Virudhunagar S.Vellaichamy Nadar Polytechnic College (Autonomous)

Programme : I Year Engg. **Course: Applied Mathematics**

Reg. No. | | | | | | |

Model Examination - March 2020
(Time - Three Hours)
(Maximum marks: 75)

[N.B:- (1) Answer any five Questions in each of PART-A & PART -B
(2) Answer any two Divisions of each question in PART-C
(3) Each question carries 2(two) marks in PART –A, 3(three) marks in PART –B and 5(five) marks for each division in PART- C]

Part – A **(5 × 2 = 10 Marks)**

1. Find the value of $[\vec{i}+\vec{j} \quad \vec{j}+\vec{k} \quad \vec{k}+\vec{i}]$
2. If E(X) = 5 $E(X^2) = 35$, then find variance of X
3. In a binomial distribution, if n = 6 and $p = \frac{1}{3}$. Find mean and variance.
4. The distance travelled by a particle in time 't' seconds is given by $s = t^3 - 2t^2 + 6t + 5$.
   Find the velocity after t = 3 sec.
5. Find the slope of the normal to the curve $y^2 = 4x$ at the point (2, -4)
6. Evaluate: $\int \log x \, dx$
7. Solve: $\frac{dy}{dx} = e^{x-5y}$
8. Find the Complimentary function of $(D^2 - 2D + 1)y = e^{3x}$

Part – B **(5 × 3 = 15 Marks)**

9. Find the moment of the force $3\vec{i} + \vec{j} + \vec{k}$ acting through the point (2, 2, 2) about the point (1, 1, 1)
10. Show that the vectors $3\vec{i} + 2\vec{j} - 2\vec{k}$, $5\vec{i} - 3\vec{j} + 3\vec{k}$ and $5\vec{i} - \vec{j} + \vec{k}$ are coplanar.
11. Show that $f(x) = \begin{cases} \frac{2x}{9}, & 0 < x < 3, \\ 0, & otherwise \end{cases}$ *is probability density function.*
12. In a Poisson distribution, if P(x = 2) = P(x = 1) then find the mean.
13. Find the minimum value of $y = x^2 - 4x + 3$
14. Evaluate : $\int x^2 \cos 4x \, dx$
15. Find the area bounded by the curve $y = 6x^2 + 3$, the X - axis and the lines x = 1 and x = 2
16. Solve : $(D^2 + 7D + 12)y = 0$

Turn over...

Part – C (5 × 2 × 5 = 50 Marks)

17. a) If a particle moves from the point $3\vec{i} - \vec{j} + \vec{k}$ to the point $2\vec{i} - 3\vec{j} + \vec{k}$ due to the forces $2\vec{i} + 5\vec{j} - 3\vec{k}$ and $4\vec{i} + 3\vec{j} + 2\vec{k}$. Find the total work done by the forces.

b) If $\vec{a} = 2\vec{i} + 3\vec{j} + \vec{k}$, $\vec{b} = \vec{i} - 2\vec{j} + 3\vec{k}$, $\vec{c} = 3\vec{i} + 2\vec{j} - 5\vec{k}$,
verify that $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a}.\vec{c})\vec{b} - (\vec{a}.\vec{b})\vec{c}$

c) If $\vec{a} = \vec{i} - \overline{2j} + 2\vec{k}$, $\vec{b} = \overline{2i} + \vec{j} + \vec{k}$, $\vec{c} = \vec{i} - \vec{j} + 3\vec{k}$ and $\vec{d} = \vec{i} - \vec{j} - \vec{k}$
find $(\vec{a} \times \vec{b}).(\vec{c} \times \vec{d})$

18. a) A random variable X has the following probability Distribution

X	0	1	2	3	4	5
P(X= x)	a	3a	5a	6a	9a	10a

Find i) 'a' ii) P (X ≥3) iii) P (1 < X < 5).

b) A random variable X has the following probability distribution

X	-3	6	9
P(X = x)	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{1}{3}$

Find the mean and variance

c) Ten coins are tossed simultaneously, find the probability of getting
i) exactly 7 heads ii) atleast 7 heads

19. a) The distance travelled by a particle is given by $s = 2t^3 - 9t^2 + 12t + 6$.Find the acceleration when velocity is zero. Also find the velocity when acceleration vanishes.

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

c) Find the maximum and minimum values of $y = (x - 1)^2(x - 2)$

20 a) Evaluate: i) $\int x\log x \, dx$ ii) $\int x^3 \log x \, dx$

b) Evaluate: i) $\int x \sin 3x \, dx$ ii) $\int x^2 e^{-2x} \, dx$

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

21 a) Solve: $(1 + e^x) \sec^2 y dy - e^x \tan y \, dx = 0$

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

c) Solve : $(D^2 - 5D + 4)y = e^{-3x}$

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Part – A

(5 × 2 = 10 Marks)

1. Express $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d})$ in the form of determinant
2. If $E(X) = E(X^2) = 0.5$, then find variance of X
3. The mean and variance of Binomial distribution are 4 and 3 respectively. Find the value of 'n'
4. The distance travelled by a particle in time 't' seconds is given by $s = 2t^3 - 3t^2 + 12t + 5$. Find the initial acceleration.
5. Find the slope of the normal to the curve $y^2 = 8x$ at the point (2,-4)
6. Evaluate : $\int x \log x \, dx$
7. Solve : $xdy + ydx = 0$
8. Find the Particular integral of $(D^2 - 8D + 16)y = e^{3x}$

Part – B

(5 × 3 = 15 Marks)

9. Find the moment about the point $\vec{i} + 2\vec{j} - \vec{k}$ of the force $3\vec{i} + \vec{k}$ acting through the point (2, -2, 2)
10. Find the value of 'm' if the vectors $\vec{i} + 2\vec{j} - \vec{k}$, $2\vec{i} + m\vec{j} - 3\vec{k}$ and $3\vec{i} + \vec{j} + 4\vec{k}$ are coplanar.
11. Show that $f(x) = \begin{cases} \frac{2}{9}x, & 0 < x < 3, \\ 0, & otherwise \end{cases}$ *is probability density function.*
12. In a Poisson distribution, if $P(x = 3) = P(x = 2)$ then find the mean.
13. Find the maximum value of $y = 1 + 2x - 3x^2$
14. Evaluate : $\int x^2 \sin 3x \, dx$
15. Find the area bounded by the curve $y = 2x^2 + 2$, the X - axis and the lines $x = 1$ and $x = 2$
16. Solve : $(D^2 + 6D + 9)y = 0$

Turn over...

(5 × 2 × 5 = 50 Marks)

Part – C

17. a) The work done by the force $5\vec{i} - \lambda\vec{j} + 3\vec{k}$ displacing a particle from the point (2, 4, 8) to the point (8, -2, 6) is 30 units. Find the value of λ.

b) If $\vec{a} = 2\vec{i} + 3\vec{j} + \vec{k}$, $\vec{b} = \vec{i} - 2\vec{j} + 3\vec{k}$, $\vec{c} = 3\vec{i} + 2\vec{j} - 5\vec{k}$, verify that $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a}.\vec{c})\vec{b} - (\vec{a}.\vec{b})\vec{c}$

c) Prove that $[\vec{a} \times \vec{b} \quad \vec{b} \times \vec{c} \quad \vec{c} \times \vec{a}] = [\vec{a} \quad \vec{b} \quad \vec{c}]^2$

18. a) A random variable X has the following probability Distribution

X	0	1	2	3	4	5
P(X= x)	a	2a	4a	7a	10a	16a

Find i) 'a' ii) P (X ≤3) iii) P (2 < X < 5).

b) A random variable X has the following probability distribution

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

Find the mean and variance

c) Eight coins are tossed simultaneously. find the probability of getting i) exactly 6 heads ii) atleast 6 heads

19. a) The distance travelled by a particle is given by $s = 2t^3 - 9t^2 + 12t + 6$.Find the acceleration when velocity is zero. Also find the velocity when acceleration vanishes.

b) Find the equation of the tangent and normal to the curve $y = 2 - 3x + 4x^2$ at the point (2, 3)

c) Find the maximum and minimum values of $y = (x - 1)^2(x - 2)$

20 a) Evaluate: i) $\int logx \ dx$ ii) $\int x^n logx \ dx$

b) Evaluate: i) $\int x \cos 2x \, dx$ ii) $\int x^2 e^{-3x} \, dx$

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

21 a) Solve: $(1 - e^x) \sec^2 y dy + e^x \tan y \, dx = 0$

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

c) Solve : $(D^2 - 13D + 12)y = 2e^{5x}$

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