Instructions:

DO NOT write or mark anything on the question paper

i) The question paper has 5 parts namely A, B, C, D & E. Answer all the parts

ii) Part –A carries 10 marks, part -B carries 20 marks, part –C carries 30 marks and part- E carries 10 marks

iii) Write the question number properly as indicated in the questions paper

PART – A

I.   **Answer all the questions:**   **10 x 1 = 10**

1.   If $A = \begin{bmatrix} 3 & 2 & x \\ 4 & 1 & -1 \\ 0 & 3 & 4 \end{bmatrix}$ is a singular matrix, find x.

2.   A box contains 5 red balls, 8 green balls and 10 pink balls. A ball is drawn at random from the box. what is the probability that the ball drawn is either red or green.

3.   Write the contrapositive of the proposition. If $x^n = y^n$ then $\dfrac{x^n - a^n}{x - a} = na^{n-1}$.

4.   Find the fourth proposition of $\dfrac{1}{2}, \dfrac{1}{3}, \dfrac{1}{4}$.

5.   Find the index of learning for 70% learning effect.

6.   If cot A = $\dfrac{12}{5}$ and A is acute, find sin 3A.

7.   If the length of a latus rectum of $y^2 = 8kx$ is 4 find k.

8.   Evaluate $\displaystyle\lim_{x \to -1} \dfrac{x^9 + 1}{x^5 + 1}$

9.   Differentiate w.r.t 'x' $\log a + \Pi e^{\Pi x} + 5^{\Pi x + 1}$

10. Integrate: $\sin 30° + \sqrt[3]{x^{5/2}}$.

PART – B

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

11. If $A = \begin{bmatrix} 5 & 3 \\ -2 & 4 \end{bmatrix}$ & $B = \begin{bmatrix} 2 & -3 \\ 4 & -8 \end{bmatrix}$ verify that (adj A) . (adj B) = adj (BA)

12. In how many ways can 10 different precious stones be set to form necklace.

13. Find x if $^{99}C_{40} + {}^{99}C_x = {}^{100}C_{59}$.

14. Find the 7th term in $\left(3x^2 - \dfrac{y}{3} \right)^9$.

15. If a + b = a − b = 4:3 find the value of a and b.

16. What is the market value of 12% stock when an investment of ₹6900 produces an income of ₹720.

17. A shopkeeper purchased a TV at a discount of 30% of the listed price of ₹24,000. The shopkeeper offer a discount of 10% of the listed price to the customer. If the VAT is 10% . Find the VAT paid by the shopkeeper.

18. If $\tan \alpha = \dfrac{n}{n+1}$ and $\tan \beta = \dfrac{1}{2n+1}$ then show that $\alpha + \beta = \dfrac{\Pi}{4}$.

19. Show that the line 3x-4y+6=0 touches the circle $x^2 + y^2 - 6x + 10y - 15 = 0$.

20. Show that the function $f(x) = \{ \dfrac{x^2 - 25}{x - 5}$ when $x \neq 5$ is continous at x = 5.

         10   when x = 5

21.   If $x = 3\cos\theta - 2\cos^3\theta$, $y = 3\sin\theta - 2\sin^3\theta$ then find $\dfrac{dy}{dx}$.

22.   If $v = \sqrt{s^2 + 1}$ then prove that acceleration is 's'.

23.   Evaluate $\int \left(2x^2 - 6x + 4\right)^{3/2} (2x - 3)\, dx$.

24.   Find the total revenue in rupees by raising the output from 10 units to 20 units when the marginal revenue function is $2q^2 - q$ where q is the output.

Section - C

III.   Answer any TEN questions.   **3 x 10 = 30**

25.   Solve by Cramer's rule. 5x-7y-3=0
$$7x-5y-9=0$$

26.   Find the number of permutations of the letters of the word ASSASSINATION. In how many of these.
a) the vowels are in even places.
b) vowels are in odd places.
c) the word NATION is always present together.

27.   The probability that a MBA aspirant will join IIM is $\dfrac{2}{5}$ and that he will join XLRI is $\dfrac{1}{3}$. Find the probability that (a) he will join IIM or XLRI,   (b) he will join neither IIM nor XLRI.

28   Two numbers are in the ratio 6:7. If the difference of their squares is 117. Find the numbers.

29.   Construct the truth table for the proportion $(p \wedge q) \to (r \vee \sim s)$.

30.   The banker's gain on a bill is $\dfrac{1}{9}$ th of the banker's discount, rate of interest being 10% p a find the unexpired period of the bill.

31.   Prove that $\dfrac{\cot A}{\cot A - \cot 3A} + \dfrac{\tan A}{\tan A - \tan 3A} = 1$.

32.   Find the equation of the circle concentric with the center of the circle $x^2 + y^2 - 2x + 2y - 1 = 0$ and having double its area.

33.   Find the equation of parabola when the focus is (-3, 0) and directrix is x = 3.

34.   If $y = (\sin x)^{(\sin x)^{------\infty}}$ find $\dfrac{dy}{dx} = \dfrac{y^2 \cot x}{1 - y\log(\sin x)}$

35.   The angles of depression of two boats as observed from the mast head of a ship 50m high are 45° and 30°. What is the distance between the boats if they are on the same side of the mast head in line with it?

36.   Differentiate: $y = (\sin x)^x + x^{\sin x}$ w.r.t x.

37.   Evaluate $\int \dfrac{3x + 2}{2x - 5}\,dx$

38.   Integrate $\sec^3 x \cos x$ w r t x.

Part - D

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

39.   Find the term independent of x in $\left(\dfrac{3x^2}{2} - \dfrac{1}{3x}\right)^9$.

40.   Resolve into the partial fractions $\dfrac{2x^3 + x^2 - x - 3}{x(x-1)(2x+3)}$

41.   Examine whether the proposition is logically equivalent $\sim(p \leftrightarrow q)$ and $(p \wedge \sim q) \vee (q \wedge \sim p)$.

42.   If two men and four women can do a work is 33 days and 3 men and 5 women can do the same work is 24 days. How long shall 5 men and 2 women take to do the same work?

43.   A company requires 100 hours to produce the first ten units at 15 per hour. The learning curve effect is 80%. Find the total labour cost to produce a total of 160 units.

44   Solve the LPP using graphical method.

$$\text{Minimise} \qquad\qquad z = 3x + 5y$$
$$\text{subject to constraint} \quad : \quad x + 3y \geq 3$$
$$x + y \geq 2 \qquad x, y \geq 0$$

45.   Prove that $\cos^2 A + \cos^2 B - \cos^2 C = 1 - 2\sin A \sin B \sin C$.

46.   Find the equation of circle passing through the points (0, -3) and (0, 5) and whose centre lies on $x - 2y + 5 = 0$.

47.   If $y = e^x \log x$ show that $xy_2 - (2x + 1)y_1 + (x - 1)y = 0$.

48.   Find the area of the region included between the curve $4y = 3x^2$ and the line $3x - 2y + 12 = 0$.

PART – E

V.   Answer any ONE question: **1 x 10 = 10**

49.   a) Prove that $\lim\limits_{\theta \to 0} \dfrac{\sin\theta}{\theta} = 1$ and hence deduce that $\lim\limits_{\theta \to 0} \dfrac{\tan\theta}{\theta} = 1$ (θ in radians)   (6)

        b) Find the value of $(0.98)^5$ using binomial theorem upto 4 decimal places   (4)

50.   a) A sales person Bumrah has the following record of sales for the month of January February and March 1996 for three products A, B & C. He is paid a commission at fixed rate per unit but at varying rates for products A,B and C

Months	Sales in units			Commission (in ₹)
	A	**B**	**C**	
January	9	10	2	800
February	15	5	4	900
March	6	10	3	850

Find the rate of commission payable on A, B &C per unit sold.

b) The demand function of a firm is p=500-0.2q and the total cost C=25q+10000. Find the output at which the profit of the firm is maximized. What is the price charged.

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