B.A.R.C.H. / B.TECH. (AUTUMN SEMESTER) EXAMINATION
(ARCHITECTURE / CIVIL ENGINEERING)
DESIGN OF CONCRETE STRUCTURES-II
(CE-411)

Maximum Marks: 60 Credits: 04 Duration: Three Hours

Note: (i) Answer all the questions.
(ii) Assume suitable data, if not given.
(iii) Use of IS codes 456, 875(Part-II), 1893, 3370 and IRC loading charts are allowed.

Q1. Design 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/m³. 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). 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 and vertical seismic coefficient for a damping of 5%.

Q2. Design top dome, top ring beam and cylindrical wall of an Intze tank shown in Fig.1. Use M-20 grade concrete and Fe-415 steel.

OR

Q2'. Design a rectangular tank having dimensions 5 x 2.5 x 2m. The 2m high walls are rigidly jointed at the vertical edges and are pin jointed at the base and roof slab at their horizontal edges. The tank is supported on all sides under the wall.Use M-20 grade concrete and Fe-415 HYSD bars.
Q3. Design a slab culvert for span of 3m and clear carriage way width of 10m between kerbs suitable for IRC class A loading. Use M-20 grade concrete and Fe-415 HYS bars. (12)

Q4(a) Write Short notes on:

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

Q4(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 50mm by tendons of area 400mm². Assuming $E_s = 2 \times 10^5$ N/mm²; $E_c = 0.333 \times 10^5$N/mm²; 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. (05)

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. (12)

OR

Q5. Design the heel slab of a cantilever retaining wall to retain an earth embankment 4m high above ground level. The density of earth is 18 KN/m³ 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/m² and the coefficient of friction between soil and concrete is 0.5. Adopt M-20 grade concrete and Fe415 HYSD bars. (12)
Q: 1a  What are the assumptions of Rankine's theory of earth pressure? Derive an expression for active and passive thrust acting on retaining wall having backfill of $c-\phi$ soil. (04)

Q: 1b  Determine the magnitude and point of application of total lateral earth pressure acting on the vertical face of a retaining wall of height 6.0 m when wall moving away from the backfill. Use the following data:
Layer I: Thickness=4.0 m, $c = 20$ kN/m$^2$, $\phi = 10^\circ$ and $\gamma = 18$ kN/m$^3$
Layer II: Thickness=2.0 m, $c = 0.0$ kN/m$^2$, $\phi = 30^\circ$ and $\gamma = 22$ kN/m$^3$

Q. 1(a)  What are the different types of sheet pile walls? Draw the sketches to show the pressure distribution. Briefly explain the procedure for checking stability of a cantilever sheet pile wall. (05)

Q: 1' b  Determine the active thrust, passive thrust and safe depth of embedment of sheet pile wall (Fig. 1). (07)

Q: 2a  Explain the concept of stability analysis of slopes and describe friction circle method in detail. (04)

Q: 2b  An infinite slope in a sandy soil is inclined at $20^\circ$ to the horizontal. The properties of the soil are:
$c = 20$ kN/m$^2$, $\phi = 34^\circ$, $\gamma = 17$ kN/m$^3$, $\gamma_{sat} = 21$ kN/m$^3$
A hard layer exists 5 m below and parallel to the surface. What is the factor of safety against slip when (a) the slope has negligible water in it, (b) the slope is completely submerged with seepage parallel to the surface and (c) the water table level is parallel to the ground surface at 2.5 m depth, seepage being parallel? (08)

Q: 3a  Explain any four of the following terms:
(i)  Net safe bearing capacity
(ii) Local shear failure
(iii) N-value of SPT
(iv) Differential settlement of footing
(v)  Plate load test

(04)
Q: 3b

Determine the gross safe and net safe bearing capacity of 2m wide strip and 2.5m x 2.5m square footings resting at 1.5m depth on sand having the properties:
\( \gamma = 17 \text{ kN/m}^3, \gamma_{w} = 21.5 \text{ kN/m}^3, \epsilon = 0, \phi = 36^\circ, N_c = 17.5, N_q = 7.5 \text{ and } N_f = 5 \). The water table is at 1.0m below ground surface. Use Terzaghi's theory and take factor of safety as 3.0.

Q: 4a

State the criterion for selecting a pile foundation? Explain briefly why displacement piles are suitable in loose granular fills and not in saturated cohesive soil?

Q: 4b

A group of nine piles, 8 m long is used as the foundation for a column. The piles are 300 mm in diameter with spacing of 900 mm c/c. The subsoil consists of clay with unconfined compressive strength of 180 kN/m². Estimate the safe load and check whether failure would occur by a single pile, or as a block. Take \( \alpha = 0.65 \) and F.O.S = 3.0.

(OR)

Q: 4'a

Differentiate between static and dynamic formulae for determining the bearing capacity of piles.

Q: 4'b

A 300 mm diameter concrete pile, 10 m long, was driven by double acting hammer: (rated energy =16.62 kJ, total mass = 2200 kg). The driving was done with short dolly and cushion 2.50 cm. The average penetration recorded in the last five blows was 3.0 mm/blow. Calculate the safe pile load.

Q: 5a

Explain any four of the following:

(i) Logarithmic decrement
(ii) Damping factor
(iii) Free vibration with damping
(iv) Vibration isolation
(v) Barkan's method of machine foundation

Q: 5b

An electric motor of weight 5.0 kN is mounted on an isolator block of weight 25kN. The stiffness of participating soil is 25000 kN/m. The machine is vibrated by an exciting force of 3.5 \( \sin(40 \text{ t}) \) kN. Determine magnification factor, amplitude of vibration of the block and the force transmitted to the floor. Take damping factor, \( D = 0.45 \).

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![Diagram](image-url)
Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. | Question | M.M.
--- | --- | ---
1(a) | Compare the contributions of $C_3S$ and $C_2S$ to the early strength of concrete. | [06]
1(b) | Discuss the causes of Alkali aggregate reaction. | [06]
2(a) | Discuss in detail the role of aggregates in creep and shrinkage in concrete. | [06]
2(b) | How does the relation between the modulus of elasticity and concrete vary with age? | [06]

OR

2' | What do you understand by workability of concrete? Discuss in detail factors affecting the workability of concrete. | [12]
3(a) | What is meant by Durability of Concrete and what are the causes that affects it? | [06]
3(b) | What is the mechanism of sulphate attack on the durability of concrete? How would you control the sulphate attack? | [06]
4 | Explain the merits and demerits of various non-destructive tests performed on concrete for the assessment of its quality. | [12]

OR

4' | Discuss in brief the various types of tests that are conducted for determining the tensile strength of concrete | [12]
5(a) | What are the main categories of lightweight concrete? Discuss any one of them in detail | [06]
5(b) | Explain what is meant by Ferrocement? List the advantages and uses of Ferrocement. | [06]
2013-14
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) | Discuss merits and demerits of gravity and earthen dams. | [05]
1(b) | Derive an expression for the principal and shear stresses developed in the body of a gravity dam | [10]

OR

1'(a) | Why do we need dams? Enumerate various forces acting on dams. | [05]
1'(b) | Design zone I & II of a 55m high concrete gravity dam by the method of zoning with the help of the given data:
- Fetch of reservoir (F) = 14 km
- Wind speed (V) = 88kmph
- Unit weight of dam material = 24 kN/m$^3$
- Uplift pressure coefficient (c) = 0.75
- Coefficient of friction = 0.65

2(a) | Calculate the total overturning force and overturning moment for a gravity dam profile as shown in Fig.1, under the influence of following forces:
- Weight of dam ($\gamma_m = 24$ kN/m$^3$);
- Water pressure ($\gamma_w = 10$ kN/m$^3$);
- Wave pressure (F=20Km. V=82Kmph);
- Uplift force (C =1);
- Horizontal acceleration of earth quake ($\alpha_0 = 0.05$).

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

OR

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

3(a) A V-shaped valley is approximated by a trapezium of dimensions top width 250m, bottom width 80m and depth 100m. Design a constant angle arch dam for the valley and tabulate design calculations in tabular form on the basis of thin cylinder theory. Take $\theta = 140^0$ and $f_c = 350 \text{ kN/m}^2$.

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

OR

3'(b) Explain various components of a Buttress dam by giving a neat sketch.

4(a) Write short notes on any one of the following:
   (i) Design criteria for an earthen dam
   (ii) Various components of earth dam.

4(b) Discuss various causes of earth dam failures.
B. TECH. (WINTER SEMESTER) EXAMINATION
CIVIL ENGINEERING
STRUCTURAL ANALYSIS II
CE 430

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

![Figure 1](image)

1'. Analyze the frame shown in Fig. 2 using Kani’s method. [12]

![Figure 2](image)

Contd……..2
2. Use stiffness method to analyse the frame shown in Fig. 3. Flexural rigidity, EI, of the members is constant throughout. Also draw BMD.

![Frame Diagram](image)

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

![Beam Diagram](image)

4. For the continuous beam shown in Fig. 5, draw L.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.

![Continuous Beam Diagram](image)
4' (a) A load of 60 kN per metre run, 7 m long moves on a simply supported girder of span 10 m. Find the maximum bending moment which can occur at a section 4 m from the left end support.

4' (b) Determine the maximum shear force and bending moment at a section 12 m from the left end support in a simply supported beam of span 28 m when a load system as shown in Fig. 6 crosses the beam from left to right with 10 kN load leading.

![Beam diagram with load distribution and section at 4 m and 12 m marked.]

Fig. 6

5. Draw IL - diagram for the reactions at support A and B in a two span continuous beam ABC having each span equal to 8 m. Support A is hinged, B and C are rollers. Label the diagrams with ordinate at 1 m interval.

OR

5'. Draw IL - diagram for the axial forces in the members 1, 2, 3 and 4 of the truss shown in Fig. 7.

![Truss diagram with members 1, 2, 3, and 4 marked.]

Fig. 7
IV YEAR B.TECH EXAMINATIONS
(CIVIL ENGINEERING)
WATER POWER ENGINEERING
(CE - 432)

Maximum Marks = 60  
Duration = Three Hours

Note: Attempt all questions. All questions have equal marks. Assume suitable data if needed. Terms used have their usual meanings.

Q1(a) List out any three conventional and three non-conventional sources of energy in nature. Name any two wind plants of India with their installed capacities.  

Q1(b) Draw the neat sketch of any existing super hydro plant showing all its necessary components. Also mention its hydraulic features.

Q1(c) Calculate head loss through trash rack using following data:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear spacing of bars</td>
<td>10 cm</td>
</tr>
<tr>
<td>Thickness of bars</td>
<td>1.0 cm</td>
</tr>
<tr>
<td>Angle of inclination of bars with horizontal</td>
<td>60°</td>
</tr>
<tr>
<td>Coefficient of head loss</td>
<td>2.42</td>
</tr>
<tr>
<td>Discharge in front of bars</td>
<td>100 m³/s</td>
</tr>
<tr>
<td>Length of trash rack</td>
<td>10 m</td>
</tr>
<tr>
<td>Depth of flow of water in front of rack</td>
<td>5 m</td>
</tr>
</tbody>
</table>

OR

Q1’(a) List out the basis on which penstocks are classified. For a hydro-electric power house, following data are available at a site. Using empirical equations calculate the diameter of the penstocks.

Discharge through penstocks \( Q = 10 \, m³/s \)

Power output \( P = 5 \, MW \)

Effective head \( H = 50 \, m \)

Efficiency of power generation is 96 %

Q1’(b) A power channel is supplying water to a hydro-power plant. The channel takes one third of the water of the main canal which has 20 m bed width and 3 m depth. The velocity of flow in the main canal is 1.8 m/s. The difference in head race and tail race is 6.5 m. If the efficiency of power generation is 96 %, find the capacity of power house in M.W. and classify the power house based on head and installed capacity.

Q1’(c) Differentiate among:

(i) Storage and pondage
(ii) Penstock and manifold
(iii) Pump and turbine

07

05

03

Contd......2
Q2. The load on a hydel plant varies from a minimum of 10 MW to a maximum of 35 MW. Two turbo-generators of capacities 22 MW each have been installed. Calculate

- (i) Total installed capacity of the plant
- (ii) Annual load factor
- (iii) Capacity factor
- (iv) Utilization factor
- (v) Maximum demand

Q3. What are the functions of surge tanks in hydro-power plants? Taking usual symbols derive expressions for maximum upsurge for a surge tank.

OR

Q3'(a) Discuss the phenomena of water hammer? Mention the limitations of rigid water column theory.

(b) Write the functions of following:
- (i) Surge tank
- (ii) Draft tube
- (iii) Head race tunnel
- (iv) Spiral casing
- (v) Intake

Q4 (a) Define specific speed of a turbine. How turbines are classified based on head, specific head and installed capacity? Give examples of two impulse and two reaction turbines.

(b) Explain, how the cavitation develops in hydromachines.

Determine the absolute pressure head at the inlet of a vertical divergent draft tube which has following geometrical and hydraulic data.

<table>
<thead>
<tr>
<th>Inlet diameter</th>
<th>0.8 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet-diameter</td>
<td>1.2 m</td>
</tr>
<tr>
<td>Overall length</td>
<td>6.0 m</td>
</tr>
<tr>
<td>Length of draft tube drowned</td>
<td>0.5 m</td>
</tr>
<tr>
<td>Head loss</td>
<td>0.3 times velocity head at outlet</td>
</tr>
<tr>
<td>Velocity of flow at inlet</td>
<td>6.0 m/s</td>
</tr>
</tbody>
</table>
B. TECH (AUTUMN VII SEMESTER) EXAMINATION
CIVIL ENGINEERING
ADVANCED HIGHWAY ENGINEERING
(CE - 433)

MM : 60

Duration: Three Hours

1(a) Briefly discuss the importance of highway maintenance. (5)

(b) What are the various types of failures in flexible pavements? (10)

(OR)

1' Write short notes on:
(i) Map cracking
(ii) Reflection cracking
(iii) Mud pumping
(iv) Spalling of joints
(v) Scaling of cement concrete

(15)

2(a) Discuss the importance of highway drainage. (5)

(b) Explain in detail about the design approach for the surface drainage of a highway. (10)

3(a) Discuss the modified Westergaard's concepts and assumptions. Explain modulus of sub grade reaction and radius of relative stiffness. (5)

3(b) Determine the stresses of a cement concrete pavement by:
(a) Modified Westergaard's stress equations
(b) IRC stress charts (Fig. 1)

Modulus of elasticity of concrete = 3.0x10^5 kg/cm^2
Poisson's ratio of concrete = 0.15
Thickness of concrete = 18 cm
Modulus of subgrade reaction = 8.5 kg/cm
Wheel load = 5100 kg
Radius of loaded area = 15 cm

(OR)

3' Design a flexible pavement consisting of Water Bound Macadam base course and bituminous concrete surface course of thickness 7.5 cm by California R-value (Stabilometer) method using the following data:

(15)

Contd.......2
(i) Traffic index = 10.5, (ii) C-value of base course = 15, (iii) C-value of bituminous concrete surface course = 60, (iv) Test results on subgrade soil are as under:

<table>
<thead>
<tr>
<th>Moisture content (%)</th>
<th>R-value</th>
<th>Pressure (kg/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Expansion</td>
</tr>
<tr>
<td>16.5</td>
<td>60</td>
<td>1.2</td>
</tr>
<tr>
<td>19.0</td>
<td>41</td>
<td>0.9</td>
</tr>
<tr>
<td>22.5</td>
<td>15</td>
<td>0.4</td>
</tr>
</tbody>
</table>

4(a) How are landslides caused in hill roads and how can they be prevented? (7)

4(b) What are the special points to be considered in the alignment of hill road? Discuss. Specify the details of geometric design and standards of hill roads including hair pin bends.

(Fig. 1: IRC Charts)
Maximum Marks: 60

Credits: 04

Duration: Three Hours

Note: (i) Answer all the questions.
(ii) Assume suitable data, if not given.

Q1(a) Define Response spectrum. (02)

Q1(b) A building structure is subjected to a band limited white noise power spectral density function with a cut off frequency of 30 radians per sec. The overlying soil has a shear wave velocity of 80m/sec and material damping as 5% for a depth of 20m. PGA at base is 0.2g. Find the free field ground acceleration at \( \omega = 4 \) rad/sec. Assume \( P_f = 3.2 \). (04)

Q1(c) The epicentral frequency of an earthquake that occurred in 1920 is estimated to be IX on MMI scale. Estimate the approximate magnitude of the earthquake (02)

Q1(d) A vertically propagating shear wave travels upwards through a layered soil with the shear wave velocity and density of the bottom layer as \( V_1 = 750 \text{m/s} \); \( P_1 = 2.24 \text{ Mg/m}^3 \) and the shear wave velocity and density of the top layer as \( V_2 = 400 \text{m/s} \); \( P_2 = 1.76 \text{ Mg/m}^3 \) and Incident ray Displacement Amplitude = 4.77 mm. Compute the amplitude of reflected and transmitted wave. (02)

Q2. The plan and elevation of a three storey RCC school building is shown in Fig.1. 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 DL is 10 kN/m^2 and floors are to cater to an IL of 3kN/m^2. Determine the design seismic loads on the structure. (Take Importance factor \( I = 1.5 \), Response reduction factor \( R = 5 \), Zone factor \( Z = 0.36 \) and \( Sa/g \) for medium soil = 2.5). (12)

Q3(a) Define bands. At what levels in a masonry building would you provide them? Give justifications for each of them. (09)

Q3(b) Explain Elastic Rebound Theory. (03)

OR

Q3*(a) Discuss the possible damages to RC buildings in earthquake prone regions. (08)

Q3*(b) Describe the different types of faults with neat sketches. (04)

Contd......2
Q4(a). Describe, with the help of neat sketches, restoration and strengthening of RC beams and columns. (09)

Q4(b). What are the principles of earthquake resistant design of RC buildings? (03)

OR

Q4'. Discuss the effect of structural irregularities on the performance of RC buildings during earthquakes. (12)

Q5. 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 = 2k
Stiffness of columns of first floor = k
First Floor mass = 2m
Second floor mass = m
Assume k = 24Ei/h

OR

Q5'(a) A SDF system has the following properties: \( m = 0.2533 \); \( k = 10 \), \( T = 1.0 \) sec (\( \omega = 6.283 \) rad/sec) and damping \( c = 0.159 \). Determine the response \( x(t) \) of this system to \( p(t) \) defined by the quarter cycle sine pulse as given in Table below using Newmark Beta method with delta \( t = 0.1 \) sec (10)

<table>
<thead>
<tr>
<th>time</th>
<th>( p(t) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.1</td>
<td>5</td>
</tr>
<tr>
<td>0.2</td>
<td>8.66</td>
</tr>
<tr>
<td>0.3</td>
<td>10</td>
</tr>
</tbody>
</table>

Q5'(b) Calculate the critical damping for a system for which the oscillations decayed from 0.128 cm to 0.024 cm in 18 cycles. (02)

FIGURE(S)

![Figures showing plan and elevation of a structure.](image-url)