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

Q.No. | Question                                                                 | M.M. |
---   |---------------------------------------------------------------------------|------|
1(a)  | Give the followings –                                                    | [06] |
      |   - Grammar for arithmetic expression                                     |      |
      |   - Names of the phases of compiler                                       |      |
1(b)  | Construct finite automata for followings –                               | [06] |
      |   - Identifier                                                            |      |
      |   - Numeric Constant                                                      |      |
2(a)  | Construct SLR parsing table for following grammar –                      | [06] |
      |     \[ E \rightarrow E+T \mid T \]                                       |      |
      |     \[ T \rightarrow T*F \mid F \]                                       |      |
      |     \[ F \rightarrow (E) \mid id \]                                      |      |
2(b)  | Give comparison of SLR, LALR and Canonical method.                        | [06] |

OR

2'(a) | What is left factoring? Why it is done? Explain with a suitable example. | [06] |
2'(b) | Give a grammar which recognises set of balanced parentheses. Construct canonical parsing table for your grammar. | [06] |
3(a) Describe the content of activation record block.

3(b) Give definition of followings –
- S-Attributed Definition
- L-Attributed Definition

OR

3'(a) Give syntax directed definition to convert arithmetic expression from infix to prefix format.

3'(b) What is symbol table? Describe its content and structure.

4(a) Give syntax directed translation scheme to translate if-then-else and while statement to three address code.

4(b) Describe different kinds of three address statements.

5(a) How are common sub-expressions eliminated in a block? Describe.

5(b) Write a short note on Reaching Definition Analysis.
Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. | Question                                                                 | M.M. |
-----|--------------------------------------------------------------------------|------|
1(a).| Draw the architecture of a vector-scan display system. Explain the role of the refresh buffer in such a system. Why is a vector-scan display system more flicker-prone than a raster-scan display system? | [06] |
1(b).| Why is GLUT referred to as a state machine? List and very briefly, explain any three GLUT APIs.                                                                 | [06] |
2.   | Derive the decision parameter and the initial condition for the Bresenham’s line algorithm for lines with | [12] |
      |  \(|m|<1\). If the algorithm starts from the other end-point, what should be done to ensure that the same pixel is chosen under the condition \((d_1 = d_2)\)?

2'.  | Write the midpoint circle algorithm and apply it to a circle with \(r = 20\). Show the pixel positions obtained in the first quadrant from \(x = 0\) to \(x = y\). | [12] |
3(a).| Can the matrix for the “reflection” transformation be derived from a composite sequence of basic transformations? If yes, derive the “reflection” matrix using a sequence of basic transformations for reflection about the reflection axis \(y = -x\). | [06] |
3(b).| Derive the composite matrix for scaling a 3-D object with respect to a fixed point \((x_f, y_f, z_f)\).                                                              | [06] |
4.   | Explain the Cohen-Sutherland line-clipping method. How does it speed up processing when compared to the simple line-intersection method? Apply the | [12] |

Contd.... 2
Cohen-Sutherland line-clipping method to the lines shown in the figure below:

4'. Explain the concept of perspective projection. Is it more realistic than parallel projection? Derive the perspective projection transformation matrix for a 3-D object (assumed here to be a point, P) when projected onto a viewing plane as shown in figure below:

5(a). Derive the illumination model for calculating the intensity of light on an object in a scene, taking into account both, ambient lighting and a point light source. For specular reflection, clearly differentiate between $n_s$ (specular reflection parameter) and $w(\theta)$ (specular reflection coefficient) and their effect.

5(a'). Derive the general polynomial representation of an interpolation spline, clearly identifying the constraint parameters and the blending functions within the representation. For a natural cubic spline, why are four additional geometric constraints needed and how can they be obtained?

5(b). Explain the Gouraud polygon-shading model. How does the Phong model improve upon it? Explain the significance of normal vectors when applying the above two shading models.
Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Write program segment where necessary.

Q.No. Question M.M.
1(a) When running a particular programme, computer A achieves 100 MIPS and [05]
computer B achieves 75 MIPS. However, computer A takes 60s to execute the
programme, while computer B takes only 45s. How is this possible?
1(b) Discuss the computer's architectural classification schemes and justify which one
scheme is popular and why? [05]
1(c) What is the function of a Cache memory? How are the cache mapping done to
fetch the data from the memory? [05]

2(a) Design an SIMD computer having eight processors. Draw and discuss its
single/multi stage connections, control strategies and its routing functions.

2(b) Discuss matrix multiplication on a mesh (SIMD) network. Also analyse the
complexity of the algorithm.

3(a) Why most vector processors have pipeline structure? Discuss pipelined vector
processing methods with examples.

3(b) Draw and discuss the characteristic and features of FACOM VP 200. [05]

3(C) Distinguished between UMA and NUMA multiprocessor models. [05]

OR

37(a) Discuss the cache-coherence problems and explain their remedies. [05]
3(b) Among various multiprocessor organizations, which one is better on the basis of
their various performance indices? [05]
3(c) Compare the characteristic of various vector processors. [05]
4(a) Discuss issue and criteria for designing an efficient parallel algorithm. [05]
4(b) Why PRAM model chosen to represent the parallel m/c's? Discuss search
algorithm on various PRAM models. [05]
4(c) Discuss the concept of FORK-JOIN with suitable examples. [05]

OR

4 Write Technical notes on :
(i) Grid Computing
(ii) Parallel Programming Environment
(iii) Complexity of algorithm [05x3]
2012-13
B.TECH. (WINTER SEMESTER) EXAMINATION
COMPUTER ENGINEERING
SOFT COMPUTING
CO-444

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) Give definition of the following: [05]
   (i) Soft Computing
   (ii) Fuzzy Logic
   (iii) Neural Networks
   (iv) Genetic Algorithms
   (v) Backpropagation

1(b) Name and describe the main features of Genetic Algorithms. [05]

1(c) Construct the McCulloch-Pitts networks of the expression given below: [05]
    \[ N_3(t) = N_1(t-2) \& \neg N_2(t-3) \lor \neg N_2(t-3) \lor N_1(t-2) \]

2(a) How fuzzy sets are different from crisp sets? Explain. [05]

2(b) Prove that \( X \rightarrow Y \) is a deductive consequence of \( \{ Z \rightarrow Y, X \rightarrow Z \} \). [Here X, Y & Z are the propositions and \( \rightarrow \) is implication] [05]

2(c) Discuss defuzzification and its techniques. [05]

OR

2'(a) What is a membership function? Discuss all components of a membership function. [05]

2'(b) Consider the fuzzy sets \( F \) and \( G \) defined in the interval [0, 5] by the membership functions:
    \[ \mu_F(x) = \frac{x}{x+2} \& \mu_G(x) = 2^{-x} \]. Determine the mathematical formulae and graphs of membership functions of the following fuzzy sets: \( F \cup G \), \( F \cap G \) and \( \overline{F} \). [05]

2'(c) Explain the Fuzzy Inference System. [05]
3(a) How do neural network models correspond to biological nervous systems? Explain.

3(b) Explain the different types of neural networks learning methods.

3(c) Design a multilayer \((3 - 2 - 2)\) perceptron that outputs '0' for the odd parity and '1' for the odd parity. Initially, all weights of the connecting neurons are 1.0.

OR

3'(a) Discuss the characteristics of neural networks architectures.

3'(b) Define linearly separable and inseparable patterns of the perceptron.

3'(c) Develop a Backpropagation Learning Algorithm.

4(a) How does genetic algorithm works? Explain by suitable example.

4(b) Discuss the genetic search space and fitness function.

4(c) Write short note on any ONE of the following:

(i) Neuro-Fuzzy hybrid system

(ii) Fuzzy-Genetic hybrid system
Answer all the questions. 
Assume suitable data if missing. 
Notations used have their usual meaning.

<table>
<thead>
<tr>
<th>QNo</th>
<th>Question</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Attempt any two parts.</td>
<td>5*2=10</td>
</tr>
<tr>
<td></td>
<td>(a) Who are the users of a database system? Explain the role of each.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) What is data independence? Explain how three-schema database architecture helps to achieve it?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(c) What is database management system? How can they be classified?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Attempt any two parts.</td>
<td>5*2=10</td>
</tr>
<tr>
<td></td>
<td>(a) What is a relation? What are its properties? Explain the definition of Candidate Key with a suitable example.</td>
<td></td>
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<tr>
<td></td>
<td>(b) Explain the complete syntax of SQL SELECT statement.</td>
<td></td>
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<tr>
<td></td>
<td>(c) What is integrity of database? What are different types of integrity constraints? Explain each with example.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Attempt any two parts.</td>
<td>5*2=10</td>
</tr>
<tr>
<td></td>
<td>(b) What is a functional dependency? Write the procedure to find the closure of a set of attributes under a given set of functional dependencies.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(c) What is normalization? What are its advantages? Explain using a suitable example.</td>
<td></td>
</tr>
</tbody>
</table>
4(a) Discuss the functionalities of each layer in OSI reference model in detail. In which way is OSI reference model different from TCP/IP?

4(b) Discuss about optical fiber and its propagation modes. Write down its advantages and disadvantages.

OR

4(b)' Describe error detection and correction techniques provided by the link layer.

4(c) Define channel partitioning protocol, random access protocol and taking-turns protocol.

5(a) Describe link state routing algorithm. Compare and contrast it with distance vector algorithm.

OR

5(a)' Describe distance vector routing algorithm. Compare and contrast it with link state algorithm.

5(b) Write down the techniques to improve quality of service of internet.

5(e) Write short notes-

(i) RIP and BGP

(ii) SLIP & SNMP
Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.  Question  M.M.
1(a)  Give an overview of Embedded System architecture with Diagram. Explain the components of the architecture. [05]

OR

1(a)' What is difference between Programmable ROM and Mask ROM? Explain how contents are written on Mask ROM. Implement following function on masked ROM

\[ X = Y^3 - 2Y^2 + 3 \quad \text{for} \quad Y \in [0,3]. \]

1(b)  What are RISC and CISC instruction sets? Differentiate between the two. [05]

OR

1(b)' What are the constraints to be considered while designing an embedded system? [5]

1(c)  Draw Class diagram for the following object Classes, with association names, attributes and additional object Classes if required.

Object classes: college, playground, principal, classroom, board, book, student, faculty, cafeteria, ruler, door, swing. [05]

2(a)  Draw a UML sequence Diagram of a higher priority interrupt that happens during a lower -priority interrupt handler. Assume the task are preemptive; i.e. a lower priority can't make higher priority interrupt to wait. The diagram should include the two devices, the two handlers and the background Program. [05]

Contd......
2(b) Explain any two modes out of the three modes of counters of 8051 microcontroller. [05]

2(c) If “tick” is considered as a single cycle of the system clock and “tock” as single cycle of the pre-scaled signal, assume a system clock of 16,000,000 ticks/sec. Suppose that we want to produce a pulse that is exactly 4.096 ms in duration. What prescalers should we choose and how many tocks should we wait for? (The prescaler should not exceed 1024)

OR

2(c)' A service routine is executing an instruction of 3 µs when the interrupt event occurs. The initial terminating actions, before the execution of the task related instructions start, take 0 µs before switching to the new routine and the initial actions, before the execution of the task related instructions start, take 1 µs. Assume that the present routine takes 60 µs.
   i. What is the worst case latency period when there are other three; highest priority, second highest priority and the third highest priority interrupts may be pending, which can take 80 µs, 40 µs and 100 µs, respectively, and if the new service routine cannot start instantaneously but only at the end of the present routine as in 68HC11?
   ii. What is latency for the highest priority routine?
   iii. What is the latency for the second highest priority routine?
   iv. What is the latency for the highest but two priority routine?

3(a) What are assembler directives? Explain any four. [05]

OR

3(a)' Explain the following instructions of PIC microcontroller with examples.

   i. RKFIE
   ii. SWAPF f, d
   iii. ADDWF f, d
   iv. DECFSZ f, d
   v. BFS f, b

3(b) i. START: MOVLO 0x42
    SUBLW 0x33
    SLEEP
    a. Specify the result you expect in W register.
    b. Specify the flags that are set after subtraction.

ii. START: MOVLO 0x67
    SUBLW 0x33
    SLEEP
    a. Specify the result you expect in W register
    b. Specify the flags that are set after addition.

Contd....
iii. START: MOVWF INDF

If before instruction execution,
W= 0xF5 ; FSR= 0xC2 and address content of 0xC2 = 0x00

What will be content of W, FSR and address content of 0xC2 after execution.

OR

3(b) Explain the concept of Look-up tables in PIC microcontroller with example. [5]

3(c) Explain and calculate the EXACT time required for PIC18F controller to execute LOOP1 if the operating frequency of controller is 40MHz.

START: COUNT1 EQU D'229'
REG10 EQU 0x10
MOVlw COUNT1
MOVWF REG10

LOOP1: DECf REG10+1
NOP
BNZ LOOP1

4(a) List and explain the three types of switches. [05]

4(b) Differentiate between common anode and common cathode configuration for a seven segment LED display. Write literals that will correspond to 3, 6, 9, 0 in both the configurations without lighting the decimal point LED. [05]

4(c) Write Short notes on any of the two

i. LIN

ii. LDR

iii. IrDA
As a network designer, consider an application that transmits data at a steady rate (for example, the sender generates an N-bit unit of data every $k$ time units, where $k$ is small and fixed). Also, when such an application starts, it will continue running for a relatively long period of time. Answer the following questions, briefly justifying your answer:

(i) Would a packet-switched network or a circuit-switched network be more appropriate for this application? Why?

(ii) Suppose that a packet-switched network is used and the only traffic in this network comes from such applications as described above. Furthermore, assume that the sum of the application data rates is less than the capacities of each and every link. Is some form of congestion control needed? Why?

OR

Suppose there is a 10 Mbps microwave link between a geostationary satellite (altitude: 36000Km) and its base station on Earth. Every minute the satellite takes a digital photo and sends it to the base station. Assume a propagation speed of $2.4 \times 10^8$ meters/sec.

(i) What is the propagation delay of the link?

(ii) What is the bandwidth-delay product, $R \times t_{prop}$?
Let $x$ denote the size of the photo. What is the minimum value of $x$ for the microwave link to be continuously transmitting?

1(b) Consider sending a large file of $F$ bits from Host A to Host B. There are two links (and one switch) between A and B, and the links are uncongested (that is, no queuing delays). Host A segments the file into segments of $S$ bits each and adds $h$ bits of header to each segment, forming packets of $L = (S+h)$ bits. Each link has a transmission rate of $R$ bps. Find the value of $S$ that minimizes the delay of moving the file from Host A to Host B. Disregard propagation delay.

2(a) Consider Figure 1 (a), for which there is an institutional network connected to the Internet. Suppose that the average object size is 900,000 bits and that the average request rate from the institution's browsers to the origin server is 1.5 requests per second. Also suppose that the amount of time it takes from when the router on the Internet side of the access link forwards an HTTP request until it receives the response in two seconds on an average. Model the total average response time as the sum of the average access delay (that is, the delay from the Internet router to institution router) and the average Internet delay. For the average access delay, use 

$$\frac{\Delta}{1-\Delta\beta},$$

where $\Delta$ is the average time required to send an object over the access link and $\beta$ is the arrival rate of objects to the access link.

(i) Find the total average response time.

(ii) Now suppose a cache is installed in the institutional LAN as shown in Figure 1(b). Suppose the hit ratio is 0.4. Find the total response time.
Figure 1 (a): Institutional network connected to the Internet without a Web cache (Q2(a)).

Figure 1 (b): Adding a cache to the institutional network (Q2(a)).
2(a) In this problem, we explore designing a KaZaA-like system that has ordinary nodes, group leaders, and super group leaders.

(i) Suppose each super-group leader is roughly responsible for 200 group leaders, and each group leader is roughly responsible for 200 ordinary peers. How many super-group leaders would be necessary for a network of four million peers?

(ii) What information might each group leader store? What information might each super-group leader store? How might search be performed in such a three-tier design?

2(b) What are the problems with the centralized design of Domain Name System (DNS)? What are the types of DNS servers? In addition to translating host names to IP addresses, what are the services provided by DNS?

3(a) Consider the idealized model for the steady-state dynamics of TCP. In the period of time from when the connection's window size varies from W/(2RTT) to W/RTT, only one packet is lost (at the very end of the period).

(i) Show that the loss rate is equal to

\[ L = \text{loss rate} = \frac{1}{3\frac{w^2}{8} + \frac{3}{4}w} \]

(ii) Use the result above to show that if a connection has loss rate \( L \), then its average bandwidth is approximately given by

\[ \approx \frac{1.22 \text{ MSS}}{\text{RTT} \sqrt{L}} \]

where MSS is Maximum Segment Size.

3(b) Consider the TCP procedure for estimating RTT. Suppose that \( \alpha = 0.1 \). Let \( \text{SampleRTT}_1 \) be the most recent sample RTT, let \( \text{SampleRTT}_2 \) be the next most recent sample RTT, and so on.

(i) For a given TCP connection, suppose four acknowledgements
have been returned with corresponding sample RTTs 
SampleRTT₄, SampleRTT₃, SampleRTT₂, and SampleRTT₁. 
Express EstimatedRTT in terms of the four sample RTTs. 

(ii) Generalize your formula for n sample RTTs. 
(iii) For the formula in part (ii) let n approach infinity. Comment 
on why this averaging procedure is called an exponential 
moving average. 

OR 

3’ In a Go-Back-N protocol (GBN), the sender is allowed to transmit multiple packets 
(when available) without waiting for an acknowledgement, but is constrained to 
have no more than some maximum allowable number, N, of unacknowledged 
packets in the pipeline. Design an ACK-based, NAK-free, GBN protocol for reliable 
data transfer at the transport layer. Provide extended FSM descriptions of the GBN 
sender and the receiver. With the help of a suitable diagram, explain the operation of 
the GBN protocol for the case of a window size of four packets. 

4(a) Briefly describe IP datagram fragmentation and reassembly. Suppose a datagram of 
4000 bytes (20 bytes of IP header plus 3980 bytes of IP payload) arrives at a router 
and must be forwarded to a link with a maximum transfer unit (MTU) of 1500 
bytes. Suppose that the original datagram is stamped with an identification number 
of 777. How fragmentation and reassembly are carried out for this IP datagram? 

4(b) Consider a datagram network using 32-bit host addresses. Suppose a router has four 
links, numbered 0 through 3, and packets are to be forwarded to the link interfaces 
as follows: 

<table>
<thead>
<tr>
<th>Destination Address Range</th>
<th>Link Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>11100000 00000000 00000000 00000000 through 11100000 11111111 11111111 11111111</td>
<td>0</td>
</tr>
<tr>
<td>11100001 00000000 00000000 00000000 through 11100001 00000000 11111111 11111111</td>
<td>1</td>
</tr>
<tr>
<td>11100001 00000001 00000000 00000000 through</td>
<td>2</td>
</tr>
</tbody>
</table>

Contd......6
otherwise

(i) Provide a forwarding table that has four entries, uses longest-prefix matching, and forwards packets to the correct link interfaces.

(ii) Describe how your forwarding table determines the appropriate link interface for datagrams with destination addresses:

```
11001000 10010001 01010001 01010101
11100001 00000000 11000011 00111100
11100001 10000000 00010001 01110111
```

OR

4(b') Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17/24. Also suppose that Subnet 1 is required to support up to 125 interfaces, and Subnets 2 and 3 are each required to support up to 60 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints. Also provide the range of addresses for each of the three subnets.

5(a) What is inside a router? Discuss the components of a router in detail.

5(b) Describe the link-state routing algorithm and show its working for the network of Figure 2. Discuss the problem with the link-state routing algorithm with the help of a suitable example.

Figure 2: The given network for Q5 (b).