium soil. The base dimensions of building at plinth level is 24m. Determine the design horizontal seismic coefficient for a damping of 5%.

Q2. Design top dome, top ring beam and cylindrical wall of an Intzec tank for following data.

Central rise of top dome = 1.5 m
Diameter of cylindrical vessel = 12.0 m
Height of cylindrical vessel = 4.5 m
Rise of bottom dome = 1.5 m
Mean diameter of supporting tower = 9.0 m
Q2. Design a rectangular tank having dimensions $5 \times 2.5 \times 2$ m. The height of the wall is 2 m. The walls are rigidly jointed at the vertical edges and pin jointed at the base as well as on roof slab, at their horizontal edges. The tank is supported on all sides under the wall. Use M-20 grade of concrete and Fe-415 steel bars.

Q3. Design a slab culvert for a span of 3 m and clear carriage way width of 7.5 m suitable for IRC class “A” loading. Use M-20 grade of concrete and Fe-415 steel bars.

Q4(a) Write Short notes on:

(i) Loss of prestress
(ii) Merits and demerits of prestressed concrete

Q4(b) A beam of 150 mm x 300 mm is prestressed by a force of 250 kN by steel cables located at an eccentricity of 60 mm as shown in Fig.1. Determine the loss of prestress due to creep of concrete for the following data:

\[ \sigma_{ek} = 45 \text{ N/mm}^2 \]
\[ \text{Cables} = 6 \text{ Nos. -7 mm } \phi \]
\[ \text{Creep coefficient} = 2 \]
\[ E_s = 200 \text{ kN/mm}^2 \]
\[ E_c = 30190 \text{ N/mm}^2 \]

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

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/m²
Finished load = 0.6 kN/m²

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.
Q5. Design the Toe slab of a cantilever retaining wall to retain an earth embankment 4m high above ground level. The density of earth is 18 KN/m$^3$ and its angle of repose is 30°. The embankment is horizontal at top. The safe bearing capacity of the soil may be taken as 100 KN/m$^2$ and the coefficient of friction between soil and concrete is 0.5. Adopt M-20 grade concrete and Fe415 HYSD bars.

FIGURES

![Diagram of the Toe slab design](image)

**Fig.1**

All dimensions are in mm
1(a) Explain Resal-Bell and Rankine’s theories of earth pressure on retaining walls and show pressure diagrams of active and passive state.

1(b) A masonry retaining wall with vertical back has a backfill of 8.5 m behind it. The ground level is horizontal at the top of wall and the ground water-table is at 3.5 m below the ground level. Calculate the horizontal active pressure on the wall using Rankine’s earth pressure theory. Assume $\gamma = 18$ kN/m$^3$, $c = 0.0$ kPa, $\phi = 30^\circ$, friction between wall and earth is neglected.

OR

1’(a) Explain the procedure of Rehann’s graphical method to determine the active pressure on retaining wall and also show the position of critical slip/failure plane.

1’(b) Differentiate between cantilever and anchored sheet pile walls. A coffer dam is to be constructed of cantilever sheet piling. It has to retain a soil of bulk unit weight of 18 kN/m$^3$ and an angle of shearing resistance of $27^\circ$ up to a height of 8.0 m. Find the depth to which the piles should be driven, assuming that two-third of the theoretical passive resistance is developed on the embedded length.

2(a) Discuss the probable types of failure of a finite slope and explain $\phi_u = 0^\circ$ analysis in detail. Is it a total stress or effective stress analysis?

2(b) An infinite slope of height 6 m is subjected to ground water seepage in a soil and is inclined at $15^\circ$ to the horizontal. The properties of the soil are: $c' = 10$ kN/m$^2$, $\phi = 20^\circ$ and $\gamma_{sat} = 19.8$ kN/m$^3$. If the ground water table coincides with ground surface, determine the factor of safety and comment on the stability.
3(a) Explain briefly any four of the following:
   (i) Local shear failure (ii) Limitations of plate load test (iii) N-Value of SPT (iv) Gross
       safe bearing capacity (v) Skempton’s theory (vi) Differential settlement

3(b) A footing of size 2.5 m × 2.5 m is resting at a depth of 1.5 m below the ground surface. The soil
    has a unit cohesion of 30 kN/m², angle of shearing resistance of 25° and unit
    weight of 20 kN/m³. If the water table is at the base of foundation, determine the gross
    safe bearing capacity of soil by Terzaghi’s theory. Taking factor of safety as 3.
    For φ = 25°, Nc = 21.2, Nq = 11.4 and Nr = 7.6

4(a) Differentiate between friction pile and end bearing pile. How can the load carrying
    capacity of a pile group be estimated for cohesive soils?

4(b) A group of 3×3 piles in stiff clay has piles length of 10 m, diameter 300 mm and centre to
    centre spacing 1.0 m. The value of unconfined compressive strength of clay along the
    shaft of pile is 160 kPa and at tip of pile is 260 kPa. Take adhesion factor as 0.65 and
    factor of safety as 2.5. Estimate the load carrying capacity of pile group if the pile cap is
    in contact with ground level.

4’(a) Enumerate the various methods of excavation in order to collect the disturbed and
    undisturbed soil samples for laboratory testing. Discuss any one of them in details.

4’(b) Explain briefly the load carrying capacity of pile by dynamic formulae. A steel H pile is
    driven into dense sand by a 100 kN hammer having a free fall of 1.2 m. If the penetration
    of the pile in the last 5 blows was recorded as 30 mm, determine the safe load carrying
    capacity of pile by using Engineering News formula for drop and steam hammer

5(a) Briefly explain any four of the following:
   (i) Damping Factor (ii) Natural frequency (iii) Resonance (iv) Vibration isolation

5(b) A spring mass system with viscous damping is displaced from its equilibrium position
    and released. The operating frequency is 40 rad/sec and natural frequency is 25 rad/sec. If
    the amplitude of vibration of machine diminishes by 5% each cycle, determine, (i)
    logarithmic decrement (ii) damping factor (iii) number of cycles elapsed for a 50% reduction
    in amplitude (iv) magnification factor and (v) check whether, the vibrating
    system is under damped or over damped or critically damped.
2014-15  
B.TECH. (AUTUMN SEMESTER) 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>
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<tbody>
<tr>
<td>1(a)</td>
<td>Why is grading of aggregate important with regard to the properties of concrete?</td>
<td>[06]</td>
</tr>
<tr>
<td>1(b)</td>
<td>Write short notes on any two of the following</td>
<td>[06]</td>
</tr>
<tr>
<td></td>
<td>(a) Portland Blast Furnace Slag Cement</td>
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<td></td>
<td>(b) Portland Pozzolana Cement</td>
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<td></td>
<td>(c) White Portland Cement</td>
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<tr>
<td>2(a)</td>
<td>Discuss the various factors affecting the shrinkage of concrete.</td>
<td>[06]</td>
</tr>
<tr>
<td>2(b)</td>
<td>Briefly describe Plastic Shrinkage and Drying Shrinkage</td>
<td>[06]</td>
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OR

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<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
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<tbody>
<tr>
<td>2'a</td>
<td>Explain with the help of neat diagram the fatigue strength of concrete</td>
<td>[06]</td>
</tr>
<tr>
<td>2'b</td>
<td>Discuss the influence of Coarse Aggregate on the Strength of Concrete</td>
<td>[06]</td>
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<tr>
<td>3</td>
<td>Discuss the effects of seawater on the durability of concrete. State the measures that are required to prevent the adverse effects of seawater on concrete.</td>
<td>[12]</td>
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<tr>
<td>4</td>
<td>Explain the merits and demerits of various non-destructive tests performed on concrete for the assessment of its quality.</td>
<td>[12]</td>
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OR

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
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<tbody>
<tr>
<td>4'</td>
<td>Discuss the effect of Height/Diameter Ratio on the strength of the cylinder test specimen</td>
<td>[12]</td>
</tr>
<tr>
<td>5(a)</td>
<td>What is meant by self-compacting concrete? What are the advantages of this type of concrete?</td>
<td>[06]</td>
</tr>
<tr>
<td>5(b)</td>
<td>Explain what is meant by Ferrocement? List the advantages and uses of Ferrocement.</td>
<td>[06]</td>
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</table>
B.TECH.AUTUMN (V SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
DAM ENGINEERING
(CE-428)

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) Why do we need dams? Discuss merits of earthen dams. [05]

1(b) Enumerate various types of dams. Derive an expression used for the distinction between a low and high gravity dam. [10]

OR

1'(a) Discuss various modes of failure and stability requirement of gravity dam. [05]

1'(b) Calculate the stresses developed at toe and heel of a gravity dam profile as shown in Fig.1 under reservoir full condition. Take unit weight of dam material as 24kN/m³, coefficient of uplift pressure as 0.75, Fetch of reservoir 15km and wind speed 78 km/h. [10]

![Fig. 1](image)

2(a) How the effect of earthquake is considered in the design of gravity dam? Give stepwise procedure to calculate base shear and base moment based on response spectrum method. [10]

2(b) Discuss the significance of elementary profile of gravity dam and derive a relation for the base width based on sliding criteria. [05]

OR

Contd...
2'(b) Write short notes on temperature control in mass concreting in case of gravity dam. [05]

3(a) Design a 90 m high constant angle arch dam by thin cylinder theory for a valley 50 m wide at the base and 250 m wide at a height of 100 m. Take $\theta = 140^\circ$ and $f_c = 3500 \text{kN/m}^2$. [10]

3(b) What are the assumptions of thin cylinder theory? Also mention its limitations. [05]

OR

3'(b) What is a buttress dam? Describe the functions of its component parts. [05]

4(a) Draw the neat sketch of an earth dam. Briefly explain the function of each component. [05]

4(b) List out various types of machineries involved in the construction of earthen embankments. Briefly explain the construction procedure. [10]

OR

4'(b) Discuss various types of modes of failure of earth dams with aid of neat sketches. [10]
2014-2015
B.Tech (Autumn Semester) EXAMINATION
(Departmental Elective)
Industrial Pollution Control
CE-429

Duration 3 hours
Maximum Marks : 60

Instructions:
Attempt all the questions.
Assume suitable data/value, if not given or missing.
Notations used have their usual meanings.

Q.No.1a Write basic difference and an approach towards dealing with an industrial effluent and municipal wastewater while safeguarding environment and water bodies.

Q.No.1b What is the significance of COD and BOD tests? On what principle these tests are based upon? Explain the procedure of these tests in brief.

Q.No.1c 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.

Q.No.1d Discuss the steps you may take for conducting an industrial survey for the purpose of developing its environmental management plan.

Q.No.2a What are the major categories of pollution? List some of the them, their causes, symptoms / effects and remedial measures.

Q.No.2b Discuss the importance of wastewater characterization. What are the general parameters you look into for measuring the water pollution?

OR

Q.No.2b' Discuss the challenges for industrial pollution control in developing countries. Also explain the strategies of developed nations in dealing with pollution related issues.

Q.No.3a A factory discharges its effluent in a nearby drain. The wastewater flow is to be measured with the help of a device as shown in the figure below.

Contd....2.
Using the following observed values, calculate the discharge in m$^3$/d:

\[ h = 20.3 \text{ cm} \]
\[ \theta = 90^\circ \]
\[ C = 0.57 \]

Q.No.3b

What are the limitations with the use of this above technique?

What is the purpose of an equalization tank? Discuss an approach towards the design of an equalization basin proportionate to flow (diurnal variation).

OR

Q.No.3'b

For a 3,500 m$^3$/d wastewater, calculate the volume of the flocculator tank, in which 38 mg/L alum dosage with flocculation at a Gt value of 4.32×10^4 that produces the optimal results and the water temperature is 20$^\circ$C. Also determine per week requirement of alum.

Q.No.4a

Write a case study on any industry of your choice while highlighting its manufacturing operations, wastewater or pollution generation sources, its treatment scheme, units, standards and disposal. Prepare a neat sketch (flow diagram) of operations in the selected industry and pollution control measures.

Q.No.4b

What are the primary and secondary sources of air pollution? List some common air pollutants, their effects on environment, human health and property.

Q.No. 5

Write brief notes on any four of the following:

a) Aerobic & Anaerobic WWT Processes with examples
b) Global warming and climate change
c) Gaussian Model for prediction of plume fall
d) UASB and its Post-Treatment Options
e) Effects of Noise Pollution and their remedial measures
Q. No.         Question                                      M.M.

1. Analyze the frame shown in Fig. 1 using Kani's method.  [12]

![Fig. 1]

OR

1' Compute the shear in columns, moments in columns, moment in beams, shear in beams and vertical reaction in columns for the frame shown in Fig. 2 by Portal method. The cross-sectional area and EI is same for all the members.  [12]

![Fig. 2]
2. Use stiffness method to analyse the beam shown in Fig. 3. Flexural rigidity, EI, of the members is constant throughout. Also draw SFD and BMD.

![Beam Diagram](image)

Fig. 3

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

![Frame Diagram](image)

Fig. 4

4 (a) A horizontal beam ABC, hinged at A, simply supported at B and the portion BC of length 8m overhanging, and has the span AB of 20m. Draw IL - Diagrams for bending moment for the sections D and E at 4m to the left and right of B, respectively. Calculate the maximum positive and negative B.M. at D and maximum bending moment at E due to a uniformly distributed load of 2 kN/m intensity and 4m long crossing the beam from one end to another. Mention the corresponding positions of the load.

4 (b) A beam ABC simply supported at A, B and C and having a hinge at D, 5m from A, has equal spans AB and BC of 10m each. Calculate the values after drawing and using their respective IL - Diagrams, of the reactions at A, B and C and shear force at a point just to the right of B, due to a uniformly distributed load of 1kN/m intensity and of 4m length, crossing the beam from end to another.
4'. For the continuous beam with internal hinges at C and D as shown in Fig. 5, draw the influence line diagram (I.L.D.) for reactions at the supports A and B; shear force and bending moment at both the sections G and H.

![Diagram of the continuous beam with internal hinges and sections labeled A to F, G and H]

Fig. 5

5'. Draw IL - diagram for the moment at support A and reaction at B in propped cantilever AB having span equal to 8m. Support A is fixed and B is a roller. Label the diagrams with ordinate at 1m interval.

OR

5'. In a three hinged parabolic arch of 30m span and 6m central rise, two point loads of 60 kN and 40 kN, spaced 3m apart, are rolling over from left to right with 40 kN load leading. Calculate maximum sagging and hogging bending moment at a section 10m from the left end support.
2014-2015

B. TECH. AUTUMN (V-SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
WATER POWER ENGINEERING
(CE - 432)

Maximum Marks: 60
Duration: Three Hours

(i) Attempt All questions. All questions carry equal marks.
(ii) Assume suitable data if required.
(iii) All symbols have their usual meanings.

1(a) List out various sources of energy. Compare Solar energy with wind energy.
Name two tidal and two super hydro power plants of India. 10

1(b) Draw neat sketch of a shaft type intake and explain its working. 05

2(a) Differentiate between:
(a) Load curve and mass curve
(b) Storage and pondage
(c) Capacity factor and Utilization factor 06

2(b) Draw following graphs and discuss their significances:
(i) Power duration curve and load duration curve
(ii) Hydrograph and load curve 04

2(c) Draw the neat sketch of tower type intake and explain its working. 05

OR

2'(a) Following data show the variation of flow in a stream. Draw the power duration curve and find:
(i) Primary Power
(ii) \( P_{20}, P_{50}, \) and \( P_{90} \)
If the primary power is to be enhanced by 30% of its original power either by providing a diesel unit or by providing a reservoir, in both cases, find the capacity of diesel unit and reservoir.

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
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<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
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<tr>
<td>m³/s</td>
<td>140</td>
<td>120</td>
<td>90</td>
<td>60</td>
<td>40</td>
<td>30</td>
<td>280</td>
<td>380</td>
<td>260</td>
<td>190</td>
<td>160</td>
<td>150</td>
</tr>
</tbody>
</table>

Take the overall efficiency as 90%. Gross Head is 52 m. The head in penstock etc. is 2.0 m of water. Take unit weight of water as 10 kN/m³.
2'(b) A main lined canal is carrying a discharge of 330 m³/s. At a particular site a distributory canal (power channel) is taking off at 70 degrees. The length of the power channel is 500 m and it carries half discharge of the main canal. The differential head between the water level in main canal and tail race (turbine level) is 10 m. About 1.5 m head is lost in the power canal. There are three sets of turbine-generator units in the power house. If the efficiency of each turbine-generator unit is 95 %, estimate the Installed capacity of the power house and classify it based on head and Installed capacity.

3(a) (i) How penstocks are classified based on supports?

(ii) Draw various types of draft tubes with neat sketches.

OR

3'(a) (i) How turbines are classified based on specific speed and power?

(ii) List out various types of lining. Discuss any one with aid of sketch

3(b) A vertical divergent draft tube 5.6 m long is provided to a Francis turbine. The diameters of the draft tube at inlet and outlet are 50 cm and 70 cm respectively. The lower end of the tube is 1.4 m below the tail race level. The velocity of water at outlet of the tube is 1.25 m/s. If the loss of the energy head in the tube is 0.25 times the velocity head at the outlet of tube, Calculate

(i) The absolute pressure at inlet of the tube and

(ii) The Efficiency of draft tube

4(a) What are surge chambers? Derive the expression for time of oscillation and maximum surge height of a simple surge chamber taking suitable notations.

OR

4'(a) List out the assumptions of rigid water column theory of water hammer. A 762 m long, 15.2 cm diameter pressure conduit is subjected with a hydraulic pressure head of 45.7 m.

(i) What will be the maximum pressure at the control gate if the initial steady flow of 0.045 m³/s is cut off uniformly in 10 seconds.

(ii) What is factor of safety if the bursting strength of the conduit is 263.4 kN/m².

4(b) Write short note on any one of the following

(i) Setting of turbines

(ii) Spiral casing

(iii) Dimensioning of power houses
2014-15
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.
--- | --- | ---
1(a) | Explain in detail the CBR method of pavement design. Discuss the advantages and limitations of this method. | 8
1(b) | Discuss the modified Westergaard's concepts and assumptions for design of highway pavements. Explain modulus of subgrade reaction and radius of relative stiffness. | 7

OR

1'(a) | What are the various wheel load factors to be considered in pavement design? Discuss in detail the significance of each. | 1
1'(b) | Briefly explain the California Stabilometer method for design a flexible pavement of highway. | 1

2(a) | What are the special points to be considered in the alignment of hill road? Discuss the details of geometric design and standards of hill roads. | 1
2(b) | 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 slip | 1
3(a) | Discuss the importance of highway drainage. What are requirements of good highway drainage. Discuss briefly the importance of highway maintenance. | 1
3(b) | Explain the design approach for surface drainage system of highway. | 1

4(a) | Discuss briefly the importance of highway maintenance. | 1
4(b) | Enumerate various types of failures in rigid pavements. Discuss any two of them in detail. | 1

(OR)

4'(b) | Enumerate various types of failures in flexible pavements. Discuss any two of them in detail. | 1
1(a) What is strong ground motion? State and discuss their characteristics. How is the epicentre of an earthquake located? [04]

1(b) How is the local magnitude of an earthquake related to the intensity of earthquake? What is the basic design philosophy of seismic design of structures? Discuss briefly the need of seismic zoning. [04]

1(c) An earthquake causes an average of 2.6m strike-slip displacement over a 75km long, 22km deep portion of transformed fault. Assuming the average rupture strength along the fault as 180kPa. Estimate the seismic moment and moment magnitude of the earthquake. [04]

OR

1'(a) List the abridged MM earthquake intensity scale and magnitude of earthquake. [04]

1'(b) In an experiment on a certain structure modelled as a single degree freedom system, the amplitude of free vibration decreased from 10mm to 4mm. If the logarithmic decrement was 0.1018 and undamped natural frequency is 40rad/sec, determine the damping ratio, damped period and number of cycles completed. [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=3 units. [04]

2 Answer any three of the followings: [4x3]

(i) How to find out storey lateral force in a three storey building using equivalent lateral force procedure as per IS 1893:2002?

(ii) 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.
(iii) Illustrate the procedure for calculation of a wind design force as per IS875-Part-3 codal method for industrial panel or cladding.

(iv) Discuss how to increase the following for a building in an earthquake prone area: (i) period of vibration (ii) energy dissipation capacity (iii) Ductility

(v) Discuss engineering aspects of cyclone disaster mitigation in terms of works need to be carried out on a continuous basis.

3 Enumerate different aspects of rock mass and slope taken into consideration for Slope Mass Rating. What measures are suggested for different classes of slopes to minimise the problem of land sliding.

4 What do you understand by disaster management? Discuss the recent events of natural disasters in India and role of government agencies in its mitigation.

5(a) What are the methods for raising Levee's height in emergencies? Explain with neat sketch.

OR

5'(a) Discuss flood bypass with neat sketch.

5(b) Water flows at a rate of $\frac{141.6 \text{ m}^3}{s}{/s}$ in a river ($n = 0.045$) whose flow cross section may be approximated as rectangle $61 \text{ m}$ wide and $3.65 \text{ m}$ deep. If a bypass could be made available to divert $28.3 \text{ m}^3/s$ of $141.6 \text{ m}^3/s$, what would be the maximum drop in stage downstream of the bypass diversion? Assume a constant width, bed slope depth throughout the length.
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 Code 1893 is allowed.

Q1(a) What is the Mohorovicic discontinuity? (2)

Q1(b) Give causes of failure of Continental Drift Theory. (2)

Q1(c) A site is surrounded by a point source at 19.2 km (M=6.5) and an area source at a distance of 12.36 km (M=7.5) from site. Determine the anticipated mean value of the PGA. (3)

Q1(d) At a recording station a difference in time of arrival between P waves and S waves was observed to be 1.5 seconds. What is the approximate distance from the station at which the event occurred? Assume P wave velocity as 4 km/sec and S wave velocity as 2 km/sec. (4)

Q1(e) Find the fault area (A) that ruptured during an Earthquake of a Mw=7.5 Earthquake. If the Earthquake ruptures the surface with an average displacement of 2.5 m? Assume G = 3 x10^{10} N/m^2. (4)

OR

Q1'(a) Explain Elastic Rebound Theory. (5)

Q1'(b) Explain saturation of Magnitude of Earthquake with the help of a diagram. (5)

Q1'(c) Derive predictive relation for Peak Ground Acceleration at a site. (5)
Q2(a) Find the natural frequencies and mode shapes of a two-story single bay shear building modeled as two DOF system with properties as given below:

\[ (12) \]

- Stiffness of columns of ground floor = \( k \)
- Stiffness of columns of first floor = \( k \)
- First Floor mass = \( m \)
- Second floor mass = \( m \)
- Assume \( k = 24E1/h^3 \)

Q2(b) A mass of 1kg is suspended by a spring of stiffness 600 N/m. The mass is displaced down from its equilibrium position by a distance of 0.01m. Find

- (i) Natural frequency of the system.
- (ii) Maximum amplitude.
- (iii) Response of the system as function of time

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

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

Q4(a) What are the lessons learnt from damages of RC buildings under past Earthquakes?

Q4(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/m\(^2\) and floors are to cater to an imposed load 3.0 kN/m\(^2\). Determine the seismic forces at different floor levels.

**OR**

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 Fig.2(a-b) having 20m x 30m plan dimensions and an overall height of 30m is to be designed at Vadodara 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.
FIGURES

Fig1(a): Plan
Fig1(b): Elevation

Fig2(a): Plan
Fig2(b): Section X-X