

Reg.No. :

--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code: 6211472

M.C.A. DEGREE EXAMINATIONS, NOV/ DEC 2024

First Semester

Master of Computer Application

P20MA105 – MATHEMATICAL FOUNDATIONS

(Regulation 2020)

Time: Three Hours

Maximum: 100 Marks

Answer ALL questions

PART – A

(10 x 2 = 20 Marks)

1. Find the sum and product of the eigen values of the matrix  $A = \begin{bmatrix} -1 & 1 & 1 \\ 1 & -1 & 1 \\ 1 & 1 & -1 \end{bmatrix}$
2. State Cayley-Hamilton theorem.
3. How many permutations are there on the word 'MALAYALAM'?
4. Define injective function.
5. Construct truth table for  $(\neg p \wedge (p \vee q)) \rightarrow q$ .
6. Let  $Q(x,y,z)$  denote the statement " $x+y=z$ " defined on the universe of discourse  $Z$ , the set of all integers. What are the truth values of the propositions  $Q(1,1,1)$  and  $Q(1,1,2)$ .
7. If  $P(A) = \frac{2}{3}$  and  $P(A \cap B) = \frac{1}{3}$  then find  $P(B/A)$ .
8. Compute the moment generating function of poison distribution.
9. Define Critical Path?
10. What is PERT method?

## PART – B

(5 x 16 = 80 Marks)

11. (a) (i) Find rank of the matrix  $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 5 & 9 \\ 2 & 4 & 6 \end{bmatrix}$  (8)
- (ii) Solve the system of equations  $x+4y+3z=0$  and  $3x+12y+9z=0$ . (8)

(OR)

- (b) (i) Find the eigen values and eigen vectors of  $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ . (8)
- (ii) Using Cayley-Hamilton theorem find the inverse of the matrix  $A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 2 & 1 \\ 1 & 1 & 3 \end{bmatrix}$  (8)

12. (a) (i) Find the number of integers between 1 to 100 that are divisible by the integers 2,3,5 or 7. (8)
- (ii) Find the number of ways in which the letters of the word TRIANGLE can be arranged such that (1) vowels occur together (2) vowels occupy odd places. (8)

(OR)

- (b) (i) Suppose that there are 9 faculty members in the Mathematics department and 11 in the computer science department. How many ways are there to select a committee to develop a discrete mathematics course at a college if the committee is to consist of 3 faculty members from the mathematics department and 4 from the computer science department? (8)
- (ii) Describe relations and types of relations. (8)

13. (a) (i) Show that  $(P \vee Q) \wedge \neg(\neg P \wedge (\neg Q \vee \neg R)) \vee (\neg P \wedge \neg Q) \vee (\neg P \wedge \neg R)$  is a tautology without using truth table. (8)
- (ii) Show that the premises “one student in this class knows how to write programs in JAVA” and “everyone who knows how to write programs in JAVA can get a high-paying job” imply the conclusion “someone in this class can get a high-paying job”. (8)

(OR)

- (b) Find the principle conjunctive normal form of  $(\neg P \rightarrow R) \wedge (Q \leftrightarrow P)$  without using truth table also find its principle disjunctive normal form. (16)

14. (a) (i) In a bolt factory machines A, B,C produce 25%, 35% and 40% of the total output respectively. Of their outputs 5%, 4%, 2% are defective bolts. If a bolt is chosen at random from the combined output what is the probability that it is defective? If a bolt chosen at random is defective what is the probability that it was produced by B? (8)

- (ii) A random variable X has the following probability function

X	0	1	2	3	4	5	6	7
P(X)	0	K	2K	2K	3K	K <sup>2</sup>	2K <sup>2</sup>	7K <sup>2</sup> +K

- Find (i) value of K, (ii)  $P(X < 6)$ ,  $P(X \geq 6)$ , (iii) the CDF of X. (8)

(OR)

- (b) (i) Six dice are thrown 729 times. How many times do you expect at least three dice to show 5 or 6? (8)  
(ii) Find MGF, mean and variance of Uniform distribution. (8)

15. (a) A project schedule has the following characteristics. Draw the network diagram, Compute the earliest & latest event time, and find the critical path & total project duration and Compute the total & free float for each activity. (16)

Activity	1-2	1-3	2-3	2-4	3-4	4-5
Time(days)	20	25	10	12	6	10

(OR)

- (b) A project has the following activities and other characteristics:

Estimated Duration (in weeks)			
Activity(i-j)	Optimistic	Most likely	Pessimistic
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

- What is the expected project length? (ii) What is the probability that the project will be completed no more than 4 weeks later than expected time? (16)

-----XXXX-----