Sample paper 2 (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 $A = \begin{pmatrix} 3 & x-1 \\ 2x+3 & x+2 \end{pmatrix}$ is a symmetric matrix, then x = a) 4 b) 3 c) -4 d) -3

2. If $A = \begin{pmatrix} k & 8 \\ 4 & 2k \end{pmatrix}$ is a singular matrix, then k = a) ±4 b) -4 c) 4 d) 0

3. If $f(x) = \frac{\sqrt{4+x} - 2}{x}$, $x \neq 0$ is continuous at x = 0, then f(0) = a)1/2 b) 1/4 c) 2 d) 3/2

4. If $e^x+e^y = e^{x+y}$ then dy/dx =a) e^{y-x} b) e^{y+x} c) $-e^{y-x}$ d) $2e^{x-y}$

5. The direction cosines of the line $\frac{4-x}{2} = \frac{y}{6} = \frac{1-z}{3}$ are
a)2/7, 3/7, 6/7 b) 1/7,2/7,3/7 c) 2/7, -6/7, 3/7 d) 1/7,-6/7,-2/7

6. Given that matrices A and B are 3xn and mx5 respectively, then the order of the matrix 5A+3B is a) 3x5, m=n b) 3x5 c) 3x3 d) 5x5

7. The order and degree of $y=px+\sqrt{a^2p^2+b^2}$, where p = dy/dx is a) 1,3 b) 2,1 c) 1,2 d) 2,3

8. Find $\int_1^2 \frac{x^4-x}{x^3} dx$ a) 1 b) 2 c) 0 d) -1

9. The integrating factor of the differential equation is $\frac{dy}{dx} + \frac{y}{\sqrt{1-x^2}} = x$
a) $e^{\sin^{-1}x}$ b) $e^{\cos^{-1}x}$ c)- $e^{\sin^{-1}x}$ d) $-e^{\cos^{-1}x}$

10. If $6\sin^{-1}(x^2-6x+8.5) = \pi$, Then x = a)1 b) 2 c)3 d) 8

11. The area enclosed by the lines y= 0, y =x, x=1 and x=2 is
a) 3/2 Squnits b) 5/2 Sq.units c) ½ Sq.unit d) 9/2 square units

12. The function $f(x) = -x^2+6x-3$ is increasing , if a) x<3 b) x>3 c) 7<x<8 d) 5<x<6
13. If a = 2i+3j-k, and b = i+2j+3k find $|a \times b|$ a)$\sqrt{165}$ b) $\sqrt{171}$c)$\sqrt{141}$) $\sqrt{131}$
14. If A = {a,b,c} and B = {-2,-1,0,1,2}, then thr total number of one to one functions from A to B is a) 60 b)30 d) 15 d) 20
15. How many equivalence relations on the set containing (1,2) and (2,1) are there in all?
a) 1 b) 4 c) 3 d) 2
16. The corner points of the feasible region determined by a system of linear constraints are (0,3),(1,1)and (3,0). Let Z = px+qy where p,q >0 > the condition on p and q so that the minimum f z occurs at (3,0) and (1,1) is a) p =2q b) p=q/2 c) p = 3q d) p = q
17. The value of $\sin(\cot^{-1}x)$ = a) $\frac{1}{\sqrt{2+x^2}}$ b) $\frac{-1}{\sqrt{1+x^2}}$ c) $\frac{1}{\sqrt{1-x^2}}$ d) $\frac{1}{\sqrt{1+x^2}}$

18. Find dy/dx, when 3x+2y = siny a) $\frac{2}{\cos y-3}$ b) $\frac{1}{3-\cos y}$ c) $\frac{2}{3-\cos y}$ d) $\frac{3}{\cos y-2}$

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.

Assertion (A) : If R be an equivalence relation defined on a set containing 6 elements. The minimum number of ordered pairs R must having is 6.
Reason (R) : R is an equivalence relation o a set A containing 6 elements = (a,a) ε R for every a ε A, so R has atleast 6 ordered pairs.

20. Assertion (A) : If p(i+J+K) is a unit vector then value of p is 2/√3
Reason(R) : Unit vector of a is given by $\frac{i+j+k}{\sqrt{3}}$ where a = $\frac{a_1i+a_2j+a_3k}{\sqrt{a_1^2+a_2^2+a_3^2}}$

Section B (VSA) :-

21. Using vectors find the value of k such that (k,-10,3), (1,-1,3) and (3,5,3) are collinear
22. Find t he vector equation of a line which passes through the point (2,3,-1) and parallel to the vector 3i+2j-8k
23. Evaluate $\int \frac{1-\cot x}{1+\cot x}dx$ (or) $\int \frac{dx}{\sin^2 x\cos^2 x}$
24 If A = $\begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$ Prove that $A-A^T$ is a skew symmetric matrix
25. Solve (1 + cosx)dy = (1-cosx) dx

Section C (SA) :-

26. Differentiate the following with respect to x $\sin^{-1}\left(\frac{2^{x+1} . 3^x}{1 + (36)^x}\right)$ (or)

Find all the points of discontinuity of the function f , where f is defined by

$$f(x) = \begin{cases} x^3-x-1 & x \le -3 \\ -2x & -3 < x < 3 \\ 3x+2 & x \ge 3 \end{cases}$$

27 The scalar product of the vector i+j+k with the unit vector along the sum of the vectors 2i+4j-5k and λi+2j+3k is equal to 1.Find the value of λ.

28. Verify that f : N → N f(x) = x+1 if x is odd
x - 1 if x is even is a bijection

29. At any point(x,y) of a curve slope of the tangent is twice the slope of the line segment joining the point of contact to the point(-4,-3). Also find the equation of the curve given that it passes through (-2,1) (or) Find the particular solution of the differential equation $(x^2+2y^2)dy + 2xydx = 0$,

30. Out of a group of 8 highly qualified doctors in a hospital, 6 are very kind and cooperative with their patients and so are very popular, while the other two remain reserved. For a health camp, three doctors are selected at random. Find the probability distribution of the number of very popular doctors. What values are expected from the doctors?

31. Find the equation of the line passing through the point (1,2,-4) and perpendicular to two lines $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$; $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$

Section D : (LA)

32. A closed circular cylinder has 2156cu.cm. what will be the radius of its base, so that its total surface area is minimum(Use $\pi = 22/7$). (or)
An open box with a square base is to be made out of a given quantity of cardboard of are c^2 square units. Show that the volume of the box is $c^3/6\sqrt{3}$ cubic units,

33. Find the area of the region bounded by Parabola $y = (3/4)x^2$ and $3x-2y+12 = 0$

34. Three bags contain balls as shown in the table below:-

Bag	White	Black	Red
I	1	2	3
II	2	1	1
III	4	3	2

A bag is chosen art random and two balls are drawn from it. They happen to be white and red. What is the probability that they come from the III bag.

35. Solve the following LPP Graphically
Minimize $Z = 5x+7y$ S.t $2x+y \geq 8$; $x+2y \geq 10$, $x, y \geq 0$

Section E (Case study)

36. Three shopkeepers Ram Lal, Shyam Lal, and Ghansham are using polythene bags, handmade bags (prepared by prisoners), and newspaper envelopes as carrying bags. It is found that the shopkeepers Ram Lal, Shyam Lal, and Ghansham are using (20,30,40), (30,40,20), and (40,20,30) polythene bags, handmade bags, and newspapers envelopes respectively. The shopkeeper's Ram Lal, Shyam Lal, and Ghansham spent ₹250, ₹270, and ₹200 on these carry bags respectively.
i) What is the cost of one polythene bag? ii)What is the cost of one handmade bag?
iii)What is the cost of one newspaper bag? Iv) What is the total cost of all the bags?

37. In a family there are four children. All of them have to work in their family business to earn their livelihood at the age of 18.
i) What is the probability that all children are girls, if it is given that elder child is a boy?
ii)What is the probability that all children are boys, if two elder children are boys?
iii)Find the probability that two middle children are boys, if it is given that eldest child is a girl (or) Find the probability that all children are boys, if it is given that eldest child is a girl?

38. Two motorcycles A and B are running at the speec more than allowed speed on the road along the lines $r = \lambda(i+2j-k)$ and $r = 3i+3j+ \mu(2i+j+k)$ respectively.

i) Find the Cartesian equation of the line along which motorcycle A is running?

ii) Find the shortest distance between the given lines?

"Tell me and I forget. Teach me and I remember. Involve me, and I learn.".