PAPER-III
COMPUTER SCIENCE AND APPLICATIONS

Signature and Name of Invigilator

1. (Signature) _____
   (Name) _____
2. (Signature) _____
   (Name) _____

Roll No. | | | | | | | | |
(In figures as per admission card)

Roll No._____
(In words)

D 8 7 1 0

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

Number of Pages in this Booklet : **32** Number of Questions in this Booklet : **19**

Instructions for the Candidates

1. Write your roll number in the space provided on the top of this page.
2. Answer to short answer/essay type questions are to be given in the space provided below each question or after the questions in the Test Booklet itself.

   No Additional Sheets are to be used.
3. At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :
   (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal and do not accept an open booklet.
   (ii) **Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.**
4. Read instructions given inside carefully.
5. One page is attached for Rough Work at the end of the booklet before the Evaluation Sheet.
6. If you write your name or put any mark on any part of the Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
7. You have to return the test booklet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the Examination Hall.
8. **Use only Blue/Black Ball point pen.**
9. **Use of any calculator or log table etc., is prohibited.**

परीक्षार्थियों के लिए निर्देश

1. पहले पृष्ठ के ऊपर नियत स्थान पर अपना रोल नम्बर लिखिए ।
2. लघु प्रश्न तथा निबंध प्रकार के प्रश्नों के उत्तर, प्रत्येक प्रश्न के नीचे या प्रश्नों के बाद में दिये हुए रिक्त स्थान पर ही लिखिये ।

   इसके लिए कोई अतिरिक्त कागज का उपयोग नहीं करना है ।
3. परीक्षा प्रारम्भ होने पर, प्रश्न-पुस्तिका आपको दे दी जायेगी । पहले पाँच मिनट आपको प्रश्न-पुस्तिका खोलने तथा उसकी निम्नलिखित जाँच के लिए दिये जायेंगे, जिसकी जाँच आपको अवश्य करनी है :
   (i) प्रश्न-पुस्तिका खोलने के लिए उसके कवर पेज पर लगी कागज की सील को फाड़ लें । खुली हुई या बिना स्टीकर-सील की पुस्तिका स्वीकार न करें ।
   (ii) कवर पृष्ठ पर छपे निर्देशानुसार प्रश्न-पुस्तिका के पृष्ठ तथा प्रश्नों की संख्या को अच्छी तरह चैक कर लें कि ये पूरे हैं । दोषपूर्ण पुस्तिका जिनमें पृष्ठ/प्रश्न कम हों या दुबारा आ गये हों या सीरियल में न हों अर्थात किसी भी प्रकार की त्रुटिपूर्ण पुस्तिका स्वीकार न करें तथा उसी समय उसे लौटाकर उसके स्थान पर दूसरी सही प्रश्न-पुस्तिका ले लें । इसके लिए आपको पाँच मिनट दिये जायेंगे । उसके बाद न तो आपकी प्रश्न-पुस्तिका वापस ली जायेगी और न ही आपको अतिरिक्त समय दिया जायेगा ।
4. अन्दर दिये गये निर्देशों को ध्यानपूर्वक पढ़ें ।
5. उत्तर-पुस्तिका के अन्त में कच्चा काम (Rough Work) करने के लिए मूल्यांकन शीट से पहले एक पृष्ठ दिया हुआ है ।
6. यदि आप उत्तर-पुस्तिका पर अपना नाम या ऐसा कोई भी निशान जिससे आपकी पहचान हो सके, किसी भी भाग पर दर्शाते या अंकित करते हैं तो परीक्षा के लिये अयोग्य घोषित कर दिये जायेंगे ।
7. आपको परीक्षा समाप्त होने पर उत्तर-पुस्तिका निरीक्षक महोदय को लौटाना आवश्यक है और इसे परीक्षा समाप्ति के बाद अपने साथ परीक्षा भवन से बाहर न लेकर जायें ।
8. केवल नीले/काले बाल प्वाईंट पेन का ही इस्तेमाल करें ।
9. किसी भी प्रकार का संगणक (कैलकुलेटर) या लाग टेबल आदि का प्रयोग वर्जित है ।

COMPUTER SCIENCE AND APPLICATIONS

PAPER-III

Note : This paper is of **two hundred (200)** marks containing **four (4)** sections. Candidates are required to attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION – I

Note : This section consists of **two** essay type questions of **twenty (20)** marks each, to be answered in about **five hundred (500)** words each. **($2 \times 20 = 40$ marks)**

1. (a) Given the inorder and preorder sequences of a binary tree, design an algorithm to generate inorder sequence of binary tree. Illustrate with an example.

   (b) Illustrate a general formula to calculate size of a queue which works on the basis of modulo function. Show different cases with example. **(10+10)**

OR

(a) Write a backtracking algorithm for the N-Queen's problem.

(b) Show that the vertex cover problem is NP-complete. **(10+10)**

2. (a) Shannon and Nyquist formulas of channel capacity places upper limit on the bit rate of a channel. Are they related and how ? What are key factors that affect channel capacity ?

(b) Explain SSL objective & layer. Give block diagram of SSL protocol stack. Discuss SSL Record and SSL Alert protocols. **(10+10)**

OR

(a) Given the relation R (ABCDEF) with the set H = {A $\rightarrow$ CE, B $\rightarrow$ D, C $\rightarrow$ ADE, BD $\rightarrow$ F}. Find the closure of BCD.

(b) Given R(A, B, C, D, E, F) and the set of function dependency on R given by F = {ABC $\rightarrow$ DE, AB $\rightarrow$ D, DE $\rightarrow$ ABC, E $\rightarrow$ C}. In what normal form is R ? If it is not in 3 NF, decompose R and find a set 3 NF projection of R. Is this set lossless and dependency preserving ? **(10+10)**

SECTION – II

Note : This section contains **three (3)** questions from each of the electives/specializations. The candidate has to choose only one elective/specialization and answer all the **three** questions contained therein. Each question carries **fifteen (15)** marks and is to be answered in about **three hundred (300)** words. **(3 × 15 = 45 Marks)**

Elective – I

3. Construct a Turing machine that computes the function

$$f(x, y) = \begin{cases} 1, & \text{if } x < y \\ 0, & \text{otherwise} \end{cases}$$ **15**

4. Show that the intersection of a content free language L and a regular language R is a content free language. **15**

5. Find a Greibach normal form grammar equivalent to the following content free grammar :

$S \rightarrow AA \mid 0,\ A \rightarrow SS|1$ **15**

Elective – II

3. State and prove channel capacity theorem. **15**

4. Describe MPEG1 and MPEG2 standards of compression. **15**

5. Explain following properties of 2D-Fourier transformation in image processing :
(a) Translation (b) Rotation (c) Linearity **15**

Elective – III

3. (a) What is convex function ? Prove that X'HX is a convex function, where H is n × n, +ve definite matrix and X is 1 × n vector. **6**

(b) Use Wolfe's method in solving the following quadratic programming problem :

Maximize $Z = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$

Subject to the constraints : $x_1 + x_2 \leq 2, x_1, x_2 \geq 0$ **9**

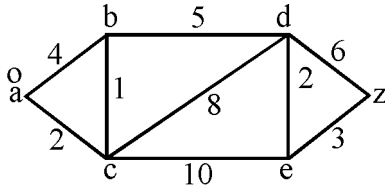
4. Use dual simplex method to solve the following L.P.P.

Minimize $Z = 10x_1 + 6x_2 + 2x_3,$

Subject to the constraints : $-x_1 + x_2 + x_3 \geq 1, 3x_1 + x_2 - x_3 \geq 2,$ **15**

$x_1, x_2, x_3 \geq 0$

5. Use Dijkstra's Algorithm, to find the length of shortest path between the vertices a and z for the following network : **15**



Elective – IV

3. Discuss how do you design multilayer perceptron net. Justify with an example. **15**

4. Describe back propagation algorithm in Neural network. Mention one application where back propagation effectively works. **15**

5. Bring out the significance of fuzzy theory. Consider fuzzy sets A, B and C defined in the interval X = [0, 10] of real numbers

$$A(x) = \frac{x}{x+2}, \; B(x) = 2^{-x}$$

$$C(x) = \frac{1}{1 + 10\,(x-2)^2}$$

Calculate the α-cuts and strong α-cuts of these fuzzy sets for the values $\alpha = 0.2, 0.5$ and 0.8. **15**

Elective – V

3. Describe different two methods used in UNIX to change the access permission. **15**

4. In UNIX operating system how exec system call works ? Brief in detail logical format of an executable file in UNIX. **15**

5. Describe structure of WINDOWS-2000 operating system with a sketch. Mention differences between WINDOWS-XP and WINDOWS-7. **15**

SECTION – III

Note : This section contains **nine (9)** questions of **ten (10)** marks, each to be answered in about **fifty (50)** words. **(9 × 10 = 90 Marks)**

6. Draw the circuit diagram and explain the functioning of JK flip-flop. **10**

7. Consider the following graph based locking protocol, which allow only exclusive lock modes and which operate on datagraph that are in the form of a rooted directed acyclic graph.
   – A transaction can lock any vertex point.
   – To lock any other vertex, the transaction must have visited all the parents of that vertex and must be having a lock on one of the parents of the vertex.

   Show that the protocol ensures serializability and deadlock freedom. **10**

8. Explain Bezier technique for generating curves. **10**

9. Write an algorithm to delete a node from binary search tree. **10**

10. What is the purpose of multiplexing ? What are the three major multiplexing techniques ? **10**

11. Explain 'Demand paged memory management' in memory management system of operating system. What are its advantages ? **10**

12. Explain how to overload [ ] and ( ) operators. **10**

13. What are the attributes of good software ? In what ways software quality is connected with formal technical review ? **10**

14. Explain with diagram different components of an expert system. **10**

SECTION – IV

Note : This section contains **five (5)** questions of **five (5)** marks each based on the following passage. Each question should be answered in about **thirty (30)** words.

(5 × 5 = 25 Marks)

Consider the following relations concerning a driving school. The primary key of each relation is in bold face / underlined :

STUDENT : (St.Name, Class#, Th_Mark, Dr_Mark)

STUDENT_DRIVING_TEACHER : (St_Name, Dr_T_Name)

TEACHER_THEORY_CLASS : (Class#, Th_T_Name)

TEACHER_VEHICLE : (Dr–T–Name, License#)

VEHICLE : (License#, Make, Model, Year)

A student takes one theory class as well as driving lessons and at the end of the session receives marks for theory and driving. A Teacher may teach theory, driving, or both. Write the following queries in relational algebra.

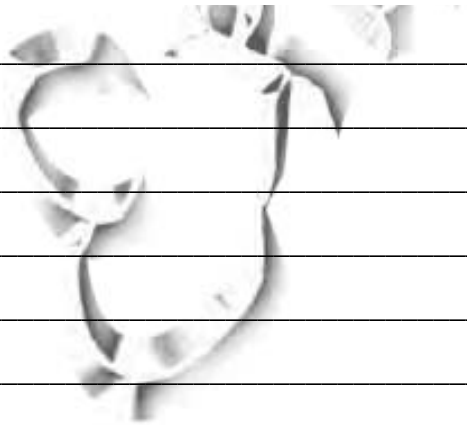
15. Find the list of teachers, who teach theory and give driving lessons on all the vehicles. **5**

16. Find the pairs of students satisfying the following conditions :

They have different theory teachers and
They have the same theory marks
They have the same driving marks and
They have different driving teacher **5**

17. Find the list of students who are taught neither theory lessons nor driving lessons by "Johnson" (teacher). **5**

18. Find the list of students who have better marks than "John" in both theory and driving. **5**



19. Find the list of students who have more marks than the average theory marks of class 8 (class #). **5**

Space For Rough Work

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

Total Marks Obtained (in words) .....

(in figures) .....

Signature & Name of the Coordinator .....

(Evaluation) Date .....