1(a) Solve the following linear programming problem using M-method:

Max \( Z = -2x_1 - 3x_2 \)
Subject to \( x_1 + x_2 \geq 2 \)
\( 2x_1 + x_2 \leq 10 \)
\( x_1 + 2x_2 \leq 8 \)
\( x_1, x_2 \geq 0 \)

1(b) Write the dual of the following linear programming problem:

Min \( Z = -x_1 + 2x_2 + 3x_3 \)
Subject to \( -x_1 + x_2 + x_3 \geq 3 \)
\( x_1 + 2x_2 + x_3 \leq 10 \)
\( x_1, x_2, x_3 \geq 0 \)

Also solve the dual linear programming problem by graphical method.

2(a) Suppose that \((X, Y)\) is uniformly distributed over the triangle \(O (0, 0), A (-1, 2)\) and \(B (1, 2)\). Find \(E(X), E(Y), V(X), V(Y)\) and \(\rho\).

2(b) Suppose the heights of men are normally distributed with mean 68 inches and standard deviation 2.5 inches. Find the percentage of men who are

(i) between 66 inches and 72 inches.

(ii) at least 71 inches.

3 Answer any three parts

(a) A lot consists of 10 good articles, 4 with minor defects and 2 with major defects. Two articles are chosen without replacement. Find the probability that

\[ \text{Contd...2.} \]
(i) at least one is good.

(ii) both have major defects.

(b) Given $P(A) = 0.4$, $P(B) = 0.5$ and $P(A \cap B) = 0.1$. Evaluate $P(A | B)$, $P(A | B')$, $P(A' | B)$, $P(B | A')$.

(c) In a bolt factory, machines A, B and C manufacture 25, 35, and 40 percent of the total output respectively. Of their outputs 5, 4, and 2 percent, respectively, are defective bolts. A bolt is chosen at random and found to be defective. What is the probability that the bolt came from machine C?

(d) Whenever an experiment is performed, the occurrence of a particular event A equals 0.3. The experiment is repeated, independently, until A occurs. Compute the probability that it will be necessary to carry out a fourth experiment.

Answer any three parts.

(a) If $T$, the time to failure, is a continuous random variable with probability distribution function $f(t)$ and if $P(0) = 0$, where $F$ is the cumulative distribution function, then express $f(t)$ in terms of hazard function $Z(t)$.

(b) Let $T$, the time to failure, be a continuous random variable, assuming all non-negative values, show that $T$ has an exponential distribution if and only if it has a constant failure rate.

(c) Suppose that $T$, the time to failure, of an item is normally distributed with mean 90 hours and standard deviation 5 hours. In order to achieve a reliability of 0.95, how many hours of operation may be considered?

(d) 200 digits were chosen at random from a set of tables. The frequencies of the digits were:

<table>
<thead>
<tr>
<th>Digit</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>2</td>
<td>23</td>
</tr>
<tr>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>22</td>
</tr>
<tr>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>21</td>
</tr>
<tr>
<td>9</td>
<td>15</td>
</tr>
</tbody>
</table>

Use the chi-square test to assess the correctness of the hypothesis that the digits were distributed in equal number in the table from which these were chosen. ($\chi^2$ for 9 degree of freedom at 5% level = 16.919)

Contd.....3.
\[ 0 \leq z \leq \sigma \rightarrow \frac{1}{\pi \sigma^2} \int_{-\infty}^{z} e^{-\frac{t^2}{\sigma^2}} \, dt = \Phi(z) \]

\text{(continued)}
2015-16
M TECH(WINTER SEMESTER) EXAMINATION
CIVIL ENGINEERING
FINITE ELEMENT ANALYSIS
CE-606

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 | MM
---|---|---
1 (a) | State the differences between finite-element method and finite-difference method. | 03

OR

1 (b) | Derive elastic property matrix for plane stress problems. | 03
1 (b) | Develop global stiffness matrix for pin jointed truss element as shown in Fig. 1. Use Direct equilibrium approach. | 12

![Fig. 1](image)

2 (a) | State and explain the principle of minimum potential energy. | 03
2 (b) | Using minimum potential energy principle, determine the forces developed in all the members of the truss as shown in Fig. 2. | 12

![Fig. 2](image)

Contd.....2.
2 (b') Determine reactions at the supports of the beam as shown in Fig. 3 using Finite Element Technique.

\[ E = 2.0 \times 10^5 N/mm^2 \]
\[ I = 5 \times 10^6 mm^4 \]

Fig. 3

3. Combine any two elements from the following choices and connect them node-to-node (i.e., two 2-noded elements); determine the shape functions using polynomial functions (generalized coordinates).
   i) two noded frame element of length L/2,
   ii) two noded bar element of length L/2,
   iii) two noded beam element of length L/2.

You can make use of a maximum of two constraints at your will. Also draw variation of shape functions.

4 (a) Explain the principle of virtual displacements.
4 (b) Solve the three bar truss problem given in Fig. 2 by using virtual displacement principle.

OR

4' (a) Explain the following:
   i) Natural coordinate system,
   ii) Lagrange polynomials.

Also determine the shape functions for 4-noded rectangular element on the basis of above methods. Write them in generalized form and compare them by drawing the variation of shape functions.

4' (b) Form the matrix \( \{u\}_e \) using natural coordinate system for the arbitrary element type (7-noded) shown in Fig. 4.
2015-16
M.TECH. (WINTER SEMESTER) EXAMINATION
CIVIL (STRUCTURAL ENGINEERING)
STRUCTURAL DYNAMICS
CE-607

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) | Derive the responses for single degree free vibration system under critical, under-damped and over-damped condition. Plot the motion diagram for critically damped, over-damped and under-damped system. | [5]
1(b) | A single degree of freedom system consists of a mass with weight of 175kg and a spring constant K=530kN/m. while testing the system a relative velocity of 30cm/s was observed on application of a force of 450N. determine the damping ratio, damped frequency of vibration, logarithmic decrement and the ratio of two consecutive amplitudes. | [5]
1(c) | A commercial air-conditioning unit weighing 6000N is located at the middle of two parallel simply supported steel beams whose clear span is 5m. The motor runs at 300rpm and its rotor produces a rotating unbalanced force of 450N at this speed. Assuming a viscous factor damping of 10% and neglecting the weight of the supporting beams, determine the steady-state amplitude of the vibrations which results from the rotating unbalance. The moment of inertia of each beam is 800cm$^4$. Find also the transmissibility. | [5]

OR

1'(a) | For a harmonic periodical force, prove that dynamic amplification Factor is equal to | [6]

$$\frac{1}{\sqrt{(1-\eta^2)^2 + (2\xi\eta)^2}}$$

1'(b) | Determine the free vibration response of single degree of freedom system at time t=0.2s for the following data:
Natural circular frequency $\omega = 12$ rad/s
Damping ratio $\xi = 10\%$
Initial velocity $x'(0) = 10$ cm/s
Initial displacement $x(0) = 5$ cm | [4]

Contd......2.
1(c) An instrument weighing 20kN is to be isolated from base isolation. The maximum amplitude of base vibration is 10cm and frequency 10rad/s. Determine the stiffness of the supporting system for 80% isolation. Damping of the isolator is 10%.

2(a) For the periodic force shown in Fig. 1 below, find the forcing function and responses up to third term using Fourier Series.

![Fig. 1](image)

2(b) A single degree of freedom system has a mass of 500kg, damping 5% and stiffness 30kN/m. It is subjected to a wind force as shown in Fig. 2 below. The system is at rest. Determine the displacement, velocity and acceleration up to 1 sec, if $\Delta T=0.2$ sec.

![Fig. 2](image)

3 The section of a typical two storey steel shear building is shown below in Fig. 3. The weights of the floors and walls are indicated in the figure and are assumed to include the structural weight as well. The building consists of a series of frames spaced 6 m apart. It is further assumed that the structural properties are uniform along the length of the building and, therefore, the analysis to be made of an interior frame yields the response of the entire building.

(a) Calculate the natural frequency, time period and modal shapes of the building
(b) Determine the normalized modal shapes and verify the orthogonality condition between modes.

Contd.....3.
4. A two storey frame as shown below is acted upon at floor levels by triangular impulsive forces as shown below in Fig. 4.

Fig. 4 (a) Two storey shear building (b) Impulsive loading (10^5 = 10000 N)

The natural frequencies and the normalized modes for the frame is as:

\[ \omega_1 = 11.8 \text{ rad/s}, \quad \omega_2 = 32.9 \text{ rad/s'} \]
\[ \phi_1 = 0.06437, \quad \phi_2 = 0.0567, \]
\[ \phi_1 = 0.08130, \quad \phi_1 = -0.0924. \]

Determine the maximum floor displacement and the shear forces in the columns. The maximum dynamic load factor for the undammed oscillator acted upon by triangular force can be obtained from the following Fig 5.
OR

4' Derive the general equation for free vibration of a uniform beam subjected to any dynamic system of loading. Calculate the natural frequency and normal modes for a beam fixed at both the ends.

Note: The properties of the sections used in question No. 3 are as follows:

<table>
<thead>
<tr>
<th>Section</th>
<th>ISMB 250</th>
<th>ISMB 400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (mm x mm)</td>
<td>125 x 250</td>
<td>140 x 400</td>
</tr>
<tr>
<td>Flange Thickness (mm)</td>
<td>12.5</td>
<td>16.0</td>
</tr>
<tr>
<td>Web Thickness (mm)</td>
<td>6.9</td>
<td>8.9</td>
</tr>
<tr>
<td>Sectional Area cm²</td>
<td>47.55</td>
<td>78.46</td>
</tr>
<tr>
<td>Weight (kg per metre)</td>
<td>37.3</td>
<td>61.6</td>
</tr>
<tr>
<td>Moment of Inertia (cm⁴)</td>
<td>$I_{xx} = 5136.6$</td>
<td>$I_{xx} = 20458.4$</td>
</tr>
<tr>
<td></td>
<td>$I_{yy} = 334.5$</td>
<td>$I_{yy} = 422.1$</td>
</tr>
</tbody>
</table>
M.TECH. (WINTER SEMESTER) EXAMINATION
CIVIL (STRUCTURAL ENGINEERING)
ADVANCED STEEL DESIGN
CE-608

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.
Relevant IS Code and Steel Table is permitted.

Q.No. Question

1(a) Find the collapse load for a single storey two bay portal frame. The column height is 5m and span of each beam 4m. The frame is subjected to a point load 2W at mid span of each beam and a horizontal load W. The moment of resistance of all three columns is Mp and that of Beams is 2Mp. Assume column to be fixed at base.

M.M. [10]

1(b) What are the factors that affect the fatigue life of a structure?

[5]

OR

1'(a) Design a suitable section for a three span continuous beam each having a span of 10 m and supporting a dead load of 15 kN/m and a live load of 25 kN/m by plastic design procedure.

M.M. [15]

2. Design stays and longitudinal beams for an overhead rectangular riveted steel tank (flat bottom) of capacity 70000 litres. The centre to centre distance between longitudinal beams are 1.22 m. The available width and length of plates are 1.22 m and 6 m respectively. The staging consist of 4 columns spaced 4.88 m x 3.66 m and the bottom of the tank is 9.14 m above the ground level. Show by a neat sketch the tank with staging and other the arrangement of various components. Take the value of permissible stresses in plates as follows.

Direct Tension = 0.8 x 0.6 \( f_p \)

Bending Tension and Bending Compression = 0.8 x 0.66 \( f_p \)

All other stresses (rivets) = 0.8 times those specified in IS: 800

Contd.....2.
3. A self-supporting steel stack is 80 metres high and its diameter at the top is 3 metres. Configure the chimney. Design the plates for the stack at the junction of cylindrical and flared portion. Adopt the wind force as per IS: 875. The chimney is situated in terrain category 3 and the class is B. The basic wind speed of the region is 47 m/s. Divide the cylindrical portion of the chimney in 5 parts to calculate the bending moment due to wind the junction of cylindrical and flared portion. Assume the value of allowable stress in axial compression and in bending as 71.8 N/mm² and 78.7 N/mm² respectively.

4. Pratt truss girder through bridge is provided for single broad gauge track. The effective span of the bridge is 45 m. The cross girders are spaced 4.5 m apart. The stringers are spaced 2 m between centre lines. 0.6 kN per metre stock rails and 0.4 kN per metre check rails are provided. Sleepers are spaced at 0.45 m from centre to centre and are of size 2.8 m x 0.25 m x 0.25 m. Weight of timber may be assumed as 7.5 kN/m³. Note: Equivalent uniformly distributed live loads (EUDLL) on each track for broad gauge bridge are as follows:
   \[ \text{Span (m)} = 45 \]
   \[ \text{Total load for B.M. (kN)} = 3950 \]
   \[ \text{Total Load for S.F. (kN)} = 4250 \]
   \[ \text{Impact Factor} = 0.339 \]

OR

4'. A microwave tower of 50m height as shown in Fig.1 is proposed over a hill top. The height of the hill is 50 m with a gradient of 1 in 4. The terrain category is 3 and the class is B. The tower is proposed at Coimbatore where the basic wind speed is 39 m/s. Compute the design wind pressure. The tower is mounted with a hollow hemispherical dome of 2m diameter weighing 10 kN. Calculate the solidity ratio for top five panels. Also compute the forces and stresses in members of top panel only. Design as per relevant codes.

Contd....3.
2015-16
M. Tech (II Semester Examination)
(Civil Engineering)
(Structural Engineering)
Construction Planning and Management
(CE-609)

Maximum Marks: 60
Duration: 3 Hours

Note:
1. Answer any Five Questions
2. All parts of a question should be attempted in one continuation in one copy
3. Answer to any part of the question should begin from FRESH page
4. All questions carry equal marks

Q.1 (a) Write a brief account on profile of construction industry in India
(b) Discuss inherent nature of construction project in detail

Q.2 (a) What do you understand by term specification. Discuss each in detail with example
(b) Discuss with example, various types of discounts offered by the seller company in detail

Q.3 (a) List and discuss factors of production needed for any economic activity in detail
(b) Define the following types of cost with application 1X6
   (i) Direct Cost
   (ii) Fixed Cost
   (iii) Opportunity Cost
   (iv) Conversion Cost
   (v) Sunk Cost
   (vi) Historical Cost

Q.4 (a) Discuss concept of wage and its types in detail

Contd.....2.
Write down the H R (Human Resource) hierarchy of Structural Engineering consultancy firm. Discuss role of each position in

Q5  (a) What is Working capital management theory; discuss its operating cycle with diagram. (6)
(b) Discuss advantages and disadvantages of FIFO and AVCO methods. (6)

Q6  (a) Write down the fundamental equation of Balance Sheet and discuss the terminology involved in it. (6)
(b) Briefly describe about the Convention of materiality and Convention of conservatism. (6)
OR
(b') What is depreciation and list down various methods of depreciation calculation (6)
Q.No. 1(a) | Explain the following:
---|---
(i) Deterministic and probabilistic processes (ii) Storm transposition and maximization (iii) Probable maximum precipitation

1(b) The ordinates of the recession limb of a hydrograph are listed below. Assuming that runoff consist of only direct runoff and base flow, find the recession constants for the base flow and direct runoff.

<table>
<thead>
<tr>
<th>Time (days)</th>
<th>Flow (m³/s)</th>
<th>Time (days)</th>
<th>Flow (m³/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>411</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>15</td>
<td>358</td>
<td>21</td>
<td>83</td>
</tr>
<tr>
<td>16</td>
<td>250</td>
<td>22</td>
<td>70</td>
</tr>
<tr>
<td>17</td>
<td>192</td>
<td>23</td>
<td>58</td>
</tr>
<tr>
<td>18</td>
<td>151</td>
<td>24</td>
<td>49</td>
</tr>
<tr>
<td>19</td>
<td>122</td>
<td>25</td>
<td>41</td>
</tr>
</tbody>
</table>

OR

1'(a) Enumerate various methods of flood estimation.

1'(b) What do you mean by regional flood frequency analysis? Explain the procedure suggested by Daryample and Benson for checking the homogeneity of region for the available data.

2 The ordinates of a 2 - h U.H. of a basin of area 300 km² measured at 1 - h intervals are 5, 35, 65, 90, 105, 92, 78, 67, 57, 48, 40, 33, 26, 22, 16, 12, 8, 5, 2 and 1 m³/s respectively. Obtain the ordinates of a 3 - h U.H. for the basin using the S-curve technique.

Contd....
Differentiate between unit hydrograph and instantaneous unit hydrograph. Derive a 3-h synthetic unit hydrograph of a basin with the following data: Basin area = 3000 km², Length of the main stream = 110 km; Distance from centroid of the basin to the outlet = 60 km. The Synder’s coefficients $C_t$ and $C_p$ may be assumed to be 1.56 and 0.60 respectively.

A drainage basin of area 600 Km² has experienced an 8-h storm with rainfall intensities of 3 and 2 cm/h in successive periods of 4-h each. The distribution ratios of the distribution graph for storms of 4-h duration are 0.05, 0.15, 0.30, 0.20, 0.13, 0.09, 0.055 and 0.025. Determine the ordinates of discharge hydrograph. Assume an average $\Phi$-index of 1.0 cm/h and take a constant base flow of 5 m³/s.

OR

A reservoir has the following elevation, discharge and storage relationships:

<table>
<thead>
<tr>
<th>Elevation (m)</th>
<th>Storage (Mm³)</th>
<th>Outflow discharge (m³/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.00</td>
<td>3.350</td>
<td>0</td>
</tr>
<tr>
<td>100.50</td>
<td>3.472</td>
<td>10</td>
</tr>
<tr>
<td>101.00</td>
<td>3.880</td>
<td>26</td>
</tr>
<tr>
<td>101.50</td>
<td>4.383</td>
<td>46</td>
</tr>
<tr>
<td>102.00</td>
<td>4.882</td>
<td>72</td>
</tr>
<tr>
<td>102.50</td>
<td>5.370</td>
<td>100</td>
</tr>
<tr>
<td>102.75</td>
<td>5.527</td>
<td>116</td>
</tr>
<tr>
<td>103.00</td>
<td>5.856</td>
<td>130</td>
</tr>
</tbody>
</table>

When the reservoir level was at 100.50 m, the following flood hydrograph entered the reservoir:

<table>
<thead>
<tr>
<th>Time(h)</th>
<th>0</th>
<th>6</th>
<th>12</th>
<th>18</th>
<th>24</th>
<th>30</th>
<th>36</th>
<th>42</th>
<th>48</th>
<th>54</th>
<th>60</th>
<th>66</th>
<th>72</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge (m³/s)</td>
<td>10</td>
<td>20</td>
<td>55</td>
<td>80</td>
<td>73</td>
<td>58</td>
<td>46</td>
<td>36</td>
<td>25</td>
<td>20</td>
<td>15</td>
<td>13</td>
<td>11</td>
</tr>
</tbody>
</table>

Route the flood by Goodrich method.
2015-2016
M.TECH. (II SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
HYDRAULIC STRUCTURES
HYDROPOWER STRUCTURES

(CE - 617)

Maximum Marks: 60
Duration: Three Hours

(i) Attempt All questions. Each question carries equal marks.
(ii) Assume suitable data if required.
(iii) Symbols used have their usual meanings.

Q. No.

1(a) List out any five sources of energy. Compare basic features of hydro power plants with atomic power plants. Name any two tidal power plants of India or abroad with their installed capacities.

1(b) Draw the neat sketch of Sanjay Vidyut Pariyojana and properly label it.

OR

1'(a) Differentiate among:
   (i) Penstock and manifold
   (ii) Plant use factor and load factor
   (iii) Flow duration and power duration curves

1'(b) Following data indicates the average monthly flow of a river in a driest year on record:
   Month  Jan  Feb  March  April  May  June  July  Aug  Sept  Oct  Nov  Dec
   Cumecs  125  105  85   65  45   50  80   235  315  205  130  120

   Assuming overall efficiency of turbine as 90 %, construct and plot a power duration curve. Gross head = 105 m, head loss 2.0 % of the gross head, specific weight of water = 10 kN/m³.
   Using this graph find:
   (i) Base power
   (ii) P85, P50 and P15

Contd.....2.
2(a) How tunnels are classified based on shape, function and their alignment? (07)

2(b) What is penstock? Deduce the formula to find the diameter of the penstocks by analytical method. (08)

OR

2'(b) What are draft tubes? Draw the neat sketches of any two types of draft tubes. (08)

How the efficiency of a draft tube is defined?

3(a) What are the main functions of surge chambers? Draw neat sketch of a differential type surge chamber.

A hydropower scheme has a surge tank at the end of a 2.5 Km long tunnel having 4.5 m diameter. The surge tank which is rectangular in section may be presumed to be of circular cross section with 16.0 m diameter. The penstocks system consists of 5 penstocks each 1.525 m diameter and 3.8 m long. These can be represented by a single penstock, 380m long and 3.41 m in diameter. The friction factors for tunnel and penstocks are 0.017 and 0.031 respectively. The acoustic wave velocity in the penstock is 1430 m/s. In steady state, the head reservoir level is EL 457.00 m with a discharge of 26.0 m³/s. Find maximum upsurge, down surge and time of oscillation of the surge.

3(b) Explain the phenomenon of water hammer in a pressure conduit when end gate is closed suddenly. (05)

4(a) What is specific speed of turbines? How turbines are classified based on it? (07)

4(b) Discuss in detail the various safety measures to be considered during the construction of Civil Engineering Projects. Why is it so important? (08)

OR

4'(b) Write short notes on any two of the following: (08)

i) Dimensioning of power house
ii) Pumped storage schemes
iii) Head loses in Intakes
iv) Elastic column theory of water hammer analysis
M. Tech. WINTER (II SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
(HYDRAULIC STRUCTURES)
Advanced Hydraulics
CE-618

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). Draw the neat sketches of various sharp crested non-rectangular weirs and write their discharge formulae. [04]
1(b). Design a Sutro weir for use in 0.60 m wide rectangular channel to have linear discharge relationship in the discharge range from 0.25 m³/s to 0.60 m³/s. The base of the weir will have to span the full width of the channel. Assume $C_d = 0.62$. [08]
1'(b). A horizontal trapezoidal channel of bed width 7m and side slopes 1:1 carries a discharge of 20 m³/s. If the depth after the hydraulic jump is 2.25m, prepare specific energy diagram and calculate the sequent depth and energy loss. [08]
2. Enumerate spatially varied flow situations in open channel. Derive the basic differential equation of SVF with increasing discharge stating its assumptions. [12]
3. A lateral spillway channel is trapezoidal in cross section with $B = 5$ m, side slope $m = 1$ and $n = 0.018$. The bed slope is 0.10. If the lateral inflow is 2.5 m³/s/m, find the critical depth and its location. Assume $\beta = 1.20$. [12]
3’. A rectangular channel is 1.5 m wide carries a flow of 2 m³/s at a Froude number of 0.3. A uniformly discharging side weir with crest at 0.4m above the bed is proposed to divert a flow of 0.2 m³/s. Design the length of the side weir and the geometry of the channel at the weir. [12]
4(a). Explain the Fick’s law of diffusion in an open channel. Differentiate between advective and turbulent diffusion. [04]
4(b). An industry is located on the bank of river of 30 m width and 1.5m depth. The slope of the river is $1.8 \times 10^{-4}$ and $n = 0.02$. The industry discharges 0.1 m³/s of effluent continuously into the river. Find the concentration 15 km downstream of the point of discharge, 4 hours after the start of injection. (Use Table for error function) [08]

Contd.....2.
5. Write short note on any three of the following:
(a) Self-aeration in Hydraulic jump
(b) Trench weirs
(c) Longitudinal dispersion
(d) Modular limit

<table>
<thead>
<tr>
<th>ξ</th>
<th>erf (ξ)</th>
<th>erfc (ξ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0</td>
<td>1.0</td>
</tr>
<tr>
<td>0.1</td>
<td>0.1129</td>
<td>0.8871</td>
</tr>
<tr>
<td>0.2</td>
<td>0.2227</td>
<td>0.7773</td>
</tr>
<tr>
<td>0.3</td>
<td>0.3286</td>
<td>0.6714</td>
</tr>
<tr>
<td>0.4</td>
<td>0.4284</td>
<td>0.5716</td>
</tr>
<tr>
<td>0.5</td>
<td>0.5205</td>
<td>0.4795</td>
</tr>
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<td>0.8427</td>
<td>0.1573</td>
</tr>
<tr>
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<td>0.0897</td>
</tr>
<tr>
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<td>0.9523</td>
<td>0.0477</td>
</tr>
<tr>
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<td>0.9763</td>
<td>0.0237</td>
</tr>
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<td>1.8</td>
<td>0.9891</td>
<td>0.0109</td>
</tr>
<tr>
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<td>0.9953</td>
<td>0.0047</td>
</tr>
<tr>
<td>2.5</td>
<td>0.9996</td>
<td>0.0004</td>
</tr>
<tr>
<td>3.0</td>
<td>0.99998</td>
<td>0.00002</td>
</tr>
</tbody>
</table>
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) Briefly describe the importance of mass balance concept in reactor kinetics. [03]
1 (b) Differentiate between the working of a CSTR and PFTR. Which type of reactor you would recommend for the treatment of toxicants? [05]
1 (c) Determine the number of completely mixed chlorine contact tanks for reducing the bacterial count of water sample from 100000 organisms per mL to 20 organisms per mL. Take the value of first order reaction rate constant as 6.0 hr⁻¹. [04]

OR

1' (a) Derive the equation used for the determination of effluent concentration for a tracer in a CSTR receiving continuous input of a tracer undergoing decay. Assume non steady state conditions. [04]
1' (b) What volume of PFTR is required to remove 90% of a substance that decays according to first order reaction rate constant of 0.05 d⁻¹. The flow rate is 395 m³/d. Continue the exercise for CSTR with the same efficiency and flow rate. [04]
1' (c) Derive the equation used for the determination of effluent concentration of a tracer undergoing decay in a plug flow reactor operating under steady state conditions. [04]

2 (a) Derive the equations used for the determination of kinetic constants in a CSTR without recycle. [04]
2(b) Laboratory reactors have been operated at different SRT values at steady state to obtain biological kinetic coefficient for a wastewater with soluble constituents only. [08]

Contd.....2.
The reactors are completely mixed and are provided with clarifiers for solids recycle. Take the value of detention time as 0.167 d and the SRT values have been varied for the five tests. Following table summarises the results of the tests.

<table>
<thead>
<tr>
<th>Test no.</th>
<th>SRT, d</th>
<th>S₀, mg COD/L</th>
<th>S, mg COD/L</th>
<th>X, mg VSS/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.1</td>
<td>400</td>
<td>10.0</td>
<td>3950</td>
</tr>
<tr>
<td>2</td>
<td>2.1</td>
<td>400</td>
<td>14.3</td>
<td>2865</td>
</tr>
<tr>
<td>3</td>
<td>1.8</td>
<td>400</td>
<td>20.0</td>
<td>2150</td>
</tr>
<tr>
<td>4</td>
<td>0.9</td>
<td>400</td>
<td>47.5</td>
<td>1100</td>
</tr>
<tr>
<td>5</td>
<td>0.6</td>
<td>400</td>
<td>101.6</td>
<td>660</td>
</tr>
</tbody>
</table>

From these results determine the values of kinetic constants.

3 (a) Differentiate between the workings of activated sludge process and trickling filter.

Design a two stage high rate trickling filter for the treatment of 30 MLD of sewage.
Take influent BOD as 200 mg/L. It is desired to have 30 mg/L of BOD in the treated effluent. Assume R=1.

3 (b) Briefly explain why yield coefficient has a lower value in anaerobic treatment as compared to aerobic treatment.

3 (c) What is meant by \( \Theta_c^{\text{min}} \) and explain its significance in biological treatment of wastewater.

4(a) Describe in detail the different biological nitrogen removal processes.

4 (b) Write down the overall equations for Denitrification process. Calculate the methanol requirement for a conventional denitrification process handling a wastewater flow of 10000 m³/d. The effluent from nitrification reactor contain 0.8 mg/L of D.O., 35.0 mg/L of nitrate and 4.5 mg/L of nitrite.

5. Answer any four of the following
   (i) Nutrient requirements in anaerobic treatment.
   (ii) RBC reactor
   (iii) Toxicity considerations in Anaerobic process
   (iv) Modified forms of Activated Sludge Process
   (v) Upflow Anaerobic Sludge Blanket Reactor
   (vi) Stabilization Ponds and Wetlands
2015-2016
M.Tech. II (Winter Semester) Examination
CIVIL ENGINEERING
(Environmental Engineering)
INDUSTRIAL WASTEWATER TREATMENT
CE-627

Maximum Marks: 60
Duration: Three Hours

Answer all questions.
Assume suitable data where necessary.
Notations used have their usual meaning.

Q1 (a) Write the steps for conducting industrial waste survey. How does it help in waste management for an industry? (5)

Q1 (b) Highlight the scope of employing volume reduction and strength reduction for waste management in industries. (5)

OR

Q1 (b') Discuss the importance of equalization and neutralization in industrial wastewater treatment. Give examples from industry where these techniques are employed. (5)

Q1 (c) List various methods for wastewater flow measurement in an industry. Determine the minimum dimensions of a V-notch and approach channel to measure a maximum discharge rate of 1500 m³/d. (5)

OR

Q1 (c') Using the following data, determine the volume of basin required for flow equalization. (5)

<table>
<thead>
<tr>
<th>Time (hrs)</th>
<th>Flow (m³/s)</th>
<th>Time (hrs)</th>
<th>Flow (m³/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 1</td>
<td>0.275</td>
<td>12 - 13</td>
<td>0.425</td>
</tr>
<tr>
<td>1 - 2</td>
<td>0.220</td>
<td>13 - 14</td>
<td>0.405</td>
</tr>
<tr>
<td>2 - 3</td>
<td>0.165</td>
<td>14 - 15</td>
<td>0.385</td>
</tr>
<tr>
<td>3 - 4</td>
<td>0.130</td>
<td>15 - 16</td>
<td>0.350</td>
</tr>
<tr>
<td>4 - 5</td>
<td>0.105</td>
<td>16 - 17</td>
<td>0.325</td>
</tr>
<tr>
<td>5 - 6</td>
<td>0.100</td>
<td>17 - 18</td>
<td>0.325</td>
</tr>
<tr>
<td>6 - 7</td>
<td>0.120</td>
<td>18 - 19</td>
<td>0.330</td>
</tr>
<tr>
<td>7 - 8</td>
<td>0.205</td>
<td>19 - 20</td>
<td>0.365</td>
</tr>
<tr>
<td>8 - 9</td>
<td>0.355</td>
<td>20 - 21</td>
<td>0.400</td>
</tr>
<tr>
<td>9 - 10</td>
<td>0.410</td>
<td>21 - 22</td>
<td>0.400</td>
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<tr>
<td>10 - 11</td>
<td>0.425</td>
<td>22 - 23</td>
<td>0.380</td>
</tr>
<tr>
<td>11 - 12</td>
<td>0.430</td>
<td>23 - 24</td>
<td>0.345</td>
</tr>
</tbody>
</table>

Contd.....2.
Q2 (a) Give a flow diagram of operation/processes in an electroplating industry. How do you treat cyanide and chromium waste streams of an electroplating industry? If, industry discharges 50 m³/d waste containing 300 mg/L NaCN, what amount of chemicals are required for cyanide destruction?

Q2 (b) Estimate the amount of brine mud generated and loss of mercury through different routes for a Chlor-Alkali industry producing 20,000 tonnes NaOH/yr. The concentration of mercury in various streams is given as follows:
- brine mud 8.5 mg/g of mud,
- caustic soda 22 g/T,
- hydrogen 5 g/T,
- wastewater 1 g/T

Q3 (a) Suggest a treatment scheme for an industry having the following wastewater characteristics:
- Flow 1000 m³/d,
- BOD 1200 mg/L,
- COD 2500 mg/L,
- suspended solids 1500 mg/L,
- oil and grease 100 mg/L,
- pH 4.5

The discharge is intermittent due to batch processes being practiced in the industry.

Q3 (b) Describe the manufacturing process and waste management plan in a brewery. The wastewater from a brewery producing 100 kilolitres/day beer is to be treated in a UASB reactor. Calculate the size of the reactor and SRT using the following data:
- COD 4000 mg/L,
- Suspended Solids 1000 mg/L (50% biodegradable),
- Yield coefficient 0.1 g/g,
- k_d 0.05/d,
- COD removal efficiency 65%

Assume a volumetric loading rate of 6 kg/m³-d and an average suspended solids conc. in the digestion zone as 50 kg/m³.

Q3 (b') What is chemical pulping? How are chemicals recovered from black liquor? Describe the various methods being practiced for the pulp and paper mill wastewater treatment.

Q4 Describe the manufacturing process and the points of waste generation along with the composite wastewater characteristics for any three of the following industries. Also, suggest and explain the wastewater treatment scheme for these industries.
(i) Tannery
(ii) Distillery
(iii) Slaughterhouse
(iv) Sugar
(v) Textile
M. TECH. (II - SEMESTER) EXAMINATION
CIVIL ENGINEERING
Wastewater Treatment Plant Design & Operation
(CE-629)

Maximum Marks: 60
Duration: Three Hours

Instructions:
Assume suitable data if required
A municipal Sewage treatment plant is designed to cater the future population of
120,000, receiving water supply @ 250 L/capita.day; if the wastewater flow is
22,000m³/d, peak factor 2.25, BOD 250 mg/L, TSS 300 mg/L, VSS 180 mg/L:

ATTEMPT ANY FOUR (04) QUESTIONS BELOW USING ABOVE DATA

1. What is the per capita daily BOD and flow contribution? 15
II. What percent of water supply is collected as sewage?
III. What will be the concentration of total nitrogen (ammonia N + organic
    nitrogen) in sewage if the per capita contribution is 10 g/d?

2. If the screen channel in above mentioned plant is 2m wide, 0.55 m deep (effective)
    consisting of 10 mm x 10 mm square bars with 10 mm clear opening between bars.
   I. Calculate the approach velocity and the velocity through screens at max flow.
   II. What will be the head loss in screens when it is clean and when it is 50%
       clogged

3. If the rectangular Grit channel in above mentioned plant is 12 m long, 2m wide,
    and 0.8 m maximum water depth (effective), 3 nos. (2 duty, 1 standby) each
    handling 1/2 of maximum flow, velocity controlled by proportional flow weir, the
    invert level of the grit channel is 0.25 m below that of the screen channel;
   I. Calculate the overflow, velocity, assuming that 33% of the surface area is
      not effective due to inlet and outlet disturbances, scouring velocity and
      detention time at maximum flow?
   II. Check the scouring velocity at average flow.
   III. What grit space should be provided if the grit volume is 0.15 m³/1000 m³
        wastewater?

4. If the Grit Channel consists of rectangular section, 12 m long, 2m wide, 0.8 m
    maximum water depth, 3 nos, each handling 1/2 maximum flow, velocity control
    by proportional flow weir, the invert level of the grit channel is 0.25 m below that
    of the screen channel.
    Calculate the overflow, velocity, assuming that 33% of the surface area is not

Contd....2.
effective due to inlet and outlet disturbances, scouring velocity and detention time at maximum flow?

I. Design the proportional flow weir.
II. Check the scouring velocity at average flow.

What grit space should be provided if the grit volume is 0.15 m³/1000 m³ wastewater?
assume C = 0.61 and a = 0.035 m

5. The primary Circular sedimentation tanks 22.5 m dia, 2.8 m water depth, 2 nos, is parallel, overflow weir 90° V – notches, 30 cm center to center, effluent launder, 0.6 m wide
I. Calculate overflow velocity, weir loading and detention time.
II. What will be the depth of flow over the V- notches and minimum and maximum water depth in the effluent launder at maximum flow?
III. Design a suitable splitter box to divide the incoming flow from the grit channel in two equal streams.
IV. What is the BOD and TSS concentration of the settled effluent?
Assume: Rectangular weir: C = 0.42, V – notch weir: C = 1.41
Effluent launder: Depth at exit end under free fall, y_e = (Q²/b² g)¹/³, depth at closed end d = 3y_e

6. Aeration tank is 15 m wide, 30 m long, 2.5 m water depth, 2 nos, in parallel, 2 surface aerators in each bay. Assume Y = 0.5 and k_d = 0.08 d⁻¹
I. Calculate F/M, assume effluent BOD = 20 mg/L and MLSS = 3,000 mg/L
II. Calculate excess sludge in kg/d and m³/d if settled sludge from the secondary sedimentation tank has SS = 10,000 mg/L.
III. What should be the recirculation rate for the return sludge?
IV. Calculate SRT for the system.
V. Calculate the oxygen requirement of the system.
VI. What should be the size of aerators, if oxygenation efficiency under standard conditions is 2.25 kg O₂/ kwh? Assume operating temperature between 20 and 30 °C.
2015-16
M.TECH. (II SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
STRUCTURAL ENGINEERING
ADVANCED CONSTRUCTION MATERIALS
(CE-642)

Maximum Marks: 60 Credits: 04 Duration: Three Hours

Attempt all the questions. All questions carry equal marks.

Q.No.          Question                                      M.M.
1(a) With the help of neat sketch describe the structure and growth of an Exogenous tree.  [10]
1(b) Enumerate the characteristics of good timber.                                     [05]
2(a) Describe in brief the various defects in painting.                                 [06]
2(b) What are the ingredients used in oil paints? State the function of each of them.    [09]

OR

2'(a) What is varnish? What are its ingredients and where it is used?                   [07]
2'(b) Write short note on the followings:                                               [08]

(i) Homo-polymers and co-polymers                                                     
(ii) Distemper                                                                         
(iii) Enamel paints                                                                   
3(a) What are Fibre Reinforced Polymeric (FRP) meshes?                                 [03]
3(b) Discuss in details the factors affecting the properties of Fibre Reinforced Concrete (FRC). [12]

OR

3' Write short note on any Three of the followings:                                      [15]

(i) Compact Reinforced Composites (CRC)                                               
(ii) Polymer concrete.                                                                 
(iii) High Fibre Volume Micro-Fibre Systems.                                          
(iv) Stress – strain curve of FRC under tension.

4(a) What are the advantages and disadvantages of Ferrocement? Write down the normal ranges of composition of Ferrocement. [09]
4(b) Explain the behaviour of RCC and Ferrocement under tension.                       [06]
2015-16
M. TECH. (WINTER SEMESTER) EXAMINATION
STRUCTURAL ENGINEERING-II SEMESTER
TALL BUILDINGS
CE - 644

Maximum Marks: 60. Credits: 04 Duration: Three Hours

Answer all the questions. Assume suitable data if missing. Notations used have their usual meaning. Use of IS:875(Part-III) and IS 1893 (2002) is permitted.

Q. No. Question M.M.

1.(a) Briefly discuss the factors affecting planning of a tall building. [10]
1.(b) What are the two basic modes of frame instability? Explain. [5]

2. Using the provisions of IS:1893 (2002), evaluate the lateral forces and storey shear at each floor of a 14 storeyed SMRF hospital building located in seismic zone V resting on hard rock soil. The roof and floor loads are 30 kN and 40 kN respectively. The height between the floors is 3 m and the total height of the building is 42 m. The loads are lumped at respective floor level. [15]

OR

2. A four storey OMRF building, located in seismic zone IV rests on medium stiff soil. The roof and floor loads are 40 kN and 80 kN respectively. Determine the design seismic forces for the building using dynamic analysis and show the floor wise distribution of lateral forces using the free vibration properties of the building as given below. Use the provisions of IS: 1893 (2002). [15]

<table>
<thead>
<tr>
<th>Natural Period (sec)</th>
<th>Mode I 1.40</th>
<th>Mode II 0.59</th>
<th>Mode III 0.37</th>
<th>Mode IV 0.30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mode shape coefficient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th floor</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>3rd floor</td>
<td>2.05</td>
<td>1.12</td>
<td>-0.59</td>
<td>-2.08</td>
</tr>
<tr>
<td>2nd floor</td>
<td>2.89</td>
<td>-0.40</td>
<td>-0.48</td>
<td>5.82</td>
</tr>
<tr>
<td>1st floor</td>
<td>3.34</td>
<td>-1.63</td>
<td>0.54</td>
<td>-3.09</td>
</tr>
</tbody>
</table>

Contd....2.
3(a) Explain the complexity involved in the analysis of tall buildings subjected to wind loads. Enumerate the idealisation made for simplifying the analysis.

3(b) What do you understand by “Tuned Mass Dampers”? With the help of dynamic equation of equilibrium explain its mechanism.

OR

3. Use Gust factor method of IS:875 (Part III) to calculate wind forces at 3m, 15m, 24m, 36m, 45m, 54m, 60m and 75m on an intermediate frame of a 25-storied RC framed building having the following details:

Plan Size: 30 m x 72 m
Column spacing both way: 6m
Height of each storey: 3m
Mean probable life of the building: 100 years
Location: Aligarh
Assume all other necessary data suitably if required.

4. What are the advantages of shear walled structural system over the other types of structural system? Discuss how the location of shear wall is decided in a tall building structural system.
2015-16
M.TECH. (WINTER SEMESTER) EXAMINATION
ENVIRONMENTAL ENGINEERING
Biological Processes - II
CE 655

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) Describe the metabolism involved in anaerobic treatment. [02]
1(b) Discuss in detail the toxicity of ammonia and sulphide on methane bacteria [05]
1(c) Discuss in detail the methanogenic activity test. Describe its procedure and applications in biological treatment of wastewater. [08]

OR

1’ (c) Describe the operation of MBBR in detail. Also discuss its design criteria [08]
2(a) What is the significance of BMP test? A BMP test on industrial wastewater yielded the following results [05]

<table>
<thead>
<tr>
<th>Volume of sample (mL)</th>
<th>Gas production (mL)</th>
<th>Methane %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (Control)</td>
<td>100</td>
<td>65</td>
</tr>
<tr>
<td>5</td>
<td>220</td>
<td>65</td>
</tr>
<tr>
<td>10</td>
<td>250</td>
<td>65</td>
</tr>
<tr>
<td>25</td>
<td>350</td>
<td>65</td>
</tr>
</tbody>
</table>

What is the anaerobically degradable COD in this wastewater?

2(b) Design an anaerobic digestion tank for primary and secondary sludges obtained from a municipal wastewater treatment plant using conventional activated sludge process. The following information is available:
(i) Flow 5000 m³/d, BOD 150 mg/L, suspended solids 300 mg/L
(ii) Primary sedimentation tank removes 30% BOD and 70% suspended solids
(iii) Aeration tank HRT 6h, SRT 5d, MLSS 2000 mg/L, Y 0.5g/g, k_d 0.05/d
(iv) Sludge solids: primary 2% secondary 1%
(v) Organic solid content: primary 70%, secondary 80%

Contd.....2.
3 (a) Briefly describe anaerobic contact process and give its design criteria. [5]

3 (b) Write a short note on rotating biological contractors. How much surface area is available on a RBC with a 9m shaft supporting 2.5 m diameter disks spaced at 3.5 cm centre to centre with a thickness of 1.4 cm. What flow rate could be handled for an influent BOD of 150 mg/L to achieve a maximum loading of 0.012 kg/m²-d. [10]

OR

3* (b) Draw a neat sketch of a UASB reactor and briefly explain its functioning. Design a UASB reactor (including effluent gutter) for domestic sewage with an average flow of 20000 m³/d. Assume a peak factor of 2.25. [10]

4 (a) Describe the function of distribution chamber and feed box in a UASB reactor. What is the design criterion for the feed box? [04]

4 (b) Describe the cycles of operations involved in anaerobic sequencing batch reactor. [04]

4 (e) Discuss in detail the enhanced biological phosphorous removal process. Describe the mechanism involved. [07]
2015-16
M.TECH. (WINTER SEMESTER) EXAMINATION
CIVIL (ENVIRONMENTAL)
SOLID AND HAZARDOUS WASTE MANAGEMENT
CE-656/CE-685

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 are the environmental impacts of improper disposal of solid waste on land and poorly designed landfills? [06]

1(b) What are the different functional elements of solid waste management? Explain each element briefly. [06]

2(a) Municipal solid waste is to be collected from residential area using stationary container collection system having 3m³ containers. Determine the truck capacity for the given conditions

i) Container size = 3m³ ii) Container utilizing factor = 0.75 iii) Average number of container sat each station = 2 iv) Collection Vehicle Compaction ratio = 2.5 v) Container unloading time = 0.2 hours/container vi) Average drive time between container locations = 0.1 hour vii) One way haul distance = 25 km viii) Speed limit = 60 km/hour ix) Time from garage to first container location = 0.25 hours x) Time from last container location to garage = 0.20 hours xi) Number of trips to disposal site per day = 2 xii) Length of working day = 8 hours. [06]

2(b) Discuss the cost curve for direct haul system and cost curve for transport when transfer station is included. [06]

2(b) What are the factors taken when laying out collection routes? Differentiate between Hauled Container System and Stationary Container System. [06]

Contd.....2.
3(a) Describe the different steps involved in the anaerobic digestion of Solid Waste degradation.

3(b) Discuss the different biological stages involve in the decomposition of solid waste in landfill.

OR

3'(b) What are the parameters which affects the composting process? What is the role of mesophilic and thermophilic microorganism in composting process?

4(a) What are the different biological processes used for treatment of leachate?

4(b) What will be the theoretical volume of methane gas that would be generated from anaerobic digestion of a 1.5 tonne of waste having composition C_{40}H_{90}O_{50}N? How many moles of air are required to oxidize completely one tonne of waste having composition C_{40}H_{90}O_{50}N. Assume density of methane as 0.7167 kg/m³.

5(a) What is Mass burn and Refuse Derived Fuel (RDF)? Explain briefly about the process to obtain RDF?

OR

5'(a) What are the different Hazardous waste treatment technologies? Describe the deep well injection system for hazardous waste.

5(b) Briefly explain the process of recycling of plastics and metals from municipal solid waste.
2015-2016
M.TECH. (II SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
INSTRUMENTAL METHODS FOR ENVIRONMENTAL
ANALYSIS
(CE-658/683)

Maximum Marks : 60

Answer all the questions.
Assume any data judiciously, if required

Q.1(a) Describe the general guidelines for surface and ground water sampling. 5.0

Q.1(b) What are the different methods for water sampling? Discuss their merits and demerits for environmental analysis. 5.0

OR

Q.1(b) The concentration of arsenic and selenium in drinking water well were 2.0 and 3.5ppb. Convert arsenic concentration into ppm and mg/l and convert selenium concentration into molarity (M) and micro molarity. The atomic weight of Se is 79. 5.0

Q.1(c) Describe the utility of standard calibration curve used in analytical analysis. 5.0

Q.2(a) Explain the principle behind the Nephelometric measurements? How Nephelometry does differ from Turbidimetry? Explain. 5.0

OR

Q.2(a) How could you compare the values for the turbidity obtained for clear drinking water and textile industry wastewater? 5.0

Q.2(b) A spectrometric method was developed to determine nitrite (NO₂⁻, MW=46g/mol) in human saliva and rain water. The method was reported to have an absorption maximum of 546 nm and molar absorptivity of 4.6x10^4 l/(mol.cm). What range of concentrations can be measured so the absorbance remains within the range 0.05-0.80, using 1.0 cm cell? 7.0

Continue at Page No.02
Q.2(c) Explain the difference between absorption spectroscopy and emission spectroscopy.

Q.3(a) Discuss the nebulization and atomization process. Why higher sensitivity is achieved in flameless graphite furnace atomic absorption than flame atomic absorption?

Q.3(b) What are the major factors (criteria) in the selection of atomic spectroscopic instruments for metal analysis?

OR

Q.3(b') Briefly explain the concept of separation of compound using gas chromatography. Give your opinion regarding the classification of chromatographic techniques.

Q.4(a) Describe the working of any three of the following terms
   i) GC columns
   ii) GC Detectors
   iii) Carrier Gases
   iv) GC – Mass

Q.4(b) Two chemicals A and B are separated on GC capillary column with retention times of 14.6 and 18.3 min, and peak widths at base are 0.80 and 0.93 min for A and B respectively. An unretained air peak occurs at 1.2 min. Calculate retention factor, separation factor, resolution and average plate number.

END
2015-16
M.TECH. (WINTER SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
(HYDRAULIC STRUCTURES)
WATER RESOURCES ENGINEERING
CE-662

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 various aspects of the problem of Interlinking of Rivers in India. [08]

1(b) Write a note on Future of Water Resources Engineering. [07]

OR

1'(b) What are the different levels of planning in Water Resources Management? [07]

2(a) Discuss various steps in an Engineering Economy Study. [07]

2(b) Define Capital Recovery Factor. Two alternative plans are considered for a section of an aqueduct. Plan A uses a tunnel; plan B uses a section of lined canal and a section of steel flume. In plan A, the estimated first cost of the tunnel is $450,000, its estimated annual maintenance cost is $4000, and its estimated life is 100 yr. Estimated first costs and lives for the elements of plan B are canal (not including line), $120,000, 100 yr; canal lining, $50,000, 50 yr. The annual maintenance cost is $10,500. The interest rate to be used in the economy study is 6% annum. The study period is 100 yr. All salvage values are assumed to be negligible. Compare the equivalent annual costs for both the plans. [08]

OR

2'(a) Write a note on ‘Environmental consequences of water resources projects’. [07]

2'(b) What do you understand by ‘Multi-purpose Projects’? Discuss the functional requirements in Multipurpose projects. [08]

Contd.....2.
3(a) What do you mean by Flood-Bypass? Explain with sketches.

OR

3'(a) List the structural and non-structural measures for long/short term protection from floods.

3(b) Water flows at the rate of 140 m$^3$/s in a river (n = 0.05) whose flow x-section can be approximated as a rectangle 60 m wide and 3.5 m deep. If a bypass could be made available to divert 28 m$^3$/s. What would be the maximum drop in stage downstream of the bypass diversion? Assume a constant river width, bed slope and Manning’s n.

4(a) Discuss the various methods with neat sketch diagram for raising the levee height in emergencies.

4(b) Four alternative small scale hydro electric projects are under constructions. The estimated annual costs and benefits of the projects are tabulated as follows:

<table>
<thead>
<tr>
<th>Project</th>
<th>Annual Cost’s ($)</th>
<th>Annual Benefit’s ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>105,000</td>
<td>140,000</td>
</tr>
<tr>
<td>B</td>
<td>145,000</td>
<td>250,000</td>
</tr>
<tr>
<td>C</td>
<td>250,000</td>
<td>400,000</td>
</tr>
<tr>
<td>D</td>
<td>340,000</td>
<td>460,000</td>
</tr>
</tbody>
</table>

(a) Which of these projects would you select?

(b) Give at least two reasons why you have reached at this decision?