1. (a) Fit a curve of the form $y = a \sin x + b \cos x$ in the least square sense to the data:

<table>
<thead>
<tr>
<th>$x^0$</th>
<th>$y^0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-1</td>
</tr>
<tr>
<td>30</td>
<td>0.1340</td>
</tr>
<tr>
<td>45</td>
<td>0.7071</td>
</tr>
<tr>
<td>60</td>
<td>1.2320</td>
</tr>
<tr>
<td>90</td>
<td>2</td>
</tr>
</tbody>
</table>

OR

(a') Approximate $x^2$ by a function of the form $ae^x + be^{-x}$ in the last square sense on [0,1].

(b) Consider the initial value problem:

$$\sqrt{xy}'' = y'y + x\sqrt{x}, \quad y(1) = 1, \quad y'(1) = 1.$$ 

Find values of $y(1.5)$ and $y(2.0)$ by Modified-Euler's method, choosing $h = 0.5$.

OR

(b') Consider the initial value problem

$$y'' = \frac{x^2 + y^2}{x + y}, \quad y(1) = 1, \quad y'(1) = 1$$

obtain the value of $y(0.2)$ by Runge-Kutta method of order 4 by chosing $h = 0.2$.

2. (a) Apply three iterations to solve integral equation

$$y(x) = 1 + x + \int_{0}^{x} (x - t) y(t) dt, \quad y(0) = 1.$$ 

(b) Answer any two parts:

(i) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, \quad 0 < x < 1, \quad t > 0$ with the conditions:

$u(x, 0) = 1, \quad u(1, t) = 0, \quad \frac{\partial u}{\partial x}(0, t) = 0$.

taking $h = \frac{1}{4}, \quad k = \frac{1}{32}$ \text{ upto } t = \frac{1}{8}.

(ii) Given $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$,

$u(x, 0) = x^2 + 1, \quad u(1, t) = t^2$

$\frac{\partial u}{\partial t}(x, 0) = x, \quad \frac{\partial u}{\partial t}(0, t) = t$

Choose $h = 0.1$ and solve upto two time levels.

Contd......2
(iii) Given \( \frac{\partial f}{\partial t} = 2 \frac{\partial^2 f}{\partial x^2}, \quad t \geq 0, \quad 0 \leq x \leq 6. \)

Initial conditions: \( f(x, 0) = 10 \ (6 - x), \quad 0 \leq x \leq 6 \)

Boundary conditions \( f(0, t) = -10, \quad f(6, t) = 10. \)

Solve the above partial differential equation by Crank-Nicolson scheme.

3. (a) The joint probability distribution of a two dimensional random variable is given by

\[ f(x, y) = \begin{cases} e^{-x}, & y > 0, \quad x > y \\ 0, & \text{elsewhere} \end{cases} \]

Calculate the following:

(i) \( E(X), E(Y), E(X, Y). \)

(ii) The correlation coefficient \( \rho \)

(b) Suppose \( X \) and \( Y \) are independent random variables with the following probability distribution function

\[ X : g(x) = \frac{2}{3} x, \quad 1 < x < 2 \]

\[ Y : h(y) = \frac{8}{3y^3}, \quad 1 < y < 2 \]

Find the probability distribution function of \( W = X/Y. \)

OR

(b') A sample of size 5 is obtained from a random variable with distribution \( N(12, 4) \)

(i) Find the probability \( P(10 < \bar{X} < 13) \)

(ii) Find the probability that the maximum of the sample exceeds 14.

4. (a) In telegraph signal, the stochastic process \( x(t) \) is defined as:

\[ x(t) = \begin{cases} 1 & \text{if the total number of points in } (0, t) \text{ is even} \\ -1 & \text{if the total number of points in } (0, t) \text{ is odd} \end{cases} \]

Find \( E(x(t)) \) and auto correlation coefficient \( R(t_1, t_2). \)

(b) Discuss the random walk problem. Find the value of \( E(x(t)), \) where \( x(t) \) is the stochastic process of the random walk problem. Also calculate \( E(x^2(t)). \)

OR

(b') If the roots of \( x^2 - ax + b = 0 \) are real and \( b \) is positive but otherwise unknown. What is the expected value of the roots of the equation. Assume that \( b \) has uniform distribution in the permissible range.

*****

cont...
(x \leq z) \equiv P \left( \frac{x - \mu}{\sigma} \leq \frac{z - \mu}{\sigma} \right) = (z)\Phi

\text{(continued) Table 1: Values of the Standard Normal Distribution Function}
Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. Question

1(a) Write short notes on:
   i. System software and its characteristics.
   ii. Formal Technical Review.
   iii. Umbrella activities.

1(b) What are the problems associated with software development? How does adoption of software engineering practices address those problems?

OR

1'(a) Explain why software maintenance is more complex than hardware maintenance? Discuss the various types of software maintenance.

1'(b) Discuss the customer myths associated with software development.

2(a) What do you understand by process maturity? How is process maturity assessed for a software development organization?

2(b) With the help of a diagram, explain the spiral process model of software development. Which kind of software projects is best developed using this model?

OR

2'(a) Discuss the incremental process model of software development. How is it different from the prototyping model?

2'(b) What are Fourth Generation Techniques? How are they useful in software development?

Contd.....2.
3(a) What is McCall’s triangle of quality? Explain. [05]

3(b) What is Earned Value Analysis? Explain the significance of various parameters and indices. Use suitable diagram. [07]

OR

3'(a) With the help of a suitable diagram, explain the staffing pattern for software development projects. What is the impact of schedule change on project cost? [05]

3'(b) The following table indicates the various tasks involved in completing a software project, the corresponding duration in weeks, and the dependencies for each task.

<table>
<thead>
<tr>
<th>Task</th>
<th>Duration</th>
<th>Dependencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>D</td>
<td>5</td>
<td>B</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>C</td>
</tr>
<tr>
<td>F</td>
<td>4</td>
<td>C</td>
</tr>
<tr>
<td>G</td>
<td>2</td>
<td>E</td>
</tr>
<tr>
<td>H</td>
<td>3</td>
<td>F</td>
</tr>
<tr>
<td>I</td>
<td>2</td>
<td>D,G,H</td>
</tr>
</tbody>
</table>

a) Draw the activity network representation of the tasks.

b) Determine ES, EF, LS, LF and slack time for every task and find the Critical Path.

c) Develop the Gantt chart representation for the software project.

4(a) What are the characteristics of a good SRS document? Outline the structure of an SRS document as envisaged by the IEEE 830 standard. [05]

4(b) Define cohesion and coupling. Discuss their types. [07]

5(a) What is Black Box Testing? Briefly explain the various techniques used in Black Box Testing. [06]

5(b) Draw the Control flow graph for the pseudo code given below. Identify the various [06]

Contd….3.
regions of the graph and find a basis set. Determine the cyclomatic complexity of the pseudo code.

<initialization statements>
While ( (condition) AND (condition) )
{
  <statement>
  <statement>
  <statement>
  If ( (condition) AND (condition) )
  {
    <statement>
    <statement>

  }
Else If (condition)
  {
    <statement>
    <statement>

  }
Else
  {
    <statement>

  }
}
2015-16
M.TECH. (AUTUMN SEMESTER) EXAMINATION
COMPUTER ENGINEERING
SELECTED TOPICS IN COMPUTER SYSTEMS
CO-602

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 Cloud Computing. List Pros and Cons of Cloud Computing.  [05]
1(b)  Distinguish among SaaS, PaaS and IaaS with proper examples.  [05]
1(c)  Define Virtualization. What is the difference among full, para- and hardware-assisted virtualization?  [05]

2(a)  State the principle of optimality. Apply the principle of optimality on 0/1 Knapsack problem to obtain optimal solution f(i,y), where f(i,y) denotes the value of an optimal solution to the knapsack instance with remaining capacity y and remaining objects i, i+1, ... , n. Given n=5, p=[6,3,5,4,6], w=[2,2,6,5,4] and c=10, determine f(1,10). Where, n—no of items, p—profit of respective item, w—weight of respective item and c—capacity of knapsack. Also find the complexity of solution.  [10]

2(b)  Write the function ‘PrintMatchedPairs(char *expression)’ using stack to print indices of left and right matching parenthesis.  [05]

OR

2'(a)  Given the following algorithm,
QUICKSORT(A, p, r)
   1.  If p < r
   2.     q = PARTITION(A, p, r)
   3.     QUICKSORT(A, p, q-1)
   4.     QUICKSORT(A, q+1, r)

Write the PARTITION algorithm, taking A[r] as the pivot element. Apply the

Contd.....2.
algorithm on the array [2, 8, 7, 1, 3, 5, 6, 4]. Show the intermediate steps. Find the complexity for worst-case and best-case partitioning.

2'(b) Given the node of a tree:-

```c
struct node
{
    int data;
    struct node* left;
    struct node* right;
};
```

Write a function `int size(struct node* node)` to find size of a binary tree, size of the tree is the no of elements in the tree.

3(a) Define the data structure priority queue. If the priority queue is represented as unordered sequential list find the complexity of insertion, deletion and search. If the priority queue is represented as ordered list find the complexity of insertion, deletion and search.

3(b) Write function to perform Heapsort in O(nlogn) time.

4(a) Articulate important design considerations for developing applications that can leverage the benefits of Cloud Computing.

4(b) Elaborate a typical reference architecture for any ONE of the following multi-tier cloud applications, in detail:

   i) Banking and Financial Applications (E-Commerce, Business to Business)
   ii) Content Delivery Applications (Video Webcasting, On-line Photo Albums
   iii) Compute Intensive Applications (Data Analytics, Media Transcoding)

OR

4'(a) What are the data security measures that should be employed by Cloud Service providers in order to Secure Data-at-Rest and Data-in-Motion?

4'(b) Elaborate any ONE of the following Design Methodologies for Cloud Applications, in detail:

   i) Service Oriented Architecture (SOA)
   ii) Cloud Component Model (CCM)
   iii) Model View Controller (MVC)
M.TECH. (AUTUMN SEMESTER) EXAMINATION
COMPUTER ENGINEERING
INTERACTIVE COMPUTER GRAPHICS
CO-609

Maximum Marks: 60  Credits: 04  Duration: Three Hours

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

Q.No.  Question  M.M.

1  Write brief answers for any FOUR of the following:  [12]
   i) Operating principle of Liquid Crystal Displays with illustrations
   ii) Limitations of Liquid Crystal Displays
   iii) Synthetic Camera Model and Field of view of a camera
   iv) Difference between Affine Space and Euclidean Space
   v) Stereoscopic vision
   vi) Should the resolution of hand held devices continue to increase or no advantage accrues after certain resolution? Justify.

2(a)  Show how a plane can be defined by a point and two vectors or by three points in Affine Space.  [06]

2(b)  A line is specified by \( y = mx + c \). Determine the affine transformation that reflects a two dimensional point about this line.

OR

2'(a)  A vector is represented as \( w = v_1 + 3v_2 + 5v_3 \) in terms of three basis vectors \( \{v_1, v_2, v_3\} \). Determine its representation in new bases formed by \( \{u_1, u_2, u_3\} \) where

\[
\begin{align*}
   u_1 &= v_1 \\
   u_2 &= v_1 + v_2 \\
   u_3 &= v_1 + v_2 + v_3
\end{align*}
\]

2'(b)  Determine the transformation that rotates an object by an angle \( \theta \) in anti-clockwise direction about x-axis with respect to a fixed point \( (x_6, y_6, z_6) \).  [06]

3(a)  Distinguish between Parallel and Perspective Projections with suitable illustrations.  [03]
3(b) Determine and plot the perspective projection on xy plane of a Unit Cube placed in +ve octant and aligned with xy plane (Figure 1.) when the view plane is xy-plane. and the observer is at (a) (0.5,0.5,-1) and (b) (0.5,0.5,-10)

4(a) Explain why Cohen-Sutherland line clipping algorithm cannot be applied for Polygon clipping. Describe Weiler-Atherton Polygon clipping algorithm.

4(b) Describe Warnock's Area Coherence algorithm for hidden surface removal with suitable example. What are its limitations?

OR

4'(b) Prove that De Casteljau Algorithm results in generation of Bezier curves.

5(a) What are the properties of light sources and surfaces with reference to shading? Explain Phong Illumination model.

5(b) Explain how approximate shade at any point is obtained using (a) Gouraud and (b) Phong shading techniques.
2015-2016
M. Tech. 1st Semester Examination
(Computer Science and Engineering)
DIGITAL SYSTEM DESIGN (CO-623)

Maximum Marks: 60 Duration: Three Hours

- Attempt All questions.
- Symbols and notation used have their standard meanings.
- Assume suitable data if required.

1(a) Describe Metastability, clock and signal skew. What is setup and hold timing requirement in sequential circuit. 4
(b) Explain digital system design flow using Y Chart (D.Gaelski Chart). 5
(c) What are Modularity, Locality and Regularity? 3

OR

1'(a) Why the performance of the digital system is sacrificed to reduce the design cycle time? Explain the design flow with the help of flowchart. 6
(b) Explain briefly, the different design styles for digital system. Explain, how a three-input Look-up-Table of an FPGA CLB is used to design a three variable combinational system. 6

2(a) In a Finite State Machine (FSM) if the output is considered valid just after the active edge of the controlling clock, what is the type of this FSM? Explain. 4
(b) What is a state in FSM? What is the effect of optimal state encoding on FSM? 4
(c) Draw the state diagram of an even counter that counts 0,2,4,6,0,2,..... in a cyclic order. 4

OR

2' The state diagram of a sequence detector is shown in figure 1.
   a. Determine the sequences detected by the machine.
   b. What type of machine does the state diagram represent.
   c. Minimize the number of states. Assign suitable codes to the states using Armstrong-Humphrey Rules.

![Figure 1](image)

Contd....2.
3 (a) What are the different modes of a port in VHDL? Describe briefly. Write the VHDL code for a signal that is declared as a user defined type that can accept a 2-dimensional data.

(b) What are the different types of concurrent signal assignment statements in VHDL? Give the syntax of each type of statements.

(c) List different types of operator used in VHDL according to their priority.

4(a) Give the structural VHDL model of a 4-bit comparator using 4, single bit comparator.

(b) What are positional association and named association in component instantiation statements.

OR

(b') What are the different types of generate statements used in VHDL and which types of systems structures are modeled by their use?

5(a) Write the VHDL codes for the circuit shown in figure 2.

\[ F_1 = A \text{xor} B \]
\[ F_2 = F_1 \text{or} B \]

![Figure 2](image)

(b) The predefined signal attributes are given below; explain the information provided by them.

- `signal_name'ACTIVE`
- `signal_name'QUITE`
- `signal_name'EVENT`
- `signal_name'STABLE`
- `signal_name'LAST_EVENT`
- `signal_name'DELAYED(T)`
- `signal_name'TRANSACTION`
- `signal_name'LAST_VALUE`