

**Time: 3 hours 15 minutes**

**Max Marks: 100**

- Instructions :** 1) The question paper has 5 parts A, B, C, D & E. Answer all the parts.  
2) Part A carries 10 marks, Part B carries 20 marks, part C carries 30 marks, part D carries 30 marks and part E carries 10 marks.  
3) Write the question numbers properly as indicated in the question paper.

**PART - A**

**I. Answer all the questions :**

**10×1=10**

1. Find 'x' such that  $\begin{bmatrix} 3 & x \\ 4 & 7 \end{bmatrix}$  is symmetric.
2. If  ${}^nC_{10} = {}^nC_5$ , find  ${}^nC_{14}$ .
3. Negate "If 2 straight lines are parallel then they do not Intersect".
4. Find the Fourth proportional of 6, 14, 15.
5. Define Learning Curve Ratios.
6. Express:  $\cos 6\theta + \cos 2\theta$  as the product of two trigonometric function.
7. Find the Radius of the circle  $2x^2 + 2y^2 - 8 = 0$ .
8. Evaluate:  $\lim_{x \rightarrow -3} \left[ \frac{x^3 + 27}{x + 3} \right]$
9. Differentiate:  $x^e + e^x + e^e$  w.r.t  $x$ .
10. Evaluate:  $\int (3x^2 - 5x + 1) dx$

**PART - B**

**II. Answer any Ten questions :**

**10×2=20**

11. Solve by Cramer's Rule:-  $3x + 4y = 7$ ,  $7x - y = 6$ .
12. How many 4 digit number can be formed with the digit 0,2,3,5,7 such that no digits are repeated.
13. If  $P(A) = \frac{1}{2}$ ,  $P(B) = \frac{1}{3}$ ,  $P(A \cup B) = \frac{7}{12}$ , find  $P\left(\frac{B}{A}\right)$
14. Write the converse and contrapositive of "If a Rectangle is a square then it is not a Parallelogram."

15. Two numbers are in the ratio 3:5. If 5 is added to each, then their ratio becomes 2:3. Find the numbers.
16. Find the true discount on a bill of ₹1380 due  $1\frac{1}{2}$  years after at 10% per annum.
17. If  $\tan A = \frac{1}{2}$  and  $\tan(A - B) = \frac{2}{7}$ , find  $\tan B$ .
18. Find the Focus and the equation of directrix of the parabola  $2y^2 + 16x = 0$ .
19. Evaluate:  $\lim_{x \rightarrow 0} \left( \frac{\cos^2 x}{1 - \sin x} \right)$ .
20. Differentiate:  $(\tan x)^x$  w.r.t  $x$ .
21. If  $A = 5t^2 + 4t - 8$ , find the Initial velocity and acceleration ( $S = \text{distance} = \text{ft}$ ,  $t = \text{time (sec)}$ ).
22. The total cost function is given by  $C = 250x + 45x^2 - x^3$  find the marginal cost and average, cost.
23. Evaluate:  $\int \frac{x}{(x^2 + 5)} dx$
24. Evaluate:  $\int_1^2 x \cdot e^{2x} dx$

**PART - C**

III. Answer any Ten questions :

10×3=30

25. Verify  $A \cdot \text{adj } A = |A| \cdot I$ . If  $A = \begin{bmatrix} -2 & 3 \\ -4 & -6 \end{bmatrix}$  and  $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
26. Prove that  $\begin{vmatrix} x & p & q \\ p & x & q \\ p & q & x \end{vmatrix} = (x + p + q)(x - p)(x - q)$ .
27. Find the number of permutations of the letters of the word ASSASSINATION. In how many of these  
(a) Begins with AS and ends with AS'      (b) 4S's are together  
(c) 3A's are not together.
28. Two cards are drawn from a well shuffled pack of 52 playing cards. Find the probability that.  
(i) both are same colour      (ii) both belong to same suit  
(iii) one queen and the king.
29. ₹ 5625 is divided among A, B and C so that A receives one half as much as B and C together receive, and B receives one fourth of what A and C together receive. Find the share of A, B and C.

30. A bill for ₹12,900 was drawn on 3<sup>rd</sup> Feb 2017 at 6 months and discounted on 13<sup>th</sup> March 2017 at 8% p.a. For What sum was the bill discounted and how much did the Banker gain in this transaction?
31. Raman holds ₹ 8,000 of 3% stock. He sells it at ₹ 110 and invests the proceeds in 5% stock, thereby his income increases by ₹ 260. Find the market price of 5% stock.
32. A colour T.V. is marked for sale for ₹17,600 which include the sale tax at 10%. Calculate the sale tax paid.
33. Find the equation of parabola if the vertex is at origin, axis y-axis and passing through  $\left(\frac{1}{2}, 2\right)$ .
34. If  $x = a \cos(\log t)$ ,  $y = a \log(\cos t)$ , find  $\frac{dy}{dx}$ .
35. Divide 64 into two parts such that the sum of their cubes is minimum.
36. The volume of a sphere is increasing at the rate  $4\pi$  c.c./sec. Find the rate at which the area of the cube increases when its radius is 10cm.
37. Evaluate:  $\int \frac{8x+1}{(x+1)(x-3)} dx$
38. If the marginal cost function is  $(3x^2 - x + 5)$  where 'x' is the output, then find the total cost, Average cost, and total variable cost given that the fixed cost is ₹125.

**PART - D**

IV. Answer any 6 questions:

5×6=30

39. Solve the following system of simultaneous equation by matrix method:  
 $3x - y + 2z = 13$ ,  $2x + y - z = 3$ ,  $x + 3y - 5z = -8$  by matrix method.
40. Resolve into partial fraction:  $\frac{1+2x}{(x-1)(x+2)^2}$
41. Verify:  $\sim[\sim p \rightarrow q] \rightarrow \sim(p \wedge \sim q)$  is a Tautology or Contradiction or Neither.
42. 8 men and 16 women can finish a job in 6 days but 12 men and 24 women can finish it in 8 days. How many days will 26 men and 20 women take to finish the job?
43. A motor company Ltd., has observed that a 90% learning effect applies to all labour related costs. Whenever a new product is taken up for a production. The anticipated production to 320 units for the coming year. The production is done in lots of 10 units each. Each lot requires 1000 hours at ₹15/hour. Calculate the total labour hour and labour cost to manufacture 320 units? 4m

44. Solve the following LPP by graphically:

Maximise:-  $Z = 60x + 40y$

Subject to constraints:-  $2x + y \leq 60$

$x \leq 25$

$y \leq 35$

and  $x \geq 0, y \geq 0$

45. Prove that:  $\cos 20^\circ \cdot \cos 40^\circ \cdot \cos 60^\circ \cdot \cos 80^\circ = \frac{1}{16}$

46. Find the co-efficient of  $\frac{1}{x^{17}}$  in the expansion of  $\left(x^4 - \frac{1}{x^3}\right)^{15}$ .

47. If  $y = [x + \sqrt{a^2 + x^2}]^n$  show that  $(a^2 + x^2)y_2 + xy_1 - n^2y = 0$ .

48. Find the area bounded by the parabola  $y^2 = 4x$  and the line  $y = 2x - 4$ .

**PART - E**

V. Answer any ONE question

1×10=10

49. (a) Prove that  $\lim_{x \rightarrow 0} \left(\frac{\sin x}{x}\right) = 1$  and hence deduce that  $\lim_{x \rightarrow 0} \left(\frac{\tan x}{x}\right) = 1$  ( $x$  in radians).

(b) Find the value of  $(0.97)^5$  upto 5 place of decimal using Binomial theorem.

50. (a) Show that the following points are concyclic A(2, -4), B(3, -1), C(3, -3) and D(0, 0).

(b) The angle of elevation of the top of a tower from two points distant 'a' and 'b' ( $a < b$ ) from its foot and the same straight line from it are  $30^\circ$  and  $60^\circ$ . Show that the height of the tower is  $\sqrt{ab}$ .