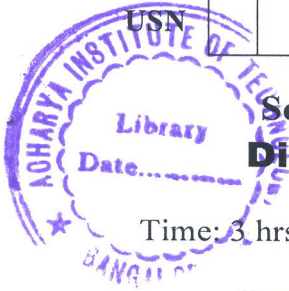


# CBCS SCHEME

18MCA23



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## Second Semester MCA Degree Examination, June/July 2019 Discrete Mathematical Structures and Statistics

Time: 3 hrs.

Max. Marks: 100

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

### Module-1

- 1 a. Prove the following conditional is a tautology.  
 $[(p \leftrightarrow q) \wedge (q \leftrightarrow r) \wedge (r \leftrightarrow p)] \leftrightarrow [(p \rightarrow q) \wedge (q \rightarrow r) \wedge (r \rightarrow p)]$  (07 Marks)
- b. Given the following proposition, write  
i) Direct proof ii) Indirect-proof  
"If  $n$  is an odd integer, then  $(n+1)!$  is an even integer." (07 Marks)
- c. Using the laws of logic prove the following conditional expression:  
 $[(p \vee q) \wedge (p \vee \sim q)] \vee q \Leftrightarrow p \vee q$  (06 Marks)

OR

- 2 a. Prove the following argument is valid :  
$$\begin{array}{l} p \rightarrow q \\ r \rightarrow s \\ \hline p \vee s \\ \therefore q \vee s \end{array}$$
 (07 Marks)
- b. Negate and simplify the following:  
i)  $\exists x, [p(x) \vee g(x)]$  ii)  $[\exists x, [p(x) \vee q(x)]] \rightarrow r(x)$  (07 Marks)
- c. Summarize the laws of logic. (06 Marks)

### Module-2

- 3 a. Determine sets A and B, given that:  
 $A - B = \{1, 2, 4\}$ ,  $B - A = \{7, 8\}$  and  $A \cup B = \{1, 2, 4, 5, 7, 8, 9\}$ . (07 Marks)
- b. For any three sets A, B, C prove that  
i)  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$   
ii)  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$  (07 Marks)
- c. State and prove the addition theory in probability. (06 Marks)

OR

- 4 a. A problem is given to four students A, B, C, D whose chances of solving it are  $1/2$ ,  $1/3$ ,  $1/4$ ,  $1/5$  respectively. Find the probability that the problem is solved. (07 Marks)
- b. The probabilities that three persons x, y, z hit a target in one attempt are  $1/6$ ,  $1/4$  and  $1/3$  respectively. If each of these shoots once at a target-find:  
i) The probability that the target is hit  
ii) The probability that the target is hit by exactly one person. (07 Marks)
- c. Prove the Demorgan laws, for any two sets:  
i)  $\overline{A \cup B} = \overline{A} \cap \overline{B}$  ii)  $\overline{A \cap B} = \overline{A} \cup \overline{B}$  (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg.  $42+8=50$ , will be treated as malpractice.

**Module-3**

- 5 a. Find the number of permutations of the letters of the word 'INSTITUTION'
- How many of these begin with I?
  - How many of these begin with I and end with N?
  - In how many the 3 T's are together? (07 Marks)
- b. Prove the following by using Mathematical induction for every positive integer n:
- $$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{1}{6} n(n+1)(2n+1) \quad (07 \text{ Marks})$$
- c. Given the recurrence relation  $a_n = a_{n-1} + 4$  with  $a_1 = 2$  obtain an explicit formula for the given sequence. (06 Marks)

**OR**

- 6 a. Find the coefficient of  $x^4$  in the expansion of  $\left(2x^2 - \frac{3}{x}\right)^8$ . (07 Marks)
- b. A man has 7-relatives, 4-of them are ladies and 3-gentlemen. His wife has also 7-relatives 3-of them are ladies and 4-gentlemen. In how many ways can they invite a dinner party of 3-ladies and 3-gentlemen so that there are 3 -of the man's relative and 3 - of the wife's relatives? (07 Marks)
- c. The Fibonacci numbers are defined by  $F_0 = 1, F_1 = 1$  and  $F_n = F_{n-1} + F_{n-2}$  for  $n \geq 2$ . Evaluate  $F_2$  to  $F_{10}$ . (06 Marks)

**Module-4**

- 7 a. The probability distribution of a finite random variable - X - is given by

X :	-2	-1	0	1	2	3
P(X) :	0.1	K	0.2	2K	0.3	K

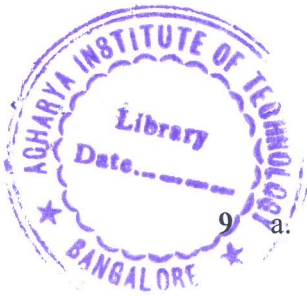
- Find: i) The value of K ii) Mean iii) Variance and standard deviation. (07 Marks)
- b. In a certain town the duration of the shower is exponentially distributed with a mean 5-min. What is the probability that a shower will last for
- 10-min or more
  - less than 10-min
  - Between 10 and 12 min. (07 Marks)
- c. The weekly wages of workers in a company are normally distributed with mean of Rs.700 and standard deviation of Rs.50. Find the probability that the weekly wage of a randomly chosen worker is
- Between Rs.650/- and Rs.750
  - More than Rs.750/- (06 Marks)

**OR**

- 8 a. Obtain the mean and standard deviation of the Poisson distribution. (07 Marks)
- b. The probability density function of a variate X - is given by the following table:

X :	0	1	2	3	4	5	6
P(X) :	K	3K	5K	7K	9K	11K	13K

- Find: i) The value of K ii)  $P(X < 4), P(X \geq 5)$ . (07 Marks)
- c. The number of telephone lines busy at an instant of time is a binomial variate with  $P = 0.2$ . If at an instant 10 lines are chosen at random what is the probability that
- 5-lines are busy
  - At most 2-lines are busy. (06 Marks)

**Module-5**

- 9 a. By the method of least squares, find the straight line that fits the following data: ( $y = ax + b$ )

x:	1	2	3	4	5
y:	14	27	40	55	68

(07 Marks)

- b. Find the correlation coefficient for the two groups,

x :	92	89	87	86	83	77	71	63	53	50
y :	86	83	91	77	68	85	52	82	37	57

(07 Marks)

- c. Define the terms

- i) Coefficient of correlation
- ii) Regression
- iii) Principle of least squares.

(06 Marks)

**OR**

- 10 a. Find the correlation coefficient 'r' and the equations of the lines of regression for the following values of x and y

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

(10 Marks)

- b. Fit a curve of the form  $y = ae^{bx}$ , to the following data:

x:	5	15	20	30	35	40
y:	10	14	25	40	50	62

(10 Marks)

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