SRI BHAGAWAN MAHAVEER JAIN COLLEGE, V.V. Puram

II PU MOCK PAPER –I

MATHEMATICS

Instructions :

(i) The question paper has five parts namely A, B, C, D and E. Answer all the parts.

(ii) Use the graph sheet for the question on linear programming in PART E.

PART – A

I Answer ALL the questions: 10 x1=10

1. Is *: R →R detained by (a,b)=a+4b^2 is a binary operation.

2. Write the range of y = Sin^{-1}(x).

3. If a matrix has 13 elements what are the possible orders it can have.

4. If A is an invertible matrix of order 2 and |A| = 15 find det (A^{-1}).

5. If $y = \sin^3 x + \cos^6 x$ find $\frac{dy}{dx}$.

6. Evaluate $\int \sec^2(7-4x)\,dx$

7. If the vectors 2i + 3j – 6 k and 4i – mj – 12k are parallel. Find m.

8. Find the equation of the plane having intercepts 3 on the y axis and parallel to ZOX plane.

9. Define constraints of a LPP.

10. If $P(A) = \frac{1}{2}$, $\mathrm{P}(B) = \frac{1}{3}$, and $\mathrm{P}(A \cap B) = \frac{1}{6}$. Show that A and B are independent events.

PART – B

II Answer any TEN questions: 10 x 2 = 20

11. Show that f: R→R define by f(x) = x^2 is neither one – one nor onto.

12. Prove that $\cos^{-1}(-x) = \pi - \cos^{-1}(x) \quad x \in [-1,1]$

13. Find the value of cos^{-1}(1/2) + 2 sin^{-1}(1/2).

14. Show that the points A (a, b+c), B (b,c+a), C (c, a+b) are collinear.

15. Find the derivative of cos (logx+e^x), x>0.

16. If $y = \log_7(\log x)$ prove that $\frac{dy}{dx} = \frac{1}{x \log x \log 7}$.

17. Find the equation of normal to the curve $2y + x^2 = 3$ at (1.1).

18. Evaluate $\int \cot x . \log(\sin x)\, dx$.

19. Evaluate $\int \frac{\cos\sqrt{x}}{\sqrt{x}} dx$.

20. Form the D E representing the family of curve y = mx where 'm' is arbitrary constant.

21. Find the area of the parallelogram whose adjacent sides are given by vectors $\vec{a} = 3i + j + 4k$ and $\vec{b} = i - j + k$.

22. Find the projection of the vectors i+3j+7k on the vector 7i-j+8k.

23. If a plane has the intercepts a,b,c and is at a distance 'p' units from the origin. Prove that $\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} = \frac{1}{p^2}$.

24. Find the conditional probability of obtaining a sum greater than 9, given that the black die resulted in a number 5.

PART- C

III Answer any TEN questions: 10 x 3 =30

25. Consider f : N→N g : N→N and h : N→R defined as f(x) = 2x, g(y) = 3y +4, and h(z) =SinZ ∀ x,y,z ∈N.

26. Prove that $\sin^{-1}(5/13) + \cos^{-1}(3/5) = \tan^{-1}(63/16)$.

27. If $F(x) = \begin{bmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$ Show that F(x). F(y) = F(x+y).

28. Verify Rolle's theorem for the function $f(x) = x^2 + 2x - 8 \quad x \in [-4, 2]$

29. Find two positive number x and y such that x + y = 60, and xy^3 is maximum.

30. Find the equation of the tangent to the curve $y = x^2 - 2x + 7$ which is parallel to the line $2x - y + 9 = 0$

31. Evaluate $\int \frac{Sin^3 x + \cos^3 x}{Sin^2 x \cos^2 x} dx.$

32. Find $\int_0^2 \left(x^2+1\right) dx$ as the limit of a sum.

33. Find the area bounded by the curve $x^2 = 4y$, and the line $x = 4y – 2$.

34. Find the particular solution of the DE $x (x^2-1) \frac{dy}{dx} = 1$ given that y = 0 when x = 2.

35. The two adjacent sides of a parallelogram are 2i – 4j + 5k and 2i – 4j + 5k. Find the unit vector parallel to its diagonals. Also find its area.

36. Find the value of λ, such that the four points A(3,2,1), B(4, λ, 5) C(4,2,-2) and D(6,5,-1) are coplanar.

37. Find the cartesian and vector equation of the line that passes through the points (3, -2, -5) and (3, -2, 6).

38. Find the probability distribution of the number of success in 2 tosses of a die, where a success is detained as “number greater than 4”.

PART-D

IV Answer any SIX questions: 6 x 5 = 30

39. Show that $f:[-1,1] \to R$ given by $f(x) = \frac{x}{x+2}$ is one-one. Find the inverse of $f:[-1,1] \to range$ of f. .

40. If A = $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$ Prove that $A^3 – 6A^2 + 7A + 2I = 0$.

41. The cost of 4kg onion, 3kg wheat, and 2kg rice is ₹60. The cost of 2kg onion, 4kg wheat, and 6kg rice is ₹90. The cost of 6kg onion, 2kg wheat, and 3kg rice is ₹70. Find the cost of each item per kg by matrix method.

42. If $e^y(x+1)=1$ show that $\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^2$

43. A particle moves along the curve $6y = x^3+ 2$. Find the points on the curve at which y co-ordinate is changing 8 times as fast as the x-co-ordinate.

44. Find the integral of $\sqrt{x^2+a^2}$ with respect to x and evaluate $\int \sqrt{4x^2+9}\, dx$

45. Find the area of the region in the first quadrant enclosed by $x-axis,$ the line $x=\sqrt{3}y$ and the circle $x^2+y^2=4$

46. Find the general solution of the equation $(1 + x^2)dy + 2xy\, dx = \cot x\, dx$.

47. Derive the equation of a plane perpendicular to a given vector and passing through a given point both its vector and cartesian form.

48. Find the probability distribution of number of doublets in three throws of a pair of dice.

PART – E

V Answer any ONE question: 1 x 10 = 10

49. (a) Prove that $\int_0^{\pi/2} \log \sin x dx = \frac{-\pi}{2} \log 2$. **[6]**

b) Prove that $\begin{vmatrix} a+bx & c+dx & p+qx \\ ax+b & ex+d & px+q \\ u & v & w \end{vmatrix} = \left(1-x^2\right) \begin{vmatrix} a & c & p \\ b & d & q \\ u & v & w \end{vmatrix}$ **[4]**

50. a) A diet is to contain atleast 80 units of Vitamin A and 100 units of minerals. Two foods F_1 and F_2 are available. Food F_1 cost ₹4 per unit and Food F_2 cost ₹6 per unit one unit of food F_1 contains 3 units of vitamin A and 4 units of minerals. 1 unit of food F_2 cotnain 6 units of vitamin A and 3 units of minerals. Formulate this as a LPP. Find the minimum cost for diet that consists of mixture of these two foods and also meets the minimum nutritional requirements. **[6]**

b) Find k, if $f(x) = \begin{cases} \frac{k \cos x}{\pi - 2x} & \text{if } x \neq \pi/2 \\ 3 & \text{if } x = \pi/2 \end{cases}$ is continuous at $x = \frac{\pi}{2}$. **[4]**

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