Practice Paper (2023-24)

Time : 03 hrs Marks -80

General instructions:-

1.This question paper contains Five sections A,B,C,D and E. Each question is compulsory.
2. Section A has 18 MCQ's and 02 Assertion –Reason based questions of 01 mark each
3. Section B has 5 very short answer questions of 2 marks each.
4. Section C has 6 short answer questions of 3 marks each.
5. Section D has 4 Long answer questions of 5marks each.
6. Section E has 3 source based/case study questions of 4 marks each with sub parts.

Section A (MCQ)

1. If $A + B = \begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$, $A - B = \begin{pmatrix} -1 & 1 \\ 0 & -1 \end{pmatrix}$ is a symmetric matrix, then A =

a) $\begin{pmatrix} 1/3 & 1/3 \\ 2/3 & 1/3 \end{pmatrix}$ b) $\begin{pmatrix} 1/3 & 2/3 \\ 1/3 & 1/3 \end{pmatrix}$ c) $\begin{pmatrix} 1/2 & 3/2 \\ 5/2 & 5/3 \end{pmatrix}$ d) $\begin{pmatrix} 1 & 1 \\ 1/3 & 2/3 \end{pmatrix}$

2. If A_{ij} is the cofactor of the element a_{ij} of the determinant $\begin{vmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{vmatrix}$
Then find $a_{32}.A_{32}$
a)100 b)225 c0110 d)150

3. If a is a unit vector such that axi= j , then a.i = a) 1 b) 0 c)-1 d) i

4. If a = i+j+2k and b = 3i+2j-k , then the value of (a+3b).(2a-b) =
a)15 b)5 c)-15 d) 10

5. If $_0\int^{\pi/2}$logtanxdx =a) 1 b) -1 c) 0 d) 2

6. The function $f(x) = \frac{4-x^2}{4x-x^3}$ is a) discontinuous at only one point
b) discontinuous at exactly two points
c) discontinuous at exactly three points d) Continuous everywhere.

7. The value of $\tan [\frac{1}{2} \cos^{-1}(\sqrt{5}/3)]$ = a) $\frac{3+\sqrt{5}}{2}$ b) $\frac{3-\sqrt{5}}{2}$ c) $\frac{-3+\sqrt{5}}{2}$ d) $\frac{-3-\sqrt{5}}{2}$

8. Solve :- xdy +(x-1)dx = 0 a) y=logx-x+c b)y=logx+x+c c) y=-logx+c d) y=-logx-x+C

9. Let R be the relation in the set {1,2,3,4} given by R = {(1,2),(2,2),(1,1),(4,4),(1,3),(3,3)(3,2)}
Then R is a) reflexive but not transitive b) reflexive and transitive c) neither reflexive, nor transitive d) symmetric but not transitive.

10. The domain of the function $\cos^{-1}[2x-1]$ belongs to a)[0,1] b) (0,1) c)(0,1] d)[0,1)

11. Vector equation of the line $\frac{x-4}{3} = \frac{y+1}{2} = \frac{3-z}{4}$ is a) r=(4i-j+3k) + λ(3i+2j+4k)
b) r=(4i-j+3k) + λ(3i+2j-4k)
c) r=(4i+j-3k) + λ(3i+2j-4k) d) r=(4i+j-k) + λ(3i-2j-4k)

12. The degree of the equation $e^x d^2y/dx^2 + \sin(dy/dx) = 3$ is a)2 b) 0 c)not defined d) 1

13 $Z = 3x-4y$ is the objective function. If (0,4) ,(12,6) and (0,0) are the corner points of the feasible region then Maximum value of Z is given by a) 0 b) 8 c)12 d) -18

14. If a die is thrown and a card is selected at random from a deck of 52 cards, then the probability of getting an even number on the die and a spade card =
a) 1/4 b) ½ c)1/8 d) 1/3

15. The rate of change of the area of the circle with respect to its radius, when r = 3 is
a) $6\pi/5\ cm^2/cm$ b)$3\pi\ cm^2/cm$ d) $6\pi\ cm^2/cm$ d) $3\pi/5\ cm^2/cm$

16. If $\int_0^a \frac{dx}{1+4x^2} = \pi/8$, then a = a)1 b) ½ c)3 d) 0
a) 1 b) 4 c) 3 d) 2

17. The lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{4-z}{k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{-2}$ are mutually perpendicular k =
a) -2/3 b)2/3 c)-2 d) 2 .

18. If $y = Ae^{5x}+Be^{-5x}$, then d^2y/dx^2 = a) 25y b) 5y c) -25y d) 15y

19. In the following questions, a statement of Assertion (A) is followed by a statement of reason (R). Choose the correct answer out of the following choices.
a) Both (A) and (R) are true and(R) is the correct explanation of A.
b) Both (A) and (R) are true, but (R) is not the correct explanation of(A)
c) (A) is true (R) is false d) (A) is false but (R) is true.
Let R be a relation in the set A of human beings in a town at a particular time.
Assertion (A) : If R ={(x,y) : x is a wife of y}, then R is reflexive
Reason (R) : If R = {(x,y) : x is father of y}, then R is not reflexive, symmetric and transitive.

20. Assertion (A) : The acute angle θ between the line $r = i+j+2k+\lambda(i-j)$ and X axis is $\pi/4$
Reason(R) : The angle θ between the lines $r = a_1+\lambda b_1$ and $r = a_2+\mu b_2$ is $\cos\theta = \frac{a_1.a_2}{|b_1||b_2|}$

Section B (VSA) :-

21. Evaluate $\int \frac{(1+\log x)^2}{x} dx$

22. Find k if the points(k+1,1),(2k+1,3),(2k+2,2k) are colliear

23. If $y = x^{1/x}$, then find dy/dx at x = 1 (or) If x = asin2t, y = a(cos2t+logtant) , then find dy/dx

24. Evaluate $3\sin^{-1}(1/\sqrt{2}) + 2\cos^{-1}(\sqrt{3}/2) + \cos^{-1}(0)$ (or) consider $f : R \to [4, \infty)$, given by $f(x) = x^2+4$. Prove that f is bijective.

25. One card is drawn at random from a pack of well shuffled deck of 52 cards.
Let E : The card drawn is a spade. F : the card drawn is an ace. Are the events E and F are independent?

Section C (SA) :-

26. Find the value of $\int_0^\pi \frac{x\sin x}{1+\cos^2 x}$ (or) Evlauate $\int \frac{x^2+1dx}{(x^2+2)(2x^2+1)}$

27. Find the particular solution of the differential equation $(1+e^{2x})dy+(1+y^2)e^x dx = 0$ given that

y=1 when x = 0

28 If $A = \begin{pmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{pmatrix}$ then find the value of A^2-5A

29. For what value of k , the function f is continuous

$$f(x) = \begin{cases} \dfrac{k\cos x}{\pi-2x}, & x < \pi/2 \\ 3, & x = \pi/2 \\ \dfrac{3\tan 2x}{2x-\pi}, & x > \pi/2 \end{cases}$$

(or)

If $y = (\cot^{-1}x)^2$ then show that $(x^2+1)^2\, d^2y/dx^2 = 2x(x^2+1)\, dy/dx = 2$

30. If $\cot(\cos^{-1}x) = \sec\left[\tan^{-1}\dfrac{a}{\sqrt{b^2-a^2}}\right]$, then find the value of x

31. If a =i+4j+2k, b = 3i-2j+7k and c = 2i-j+4k. Find a vector d which is perpendicular to a and b and c.d = 18

Section D : (LA)

32. Find the foot of the perpendicular from P (1,2,-3) to the line $\dfrac{x+1}{2} = \dfrac{y-3}{-2} = \dfrac{z}{-1}$

Also find the image of P in the given line.

33. Using integration Find the area of the smaller region bounded by the circle $x^2+y^2 = a^2$ and $x = a/\sqrt{2}$ (or) Evaluate $\int_0^{\pi/4} \log(1+\tan x)\, dx$

34. A bag contains 4 balls. Two balls are drawn at random(without replacement) and are found to be white. What is the probability that all the balls in the bag are white?

35. Solve the following LPP Graphically
Maximize Z = 2x+5y, S.t $2x+4y \le 8$; $3x+y \le 6$, $x+y \le 4$, $x, y \ge 0$

Section E (Case study)

36. An octagonal prism is a three-dimensional polyhedron bounded by two octagonal bases and eight rectangular side faces. It has 24 edges and 16 vertices. The prism is rolled along the rectangular faces and number on the bottom face (touching the ground) is noted. Let *X* denote the number obtained on the bottom face and the following table give the probability distribution of X.

X:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
P(X):	p	2p	2p	p	2p	p^2	$2p^2$	$7p^2+p$

Based on the above information, answer the following questions : (i) Find the value of p. (ii) Find *P*(*X*>6). (iii) Find *P*(*X*=3 m), where m is a natural number. Iv) Find the mean E(X).

37. In order to set up a rain water harvesting system, a tank to collect rain water is to be dug. The tank should have a square base and a capacity of 250 m³. The cost of land is 5,000 per square metre and cost of digging increases with depth and for the whole tank, it is 40,000 h², where h is the depth of the tank in metres. x is the side of the square base of the tank in metres. Based on the above information, Answer the following questions : (i) Find the total cost C of digging the tank in terms of x. (ii) Find dC/dx (iii) Find the value of x for which cost C is minimum iv) Check whether the cost function C(x) expressed in terms of x is increasing or not, when x > 0

38. Sherlin and Danju are playing Ludo at home during Covid-19. While rolling the dice, Sherlin's sister Raji observed and noted the possible outcomes of the throw every time belongs to set {1,2,3,4,5,6}. Let A be the set of players while B be the set of all possible outcomes. A = {S, D}, B = {1,2,3,4,5,6}

i). Let $R : B \rightarrow B$ be defined by R = $\{(x, y): y \ is \ divisible$ } Id R reflexive? Symmetric? Transitive?

ii). Raji wants to know the number of functions from A to B. How many number of functions are possible?

iii). Let R be a relation on B defined by R = {(1,2), (2,2), (1,3), (3,4), (3,1), (4,3), (5,5)}. Then R is Symmetric? Reflexive?transitive?

iv). Raji wants to know the number of relations possible from A to B. How many numbers of relations are possible?

"The way to get started is to quit talking and begin doing."