2014-2015
M.TECH. AUTUMN (III SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
STRUCTURAL ENGINEERING
EARTHQUAKE RESISTANT DESIGN OF STRUCTURES
(CE – 701)

Maximum Marks: 60
Duration: Three Hours

Note: Attempt all questions. All questions carry equal marks. Use of IS:1893-2002 is permitted. Assume data suitably if required. Symbols used have their usual meanings.

1.(a) What are the different types of seismic waves? How do they influence the structures during an earthquake? (8)
(b) What are different types of earthquake magnitude? What causes the saturation of Ms and Mw? Which is the best magnitude? (4)

OR

1'.(a) Explain the splint and bandage technique of strengthening of masonry building. (6)
(b) Explain the qualitative tests for determining suitability of soil for earthen construction. (6)

2.(a) What are the aims of earthquake resistant design? (4)
(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 $\ddot{u}_g(t)$? (4)
(c) What are the factors influencing the response spectra? (4)

OR

2'.(a) Explain the brittle and ductile failures of flexural members. (4)
(b) What is rotational ductility? (2)
(c) A rectangular column of section $d \times b$ and height $h$, here $d = 2b$ has to be provided with reinforcement for ductility. Show the reinforcement detail in section as per IS: 13920-1993. (6)

3. (a) What is a soft storey? Explain the behaviour of soft first storey building. How can the sudden changes in stiffness be avoided? (4)
(b) Explain typical types of damages and failure of stone buildings in earthquakes. (4)
(c) Give the details of types of isolators used and its location in a building. (4)

4.(a) Briefly discuss the structural behaviour of masonry structure during earthquake. (4)
(b) Design and detail lintel band and roof band for a masonry building. Following data are given:
   Plan dimension $= 4m \times 6m$
   Height of the building $= 3.3m$
   Thickness of the wall $= 0.225m$
   Thickness of the roof slab $= 0.125m$
   Design seismic coefficient $= 0.19$
   Use M20 concrete and Fe 415 steel. Assume suitably any other data required. (8)

5. Write short notes on any three of the following: (4x3 = 12)
(a) Effect of eccentricity between centre of mass and stiffness in buildings
(b) Tests on assemblage to ascertain the strength of brick masonry
(c) Liquefaction and its effects on structures
(d) Typical types of damages and failure of stone buildings in earthquakes
(e) Difference between repair, strengthening and retrofitting of structure
M. TECH. (III SEMESTER) EXAMINATION 
(CIVIL ENGINEERING) 
HYDRAULIC STRUCTURES 
SPILLWAYS AND ENERGY DISSIPATORS 
(CE-711) 

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) Compute the discharge over an Ogee spillway with a head of 2.0m. The length of spillway is 100m. The crown of spillway is 8.0m above the bottom of approach channel having the same width as that of spillway. Take spillway coefficient as 2.20 [05]
1(b) Enumerate various types of spillways. Describe the construction and working of saddle siphon spillway by giving a neat sketch. [07]

OR

1'(b) Calculate the design head over an Ogee spillway having seven span of 10m each, to pass safely a discharge of 6850 cumec. Take:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pier contraction coefficient ($k_p$)</td>
<td>0.02</td>
</tr>
<tr>
<td>Spillway coefficient</td>
<td>2.10</td>
</tr>
<tr>
<td>Abutment contraction coefficient ($k_a$)</td>
<td>0.10</td>
</tr>
</tbody>
</table>

[07]

2(a) List various types of spillway gates. Describe with the help of a neat sketch the construction and working of a Radial gate. [07]
2(b) Discuss the importance of spillway in a river valley project. [05]
3(a) Explain the role of jump height curve and tail water curve in selection of a energy dissipating device. [05]
3(b) Design a suitable stilling basin at the toe of a spillway from the following data:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge intensity ($q$)</td>
<td>24.6 cumec /m</td>
</tr>
<tr>
<td>Cv</td>
<td>0.90</td>
</tr>
<tr>
<td>HFL in the reservoir</td>
<td>100m</td>
</tr>
<tr>
<td>Spillway Crest Level</td>
<td>95.00</td>
</tr>
<tr>
<td>River Bed Level</td>
<td>59</td>
</tr>
<tr>
<td>Tail Water Level</td>
<td>69.00</td>
</tr>
</tbody>
</table>

[07]

OR

3'(a) How are the following parameters finalized in case of a hydraulic jump type energy dissipation arrangement?

(i) Level of the basin (ii) Length of the basin (iii) Slope of the basin. [05]
3'(b) Explain the Ski jump energy dissipater with a neat sketch. Describe the design procedure of solid roller bucket.

4(a) Discuss the design considerations for the location of main as well as emergency spillways.

4(b) Determine the number of siphon units required to pass a flood discharge of 650 Cumec. The other required data is given below:
- Full reservoir level: 236.00m
- Level of centre of siphon outlet: 230.60m
- Highest flood level: 236.80m
- Dimensions of throat of siphon: 4.0m x 1.5m

5 Give the hydraulic design of upstream profile of an Ogee spillway with the help of data given below:
- Design Discharge: 5000 Cumec
- No. of span: 7
- Length of each span: 12m.
- Spillway coefficient: 2.20
- Pier coefficient (kp): 0.01
- Abutment coefficient (ka): 0.10

Contd. - 3.
**FIGURE 1**

**USBR Stilling basin II**

<table>
<thead>
<tr>
<th>F₁</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
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<tbody>
<tr>
<td>Lₜ/y₂</td>
<td>2.3</td>
<td>2.5</td>
<td>2.6</td>
<td>2.7</td>
<td>2.8</td>
<td>2.8</td>
<td>2.8</td>
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<tr>
<td>h₃/y₁</td>
<td>1.5</td>
<td>1.7</td>
<td>2.0</td>
<td>2.3</td>
<td>2.7</td>
<td>3.0</td>
<td>3.3</td>
</tr>
<tr>
<td>h₄/y₁</td>
<td>1.2</td>
<td>1.3</td>
<td>1.5</td>
<td>1.6</td>
<td>1.7</td>
<td>1.8</td>
<td>1.9</td>
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</tbody>
</table>

**USBR Stilling basin III**

<table>
<thead>
<tr>
<th>F₁</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>TWD=1.05y₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lₜ/y₂</td>
<td>3.6</td>
<td>4.0</td>
<td>4.2</td>
<td>4.3</td>
<td>4.3</td>
<td>4.3</td>
<td></td>
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2014-2015
M. TECH. AUTUMN (III SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
WATER TREATMNT PLANT DESIGN & OPERATION
(CE-721)
Maximum Marks : 60
Answer all the questions.
Assume any data judiciously, if required

Q.1(a) Why is water softening necessary in water treatment and how it can be achieved?

Q.1(b) A multistory residential apartment is having a present population of 1800. Calculate the future water demand and design the following intake structures:
   (i) Intake well (assume detention time = 5-10 min and depth = 4-10 m)
   (ii) Pen stock (assume velocity through pen stock = 0.6-1.0 m/s)
   (iii) Bell mouth strainer (assume hole dia = 6-12 mm, velocity of flow = 0.20-0.30 m/s)
   (iv) Gravity main (assume conduit velocity = 0.7-0.8 m/s)

OR

Q.1(b') For the above residential apartment design the following components:
   (i) Jack well (assume detention time = 5-6 min, suction head < 10 m)
   (ii) Pumps (assume pump efficiency >= 75%, friction factor = 0.02, velocity = 0.7-1.5 m/s)
   (iii) Rising main

Q.2 Propose various water treatment schemes for the given water quality parameters and find out lime and soda ash required for the given parameter.
   (i) pH = 7.5
   (ii) Total alkalinity = 415 mg/l
   (iii) Total hardness = 550 mg/l
   (iv) Calcium hardness = 150 mg/l
   (v) Magnesium hardness = 42.0 mg/l
   (vi) Sulphates = 595 mg/l
   (vii) Chlorides = 1200 mg/l
   (viii) Flow rate 0.30 MLD

Draw meq/L bar diagram for finished and raw water.
Q.2' Design a rapid mixing unit for a water treatment plant with a design flow of 300 m$^3$/d. The ratio of tank height to diameter is 1.3:1. The design velocity gradient and detention time are 600 s$^{-1}$ and 40 sec respectively. Design the basin dimensions and the input power required.
Assume:
Ratio of impeller diameter to tank diameter = 0.4:1
Rotational speed of impeller = 120 rpm

Q.3(a) Design a circular sedimentation tank for 0.3 MLD flow rate having 3 hr detention time. Assume minimum size of the flock to be removes is 0.8 mm and specific gravity is 1.002.

Q.3(b) Describe how a jar test is performed and describe its importance in plant operation.

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

OR

Q.4(a)' Name and discuss the various mechanisms thought to occur during coagulation.

Q.4(b) Describe the purpose of microstrainer in water treatment.

Q.4(c) What is the purpose of recarbonation in water treatment.