1. Find:
   (a) The global stiffness matrix
   (b) Displacements of node 1, 2 and 3,
   (c) The reaction forces at the supports, and
   (d) The forces in the springs, for the spring system as shown in figure-1 as per following data:
   \[ K_1 = 200 \text{ N/mm}, \quad K_2 = 150 \text{ N/mm}, \quad K_3 = 100 \text{ N/mm} \]
   \[ K_4 = 200 \text{ N/mm}, \quad F_1 = 300 \text{ N}, \quad F_3 = 500 \text{ N} \]

```
\begin{align*}
1' & \quad \text{Derive an expression for the stiffness matrix } [K] \text{ for the rectangular finite element plate. The plate is of length } a \text{ width } b \text{ and thickness } t \text{ along the } X, Y \text{ and } Z \text{ axes.} \quad 20
\end{align*}
```

2. Determine the displacements and reaction forces at supports of the plane truss shown in figure-2 as per the following data:
   \[ P = 1000 \text{ kN}, \quad L = 1m, \quad E = 210 \text{ GPa} \]
   \[ A = 6.0 \times 10^{-4} \text{ m}^2 \text{ for elements (1) and (2)} \]
   \[ A = 6 \sqrt{2} \times 10^{-4} \text{ m}^2 \text{ for element (3)} \]

```
\begin{align*}
2' & \quad \text{Determine the displacements and reaction forces at supports of the plane truss as shown in figure-2 as per the following data:} \quad 20
\end{align*}
```
3. Consider the twin steel plate as shown in figure-3. The plate has a uniform thickness \( t = 25 \text{mm} \), Young’s Modulus \( E = 2 \times 10^5 \text{ N/mm}^2 \) and weight density \( P = 7800 \text{ kg/m}^3 \). In addition to its self-weight, the plate is subjected to a point load \( P = 1000 \text{ N} \) at its midpoint.

(a) Model the plate with two finite elements
(b) Write down expressions for the element stiffness matrices and element body force vectors, for each element.
(c) Assemble the structural stiffness matrix.
(d) Using the elimination approach, solve for the global displacement vector.
(e) Evaluate the stresses in each element.
(f) Determine the reaction force at the support.

3’. Derive the stiffness matrix for a bar (two nodded beam element) using a formal approach. Assume linear shape functions.

4. Determine the support reaction forces at the two ends of the bar shown in figure-4, given the following data:

\[
P = 6 \times 10^4 \text{ N}, \quad E = 2 \times 10^4 \text{ N/mm}^2, \quad A = 250 \text{ mm}^2, \quad L = 150 \text{ mm}, \; \Delta = 1.2 \text{ mm}
\]
1. (a) For the system shown in Fig.1 calculate the natural frequency of vibrations, if $K_1 = 20 \text{ N/cm}$, $K_2 = 10 \text{ N/cm}$, $K_3 = K_4 = K_5 = 10 \text{ N/cm}$, and $w = 25 \text{ N}$

(b) A machine of weight $W = 3860 \text{ lb}$ is mounted on a simple supported steal beam as shown in Fig. 2. A piston that moves up and down in the machine produces a harmonic force of magnitude $F_0 = 7000 \text{ lb}$ and frequency $w = 60 \text{ rad/sec}$. Neglecting the weight of the beam and assuming 10% of the critical damping, determine (a) the amplitude of the motion of the machine (b) the force transmitted to the beam supports (c) the corresponding phase angle.

2. (a) A spring mass systems has spring stiffness $KN/m$ and mass $m; Kg$. Its natural frequency of vibration is 10 Hz. An extra 4 Kg mass is coupled to $m$ and the natural frequency reduces to 2 Hz. Determine $K$ and $m$. 

Contd.....2
(b) The base of machine foundation vibrates at an amplitude of 15mm and a frequency of 12 cycles/min. If the mass is 10 Kg and spring stiffness is 100 N/m. Calculate the absolute as well as relative amplitudes of vibration of mass. Take critical damping ratio 10%.

3. Determine the first three terms of the Fourier series expansion for the time varying force shown in Fig. 3.

![Figure 3](image)

4. A single degree of freedom system has a mass of 500 Kg, damping 5% and stiffness 20 KN/m. It is subjected to a wind force as shown in Fig. 4. The system is initially at rest. Determine the displacement, velocity and acceleration upto 0.5 sec, if \( \Delta t = 0.1 \) sec. Use New mark-\( \beta \) method \( \left( \beta = \frac{1}{4}, \gamma = \frac{1}{2} \right) \).

![Figure 4](image)

5.(a) Find the damping ratio for the second mode of a system which has 5% damping in first and third modes for the system whose natural frequencies in first three modes are 12.01, 25.47 and 38.9 rad/sec, respectively.

(b) Using Stodola process find the mode shape for a five storey frame whose dynamic flexibility matrix \([D]\) is given as:

\[
[D] = \begin{bmatrix}
0.35 & 0.3 & 0.3 & 0.3 & 0.25 \\
0.35 & 0.6 & 0.6 & 0.6 & 0.5 \\
0.35 & 0.6 & 1.2 & 1.2 & 1.0 \\
0.35 & 0.6 & 1.2 & 1.8 & 1.5 \\
0.35 & 0.6 & 1.2 & 1.8 & 2.5
\end{bmatrix}
\]
6. A rigid two storey frame as shown in Fig. 5 is subjected to a suddenly applied force at the first floor mass. \( P(t) = p_0 \) at \( t \geq 0 \) where \( p_0 = 200 \, \text{KN} \). Derive equation for the lateral displacement as function of time. Neglect damping.

\[\begin{array}{c}
m_2 = 50 \, \text{Kg} \\
\end{array}\]

\[\begin{array}{c}
m_1 = 100 \, \text{Kg} \\
k_2 = 200 \, \text{KN/m} \\
k_1 = 200 \, \text{KN/m} \\
p_0 = 200 \, \text{KN} \\
\end{array}\]

Fig. 5

7. (a) Show that the modes are orthogonal in nature.

(b) For the two storey shear frame Building as shown in Fig. 6, determine the free vibration response due to an initial displacement \( x(0) = \begin{bmatrix} 1/2 \\ 1 \end{bmatrix}^T \). Assume 5\% damping in each mode.

\[\begin{array}{c}
m \\
2m \\
k \\
2k \\
\end{array}\]

Fig. 6
1. A three span continuous beam is loaded as shown in figure – 1. Design the beam for each span to achieve maximum economy.

![Beam Diagram](image)

OR

1'. In a three-storey, single bay, fixed-base rectangular frame ABCDEFGH, each storey is of height 3m and the span of each beam is also 3m. The plastic moments of the members are as follows:

- Upper storey columns CD and EF = 30KN-m
- Middle storey columns BC and GF = 60KN-m
- Lower storey columns AB & HG = 90KNm
- Beam DE = 30KNm
- Beam CF & BG = 60KNm

Concentrated horizontal loads $10\lambda$ KN, $20\lambda$ KN and $30\lambda$ KN are applied at E, F and G respectively in same direction. Find the collapse load factor.

2. A Pratt-truss through bridge is provided for single broad gauge track. The effective span of the bridge is 45m. The cross girders are spaced 4.5m apart. The stringers are spaced 2m between centre lines where as 0.60KN per meter stock rail and 0.40KN per meter check rails are provided. The sleepers are spaced at 0.45m from centre to centre and are of size 2.8m x 0.25m x 0.25m. Weight of timber may be assumed as 7.5KN/m$^3$. The main girders are provided at spacing of 7m between their centre lines. Design any top chord member.

The bridge is to carry standard main line loading. The equivalent uniformly distributed line loads (EUDLL) in KN for B.M. and S.F. are 3995 and 4301 respectively on each track for main line at 45m length and at impact factor of 0.339.
2'. A self supporting steel chimney is 80 metres high and its diameter at the top is 3m. Design the plates for the stack at 10m from the top. Adopt the wind force as per IS-875. The location of the place is such that the intensity of wind pressure upto 30m height is 1.5 KN/m², where as the wind pressure at the top of the chimney is 1.83KN/m². In between the wind pressure is varying linearly. Assuming that the allowable stress in axial compression and in bending for circular steel chimney are 71.8 N/mm² and 78.7 N/mm² respectively.

3. A microwave tower is proposed at Sriperumbudur-Madras on a hill top. The height of the tower is 80m. The hill is 300m high with a gradient of 1 in 5 on the right side and a gradient of 1:3 on the left side of the crest (i.e. the actual length of the upward slope on either side of the crest are 1500m and 900m respectively). The tower is proposed at distance of 100m from the crest on the down word slope. The tower to be designed for a period of 50 years. Calculate the design wind pressure on the tower on both sides of the hill. Adopt the wind forces as per IS-875-Part 3.

4. Design an over head riveted steel rectangular flat bottom tank of capacity 75,000 litres. The available width and length of plates are 1.25m and 6.30m respectively. Design also the T-cover for the joint of the plates. The height of water in the tank is restricted to 2.30m.
2010 – 2011
M.TECH (II SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
(STRUCTURAL ENGINEERING)
CONSTRUCTION, PLANNING AND MANAGEMENT
(CE-609)

Maximum Marks: 75

Duration: Three Hours

Note:
(i) Answer any five questions.
(ii) All parts of a question should be attempted in continuation.
(iii) All questions carry equal marks.

1. (a) Write down the definition of Project given by “Project Management Institute USA and UNIDO, examine it critically. (04)

(b) Discuss inherent characteristic of a Project in detail. (06)

(c) Explain the concept of Project Life Cycle. Discuss each phase in brief. (05)

2. (a) In what ways purchasing of capital equipment is different from routine purchasing. (08)

(b) Discuss the various issues to be examined during the purchase of construction equipment. (07)

3. (a) Discuss various types of estimates in detail with their degree of accuracy. Support your answer with examples. (06)

(b) Explain the following with example. (06)

(i) Fixed Cost
(ii) Variable Cost
(iii) Cost in Place
(iv) Sunk Cost
(v) Opportunity Cost
(vi) Attendant Cost.

(c) Explain the concept of “Ceiling Limit” with suitable example”. (03)

4. Write short notes on any three of the following: 5x3 = 15

(i) Value Engineering
(ii) Wage concept
(iii) Specification
(iv) Social Cost Benefit Analysis
(v) Linear Programming

5. (a) Write down various objectives of purchasing. (05)

(b) Explain the difference in Industrial purchasing and House Hold purchasing. Support your answer with example. (03)

(c) What do you understand by the term specification? Explain different types of specification used in industry with example. (07)

6. (a) Define the terms tender offer, acceptance, earnest money, in context of contracts. (03)

(b) Explain in brief the procedure of prequalification of contractor, state its advantages and drawbacks. List the main points to be considered while pre-qualifying the contractors. (06)

(c) Draft a tender notice for the work of construction of a school building costing Rs. 1 crore. (06)

7. (a) Define the term productivity and on what factors it depends. Discuss each in detail. (05)

(b) Discuss concept of wages and its type in detail. (06)

(c) What do you understand by the term Multi skilling. Discuss its relevance in construction industry in India. (04)

****
Maximum Marks: 75

Duration: Three Hours

Note: Answer five questions, selecting at least two questions from each section.

SECTION – "A"

1. (a) Find the series solution of the equation

\[ 2x^2 \frac{d^2 y}{dx^2} + (2x^2 - x) \frac{dy}{dx} + y = 0. \]

(b) Prove that:

\[ P'_{n+1}(x) - P'_{n-1}(x) = (2n+1)P_n(x). \] [8+7]

2. (a) Express \( f(x) = x^3 - 5x^2 + x + 2 \) in terms of Legendre’s polynomials.

(b) Show that:

\[ \frac{1 - z^2}{(1 - 2xz + z^2)^{3/2}} = \sum_{n=0}^{\infty} (2n+1) P_n(x) z^n. \] [7+8]

3. (a) (i) Show that:

\[ \sqrt{1 - x^2} T_n(x) = U_{n+1}(x) - x U_n(x). \]

(ii) Show that:

\[ J_4(x) = \left( J_1(x) + \frac{3}{x^2} \right) J_1(x) + \left( 1 - \frac{24}{x^2} \right) J_0(x). \] [8+7]

(b) Find the Fourier transform of

\[ f(x) = \begin{cases} x, & |x| \leq a \\ 0, & |x| > a. \end{cases} \]

4. (a) Find the Fourier Sine transform of

\[ f(x) = \frac{x}{1 + x^2}. \]

(b) The magnetic potential \( V \) for a circular disc of radius \( a \) and strength \( w \), magnetised parallel to its axis, satisfies Laplace’s equation and is equal to \( 2\pi w \) on the disc and vanishes at exterior points in the plane of the disc. Show that at the point \( (r, z), z \geq 0 \).

\[ V = 2\pi w \int_{0}^{\infty} e^{-rs} J_0(rs) J_1(as) \, ds. \] [6+9]

Contd.....2
5.(a) Find the Hankel transform of
\[ f(x) = \begin{cases} 
  a^2 - x^2, & 0 < x < a, \\
  0, & x > a
\end{cases}, \quad n = 0, \quad n = 0. \]

(b) Use simplex method to solve the LPP:
Maximize \( Z = x_1 + 2x_2 + x_3 \)
subject to:
\[ 2x_1 + x_2 - x_3 \leq 2 \]
\[ -2x_1 + x_2 - 5x_3 \geq -6 \]
\[ 4x_1 + x_2 + x_3 \leq 6 \]
\[ x_1 \geq 0, x_2 \geq 0, x_3 \geq 0. \]

SECTION – “B”

6.(a) Suppose that \( X, Y \) and \( Z \) are events such that \( P(X) = P(Y) = P(Z) = \frac{1}{4} \).
\[ P(X \cap Y) = P(Z \cap Y) = 0 \text{ and } P(X \cap Z) = \frac{1}{8}. \]
Evaluate the probability that at least one of the events \( X, Y \) or \( Z \) occurs.

(b) Suppose that the random variable \( X \) has possible values 1, 2, 3, …… and
\[ P[X = j] = \frac{1}{2^j}, \quad j = 1, 2, 3, \ldots. \]
(i) Compute \( P[X \text{ is even}] \)
(ii) Compute \( P[X \geq 5] \).

(c) The continuous random variable \( X \) has pdf \( f(x) = 3x^2, \quad -1 < x < 0 \). If \( b \) is a number satisfying \(-1 < b < 0\), compute \( P \left[ X > b \mid X < \frac{b}{2} \right] \).

7.(a) Suppose that the life length of a certain radio tube is a continuous random variable \( X \) with probability density function \( f(x) = \frac{100}{x^2}, \quad x > 100 \) and zero elsewhere
(i) What is the probability that a tube will last less than 200 hours if it is known that the tube is still functioning after 150 hours of service?
(ii) What is the probability that, if 3 such tubes are installed in a set, exactly one will have to be replaced after 150 hours of service?

(b) Suppose that 5 percent of all items coming off a production line are defective. If 10 such items are chosen and inspected, what is the probability that at most 2 defectives are found.
(c) The weather bureau classifies the type of sky that is visible in terms of "degree of cloudiness". A scale of 11 categories is used 0, 1, 2, ... , 10, where 0 represents a perfectly clear sky, 10 represents a completely overcast sky, while the other values represent various intermediate conditions. Suppose that such a classification is made at a particular weather station on a particular day and time. Let $X$ be the random variable assuming one of the above 11 values. Suppose that the probability distribution of $X$ is $p_0 = p_{10} = 0.005$, $p_1 = p_2 = p_8 = p_9 = 0.15$, $p_3 = p_4 = p_5 = p_6 = p_7 = 0.06$, then find the $E(X)$ and $V(X)$.

8.(a) Suppose that a book of 585 pages contains 43 typographical errors. If these errors are randomly distributed throughout the book, what is the probability that 10 pages selected at random will be free of errors? (Suppose that $X$ : the number of errors per page has a poisson distribution)

(b) The diameter of an electric cable is normally distribution with mean 0.8 and variance 0.0004. What is the probability that the diameter will exceed 0.81 inch?

(c) Define the moment generating function of the discrete random variable $X$. Let $X$ be the continuous random variable $X$ with pdf.

$$f(x) = \begin{cases} \frac{1}{2} e^{-\frac{x}{20}} & \text{for } x \geq 0 \\ 0 & \text{for } x < 0 \end{cases}$$

(i) Determine mgf.

(ii) Using mgf, find $E(X)$ and $V(X)$.
Table I (Continued)

\[ z > Z_d = \frac{z - \mu}{\sigma} = \frac{z - \bar{x}}{s} \]

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\[ \Phi(z) = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}} dx \]

Table I Values of the Standard Normal Distribution Function

\[ \Phi(z) \]

2029
1. (a) Define an analytic function. Show that the function \( w = f(z) = z \bar{z} \) is differentiable but not analytic at the point \( z = 0 \). Also, find where the function \( w = \frac{1}{z} \) ceases to be analytic.

(b) Show that the function \( v = \sinh x \cos y \) is harmonic and determine its conjugate.

(c) Determine the analytic function \( f(z) = P(x,y) + iQ(x,y) \), if \( P - Q \) is given to be 
\[
\frac{\cos x + \sin x - e^{-x}}{2 \cos x - e^y - e^{-y}} \quad \text{and} \quad f\left(\frac{\pi}{2}\right) = 0.
\]

2. (a) Show that the velocity potential
\[
\phi = \frac{1}{2} \log \left( \frac{(x+a)^2 + y^2}{(x-a)^2 + y^2} \right)
\]
gives a possible motion. Determine the form of streamlines and curves of equal speed.

(b) Two sources, each of strength \( +m \), placed at the points \( (\pm a, 0) \) and a sink of strength \( 2m \) is placed at the origin. Show that the streamlines are the curves
\[
(x^2 + y^2) = a^2 (x^2 - y^2 + \lambda xy),
\]
where \( \lambda \) is a variable parameter.

(c) In two dimensional irrotational fluid motion show that, if the streamlines are confocal ellipses
\[
\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1,
\]
\( \psi = A \log \left( \sqrt{a^2 + \lambda} + \sqrt{b^2 + \lambda} \right) + B \) and the velocity at any point is inversely proportional to the square root of the rectangle under the focal radii of the point.

3. (a) Explain what is meant by two dimensional source & sink. What is a two dimensional doublet? Prove that the image system of a source of strength \( +m \) placed outside the circle consists of an equal source \( +m \) at an inverse point and sink \( -m \) at the origin.

(b) Between the fixed boundaries \( \theta = \frac{\pi}{4} \) and \( \theta = -\frac{\pi}{4} \), there is a two dimensional liquid motion due to a source of strength \( m \) at the point \( r = a, \theta = 0 \) and an equal sink at the point \( r = b, \theta = 0 \). Use the method of images to show that the stream function is

\[\text{Contd.....2}\]
Show also that the velocity at \((r, \theta)\) is
\[
\frac{4m(a^4 - b^4)r^3}{r^8 - 2a^4r^4 \cos 4\theta + a^8} \frac{1}{r^8 - 2b^4r^4 \cos 4\theta + b^8}\]

4. (a) Find the Laurent expansion of the function
\[
f(z) = \frac{7z - 2}{(z + 1)z(z - 2)}
\]
in the annular region \(1 < |z + 1| < 3\).

(b) Find the poles and residues at the poles of the function \(f(z) = \frac{z}{z^2 - 3z + 2}\)
(c) Evaluate the integral \(\int_C \frac{z - 2}{z(z - 1)} dz\) where \(C\) is the circle \(|z| = 2\).

5. (a) Solve the system of differential equations
\[
\frac{dy}{dx} = xz + 1,
\frac{dz}{dx} = -xy
\]
for \(x = 0.3\) using fourth order Runge-Kutta method and taking \(\Delta x = h = 0.3\). Initial values are \(x = 0, y = 0, z = 1\).

(b) Given \(\frac{dy}{dx} - y' = 0; y(0) = 10, y'(0) = 5\), evaluate \(y(0.1)\) using Runge-Kutta method of fourth order. Take \(h = 0.1\).

(c) Classify the partial differential equation \(\frac{\partial^2 u}{\partial x^2} + 2x \frac{\partial^2 u}{\partial x \partial y} + (1 - y^2) \frac{\partial^2 u}{\partial y^2} = 0\).

6. (a) Find by Bender-Schmidt recurrence relation, the solution of the parabolic equation \(\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial x} = 0\) when \(u(0,t) = u(5,t) = 0, u(x,0) = x^2 (25-x^2)\).
Assume \(h = 1\) and find the values of \(u\) up to \(t = 3\) secs.

(b) Derive Crank – Nicolson difference scheme for the parabolic equation \(u_{tt} = au_t\) with boundary conditions as \(u (0,t) = T_0, u (5, t) = T_1\) and the initial condition as \(u (x,0) = f(x)\).

7. (a) Given the values of \(u (x,y)\) on the boundary of the square given in the figure below, evaluate the function \(u (x,y)\) satisfying Laplace’s equation \(\nabla^2 u = 0\) at the pivotal points of this figure.

Give only two iterations.
(b) Solve the partial differential equation
\( \nabla^2 u = -10 \ (x^2 + y^2 + 10) \)
over the square with sides \( x = 0 = y, \ x = 3 = y \) with \( u = 0 \) on the boundary and mesh length = 1. Give only two iterations.

8.

(a) Solve numerically \( 4 \frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2} \) given that \( u(0,t) = 0 = u(4,t) \);
\[ \left( \frac{\partial u}{\partial t} \right)_{t=0} = 0 \text{ and } u(x,0) = x (4-x) \text{ taking } h=1 \text{ and } k = \frac{1}{2} . \]
Evaluate up to \( k = 4 \).

OR

(a') Compute the quadratic functional of the differential equation:
\[ -\frac{d}{dx} \left( a \frac{du}{dx} \right) - cu + x^2 = 0 \text{ for } 0 < x < 1 \]
subject to the boundary conditions
\[ u(0) = 0, \left( a \frac{\partial u}{\partial x} \right)_{x=1} = 1. \]

(b) Solve the differential equation:
\[ -\frac{d^2 u}{dx^2} - u + x^2 = 0, \ u(0) = 0, \ u'(1) = 1 \]
by the following methods:

(i) The collocation method choosing the points \( x = \frac{1}{3} \) and \( x = \frac{2}{3} \) as the collocation points.

(ii) The least square method.
2010-2011
M.TECH. (II SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
(HYDRAULIC STRUCTURES)
ADVANCED ENGG. HYDROLOGY
(CE-616)

Maximum Marks: 75 Duration: Three Hours

Answer any four questions.
Question No. 1 is compulsory.
Assume suitable data if not given.
Notations have their usual meanings.

1.(a) Discuss Probable Maximum Flood (PMF).

(b) The concurrent observations on annual rainfall and annual runoff of a basin in
centimeters for a period of 15 years are given in table-1. Determine a linear regression
line between rainfall and runoff. What is the standard error of estimate?

2.(a) Give stepwise procedure for developing depth area duration curve.

(b) Calculate the probable maximum precipitation for the design of spillway. The
maximum annual precipitation from 1971-2000 is given in table-II. The area lies in
North India and recommended value of ‘K’ as per PMP atlas published by Indian
Institute of tropical meteorology is 15.

3.(a) Discuss the significance of Regional flood frequency analysis.

(b) Analysis of annual flood series of a river yielded a sample mean of 1000 m$^3$/s and
standard deviation of 5000 m$^3$/s. Estimate the design flood of a structure on the river
to provide 90% assurance that the structure will not fail in next 50 years. Use
Gumbel’s method and assume the sample size to be very large.

4.(a) What do you mean by flood routing? List the input data required to carryout reservoir
routing.

(b) Route the following flood hydrograph through a river reach for which Muskingum
coefficient $K = 8.0$ h and $x = 0.25$.

<table>
<thead>
<tr>
<th>Time (h)</th>
<th>0</th>
<th>4</th>
<th>8</th>
<th>12</th>
<th>16</th>
<th>20</th>
<th>24</th>
<th>28</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflow (m$^3$/s)</td>
<td>8</td>
<td>16</td>
<td>30</td>
<td>30</td>
<td>25</td>
<td>20</td>
<td>15</td>
<td>10</td>
</tr>
</tbody>
</table>
5.(a) Write short notes on the following:

(i) Instantaneous unit hydrograph and its characteristics.

(ii) Snyder’s method for synthetic unit hydrograph.

(b) The recession limb of a hydrograph is given below. The time is indicated from the arrival of peak. Assuming the interflow component to be negligible, estimate the base flow and surface flow recession coefficients.

<table>
<thead>
<tr>
<th>Time from peak (day)</th>
<th>Discharge (m³/s)</th>
<th>Time from peak (day)</th>
<th>Discharge (m³/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>90</td>
<td>3.50</td>
<td>5.0</td>
</tr>
<tr>
<td>0.50</td>
<td>66</td>
<td>4.00</td>
<td>3.8</td>
</tr>
<tr>
<td>1.00</td>
<td>34</td>
<td>4.50</td>
<td>3.0</td>
</tr>
<tr>
<td>1.50</td>
<td>20</td>
<td>5.0</td>
<td>2.6</td>
</tr>
<tr>
<td>2.00</td>
<td>13</td>
<td>5.5</td>
<td>2.2</td>
</tr>
<tr>
<td>2.50</td>
<td>9.0</td>
<td>6.0</td>
<td>1.8</td>
</tr>
<tr>
<td>3.00</td>
<td>6.7</td>
<td>6.5</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.0</td>
<td>1.5</td>
</tr>
</tbody>
</table>

6.(a) Describe the slope area method of measurement of flood discharge in a stream.

(b) For a catchment of area 300 km² the values of Nash model coefficients are found to have values of n = 4.5 and K = 3.3 hours. Determine the ordinates of

(a) Instantaneous unit hydrograph at 3 hour interval.

(b) 3 hour unit hydrograph.

**TABLE-I**

<table>
<thead>
<tr>
<th>Year</th>
<th>Rainfall</th>
<th>Runoff</th>
<th>Year</th>
<th>Rainfall</th>
<th>Runoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>106</td>
<td>48</td>
<td>1979</td>
<td>88</td>
<td>20</td>
</tr>
<tr>
<td>1972</td>
<td>96</td>
<td>30</td>
<td>1980</td>
<td>74</td>
<td>17</td>
</tr>
<tr>
<td>1973</td>
<td>95</td>
<td>33</td>
<td>1981</td>
<td>101</td>
<td>34</td>
</tr>
<tr>
<td>1974</td>
<td>100</td>
<td>29</td>
<td>1982</td>
<td>69</td>
<td>21</td>
</tr>
<tr>
<td>1975</td>
<td>66</td>
<td>14</td>
<td>1983</td>
<td>55</td>
<td>18</td>
</tr>
<tr>
<td>1976</td>
<td>45</td>
<td>9</td>
<td>1984</td>
<td>95</td>
<td>49</td>
</tr>
<tr>
<td>1977</td>
<td>83</td>
<td>22</td>
<td>1985</td>
<td>78</td>
<td>30</td>
</tr>
<tr>
<td>1978</td>
<td>83</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE -II**

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual max. precipitation</th>
<th>Year</th>
<th>Annual max. precipitation</th>
<th>Year</th>
<th>Annual max. precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>98</td>
<td>1981</td>
<td>63</td>
<td>1991</td>
<td>45</td>
</tr>
<tr>
<td>1972</td>
<td>48</td>
<td>1982</td>
<td>74</td>
<td>1992</td>
<td>66</td>
</tr>
<tr>
<td>1973</td>
<td>67</td>
<td>1983</td>
<td>77</td>
<td>1993</td>
<td>70</td>
</tr>
<tr>
<td>1974</td>
<td>71</td>
<td>1984</td>
<td>69</td>
<td>1994</td>
<td>56</td>
</tr>
<tr>
<td>1975</td>
<td>74</td>
<td>1985</td>
<td>87</td>
<td>1995</td>
<td>55</td>
</tr>
<tr>
<td>1976</td>
<td>87</td>
<td>1986</td>
<td>81</td>
<td>1996</td>
<td>43</td>
</tr>
<tr>
<td>1977</td>
<td>51</td>
<td>1987</td>
<td>65</td>
<td>1997</td>
<td>38</td>
</tr>
<tr>
<td>1979</td>
<td>49</td>
<td>1989</td>
<td>52</td>
<td>1999</td>
<td>40</td>
</tr>
<tr>
<td>1980</td>
<td>58</td>
<td>1990</td>
<td>49</td>
<td>2000</td>
<td>51</td>
</tr>
</tbody>
</table>
Maximum Marks: 75/100 (OLD)  
Duration: Three Hours

Note: Answer any FOUR questions. Assume any suitable data if not provided. Q.No. 1 is compulsory.

1.(a) Differentiate among conventional and non-conventional sources of energy giving appropriate examples. Draw a neat sketch of a tidal plant and briefly discuss its working. [8]

(b) Differentiate among:
(i) Base Load plant and Peak Load plant
(ii) Reservoir s' Forebay
(iii) Plant factor and Utilization Factor.

2.(a) How hydel schemes are classified based on head and specific speeds of turbine? [6]

(b) Using following data construct a power duration curve. [14]

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Q m³/s</td>
<td>22</td>
<td>24.5</td>
<td>23.5</td>
<td>19.6</td>
<td>19.3</td>
<td>17.3</td>
</tr>
<tr>
<td>Month</td>
<td>Jan.</td>
<td>Feb.</td>
<td>March</td>
<td>April</td>
<td>May</td>
<td>June</td>
</tr>
<tr>
<td>Q m³/s</td>
<td>15.9</td>
<td>15.6</td>
<td>14.5</td>
<td>17.8</td>
<td>18.7</td>
<td>20.2</td>
</tr>
</tbody>
</table>

Assume the net head on turbine as 92.0 m and turbine efficiency 80%. It is intended to develop electric power at a firm rate of 9 MW, either by providing a storage or by providing a stand by diesel unit and no storage. On these two cases, determine the minimum capacity of reservoir or diesel unit.

3.(a) What are the purposes of providing intakes. Name few common intakes under used in Indian Hydel Schemes. Draw the neat sketch of any one type of intake. [8]

(b) Briefly discuss the analytical approach to find the optimum diameter of a steel penstock. [12]

4.(a) What are the draft tubes? Draw the neat sketch of Moody’s type draft tube. [14]

A straight conical draft tube attached to a Francis turbine has an inlet of diameter 3 m and its outlet is 20 m². The velocity of water at inlet is 5 m/s. The inlet is set 5 m above the tail race level. Assuming the loss of head in draft tube equals half the velocity head at its outlet, determine

(i) The pressure head at the top of the draft tube.
(ii) Total head at the top taking tail race level as bottom.
(iii) Power of water at outlet of runner.

Contd.....2
(b) What is the purpose of lining? Name 5 types of lining materials used in India and abroad.

5.(a) What are the assumptions on analysis of water hammer by rigid water column theory?

(b) Develop expressions for $Z_{\text{max}}$ and $T_{\text{max}}$ for a simple surge chamber assuming sudden closure of valve and neglecting friction.

6. Write short notes on any THREE of the following:

(i) Head Losses in intakes.
(ii) Classification of tunnels.
(iii) Cavitation in turbines.
(iv) Underground Power Houses.
(v) Dimensioning of Power Houses.
2010 – 2011
M.TECH (II SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
(HYDRAULIC STRUCTURES)
ADVANCED HYDRAULICS
(CE-618)

Maximum Marks: 75 Duration: Three Hours

Note: (i) Answer all the questions.
(ii) Assume any data not given.

1. Write short notes on the following:
   (a) Surges in open channel. (05)
   (b) Lagrangian and Eulerian systems of motion. (05)
   (c) Velocity distribution in different shapes of channel sections. (05)
   (d) Factors affecting Mannings roughness coefficient (n) (05)

2. (a) Explain development of uniform flow in a long rectangular channel. (05)
   (b) Discuss the use of Energy and momentum correction factors. (05)
   (c) Discuss the design procedure for standard lined canal sections. (05)
   (d) Discuss the use of specific energy and specific discharge curves. (05)

3. (a) Show that in a uniform flow through a channel, the average shear stress at the bed is

\[ \tau = \frac{r_m R_s}{n} \]

Where \( \tau \) is the average shear stress at the bed,
\( s_o \) is the bed slope
\( r_m \rightarrow \) specific weight of water

(b) Distinguish between the flow conditions indicated and give examples. (04)
   (i) Steady flow and unsteady flow.
   (ii) Uniform and non-uniform flow.
   (iii) Critical flow, sub-critical flow.

(c) Determine critical depth of an arbitrary section whose area is given by

\[ A = K_1 y^a \]

Where \( K_1 \) is a constant
\( y \) is any depth of flow
\( a \) is an exponent.

OR

3'. (a') Discuss section factor curve for determination of critical depth in any shape of the channel.

(b') Show that the normal depth in a rectangular channel of side slopes “m” horizontal : 1 vertical is given by

\[ y_0 = 1.1892 \left( \frac{Q_n}{\sqrt{s_0}} \right)^\frac{3}{8} \left( \frac{m^2 + 1}{m^2} \right)^\frac{1}{8} \]

(c') Estimate the values of momentum correction factor “\( \beta \) ” for given values of Energy correction factor “\( \alpha \)”.

The \( \alpha \) values are 1, 1.5, 2.0

Contd....2
4. Explain the following
   (i) Control section and their advantages. (02)
   (ii) Significance of Froudi Number, Weber number Mach Number. (03)
   (iii) Discuss discharge determination in compound channel section taking into consideration Partial area Method. (05)

OR

4'. To cause the critical flow in a rectangular transition the bed is raised by 0.65 m and width is reduced by 3.0 m to 1.8 m, will the up-stream depth be affected, if so up to what extent. The velocity in the main section is 1 m/sec and depth is 2.0 m. How much depth be increase in u/s section, give type of flow up-stream.

5. (a) A trapezoidal channel bottom width 3 m and side slopes 1.5 vertical to 1 horizontal carries a discharge of 0.72 cumecs. If the depth before the jump is 33 cm, calculate the conjugate depth after the jump.

(b) Obtain an expression for a hydraulic jump in a horizontal triangular channel in terms of “r” and $F_1^2$.

Where $r = \frac{y_2}{y_1} = \frac{\text{post jump depth}}{\text{pre-jump depth}}$

(c) Mention a brief history of water distribution technology. (02)

OR

5'. (a) Obtain the Saint-Veriant’s equation for G.V.F. in a Prismatic channel. Also state the assumptions made.

(b) How will you explain dispersion in an open channel. Write Fick’s Law of diffusion and explain it. (05)
2010 – 2011
M.TECH (II SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
(ENVIRONMENTAL ENGINEERING)
BIOLOGICAL PROCESS OF WASTE WATER TREATMENT
(CE-626)

Maximum Marks: 75

Duration: Three Hours

Note: 
(i) Answer all questions.
(ii) Assume missing data suitably
(iii) The symbols have their usual meanings.

1. (a) Why can recycle flow be delivered at any point in a completely mixed basin? Would the same principle apply to a plug flow basin? (03)

(b) A completely mixed reactor receives influent containing 10mg/L of tracer for two hours. Then tracer addition was terminated but the flow remained steady. The volume of the reactor is 10L and the flow rate was 2L/h. What is the concentration of tracer in the reactor 1 hour after tracer addition was terminated? The reactor had an initial concentration of tracer of 1.0 mg/L, when tracer addition commenced. (08)

(c) Draw the hydraulic profiles of PFTR and CSTR for pulse and step input of a tracer. (04)

OR

1'. (a) Determine the volume of a completely mixed reactor required to give a treatment efficiency of 95% for a substance that decays according to first order kinetics with a rate constant of 0.05 hr⁻¹. The flow rate is steady at 300L/h and the initial concentration was 150mg/L. (05)

(b) Determine the volume of two, five, ten, twenty and fifty identical completely mixed reactors in series to provide the same degree of treatment for the conditions given above. (08)

(c) Briefly explain what happens when number of CSTRs are connected in series. (02)

2. (a) Derive the expression for efficient concentration for a plug flow reactor treating a tracer undergoing decay and working at steady state conditions. (07)

(b) Define the various kinetic coefficients, \( \mu_{\text{max}}, k_s \) and \( k_d \). Describe the significance of each coefficient. (08)

3. (a) Derive the expressions for \( S \) and \( X \) for a CSTR with sludge recycle. (07)

(b) Describe mean cells residence time, loading velocity and food to microorganisms. Explain the significance of these parameters in wastewater treatment. (08)

Contd.....2
OR

3. (a) Define a two stage high rate trickling filter for the treatment of 5000 m$^3$/d of wastewater with a BoD of 200 mg/L. The effluent BoD shall be 30 mg/L. Assume R=1.

(b') Describe with the help of equation biological denitrification process.

4. (a) Discuss in detail the different modified forms of activated Sludge Process.

(b) Briefly explain the R.B.C. process of biological treatment. Support your answer with a neat sketch.

5. (a) Describe the effect of presence of nutrients (trace elements) on the performance of anaerobic treatment.

(b) Describe the constructed wet land systems for the treatment of wastewaters.

(c) Derive the following relationship

$$1 \text{ kg COD produces } 0.35 \text{ m}^3 \text{ of CH}_4 \text{ at STP}$$
2010-2011
M.Tech (IInd Semester) Examination
(Civil Engineering)
(Environmental Engineering)
INDUSTRIAL WASTEWATER TREATMENT
CE-627
Maximum Marks: 75
Duration: Three Hours

Instructions:
Attempt/Answer all the questions.
Assume suitable data, in case if not given.
Your answer should be in order of sequence of the questions.
Notations have their usual meanings.

Q.No. 1a During the industrial survey pertaining to the pollution control, what is the necessary information that you will collect for developing an environmental management plan? 7.5

Q.No. 1b On what basis, effluent discharge standards are set? Give reasoning why permissible BOD value of 30 mg/l for Indian River Discharge is set? 7.5

Q.No. 2a Discuss the grab and composite sampling for wastewater and their merits and demerits. 7.5

Q.No. 2b Compute the COD and TOC for the following wastewater composition: 7.5
i. 173 mg/l of ethylene glycol (C₂H₆O₂)
ii. 97 mg/l of phenol

OR

Q.No. 2'a What are the benefits of in-plant waste control? 7.5

Q.No. 2'b What is the rationale for providing an equalization tank at an effluent treatment plant and not at sewage treatment facility? Do you think that if equalization tank is provided at the STP, it may produce better results? 7.5

Q.No. 3 Design an equalization tank for the following data: 15

<table>
<thead>
<tr>
<th>Time</th>
<th>Discharge, m³/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00</td>
<td>50</td>
</tr>
<tr>
<td>8:00</td>
<td>73</td>
</tr>
<tr>
<td>9:00</td>
<td>243</td>
</tr>
<tr>
<td>10:00</td>
<td>324</td>
</tr>
<tr>
<td>11:00</td>
<td>240</td>
</tr>
</tbody>
</table>
Q. No. 4
A trickling filter plant presently achieves 52 percent BOD reduction from a sugar processing industry under the following conditions:
N = 3:1
Q = 0.122 m³ / (m³.min)
D = 6.1 m
So = 850 mg/l
Flow = 3030 m³/d
n = 0.5

In-plant changes may reduce present flow by 30% and influent BOD by 20%. For the same recycle, what will be new BOD removal percent?

OR

Q. No. 4’ Prepare process flow (wastewater treatment) diagrams for the following industries:
   i. Food Processing Industry
   ii. Leather Industry
   iii. Iron & Steel

Q. No. 5
Answer the following:
   i. Properties and Specifications of commercially available activated carbon
   ii. Process applied for removal of fats and oils
   iii. Nitrification and Denitrification Processes for WWT
2010-2011
M.Tech (IInd Semester) Examination
(Civil Engineering)
Environmental Engineering
WASTEWATER TREATMENT PLANT DESIGN AND OPERATIONS
CE-629

Maximum Marks: 75
Duration: Three Hours

Instructions:
Attempt/Answer all the questions.
Assume suitable data, in case if not given.
Your answer should be in order of sequence of the questions.
Notations have their usual meanings.

1a Discuss the advantages and disadvantages of Aerobic and Anaerobic Processes for wastewater treatment. List some common wastewater treatment technologies based on aerobic & anaerobic processes that are used for sewage treatment in developing countries, like India.

1b What are the essential wastewater parameters (pollutants) you look for sewage treatment? Discuss the importance of these each parameter from environmental point of views and their removal mechanism at treatment plants.

2 Prepare flow sheet/diagram of any sewage treatment plant that you have visited and essentially discuss below mentioned points of that plant:
   i. Capacity of the Treatment Plant
   ii. Technology
   iii. Wastewater Characteristics (influent and effluent)
   iv. Different Units of the Plant
   v. Function of each unit
   vi. Any special feature which you observed

3 Design an inlet chamber, screen chamber, grit channel and a proportional weir to treat flow of 20 MLD. The size of grit particle is 0.15 mm and specific gravity is 2.65. Assume width of rectangular bar as 10mm and clear spacing of 25mm. Peak factor is 2.25. You have a choice to divide the flow into two or more streams with provision of standby.

3' Design a primary sedimentation tank (circular) of an activated sludge process based sewage treatment plant treating flow of 20 MLD. Your design should
essentially include:

i. Diameter of the tank  
ii. Water Depth and Free Board  
iii. Length of Effluent Weir  
iv. Number of V-notches  
v. Head over V-notch  
vi. Effluent launder (width of the launder and water depth at closed end)

Design an aeration tank and secondary clarifier with recycle of an Activated Sludge Process based sewage treatment plant to treat flow of 20 MLD for influent BOD of 300 mg/l, TSS 400 mg/l, and COD 450 mg/l. The outlet BOD and TSS concentration should be less than 20 mg/l and 50 mg/l respectively. Use the following data:

Mean Cell Residence Time = 10 d  
MLSS Concentration = 3000 mg/l  
Y = 0.5 g VSS/ g CODrem  
K_d = 0.1gVSS/g VSS
Underflow Sludge Concentration = 10000 mg/l

5.5a What are the different methods for sludge digestion? Discuss the advantages of anaerobic methods.  
5.5b Explain any attached growth system for wastewater treatment and its working principle. Prepare a diagram showing section of this type of treatment system.  
5.5c Write brief notes on following:

i. Concept of UASB Technology  
ii. How Sequencing Batch Reactor (SBR) can be said as a modified form of ASP?  
iii. Merits and demerits of Sludge Drying Beds and Mechanical Dewatering System
2010 – 2011
M.TECH (II SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
(STRUCTURAL ENGINEERING)
ADVANCED CONSTRUCTION MATERIALS
(CE-642)

Maximum Marks: 75

Duration: Three Hours

Note: Answer all questions.
All questions carry equal marks.

1. (a) List the various properties of wood by virtue of which it is used as a construction material. (05)
(b) Define the term “Hard Wood” and “Soft Wood” in context of Civil Engineering with examples. (04)
(c) Explain with diagram the difference between “Cross Grain”, “Coarse Grain” and “Closed Grain” with examples. (06)

2. (a) Explain different types of substrate encountered in construction industry. (06)
(b) Explain the unique property of each substrate. (06)
(c) Explain the term vehicle, body of the point, Pigment, thinner extender, drier used in paint technology with examples. (06)
(d) List and explain the parameters to be considered in selection of a paint for a particular work. (03)

3. (a) Write a detail account on manufacture of glass. (04)
(b) Explain the meaning of “Vitreous” in context of ceramics. (04)
(c) Comment on the phrase that glass is a “Super Cooled Liquid”. (04)
(d) List the parameters to be considered for the selection of glass for a particular work. (03)

4. Write short note on any three of the followings: (5x3=15)
(a) Sintering Process (b) Detects in Timber (c) Float Glass (d) Sealing Compounds (e) Structural Steel

5. (a) Discuss the advantages of F.R.C. over conventional R.C. (04)
(b) List some of the main application areas of SFRC. (03)
(c) Explain the important factors responsible for matrix deterioration in F.R.C. (04)
(d) Enumerate the main factors that affect the reinforcement corrosion in F.R.C. (04)

6. (a) What is ferrocement? (03)
(b) Give a brief account of the historical development of ferrocement. (04)
(c) Using neat sketches explain various types of wire meshes used in ferrocement. (03)
(d) Briefly explain the mechanical behaviour of a ferrocement section subjected to inplane tension using a neat sketch. (05)

7. (a) Explain some of the common techniques for monitoring the matrix deterioration in F.R.C. (07)
(b) Discuss various techniques for monitoring the corrosion of reinforcement in F.R.C. (08)

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2010 – 2011
M.TECH. (II SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
(STRUCTURAL ENGINEERING)
TALL BUILDINGS
(CE – 644)

Maximum Marks : 75
Duration : Three Hours

Note:  Answer all questions.
Assume any data suitably, if not given.
Use of relevant IS codes permissible.

1. Discuss in detail various types of horizontal and vertical framing system, commonly used in tall buildings. [15]

2.(a) Enumerate and explain the idealization needed for the dynamic analysis of tall buildings subjected to wind load. [8]
(b) Discuss various measures that can improve the ductility of tall RC framed buildings. [12]

(b') Derive expressions for ductility in singly and doubly rectangular reinforced concrete section. [12]

3. The plan of a 30-stroeyed building is shown in Figure.1. The column position are marked in figure. The building has to serve as community structure in Zone-III. Using Gust Factor Method of IS 875 (Part III) (1987), calculate wind force at 3 m, 15 m, 27 m, 39 m, 51 m, 63 m, 72 m, 75 m, 87 m and 90 m, above the ground level in an intermediate frame of the building marked by section 1-1. Following data are given:

Height of each storey = 3 m
Total height of building = 90 m
Mean probable life of the structure = 100 years
Terrain category = 3, Power law coefficient = 0.23

OR

3'. Determine the lateral forces and storey shear on an intermediate frame of a twelve storeyed, two bay, commercial building to the constructed in Aligarh, due to earthquake, using recommendation of IS:1893 Part I (2002). Following data are given:

Bay width = 7 m c/c
Frame spacing = 6 m c/c
Height of each story = 4 m
Floor thickness including floor finish = 175 mm
Size of all columns = 400 × 600 mm
Size of all beams = 300 × 500 mm
Wall thickness = 230 mm

Contd.....2
4. (a) Explain step by step procedure to estimate the lateral stiffness of a shear wall.

(b) What is “tuned mass damper”? Explain its principle and use in tall buildings.
2010 – 2011
M.TECH (II SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
(HYDRAULIC STRUCTURES)
WATER RESOURCES ENGINEERING
(CE-662)

Maximum Marks: 75
Duration: Three Hours
Note: Answer Q.No. 1 and any three more questions. Assume suitable data if required.

1. Discuss the objectives of water resources development in India. (15)

2. (a) 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 $500,000, its estimated annual maintenance is $40,000, and its estimated life is 100 years. Estimated first costs and lives for the elements of plan B are canal (not included lining), $125,000, 100yr; canal lining, $50,000, 20yr; flume, $90,000, 50yr. The annual maintenance cost is $10,500. The interest rate is 60% per annum. The study period is 100 yr. All salvage values are assumed to be negligible. Compare the equivalent annual costs for both the plans. (15)

(b) Discuss various steps in economic analysis of water resources projects in brief. (05)

3. (a) Four alternate small-scale projects are under consideration. The estimated annual costs and benefits of the projects are tabulated as follows. Which of these projects would you select?

<table>
<thead>
<tr>
<th>Project</th>
<th>Annual Cost (Rs.)</th>
<th>Annual Benefit (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100,000</td>
<td>135,000</td>
</tr>
<tr>
<td>B</td>
<td>140,000</td>
<td>250,000</td>
</tr>
<tr>
<td>C</td>
<td>250,000</td>
<td>400,000</td>
</tr>
<tr>
<td>D</td>
<td>330,000</td>
<td>450,000</td>
</tr>
</tbody>
</table>

(b) Write a note on the background of 2010-2011 Queensland (Australia) floods. (10)

4. (a) Write a note on 2011 Tohoku earthquake and tsunami. Suggest some methods for tsunamion damage mitigation. (10)

(b) Define ‘Multipurpose projects’. Discuss the functional requirements and their compatibility in Multipurpose projects. (10)

Contd......2
5. (a) A reservoir has 6 units of water to be supplied in 30 days. Two groups of crops are to be grown in the command area. For the first group of crop two units of water is required in 7 days while the second group requires one unit of crop in 8 days. The price of irrigation revenue is Rs. 150 only for the first crop requiring two units of water and Rs. 80 only for the second crop. If the revenue collection is to be the maximum, then how many units of water for each crop should be supplied?

(b) Write a brief note on Water Resources Project Formulation.

6. (a) What do you mean by Flood Bypass? Water flows at the rate of 210 m$^3$/s in a river ($n = 0.045$) whose flow cross section can be approximated as a rectangle, 70 m wide and 4 m deep. If a flood bypass could be made available divert 70 m$^3$/s of 210 m$^3$/s, what would be the maximum drop in the stage downstream of the bypass diversion? Assume constant river width, bed slope and Manning’s ‘n’.

(b) Write a note on any one of the following:-

(i) Environmental consideration in planning a water resources project.

(ii) Cost analysis for a flood-mitigation reservoir.
2010-2011
M. TECH. (II SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
INSTRUMENTAL METHODS FOR ENVIRONMENTAL
ANALYSIS
(CE-683)

Maximum Marks : 75 Duration: Three Hours

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

Q.1(a) Make a list of factors that are important in developing a sample design including where, when and how many samples are collected?

Q.1(b) Describe the advantages and disadvantages of composite sampling and systematic sampling.

OR

Q.1(b) Describe all possible physical, chemical and biological changes that can occur for the following compounds during the sample holding period. Chlorinated solvents and metals

Q.2(a) Discuss the difference between packed columns and capillary columns regarding their performance in separation.

Q.2(b) Explain the difference in light source used in atomic absorption vs. the light source used in UV-VIS spectrometer.

OR

Q.2(b) Explain in general (i) Why wavelength of less than 180 nm is hardly used in UV spectrophotometer? (ii) Why IR is less sensitive than UV but more useful than UV to deduce the structure of unknown chemicals?

Q.3(a) Discuss the various factors to be considered while selecting GC column temperature.
Q.3(a) Define the following terms: retention factor, resolution, plate number and plate height. Which one best defines the column efficiency?

Q.3(b) Draw line diagram of a GC and discuss its important components.

Q.4(a) Write the importance of GC-MS and discuss its application in environmental engineering.

Q.4(b) Name the most common detectors used for environmental trace analysis together with applications.

OR

Q.4(b) Explain why interface is important and essential for all hyphenated mass spectrometers. Describe the interface used in GC-MS.
Answer all the questions. Assume any data judiciously, if required.

Q.1(a) Define municipal solid waste. Describe the common practice of collection and transportation of municipal solid waste in India.

Q.1(b) Estimate the moisture content (wet and dry bases) of the following solid waste.

<table>
<thead>
<tr>
<th>Component</th>
<th>Mass (%)</th>
<th>Moisture (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>News paper</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>Other papers</td>
<td>27</td>
<td>6</td>
</tr>
<tr>
<td>Card board</td>
<td>33</td>
<td>5</td>
</tr>
<tr>
<td>Glass</td>
<td>5.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Plastics</td>
<td>0.50</td>
<td>2</td>
</tr>
<tr>
<td>Yard wastes</td>
<td>17</td>
<td>60</td>
</tr>
<tr>
<td>Food wastes</td>
<td>2.0</td>
<td>59</td>
</tr>
</tbody>
</table>

OR

Q.1(b)' Estimate the as discarded density of the following solid waste. If the compaction ratio is 2.5, what size collection vehicle is needed per 1000 kg of waste?

<table>
<thead>
<tr>
<th>Component</th>
<th>Mass (%)</th>
<th>Density Kg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>News paper</td>
<td>15</td>
<td>85</td>
</tr>
<tr>
<td>Other papers</td>
<td>27</td>
<td>85</td>
</tr>
<tr>
<td>Card board</td>
<td>33</td>
<td>50</td>
</tr>
<tr>
<td>Glass</td>
<td>5.5</td>
<td>195</td>
</tr>
<tr>
<td>Plastics</td>
<td>0.50</td>
<td>65</td>
</tr>
<tr>
<td>Yard wastes</td>
<td>17</td>
<td>105</td>
</tr>
<tr>
<td>Food wastes</td>
<td>2.0</td>
<td>290</td>
</tr>
</tbody>
</table>

Q.2(a) Why is disposal of municipal solid waste necessary? Describe the sanitary land filling methods for disposal of municipal solid waste.
Q.2(b) Enumerate the different type of landfills. Draw a diagram of modern sanitary land fill and discuss its necessary components.

Q.2(b)' Write the different reactions evolved during the landfill planning, designing & operation.

Q.3(a) Discuss the various initiatives taken by the government of India for hazardous waste management. Give some recent examples of disasters.

Q.3(a)' Describe the impact of improper disposal of hazardous solid waste on the human health and environment.

Q.3(b) A contractor agreed to haul the solid wastes from an industrial district of a city. The industries agreed to store their wastes on large containers located at strategic points. Due to the sizes of the containers, the hauled container system of collection is to be used. Based on a traffic study, $t_1$, $t_2$ and $d_{bc}$ were found to be 20, 25 and 8 minutes, respectively. If the round trip haul distance averaged 60 km at a speed limit of 55 mph, how many containers can be serviced on a collection day of 8 hour.

Q.4(a) What is the composting? Name the various matters that can be composted. Discuss various techniques adopted for composting in India.

Q.4(b) A plant burns 100 tones of solid waste represented by the following formula $C_{562}H_{900}O_{414}N_6$. How much air is needed if 50% excess air is used?

Q.4(b)' Estimate the theoretical volume of methane gas that would be expected from anaerobic digestion of 100 tones of wastes having the composition $C_{50}H_{150}O_{40}N_2$.

Q.5(a) Calculate the mass and volume of solid waste generated per week for a family of six.

Q.5(b) Calculate the anticipated life of a landfill site for a city having 90,000 populations, and generate refuse at the rate of 0.65 Kg/person/day. A 50,000 m$^3$ land fill site is available with an average depth of compacted refuse limited to 20m by local topography. It is estimated that the compacted surface refuse will have a unit rate of 995 kg/m$^3$ and an additional 32% of volume will be taken by cover material.
2010 – 2011
M.TECH (II SEMESTER) EXAMINATION
(CIVIL)
ENVIRONMENTAL ENGINEERING
ENVIRONMENTAL POLICIES AND IMPACT ANALYSIS
(CE-686)

Maximum Marks: 75

Note:
(i) Answer any four questions.
(ii) Q.No. 1 is compulsory.
(iii) Assume suitably if any data is required.

Duration: Three Hours

1. Derive various equations involved to find out the condition of stream in terms of its dissolved oxygen content.

2. Discuss the following:
   (i) Framework for environmental impact analysis
   (ii) Distinguish between E.I.A and E.I.S
   (iii) Distinguish between criteria and standard. Support your answer with examples.

3. What are the four levels of ambient air quality? Explain various air quality impact assessment approaches.

4. Explain in detail check list method and Leopold Matrix method for environmental impact analysis.

5. Explain various steps involved in ground water impact analysis.

6. What is the necessity of environmental policies? Discuss in detail, the acts related to air and water.

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