SRI BHAGAWAN MAHAVEER JAIN COLLEGE Vishweshwarapuram, Bangalore. **Mock Paper 2**	**Course:**	II PUC
	Subject:	Mathematics
	Max. Marks:	100
	Duration:	3:00

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 question **10 x 1 = 10**

1. Give an example of a relation which is symmetric and transitive but not reflexive.
2. Write the domain of f(x) = $\cos^{-1} x$
3. Find the value of x for which $\begin{vmatrix} 3 & x \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$
4. Define an identity matrix
5. If y = sec (2x + 3) find $\frac{dy}{dx}$
6. Write the integral of $\frac{-1}{x\sqrt{x^2-1}}$ where $x \geq 1$
7. Write the vector joining the points A(2,3,1) and B (–1, –2, –4)
8. Define collinear vectors
9. Define feasible solution
10. A pair of die is rolled. Consider events E = {2, 4, 6} and F = {1, 2}. Find $P(E|F)$.

PART – B

II Answer any TEN questions **10 x 2 = 20**

11. Define binary operation on a set. Verify whether the operation $*$ defined on z by $a * b = a^b$ is binary or not.
12. Find the simplest form of $\tan^{-1}\sqrt{3} - \sec^{-1}(\sqrt{2})$
13. Evaluate $\sin\left[\frac{\pi}{3} - \sin^{-1}\left(-\frac{1}{\sqrt{2}}\right)\right]$
14. Find the area of the triangle whose vertices are (3,8) (–4,2) and (5,1) using determinants.
15. If $y = \sin(\log_e x)$ prove that $\frac{dy}{dx} = \frac{\sqrt{1-y^2}}{x}$
16. Find the derivative of $x^{\sin x}$ with respect to x
17. Find a point on the line y = x^3 – 11x + 5 at which the tangent is y = x – 11.
18. Find $\int e^x \sec x(\sin x + \sec x)dx$
19. Evaluate $\int x^3 e^x\, dx$
20. prove that the differential equation $x^2\frac{dy}{dx} = x^2 - 2y^2 + xy$ is a homogeneous differential equation of degree 0.
21. If the position vectors of the points A and B respectively are $\hat{i} + 2\hat{j} - 3\hat{k}$ and $\hat{j} - \hat{k}$. Find the direction cosines of $\vec{AB}$

22. Find the unit vector in the direction of the vectors $\vec{a}=\hat{i}+3\hat{j}+4\hat{k}$

23. Find the distance of the point (2, 3, –5) from the plane $\vec{r}\cdot(2\hat{i}+3\hat{j}-2\hat{k})=9$

24. Two cards drawn at random and without replacement from a pack of 52 playing cards are black. Find the probability that both the cards are black.

PART – C

III Answer any TEN questions **10 x3 = 30**

25. Show that the relation R in the set of all integers, Z defined by R = {(a, b): 2 divides a – b} is an equivalence relation.

26. If $\tan^{-1}\frac{x-1}{x-2}+\tan^{-1}\frac{x+1}{x+2}=\frac{\pi}{4}$ find x

27. Using elementary transformation find the inverse of $\begin{bmatrix}1 & -1\\ 2 & 3\end{bmatrix}$.

28. Verify the mean value theorem of $f(x)=x^2-4x+3$ in the interval [a, b] where a = 1 and b = 4.

29. If $y=\cot^{-1}\left(\frac{2x}{1-x^2}\right)$ find $\frac{dy}{dx}$

30. Find the intervals in which the function is given by f(x) = x^2+2x-5 is (i) strictly increasing (ii) strictly decreasing.

31. Find the antiderivative of $f(x)$ given by $f(x)=4x^3-\frac{3}{x^4}$ such that $f^{|}(2)=0$.

32. Evaluate $\int\frac{dx}{(x+1)(x+2)}$

33. Find the area of the region bounded by the line $y^2=9x$ and the lines x = 0, x = 4 and the x – axis in the first quadrant.

34. Form the differential equation of the family of circles touching the x – axis at origin.

35. For any three vectors $\vec{a},\vec{b}$ and $\vec{c}$ prove that $[\vec{a}+\vec{b}\ \ \vec{b}+\vec{c}\ \ \vec{c}+\vec{a}]=2\,[\vec{a}\ \vec{b}\ \vec{c}]$

36. Find the area of a triangle having the points A(1,1,1), B(1,2,3) and C(2,3,1) as the vertices.

37. Find the equation of the line which passes through the point (1,2,3) and is parallel to the vector $\hat{i}+2\hat{j}+2\hat{k}$ both in vector form and Cartesian form.

38. A bag contains 4 red and 4 black balls another bag contains 2 red and 6 black balls. One of the two bags is selected at random and a ball is drawn from the bag which is found to be red. Find the probability that the ball is drawn from the first bag.

PART – D

IV Answer any SIX questions **6 x 5 = 30**

39. Verify whether the function $f:R_+\to[4,\infty)$ defined by $f(x)=x^2+4$ is invertible or not, write the inverse of f(x) if exists.

40. If A = $\begin{bmatrix}1\\ 3\\ -2\end{bmatrix}$ B = $\begin{bmatrix}2 & 4 & -6\end{bmatrix}$ verify that $(AB)^{|}=B^{|}A^{|}$

41. Solve the following system of equation by matrix method: x + y + z = 6; y + 3z = 11 and x – 2y + z =0.

42. If $y=Ae^{mx}+Be^{-nx}$ prove that $\frac{d^2y}{dx^2}-(m-n)\frac{dy}{dx}-mny=0$

43. The volume of a cube is increasing at a rate of 9 cubic centimeters per second. How fast is the surface area increasing when the length of an edge in 10centimeters

44. Evaluate $\int_2^3 x^2 dx$ as a limit of a sum.

45. Solve the differential equation ydx-(x+3y^2) dy = 0

46. Find the area of the circle 4x^2 + 4y^2 = 9.Which is interior to the parabola x^2 = 4y

47. Derive the condition for the coplanarity of two lines in space both in the vector from and Cartesian form.

48. Find the probability of getting at most two sixes in six throws of a single die.

PART – E

V Answer any ONE questions 1 x 10 = 10

49. (a) Minimize and maximize Z = 3x + 9y subject to the constraints x + 3y≤ 60; x + y ≥ 10; x ≤ y; x ≥ 0, y ≥ 0 by the graphical method

b) Prove that $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc + ab + bc + ca$

50. a) Prove that $\int_0^{2a} f(x)dx = \begin{cases} 2\int_0^a f(x)dx & if \quad f(2a-x) = f(x) \\ 0 & if \quad f(2a-x) = -f(x) \end{cases}$ and evaluate $\int_0^{2\pi} \sin^3 x \, dx$

(b) Find all points of discontinuity of $f(x) = \begin{cases} 2x+3, & \text{if } x \le 2 \\ 2x-3, & \text{if } x > 2 \end{cases}$

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