

2020

Time 3 hours

Full Marks 100

Candidates are required to give their answers in their own words as far as practicable.

Q No 1 carries 20 marks and the remaining questions carry 16 marks each.

Answer six questions in all, selecting at least one from each Group, in which Q. No 1 is compulsory.

1. Choose the correct alternative of the following :
- (a) The third divided difference with arguments 2, 4, 9, 10 of the function $f(x) = x^3 - 2x + 2$ is :
- (i) 0
 - (ii) 2
 - (iii) 1
 - (iv) None of these

- (b) Numerical differentiation is useful for :
- (i) Application to computer programs
 - (ii) Solution of algebraic equation
 - (iii) Formulation of difference equations
 - (iv) None of these
- (c) Which one of the following is true ?
- (i) $\Delta x^n = nx^{n-1}$
 - (ii) $\Delta^n e^x = e^x$
 - (iii) $\Delta \cos x = -\sin x$
 - (iv) None of these
- (d) The rate of convergence of Newton-Raphson's method is :
- (i) 1.6
 - (ii) 2
 - (iii) 1.5
 - (iv) None of these
- (e) If two events A and B are independent such that $P(A) = 0.3$, $P(B) = 0.6$ then $P(\text{neither A nor B}) = \underline{\hspace{2cm}}$
- (i) 0.42

- (ii) 0.12
- (iii) 0.28
- (iv) None of these

(f) The probability of getting a sum of 5 in a single throw of three dice is :

- (i) $\frac{1}{12}$
- (ii) $\frac{1}{36}$
- (iii) $\frac{1}{3}$
- (iv) None of these

(g) Which one of the following sets is not a convex set ?

- (i) $X = \{(x, y) : x - 2y = 2\}$
- (ii) $X = \{(x, y) : y^2 \leq x\}$
- (iii) $X = \{(x, y) : x + 2y \leq 5\}$
- (iv) None of these

(h) The assignment problem is solved by using :

- (i) Hungarian method

- (ii) Vogel's approximation method
- (iii) Lagrangian method
- (iv) None of these

Group - A

- 2. (a) Derive Newton-Raphson's method for solving algebraic equation.
- (b) Find a positive root of $x.e^x = 2$ by Regula Falsi method correct to three decimal places.
- 3. (a) Derive Newton's divided difference interpolation formula.
- (b) By means of Newton's divided differencing formula find the value of $f(15)$ from the following table :

x	f(x)
4	48
5	100
7	294
10	900
11	1210
13	2028

4. (a) Discuss the method to solve a system of linear equations using Gauss Eliminations Method.
- (b) Using Relaxation Method to solve a system of linear equation given below :

$$8x + y + z + w = 14$$

$$2x + 10y + 3z + w = -8$$

$$x - 2y - 20z + 3w = 111$$

$$3x + 2y + 2z + 19w = 53$$

5. (a) Derive Simpson's $\frac{1}{3}$ rule for finding numerical integration.
- (b) Find the Eigen values and Eigen vectors of the matrix :

$$\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$$

6. (a) Discuss Euler's Method for finding numerical solution of ordinary differential equation.

- (b) By using Milne's Predictor-Corrector formula find $y(2)$ if $\frac{dy}{dx} = \frac{1}{2}(x, y)$ given that $y(0) = 2$, $y(0.5) = 2.3636$, $y(1) = 3.595$ and $y(1.5) = 4.968$.

Group - B

- 7 (a) State and prove General addition theorem on probability.
- (b) Find the probability of arranging n books on a book shelf such that the two special books never come together.
- 8 (a) For any two events A and B show that :
- (i) $P(\bar{A} \cap B) = P(B) - P(A \cap B)$
- (ii) $P(A \cap \bar{B}) = P(A) - P(A \cap B)$
- (b) A man is known to speak the truth 3 out of 4 times. He throws a dice and reports that it is six. Find the probability that it is actually a six.

9. (a) For discrete variates X and Y prove that :
- (i) $E(X + Y) = E(X) + E(Y)$
- (ii) $E(XY) = E(X) E(Y)$

- (b) Define moment generating function of a random variable X and show that all the moments exist although its m.g.f exists.

Group – C

- 10 (a) Prove that the sphere is a convex set.
(b) Solve the following linear programming problem graphically :

$$\text{Max } Z = 5x_1 + 3x_2$$

Subject to the following constraints

$$3x_1 + 5x_2 \leq 15$$

$$5x_1 + 2x_2 \leq 10$$

$$x_1, x_2 \geq 0$$

- 11 Use simplex method to solve the following L. P. P.

$$\text{Max } Z = 5x_1 + 7x_2$$

Subject to

$$2x_1 + 3x_2 \leq 13$$

$$3x_1 + 2x_2 \leq 12$$

$$\text{and } x_1 \geq 0, x_2 \geq 0$$

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