B.TECH. WINTER (IV SEMESTER) EXAMINATION
(COMPUTER ENGINEERING)
(NUM. ANALYSIS, TRANSFORMS & PROBABILITY)

AM-262
Credits: 04

Maximum Marks: 60

Duration: Three Hours

1. (a) Evaluate the following transforms:

(i) \( L[\cos b \cdot \cos bt + t^2 u(t - 3)] \)

(ii) \( L^{-1}\left[\frac{16}{(s-2)(s+2)^2}\right] \) (by convolution theorem)

(b) Solve, by Laplace transform method, the initial value problem:
\[(D^4 - 1)x - 1; \quad x_0 = x_1 = x_2 = x_3 = 0.\]

OR

(b') Solve, by Laplace transform method, the system of equations:

\[
\begin{align*}
2 \frac{d^2 x}{dt^2} + 3 \frac{dy}{dt} &= 4 \\
2 \frac{d^2 y}{dt^2} - 3 \frac{dx}{dt} &= 0, \quad x_0 - y_0 - x_1 = y_1 = 0.
\end{align*}
\]

(c) Find the Laplace transform of periodic function \( f(t) \) with period \( 2\pi \), where:
\[
f(t) = \begin{cases} 
  t, & 0 < t < \pi \\
  2\pi - t, & \pi < t < 2\pi
\end{cases}
\]

2. (a) Solve the system of equations by Gauss elimination method:

\[
\begin{align*}
2x - y &= 0 \\
-x + 2y - z &= 0 \\
y + 2z - u &= 0 \\
z + 2u &= 1.
\end{align*}
\]

(b) Establish the formula \( x_{n+1} = \frac{1}{2} \left[ x_n + \frac{N}{x_n} \right] \) to calculate square root of \( N \) and hence find the value of \( \sqrt{5} \) correct to four decimals.

OR

(b') Find the missing values in the following table:

<table>
<thead>
<tr>
<th>( x )</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>6</td>
<td>10</td>
<td>?</td>
<td>17</td>
<td>?</td>
<td>31</td>
</tr>
</tbody>
</table>

where \( y \) is a cubic polynomial in \( x \).
(e) Apply an appropriate interpolation formula to find \( \log_{10} 301 \), where the corresponding values of \( x \) and \( \log_{10} x \) are (300, 2.4771), (304, 2.4829), (305, 2.4843) and (307, 2.4871).

3. (a) Find \( \frac{dy}{dx} \) and \( \frac{d^2y}{dx^2} \) at \( x = 6 \) from the following table:

<table>
<thead>
<tr>
<th>( x )</th>
<th>4.5</th>
<th>5.0</th>
<th>5.5</th>
<th>6.0</th>
<th>6.5</th>
<th>7.0</th>
<th>7.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>6.99</td>
<td>12.90</td>
<td>16.71</td>
<td>21.18</td>
<td>26.37</td>
<td>32.34</td>
<td>39.15</td>
</tr>
</tbody>
</table>

OR

(a') Derive Simpson's \( \frac{1}{3} \) rule from the general quadrature formula. Using this rule, evaluate \( \int x^2 \log x \, dx \), by taking four strips.

(b) Use the Runge-Kutta fourth order formula to find \( y(0.2) \) with \( h = 0.1 \) for initial value problem: \( \frac{dy}{dx} = \sqrt{x + y}, \ y(0) = 1 \).

(c) Solve, by finite difference method, the boundary value problem:

\( y'' = 1 + y' \); \( y(0) = 0 \), \( y(1) = 0 \) with \( h = \frac{1}{3} \).

4. (a) Prove that if \( A \) and \( B \) are independent events, so are \( A \) and \( B \), \( A \) and \( B \).

OR

(a') \( A, B, C \) hit a target with probabilities \( \frac{1}{2}, \frac{2}{3}, \frac{3}{4} \) respectively. If all of them fire at the target, find the probability that at least one of them hits the target.

(b) A random variable \( X \) may assume four values with probabilities \( \frac{1 + 2x}{4}, \frac{1 - x}{4}, \frac{1 + 2x}{4} \) and \( \frac{1 - 4x}{4} \). For what values of \( x \) is this a probability distribution?

(c) Suppose that the life length (in hours) of a certain radio tube is a continuous random variable \( X \) with pdf \( f(x) = \frac{100}{x^2}, x > 100 \) and 0, 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?
2012–2015
B. TECH WINTER (IV SEMESTER) EXAMINATION
(COMPUTER ENGINEERING)
(DISCRETE MATHEMATICS)
(AM–263)
CREDITS – 04

Max. Marks: 60

Note: Answer all the questions. Assume suitable data if missing.
Notations used have their usual meaning.

1. (a) Answer any three of the following: [3x3=9]

   (i) Let \( A = \{1, 2, 3, \ldots, 9\} \) and let \( \sim \) be the relation on \( A \times A \) defined by
       \[(a, b) \sim (c, d) \text{ if } a + d = b + c\]
       Prove that \( \sim \) is an equivalence relation. Also find [3, 6]

   (ii) Let \( a \) and \( b \) are integers, and suppose \( Q(a, b) \) is defined recursively by

       \[Q(a, b) = \begin{cases} 
       5 & ; a < b \\
       Q(a - b, b + 2) + a & ; a \geq b 
       \end{cases}\]

       Find \( Q(15, 2) \).

   (iii) Consider the set \( Q \) of rational numbers and let \( * \) be the operation on \( Q \) defined
       by \( a * b = a + b - ab \). Find the identity and inverse element.

   (iv) Prove that the fourth root of unity forms a multiplicative group.

   (v) Define ring and give an example of a ring with zero divisor.

   (b) Define Integral Domain and Field. Show that every field is an integral domain
       but converse is not true.

2. (a) Find the adjacency matrix for a graph consisting of \( n \) vertices but no \( [4x2=8] \)
edges.

   (i) Find the adjacency matrix for a graph having loops at each node.

   (ii) If a graph \( G \) is disconnected and consists of two components, then find
       the form of the incidence matrix.

   (iv) What do the identical column in an incidence matrix represent.

   Using Dijkstra’s Algorithm, compute the shortest path between node \( B \) to \( G \) in
   the following weighted graph. Show the intermediate result of computation.

   ![Graph Diagram]

   Contd......2.
3. (a) In how many ways can 12 students be partitioned (ordered & unordered) into four teams so that each team containing three students? 

(b) State and prove Vandermonde’s combinatorial identity. OR

(b’) Let m, n be positive integers with \( m \leq n \).

Evaluate the sum \( \sum_{r=0}^{n} \binom{n}{r} \binom{n}{m-r} \).

(c) (i) Find the closed form of the generating function for the sequence: 1, -2, 3, -4, ……..

(ii) Use generating function to solve the recurrence relation \( a_n - 7a_{n-1} + 10a_{n-2} = 0; a_0 = 3, a_1 = 3 \).

4. (a) Determine graphically the optimal solution of the L.P.P.: 
\[
\begin{align*}
\text{Max } z &= x_1 + x_2 \\
\text{subject to } &-2x_1 + x_2 \leq 1 \\
&x_1 \leq 2 \\
&x_1 + x_2 \leq 3 \\
&x_1, x_2 \geq 0
\end{align*}
\]

(b) A company has three operational departments (weaving, processing and packing) with capacity to produce three different types of clothes namely suiting, shirt and woolen yielding a profit of Rs. 2, Rs. 4 and Rs. 3 per metre respectively. One metre of suiting requires 3 minutes in weaving, 2 minutes in processing and 1 minute in packing. Similarly one metre of shirt requires 4 minutes in weaving, 1 minute in processing and 3 minutes in packing. One metre of woolen requires 3 minutes in each department. In a week, total runtime of each department is 60, 40 and 80 hours for weaving, processing and packing respectively. Formulate the L.P.P. to find the product mix to maximize the profit.

OR

(b’) Solve the following L.P.P. using simplex method:
\[
\begin{align*}
\text{Min } z &= x_1 - 3x_2 + 2x_3 \\
\text{subject to } &3x_1 - x_2 + 3x_3 \leq 7 \\
&2x_1 + 4x_2 \leq 12 \\
&-4x_1 - 3x_2 + 8x_3 \leq 10 \\
&x_1, x_2, x_3 \geq 0
\end{align*}
\]

(c) Give the dual of the LPP:
\[
\begin{align*}
\text{Min } z &= 2x_1 + 3x_2 + 4x_3 \\
\text{subject to } &2x_1 + 3x_2 + 5x_3 \geq 2 \\
&3x_1 + x_2 + 7x_3 = 3 \\
&x_1 + 4x_2 + 6x_3 \leq 5 \\
x_1, x_2 \text{ and } x_3 \text{ is unrestricted.}
\end{align*}
\]
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)  Define the equivalence relation and partial ordering relation. Give an example of each. [98]

1(b)  What is a group? Give an example. [07]

OR

1'(a) Describe the following properties of binary relation: [09]
    • Reflexive
    • Symmetric
    • Transitive

1'(b) Give definition of ring and fields. [06]

2(a)  Differentiate between adjacency matrix and incidence matrix representation of graph. [07]

2(b)  Describe any shortest path algorithm. [08]

OR

2'(a) Define in-degree and out-degree of a directed graph. In terms of in-degree and out-degree, define source vertex, sink vertex, isolated vertex and pendant vertex. [09]

2'(b) Give algorithm to perform depth first search on a graph. [06]

Contd. . . . . . . . . . . . .
3(a) There are five balls labelled as A, B, C, D and E. Compute the followings:
   i) In how many ways, these balls can be arranged such that balls A and B are
      next to each other, and balls D and E are next to each other?
   ii) In how many ways four balls can be selected such that at least one of A or B
       is definitely selected?

3(b) How do you find homogeneous solution, particular solution and total solution of a
     recurrence relation? Take suitable example to explain.

4(a) Solve the following LP problem using simplex method:

Max \(3x_1 + 2x_2\)

\[\begin{align*}
2x_1 + x_2 & \leq 120 \\
x_1 + x_2 & \leq 100 \\
x_1 & \leq 40 \\
x_1, x_2 & \geq 0
\end{align*}\]

4(b) How can you determine if an LP problem is infeasible?
2012–13
B.TECH (WINTER SEMESTER) EXAMINATION
COMPUTER ENGINEERING
SOFTWARE ENGINEERING
CO-209

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) Prototype contains only partial features of complete software. Describe the kind of features that one should implement in prototype. What is done to reduce the cost of the prototype? [08]
1(b) Suggest what step you’ll take during software development to make software more maintainable. [07]

OR

1'(a) Differentiate between followings — [08]
   i) Iterative Enhancement Model and Spiral Model
   ii) Adaptive Maintenance and Corrective Maintenance

1'(b) Give the followings — [07]
   i) Typical distribution of effort in percentage across different phases of software development
   ii) Typical distribution of error occurrences in percentage across requirement analysis, design and coding

2(a) Describe the characteristics of SRS document. [08]
2(b) What is cost schedule milestone graph? Explain using an example. [07]

OR

2'(a) Give the followings — [08]
   i) Data dictionary for the information in your course registration form.
   ii) Checklist for review meeting of SRS document (should contain at least eight distinct items).

2'(b) What is function point? How is it calculated? [07]

Contd.......

2
3(a) Write in brief about following architectural style –
   i) Pipe and Filter Style
   ii) Repository Style

3(b) What are functional cohesion and sequential cohesion? Give an example of C function for each of functional cohesion and sequential cohesion.

4(a) Describe the followings –
   i) Memory Leak Error (along with an example in C)
   ii) Halstead Measure

4(b) Consider a program which is taking $n$ integers as input and sorting them in ascending order. Write test cases for testing this program.
Q.No. | Question | M.M.
---|---|---
1(a) | Consider the continuous-time signal 
\[ x(t) = \delta(t+2) - \delta(t-2) \]  
Calculate the value of \( E_x \) for the signal 
\[ y(t) = \int_{-\infty}^{t} x(\tau)d\tau \] | [03]
1(b) | Determine which of the following signal is periodic. If periodic also findout the fundamental period. 
(i) \( x[n] = \frac{1}{2}^n u[n-3] \)  
(ii) \( x(t) = 2e^{j(t+\pi/4)}u(t) \) | [04]
1(c) | Find and sketch the even and odd components of the following:  
(i) \( x(t) = u(t) \)  
(ii) \( x(t) = \sin(\omega_0 t) u(t) \)  
OR  
1(e) | Determine which of the following signals is linear and time invariant:  
(i) \( y[n] = x[\sin(n)] \)  
(ii) \( y[n] = 2x^2[n] \) | [04]
1(d) | Consider the cascaded interconnection of three LTI systems 
\[ x[n] \quad h_1[n] \quad h_2[n] \quad h_3[n] \quad y[n] \] 
if \( h_1[n] = 2 \delta[n-3] + 5 \delta[n-6] \), \( h_2[n] = \delta[n-7] \) and \( h_3[n] = 4 \delta[n-1] + 3 \delta[n-5] \)  
Find the overall system response relating \( x[n] \) and \( y[n] \). | [04]
2(a)  (i) Find the Fourier Transform of signal

\[ x(t) = A \text{rect}(t/T) \cos(\omega_c t) \]  

(ii) Prove that if \( x(t) \) is real and even then its Fourier Transform will also be real and even.

OR

2(a') (i) Find the Fourier Transform of signal

\[ x(t) = te^{-|t|} \]  

(ii) Prove the convolution property of Fourier Transform.

2(b) Step response of an LTI system is \( (1-e^{-t} - te^{-t})u(t) \). For a certain input \( x(t) \), the output is \( (2 - 3e^{-t} + e^{-2t})u(t) \). Find the input \( x(t) \).

2(c) Determine the constraints on \( r = |z| \) for the following sum to converge:

\[ \sum_{n=-1}^{\infty} 2^{-n(n+1)}z^{-n} \]

3(a) Consider continuous-time LTI system for which the input \( x(t) \) and output \( y(t) \) are related by the differential equation \( y''(t) - 3y'(t) - 2y(t) = x(t) \). Determine the \( h(t) \) when (i) System is stable (ii) System is causal

3(b) Find the inverse z-transform of \( X(z) \) given by

\[ X(z) = \frac{3z^{-3} + 5z^{-4}}{(1 - \frac{1}{2}z^{-1})(1 - \frac{3}{2}z^{-1})}, \quad |z| > \frac{3}{2} \]

3(c) Determine the overall transfer function, using block diagram reduction method, relating \( C \) and \( R \) for the system whose block diagram is shown below.

[Diagram]

OR

3(e') A second order system is described by the following transfer function

\[ H(s) = \frac{s^2 + \omega_n^2}{s^2 + 2\zeta \omega_n s + \omega_n^2} \]

Where, \( \omega_n \) is the natural undamped frequency and \( \zeta \) is the damping ratio. Determine and sketch the unit response of the system for \( 0 < \zeta < 1 \) and define the following terms...
(i) Rise time
(ii) Peak time
(iii) Peak Overshoot
(iv) Settling time

4(a) Write down the properties of Joint Probability Distribution function.

4(b) A particular random variable has a probability distribution function given by

\[ f_X(x) = (1 - e^{-2x})u(x) \]

Find (A) \( \Pr(X > 0.5) \) (B) \( \Pr(X \leq 0.25) \) and (C) \( \Pr(0.3 < X \leq 0.7) \)

OR

4(b') Joint Probability Density Function of two random variable \( X \) and \( Y \) is given by

\[ f_{X,Y}(x, y) = \frac{1}{(x_2 - x_1)(y_2 - y_1)}, \quad x_1 < x < x_2, \quad y_1 < y < y_2 \]

\[ = 0, \quad \text{elsewhere} \]

Find marginal density functions \( f_X(x) \) & \( f_Y(y) \). Also find correlation between \( X \) & \( Y \) (\( \text{E}[XY] \)).

4(c) A random variable \( Y \) is related to the random variable \( X \) by \( Y = X^2 \). If Probability Density Function (Pdf) of \( X \) is given by \( f_X(x) = 5e^{-|x|}u(x) \).

Find the value of \( x \) and PDF of \( Y \).

4(d) Define the following terms:

(i) Ergodic random Process
(ii) Stationary Random Process
(iii) Gaussian random variable
1(a) A truck is just purchased for $4600, which is to be used for delivery in a particular city. The expected life and salvage value is 5 years and $300, respectively. The combined insurance, maintenance, fuel, and lubrication costs are expected to be $650 the first year and to increase by $50 per year thereafter, while delivery service will bring an extra $1200 per year for the company. Determine the equivalent annual worth of the truck at an interest rate of 10% per year.

1(b) A plant superintendent is trying to decide between two machines. Machine A has the first cost of $11000, annual operating cost of $3500 and salvage value at the end of its 5 years useful life is $1000. While cost for machine B is $18000, annual operating cost of $3100 and salvage value of $2000 at the end of its 10 year useful life. Compare the two alternatives on the basis of present worth using an interest rate of 12% per year.

OR

1' (b) A sum of Rs 500,000 was allotted to a city for the construction and continued upkeep of a community centre by the local government body. Annual maintenance for the centre is estimated at Rs 15000. In addition, Rs 25000 will be needed every 10 years for painting and major repairs. How much will be left for the initial construction cost, after funds are allocated for perpetual upkeep? Deposited funds can earn 6% annual interest, and these returns are not subjected to taxes.

2 (a) Three years back a machine was purchased at a cost of Rs. 300000 to be useful for 10...
years. Its salvage value at the end of its estimated life is Rs. 50000. Its annual maintenance cost is Rs. 40000. The market value of the present machine is Rs. 200000. A new machine to cater to the need of present machine is available at Rs. 250000 to be useful for 7 years. Its annual maintenance cost is Rs. 14000. The salvage value of the new machine is Rs. 20000. Using an interest rate of 15%, find whether it is worth replacing the present machine with the new one.

2(b) Using benefit-cost (B/C) ratio analysis, determine which one of the following alternatives should be selected. Each alternative has 10 years useful life with no salvage value. Assume a tax free interest rate of 12%.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>First cost, $</td>
<td>15000</td>
<td>19000</td>
<td>25000</td>
<td>33000</td>
</tr>
<tr>
<td>Annual cost, $</td>
<td>1000</td>
<td>1200</td>
<td>900</td>
<td>1100</td>
</tr>
<tr>
<td>Annual benefit, $</td>
<td>1500</td>
<td>2000</td>
<td>1900</td>
<td>2200</td>
</tr>
</tbody>
</table>

OR

2'(b) What do you mean by depreciation? Give the reasons for declining value of an asset. An asset has a first cost of $25000 and an expected salvage value of $4000 after 12 years. Calculate depreciation for the fourth year and the book value at the end of fifth year using double declining balance (DDB) method.

3 (a) What is decision making in the context of management? Explain any one decision making technique.

3 (b) Briefly describe the managerial roles and skills possessed by effective managers.

OR

3' (b) Describe the basic functions of management process.

3 (c) "Information is a key resource", comment. What are the characteristics of useful information?

4 (a) Planning is an integral part of management process. Comment on its importance. Differentiate between strategic plan and operational plan.

4 (b) Differentiate between (i) job enrichment and job enlargement; (ii) tall and flat structures.

OR
4' (a) Discuss the concept and process of control. Give the steps involved in the control process.

4' (b) What is motivation and how it is related to management process? Discuss the importance of employee motivation.

5 (a) What is forecasting? The demand for the disposable plastic tubing for a general hospital is 300, 350, 320 units for September, October, and November respectively. The forecast for September was 200 units. Using first order exponential smoothing, compute the forecast for the month of December, taking \( \alpha = 0.3 \).

5 (b) Define inventory and inventory control. Describe the basic economic order quantity model of inventory control.

5 (c) Discuss human resource planning. Give the various methods of selecting and developing human resource.

OR

5' (c) Discuss the importance of international business. Briefly describe different forms of international business.