Applied Mathematics
Subject Code: 30023

Time : 3 hrs **Max. Marks : 75**

PART - A

I. Answer any 5 questions. **(Marks : 5 x 2 = 10)**

1. A random variable has the following probability distribution. Find the value of k.

X	0	1	2	3
P(X)	k	$2k$	$3k$	$4k$

2. If $E(X) = 2$, $E(X^2) = 8$. Find variance of X.
3. In a poisson distribution if the variance is 2 and $p = \frac{1}{100}$, What is n?
4. State any two properties of normal curve.
5. If $s = 5t^2 + 6t$ find the velocity when $t = 3$ sec.
6. Find the slope of the tangent to the curve $y = x^2 - 5x + 2$ at the point $(1, -2)$.
7. What is the area bounded by the curve $y = x^3$, x axis and the ordinates $x = 1$ and $x = 4$?
8. Solve: $(D^2 - 81)y = 0$

PART - B

II. Answer any 5 questions. **(Marks : 5 x 3 = 15)**

1. A random variable X has the following probability distribution. Find E(X)

X	0	1	2	3
P(X)	$\frac{1}{7}$	$\frac{2}{7}$	$\frac{1}{7}$	$\frac{3}{7}$

2. Find the mean and variance of the binomial distribution given by

$$P(X = x) = 10C_4\left(\frac{1}{4}\right)^{x}\left(\frac{3}{4}\right)^{10-x} \text{ when } x = 0,1,....10$$

3. If Z be a standard normal variate, find the value of $P(-1 \leq Z \leq 1)$ (Given $P(0 \leq Z \leq 1) = 0.3413$).

4. If $s = ae^{t} + be^{-t}$, show that acceleration is always equal to the distance.

5. Find the maximum or minimum values of $y = x^2 - 10x$.

6. Find the volume generated when the area bounded by $y^2 = 25x$ revolves about x axis between $x = 1$ and $x = 2$.

7. Solve: $(D^2 - 3D+2)y = 0$

8. Find the particular integral of $(D^2 - 4D + 4)y = e^{-5x}$

PART - C

(Marks : 5 x 10 =50)

i) Answer any two subdivisions in each questions

ii) All questions carry equal marks

III a) A random variable X has the following probability distributions

X	0	1	2	3	4	5	6
P(X)	$2a$	$4a$	$6a$	$8a$	$10a$	$12a$	$14a$

Find (i) $P(X > 3)$ (ii) $P(X \leq 2)$ iii) $P(1 < X < 5)$

b) The random variable X has the following probability distributions

X	–3	6	9
P(X)	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{1}{3}$

Find $E(X)$, $E(X^2)$, $E(2X+1)^2$

c) Four coins are tossed simultaneously. Find the probability of getting exactly two tails.

IV. a) If 3% of electric bulbs manufactured by a company are defective, find the probability that in a sample of 100 bulbs exactly five bulbs are defective? [Given $e^{-3} = 0.0498$]

b) Given a normal distribution with mean $\mu = 50$ and $\sigma = 8$. Find the probability that X assumes a value between 34 and 62. (Given $P(0 \le Z \le 2) = 0.4772$ $P(0 \le Z \le 1.5) = 0.4332$)

c) Fit a straight line by the method of least squares for the following data.

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

V. a) The distance s metres at time t minutes of a particle moving in a straight line is given by $s = 2t^3 - 9t^2 + 12t + 6$. Find the velocity when the acceleration is zero. Find also the acceleration when the velocity is zero.

b) Find the equations of the tangent and normal to the curve $y = 6 + x - x^2$ at (2, 4).

c) Find the maximum and minimum values of the function $4x^3 - 18x^2 + 24x - 7$.

VI. a) Find the area of the circle of radius 'r'

b) Solve: $\tan x \sec^2 y \, dy + \tan y \sec^2 x \, dx = 0$

c) Solve: $\frac{dy}{dx} - \frac{2y}{x} = e^x x^2$

VII.a) Solve: $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 2y = 0$

b) Solve: $(D^2 - 4D + 13)\, y = e^{-3x}$

c) Solve : $(D^2 - 5D + 6)y = 2\cos 3x$

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PART - A

Answer any 5 questions. (Marks : 5 x 2 = 10)

1. Define random variable.
2. In a binomial distribution n=9, $p = \frac{1}{3}$ what is the value of variance.
3. What is the mean and variance of poisson distribution?
4. Write down the normal equations for the best fit for the straight line $y = ax + b$
5. If $s = 5t^2 + 6t + 5$, find the initial velocity.
6. Find the gradient of the curve $y^2 = 4x$ at (1, 2).
7. What is the volume when plane region bounded by the curve $y = \sqrt{x}$ and the lines $x = 0$, $x = 4$ about the x axis.
8. Solve: $(D^2 + 1)y = 0$

PART - B

Answer any 5 questions. (Marks : 5 x 3 = 15)

1. A random variable X has the following probability distribution. Find $P(X < 3)$

X	1	2	3	4	5
P(X)	$\frac{1}{16}$	$\frac{5}{16}$	$\frac{3}{16}$	$\frac{3}{16}$	$\frac{1}{4}$

2. If Z be a standard normal variate find $P(Z > 1.7)$ (Given $P(0 \le Z \le 1.7) = 0.4554$)

3. If the distance time relation of a moving particle is $s = 10t - 2t^2$, find the velocity and acceleration after 3 secs.

4. Find the slope of the normal to the curve $y = \sqrt{x}$ at (4, – 2).

5. Find the maximum or minimum for $y = 4x - 2x^2$.

6. Solve: $xdx = ydy$

7. Find the integrating factor of $\frac{dy}{dx} + \frac{y}{x} = \sin x$

8. Find the particular integral of $(D^2 - 9)y = \sin 2x$

PART - C (Marks : 5 x 10 =50)

i) Answer any two subdivisions in each questions

ii) All questions carry equal marks

III. a) A random variable X has the following probability distribution

X	0	1	2	3	4	5
P(X)	a	$3a$	$5a$	$7a$	$9a$	$11a$

Find (i) value of a (ii) $P(X > 3)$ (iii) $P(1 \leq X \leq 4)$

b) A random variable X has the following probability distribution

X	0	1	2	3
P(X)	$\frac{1}{3}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{3}$

Find E(X) and $E(X^2)$ and variance.

c) The mean and variance of a binomial variable are 16 and 8 respectively. Find P (X = 0) and P (X = 1)

IV. a) In a poisson distribution, if P(X=3) = P(X=2) find P(X=0) and P(X=1). [Given $e^{-3} = 0.0498$]

b) The mean score of 1000 students in an examination is 36 and standard deviation is 16. If the score of the students is normally distributed how many students are expected to score more than 60 marks.

c) Fit a straight line for the following data by the method of least squares.

x	0	1	2	3	4
y	1	1	3	4	6

a) The distance travelled by a particle along a straight line is given by $s = 2t^3 + 3t^2 - 72t + 1$. Find the acceleration when the velocity vanishes and find the initial velocity.

b) Find the equations of the tangent and normal to the curve $y = 3x^2 + 2x + 5$ at the point where it cuts the y axis.

c) Find the maximum and minimum values of $2x^3 + 3x^2 - 36x + 1$

a) Find the volume of the right circular cone of altitude 'h' and base radius 'r' by integration.

b) Solve: $\frac{dy}{dx} + \sqrt{\frac{1-y^2}{1-x^2}} = 0$

c) Solve: $\frac{dy}{dx} + y\cot x = 2\cos x$

a) Solve: $(D^2-5D+6)y = 0$ if $y = 2$ and $\frac{dy}{dx} = 1$ when $x = 0$

b) Solve: $(D^2+6D+8)y = 10e^{-4x}$

c) Solve: $(D^2 + 9)y = \sin 3x$

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