COMPUTER SCIENCE AND APPLICATIONS

Signature of Invigilators

1. .....

2. .....

PAPER–III

OCT–10/19

Roll No. ☐☐☐☐☐
(In figures as in Admit Card)

Roll. No. .....

.....
(in words)

Name of the Areas/Section (if any).....

Time Allowed : 2-1/2 hours] **[Maximum Marks : 200**

Instructions for the Candidates

1. Write your Roll Number in the space provided on the top of this page.
2. Write name of your Elective/Section if any.
3. Answer to short answer/essay type questions are to be written in the space provided below each question or after the questions in test booklet itself. No additional sheets are to be used.
4. Read instructions given inside carefully.
5. Last page is attached at the end of the test booklet for rough work.
6. If you write your name or put any special mark on any part of the test booklet which may disclose in any way your identity, you will render yourself liable to disqualification.
7. Use of calculator or any other Electronic Devices is prohibited.
8. There is no negative marking.
9. You should return the test booklet to the invigilator at the end of the examination and should not carry any paper outside the examination hall.

પરીક્ષાર્થીઓ માટે સૂચનાઓ :

૧. આ પૃષ્ઠના ઉપલા ભાગે આપેલી જગ્યામાં તમારી ક્રમાંક સંખ્યા (રોલ નંબર) લખો.

૨. તમે જે વિકલ્પનો ઉત્તર આપો તેનો સ્પષ્ટ નિર્દેશ કરો.

૩. ટૂંકનોંધ કે નિબંધ પ્રકારના પ્રશ્નોના ઉત્તર દરેક પ્રશ્નની નીચે આપેલી જગ્યામાં જ લખો. વધારાના કોઈ કાગળનો ઉપયોગ કરશો નહીં.

૪. અંદર આપેલી સૂચનાઓ ધ્યાનથી વાંચો.

૫. આ ઉત્તર પોથીમાં અંતે આપેલું પૃષ્ઠ કાચા કામ માટે છે.

૬. આ ઉત્તર પોથીમાં કયાંય પણ તમારી ઓળખ કરાવી દે એવી રીતે તમારું નામ કે કોઈ ચોકકસ નિશાની કરી હશે તો તમને આ પરીક્ષા માટે ગેરલાયક ગણવામાં આવશે.

૭. કેલકયુલેટર અથવા ઈલેકટ્રોનિકસ સાધનોનો ઉપયોગ કરવો નહીં.

૮. નકારાત્મક ગુણાંક પદ્ધતિ નથી.

૯. પ્રશ્નપત્ર લખાઈ રહે એટલે આ ઉત્તર પોથી તમારા નિરીક્ષકને આપી દેવી. પરીક્ષાખંડની બહાર કોઈ પણ પ્રશ્નપત્ર લઈ જવું નહીં.

FOR OFFICE USE ONLY
MARKS OBTAINED

Question Number	Marks Obtained	Question Number	Marks Obtained
1.		11.	
2.		12.	
3.		13.	
4.		14.	
5.		15.	
6.		16.	
7.		17.	
8.		18.	
9.		19.	
10.			

SEAL

Total Marks obtained .....

Signature of the co-ordinator .....
(Evaluation)

COMPUTER SCIENCE AND APPLICATIONS

PAPER–III

Note : This paper contains four Sections. You are required to attempt *all* of them.

SECTION I

Note : This section contains *two* questions **1** and **2**. Answer both questions in **500** words each.

1. (*a*) Show with an example how semaphore can be used in process synchronization. 10

   (*b*) Discuss message handling in Windows-NT with an example. 10

   OR

   Write short notes on :

   (*a*) Dynamic Programming

   (*b*) Divide and Conquer algorithms

   (*c*) Quicksort

   (*d*) NP-Complete Problems. 5+5+5+5

2. Draw and discuss block diagram of a general purpose microprocessor. Also explain program counter, instruction decoder, various general purpose registers and system bus in detail. 20

OR

What is a B tree ? How is it different from a Binary Tree ? Explain with suitable examples the basic operations that are performed on a B tree. 20

SECTION II

Note : Choose any *one* elective from I to V and answer all the questions (Q. **3** to Q. **5**) of the same in **300** words each.

(Elective I)

3. Prove whether the following statements are true *or* false. In case of false, give a counterexample :

   (*a*) Any n-state NFA, where all n states are final states, will accept all words in Σ^*. 5

   (*b*) All regular languages can be accepted by a DFA containing even number of states. 5

   (*c*) For any NFA A, the NFA $\bar{A}$ which is created by changing all the final states of A to non-final and vice-versa accepts the complement of L(A). L(A) is the language accepted by A. 5

4. (*a*) Convert the following CFG to GNF :

   $S \rightarrow ASa \mid Ab$

   $A \rightarrow SA \mid C$ 10

   (*b*) Write down the CFG for the following language in CNF, where T = (*a*, *b*) : 5

   All odd-length palindromes.

5. (*a*) Design a Turing Machine that can add upto four integers placed on the input tape. 9

   (*b*) Determine all the derivations of string 'abbab' for the following grammar :

   $S \rightarrow aA \mid bB \mid a \mid b$

   $A \rightarrow bB \mid aS$ 6

OR

(Elective II)

3. What is the difference between lossy and lossless compression of video ? Explain video compression with MPEG standard. 15

4. What are error correcting and detecting codes ? What are the advantages and disadvantages of these with respect to error correction and efficiency ? 15

5. (*a*) What is Discrete Spatial Fourier Transform ? 8

   (*b*) How do we perform the Spatial Image Tansformation ? 7

OR

(Elective III)

3. What is sensitivity analysis ? Discuss its significance fully from managerial viewpoint. 15

4. Explain the Hungarian Assignment Method. Is it better than other methods for solving assignment problem ? How ? 15

5. Write a short note on matroids, matric matroids and graphic matroids. 15

OR

(Elective IV)

3. There are 16 (binary and unary) operators that can be defined on two Boolean variables. Specify the two operators which cannot be represented by a single neuron of McCulloch-Pitts type with two data inputs, a bias input and an output. Discuss whether you can represent the AND, OR and XOR operators using a neuron with and without the bias input. Argue in detail what is possible and what is not. 15

4. Explain the architecture of a Multi-layer perceptron neural network. Construct an expression for the error at the output of an MLP for a given training set of patterns and derive the back-propagation learning rule that minimizes this error. Give an example of an MLP that represents the XOR binary operator. 15

5. (*a*) Given a universal set X and a non-empty family τ of subsets of X, state the requirements for a function :

$$g : \tau \rightarrow [0, 1]$$

to be called as a fuzzy measure. 7

(*b*) Specify the conditions to be satisfied by a fuzzy set on the set of real numbers to be qualified as a fuzzy number and give an example of a fuzzy number. 8

OR

(Elective V)

3. Write a YACC program to count the number of digits of an integer. 15

4. Discuss the system calls that would be helpful for displaying maximum 100 characters starting from the 25th position in a file. 15

5. Discuss message handling with suitable examples. 15

Q. No. 3. Elective .....

Q. No. 4. Elective .....

Q. No. 5. Elective .....

SECTION III

Note : Answer the following questions in **50** words each. Attempt *all* questions.

6. Explain any *three* instructions from each group of logical and arithmetic instructions available in the microprocessors you have studied. 10

7. (*a*) What is the difference between frame buffer and Z-buffer ? 5

   (*b*) Draw the general 3D-transformation pipeline. 5

8. (*a*) Explain with an example a parallel algorithm for matrix multiplication. 5

(*b*) Write a short note on code optimization. 5

9. Discuss the various network topologies. 10

10. (*a*) Explain with an example the greedy approach to problem solving. 5

(*b*) Given 2 sets of integers S_1 and S_2 and an integer x, write the outline of an algorithm which finds whether there exists an element from S_1 and an element from S_2 whose sum equals x. The complexity of the algorithm should not be more than $0(n \log n)$. 5

11. Write a simple super-class and two sub-classes with an overridden method among all the sub-classes and write a driver program that exihibits polymorphic behaviour of objects of the three classes with the overridden method being called randomly. 10

12. In which types of cohesive module maintenance is difficult ? Discuss in detail. 10

13. What is a resource allocation graph ? Give an example of it where there is no deadlock. 10

14. Describe various types of cuts used in PROLOG language along with their similarities and differences. What is the difference between cut and fail ? 10

SECTION IV

Note : Attempt all the *five* questions (**15** to **19**) in **30** words each.

15. Briefly describe the two modes of query optimizers, i.e. :

(*a*) Rule-based optimizer, and

(*b*) Cost-based optimizer. 5

16. A binary tree has 9 nodes. The inorder and preorder traversals of T yield the following sequence of nodes :

Inorder	**Preorder**
E	F
A	A
C	E
K	K
F	C
H	D
D	H
B	G
G	B

Draw the tree T. 5

17. Write a C | C++ function reverse_list (x) that relinks the nodes of a singly-linked list so that the order of the nodes is the reverse of the original order. Be sure that your function changes its argument to point to the new head of the list. 5

18. Find the shortest strings not present in the following :

(*a*) $0^* 1^* 0^* 1^*$

(*b*) $0^* + 1^* + 1^*0 + (1 + 0)^* 1$ 5

19. Given a point (x, y, z), give the transformation matrices that will translate that point by $[-2, -2, -1]$, rotate it by 90 degrees about the Y-axis and scale by a factor of 2 along the X-axis. Combine the transformation matrices into one matrix that will perform the same transformation. 5