Maximum marks: 75

Duration: Three Hours

Answer any five questions.
Use of IS: 1893 –2002 is allowed (only)
Assume any data if not given.
All questions carry equal marks.

1.(a) Explain with sketches the various strengthening techniques in masonry building. 05
(b) Explain with sketches the strengthening techniques for masonry arches. 05
(c) Show with a neat sketch the earthquake bands and vertical reinforcement in load bearing walls. 05

2.(a) Define displacement ductility factor with reference to engineering structures. Draw stress-strain diagram of unconfined and confined concrete in compression on the same curve and point out the significant difference between the two. Will the initial shape of the two curves be significantly different? Explain the role of transverse reinforcement in providing ductility to R.C. members. 05
(b) A column of rectangular section d x b and height h, where d = 2b has to be provided with reinforcement for ductility. Show reinforcement details in cross-section and elevation between floor to floor as per IS: 13920-1993. 05
(c) What is short column effect? 05

3.(a) What are the different types of seismic waves? 05
(b) What is earthquake magnitude? List the different types of earthquake magnitudes. 05
(c) What is earthquake intensity and the intensity scales as per IS code? 05

4.(a) What is base isolation? 04
(b) How a structure is assessed for suitability of provision of base isolation? 04
(c) Give details of types of isolators used and its location in a building? 04
(d) Give some examples of reported performance of buildings with base isolation in real earthquakes. 03
5. Considering first two modes only for three degree of freedom system shown in figure below, find:

(a) Mode participation factors
(b) Modal displacements
(c) Lateral forces at each floor in each mode
(d) Storey shear forces in each mode
(e) Storey shear due to all modes
(f) Base shear

Consider rock site, damping ratio is 5% of critical damping, \( Z = 0.36 \) for Zone V, and \( I/R = 1.0 \).

\[
m = \begin{bmatrix}
120 & 0 & 0 \\
0 & 120 & 0 \\
0 & 0 & 120
\end{bmatrix}
\]

\[
\phi = \begin{bmatrix}
0.0328 & 0.0737 & -0.0591 \\
0.0591 & 0.0328 & 0.0737 \\
0.0737 & -0.0591 & -0.0328
\end{bmatrix}
\]

Stiffness
\( K_1 = K_2 = K_3 = K = 10^5 \text{ kN/m} \)

Natural frequencies
\( \omega_1 = 14.03 \text{ rad/sec} \)
\( \omega_2 = 39.33 \text{ rad/sec} \)
\( \omega_3 = 56.982 \text{ rad/sec} \)

6. (a) What are the aims of earthquake resistant design?
   (b) What is a response spectra of an earthquake? Plot the different response spectra.

What are the steps involved in constructing a response spectra for a given ground motion \( \ddot{u}_g(t) \).

7. Write short notes on any two of the following:
   (a) Explain irregularity in strength and stiffness of building
   (b) Explain the failure of earthen building in earthquakes with sketches.
   (c) Explain in what ways seismic safety of soft ground storey buildings can be improved.
M.TECH. (III SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
(HYDRAULIC STRUCTURE)
SPILLWAYS AND ENERGY DISSIPATORS
(CE-711)

Maximum Marks: 75
Duration: Three Hours.

Answer any four questions.
Assume any data not given.
Question No.2 is compulsory.

1. Write short notes on any four of the following:
   (a) Chute spillway
   (b) Factors affecting selection of spillway
   (c) Pier contraction coefficient
   (d) Use of Hydraulic jump as an energy dissipator
   (e) Murphy type stilling basin.
   (f) Design criteria of saddle syphon
   (g) Self aerated flows.

2. (a) A hydraulic jump is formed in a stilling basin created by a step of height ΔZ in a rectangular horizontal channel as shown in figure below. Assuming hydrostatic pressure distribution at section (1), (2) (3) and normal hydraulic jump operation between section (1) and (2) shows that:

\[
\left( \frac{y_3}{y_1} \right)^2 = 1 + 2f_1^2 \left[ 1 - \frac{y_1}{y_3} \right] + \frac{\Delta Z}{y_1} \left[ \frac{\Delta Z}{y_1} + 1 - \sqrt{1 + 8f_1^2} \right]
\]

[Diagram of a hydraulic jump at an abrupt rise]
Also determine $\Delta Z$ when initial depth is 0.5m and $Y_3 = 3m$. Discharge is 6.65 m$^3$ / sec.

(b) For a hydraulic jump taking place in a horizontal, frictionless triangular channel show that the sequent depths $Y_1$ and $Y_2$ are related to the pre-jump Froude number $F_1$ as

$$f_1^2 = \left[ \frac{2 \eta^2 \left( \eta^2 - 1 \right)}{3 (\eta^2 - 1)} \right]$$

where $\eta = \frac{Y_2}{Y_1}$

3. A box type of drop spillway is to be installed in a gully is 75 hectares. For a return period of 25 years, the maximum rainfall depth is 150mm. The maximum length of travel for the run off is 1000 meters. The average slope of the gully is 0.5%, and the run off coefficient is 0.40, for the structure, the (B/W) where B is width and W is depth is 0.25.

Use any relation between I (rainfall intensity) and return period (T.)

Assume the value of "B" as 0.55 m and $W < 2.5 W$.

4. An overflow spillway is 40.0 m high. At the design energy head of 2.5 meter over the spillway, find the sequent depths and energy loss in a hydraulic jump formed on a horizontal apron at the toe of the spillway. Neglect energy loss due to flow over the spillway face (Assume $C_d = .738$).

5. Explain the procedure in detail the design of an ogive spillway and obtain the profile equation for downstream profile structure. Assume vertical upstream face and value of K in the equation is 2.0 and $n$ is to be taken as 1.85.

Assuming the distances from the vertical face from 0 to 20m as a gap of 1 meter obtain the vertical coordinates. Assume the shape of downstream glacis = 0.8 H: 1.

Design head is assumed to be 17m.

6. Discuss various types of stilling basins. Mention their advantages and disadvantages. More stress should be given to U.S.B.R. types of stilling basin used commonly.
2010-2011
M. TECH. (III SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
WATER TREATMENT PLANT DESIGN & OPERATION
(CE – 721)

Maximum Marks : 75
Duration : Three hours

Answer all the questions
Choose any suitable data / value as when required.

Q.1 (a) Determine the volumes of hydrogen cation and strongly basic anion 13.75 exchanger beds to demineralize 150 m³/d water that has the following chemical quality.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Cations</th>
<th>Anions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ca²⁺ =145 mg/l</td>
<td>HCO₃⁻ =258 mg/l</td>
</tr>
<tr>
<td>2</td>
<td>Mg²⁺ =18 mg/l</td>
<td>SO₄²⁻ =220 mg/l</td>
</tr>
<tr>
<td>3</td>
<td>Na⁺ =130 mg/l</td>
<td>Cl⁻ =214 mg/l</td>
</tr>
<tr>
<td>4</td>
<td>K⁺ =50 mg/l</td>
<td>NO₃⁻ =50 mg/l</td>
</tr>
</tbody>
</table>

The ion exchange capacities of hydrogen cation and anion exchange resins are 75000 and 55000 g CaCO₃/ m³ cycle, respectively. Also, calculate the required quantities of regeneration chemicals. The regeneration cycle is one per day.

Q.1 (b) A water treatment plant receives water from a long raw water line that is periodically chlorinated to reduce the growth in the transmission line. As a result, the concentration of trihalomethanes in the raw water is high. Discuss the methods of removing trihalomethane from the water supply.

OR

Q.1 (a) Design a gravity thickener that receives 2000 kg/d of sludge solids at 2 percent solids and specific gravity of 1.01. The thickener minimum hydraulic loading is 3.5 m³/ m².d, and the maximum solid loading is 75 kg/ m².d. The liquid depth in the thickener is 6 m, plus the depth of hopper. The hopper has a side slope of 20 cm/m. Calculate the thickening period, solids concentration in the thickener overflow, and the volume of thickened sludge.

Q.1 (b) What is the significance of break point chlorination in water disinfection?

Q.2 (a) A filter bed is composed of uniform sand of diameter 0.4mm, with specific gravity of 2.65 and shape factor of 0.85. The porosity of the sand is 0.4, and the water temperature is 15°C. Calculate the filtration velocity in m³/ m².h, if a head loss of 2.0 m is maintained over the top of the media. μ = 1.154x10⁻³ N-s/m². Describe how head of water is maintained in filters.

Contd......2
Q.2 (a) Determine the size of the required settling tank for a city that must treat 15000 m$^3$/d of water. Flocculating particles are produced by coagulation, and a column analysis indicates that an overflow rate of 20 m/d will produce satisfactory removal at a depth of 3.5m. Also design overflow notches.

Q.2 (b) Describe how a jar test is performed and describe its importance in plant operation.

Q.3 (a) Calculate the dimension of a rapid mix single basin to treat a flow of 9500 m$^3$/d entering into two basins. Design for a detention time of 30sec. The basin shall be square with a depth to width ratio of 1.5 to 1 and length to width ratio of 1:1.

Q.3 (b) Name and discuss the various mechanisms thought to occur during coagulation.

OR

Q.3 (b) What is the principal cleaning mechanism in back washing filters?

Q.4 (a) Design an intake tower to meet the following requirements.
Maximum water surface elevation =60m, No. of level gates =2
Minimum water surface elev. =45m, No. of gates at each elev. =2
Reservoir bottom elev. = 42 m, Flow rate = 20,000 m$^3$/d.

Q.4 (b) List the different types of aerators. What is the purpose of aeration in water treatment?