



# CBCS SCHEME

18MCA23

## Second Semester MCA Degree Examination, Jan./Feb. 2021 Discrete Mathematical Structures and Statistics

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Define a proposition, logical connectives with examples and truth tables. (06 Marks)
- b. Given the following proposition write  
(i) Direct Proof (ii) Indirect Proof  
"If 'n' is an even integer then  $n+9$  is an odd integer." (07 Marks)
- c. Using laws of logic prove the following :  
(i)  $p \rightarrow (q \rightarrow r) \Leftrightarrow (p \wedge q) \rightarrow r$   
(ii)  $p \vee [p \wedge (p \vee q)] \Leftrightarrow p$  (07 Marks)

### OR

- 2 a. Define Tautology and Contradiction. For any three propositions p, q, r prove that  
 $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$  is a tautology. (06 Marks)
- b. Test for validity of following logical statement.  
If I study, I will not fail in examinations.  
If I do not watch TV in the evening then I will study  
I failed in examination  
 $\therefore$  I must have watched TV in evening. (07 Marks)
- c. Consider the universe of set of real numbers and open statements:  
 $p(x) : x \geq 0$      $q(x) : x^2 \geq 0$      $r(x) : x^2 - 3x - 4 = 6$      $s(x) : x^2 - 3 > 0$   
Then find truth values of  
(i)  $\exists x_1 p(x) \wedge q(x)$     (ii)  $\forall x : q(x) \rightarrow s(x)$     (iii)  $\exists x_1 p(x) \wedge r(x)$  (07 Marks)

### Module-2

- 3 a. If  $A = \{1, 2, 3, 4\}$ ,  $B = \{4, 5, 6, 7\}$ ,  $C = \{3, 4, 6, 7\}$  then find  
(i)  $A - B$     (ii)  $B \cap C$     (iii)  $A \cap (B \cup C)$  (06 Marks)
- b. For any three sets A, B, C prove that  
(i)  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$   
(ii)  $\overline{A \cup B} = \overline{A} \cap \overline{B}$  (07 Marks)
- c. Define probability of an event. State and prove addition theorem of probability. (07 Marks)

### OR

- 4 a. A person known to speak truth 3 out of 4 times, He throws a die and reports that it shows 6. Find probability that it is actually 6. (06 Marks)
- b. Students x, y, z write an examination. Their chances of passing is  $1/2$ ,  $1/3$  and  $1/4$  respectively. Find probability that (i) All of them pass (ii) Atleast one of them pass. (07 Marks)
- c. A box contains 4 black, 5 white and 6 red balls. If two balls are drawn at random, find probability that  
(i) both are red    (ii) one black and 1 white. (07 Marks)

**Module-3**

- 5 a. By mathematical induction prove that for all positive integers  $n \geq 1$   
 $1 + 2 + 3 + \dots + n = \frac{1}{2}n(n+1)$  (06 Marks)
- b. A sequence  $\{a_n\}$  is defined by  $a_1 = 4$ ;  $a_n = a_{n-1} + n$  for  $n \geq 2$ .  
 Find  $a_n$  in explicit form. (07 Marks)
- c. Find the number of permutation of the word MASSASAUGA. In how many of these all A's are together? How many of them begin with S? (07 Marks)

**OR**

- 6 a. A certain question paper contains two parts A and B each contains 4 questions. In how many ways a student can answer 5 questions by selecting at least 2 from each part. (06 Marks)
- b. (i) Find the coefficient of  $x^9y^3$  in the expansion of  $(2x - 3y)^{12}$ .  
 (ii)  $x^0$  in the expansion of  $\left(3x^2 - \frac{2}{x}\right)^{15}$  (07 Marks)
- c. The Fibonacci numbers are defined by  $F_0 = 1, F_1 = 1$  and  $F_n = F_{n-1} + F_{n-2}$   
 Find  $F_4, F_6$ . (07 Marks)

**Module-4**

- 7 a. Find mean, variance and standard deviation of the probability distribution from following table.

$x_i$	1	2	3	4	5
$P(x_i)$	0.2	0.35	0.25	0.15	0.05

- (06 Marks)
- b. The probability that a man aged 60 will live to be 70 is 0.65. What is the probability that out of 10 men, now aged 60 (i) Exactly 9 will live to 70 (ii) At most 9 will live upto 70 (iii) At least 9 will live upto 70. (07 Marks)
- c. A car hire firm has 2 cars which it hires out day by day. The demand for car each day is distributed as a Poisson distribution with mean 1.5. Calculate probability that for a randomly chosen day (i) neither car is used (ii) some demand refused. (07 Marks)

**OR**

- 8 a. The length of telephone conversation has an exponential distribution with mean of 3 minutes. Find probability that a call (i) ends in less than 3 minutes (ii) Takes between 3 and 5 minutes. (06 Marks)

- b. The probability distribution of finite random variable  $x$  is given by the table

$x_i$	-2	-1	0	1	2	3
$P(x_i)$	0.1	k	0.2	2k	0.3	k

- Find  $k$ , mean, variance and standard deviation. (07 Marks)
- c. Derive expression for mean and standard deviation of binomial distribution. (07 Marks)

**Module-5**

- 9 a. Find correlation coefficient and equation of line of regression from following data:

$x$	1	2	3	4	5
$y$	2	5	3	8	7

(10 Marks)

- b. Fit a curve  $y = ae^{bx}$  for following table.

$x$	5	6	7	8	9	10
$y$	133	55	23	7	2	2

(10 Marks)

OR

- 10 a. Ten competitors of a beauty contest are judged by two Judges in following order. Compute coefficient of rank correlation.

I	1	6	5	3	10	2	4	9	7	8
II	6	4	9	8	1	2	3	10	5	7

(06 Marks)

- b. Fit a straight line  $y = ax + b$  for following data:

x	50	70	100	120
y	12	15	21	25

(07 Marks)

- c. Fit a parabola  $y = a + bx + cx^2$  for following data:

x	0	1	2	3	4
y	1	1.8	1.3	2.5	2.3

(07 Marks)

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