Roll No. ………………..

Series JPR_PB/25-26/12/041/SET No.1

Note:

- Please check this paper contains …06….. Printed pages.
- Please check that question paper contains 38 Questions.
- Please write down the serial number of the question in the answer book before attempting it.
- 15 minutes time has been allotted to read the question paper. The students will read the question paper only and will not write any answer on the answer book during this period.

Time allowed: 3 Hours Maximum Marks : 80

General Instructions:

(i) This question paper is divided into five Sections – A, B, C, D and E.

(ii) In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and questions number 19 and 20 are Assertion-Reason based questions of 1 mark each.

(iii) In Section B, Questions no. 21 to 25 are very short answer (VSA) type questions, carrying 2 marks each.

(iv) In Section C, Questions no. 26 to 31 are short answer (SA) type questions, carrying 3 marks each.

(v) In Section D, Questions no. 32 to 35 are long answer (LA) type questions carrying 5 marks each.

(vi) In Section E, Questions no. 36 to 38 are case study based questions carrying 4 marks each.

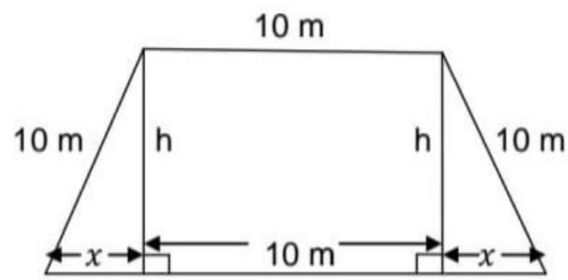
(vii) There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and 2 questions in Section E.

	Section A **This section comprises of multiple choice questions (MCQs) of 1 mark each. Select the correct option (Question 1 – Question 18)**	
Q No	Questions	Marks
1	If $\begin{bmatrix} 2a+b & a-2b \\ 5c-d & 4c+3d \end{bmatrix} = \begin{bmatrix} 4 & -3 \\ 11 & 24 \end{bmatrix}$ then the value of a+b-c+2d is (a) 14 (b) 18 (c) 81 (d) 512	1
2	If A is a matrix of order 2 and $\lvert A \rvert = 8$, then $\lvert adjA \rvert =$ (a) 1 (b) 2 (c) 2^3 (d) 2^6	1
3	The projection of the vector $\hat{\imath} + 3\hat{\jmath} + 7\hat{k}$ on the vector $2\hat{\imath} - 3\hat{\jmath} + 6\hat{k}$.	1

	(a) 1 unit (b) 6 unit (c) 5 units (d) -5 units	
4	The value of 'k' for which the function $f(x) = \begin{cases} kx^2, if\ x \leq 2 \\ 3, if\ x > 2 \end{cases}$ is continuous at x=2 (a) 3/4 (b) 4/3 (c) 7 (d) 4	1
5	The anti-derivative of $(\sqrt{x} + \frac{1}{\sqrt{x}})$ is (a) $\frac{1}{3}x^{\frac{1}{3}} + 2x^{\frac{1}{2}} + c$ (b) $\frac{2}{3}x^{\frac{2}{3}} + 2x^2 + c$ (c) $\frac{2}{3}x^{\frac{3}{2}} + 2x^{\frac{1}{2}} + c$ (d) $\frac{3}{2}x^{\frac{3}{3}} + \frac{1}{2}x^{\frac{1}{2}} + c$	1
6	The sum of the order and the degree of the differential equation $\frac{d^2y}{dx^2} = 1 + \sqrt{\frac{dy}{dx}}$ is (a)3 (b) 2 (c) 1 (d) 4	1
7	Which of the following statement is correct? (a) Every L.P.P. admits an optimal solution (b) A L.P.P. admits a unique optimal solution (c) If a L.P.P. admits two optimal solutions, it has an infinite number of optimal solutions. (d) The set of all feasible solutions of a L.P.P. is not a convex set.	1
8	Let θ be the angle between two-unit vectors $\vec{a}$ and $\vec{b}$ .Then the value of $\left\|\vec{a} - \vec{b}\right\|$ is (a) $2\sin\theta/2$ (b)$2\cos\theta/2$ (c) $2\tan\theta/2$ (d) none of these	1
9	The value of $\int_{-1}^{1} \frac{x^3}{x^2+1}dx$ is (a) 0 (b) 2 (c) $log\frac{1}{5}$ (d) $\frac{1}{5}log6$	1
10	If $[x \quad -5 \quad -1]\begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}\begin{bmatrix} x \\ 4 \\ 1 \end{bmatrix}$=0, then the value of x is (a) $5\sqrt{5}$ (b) $\pm 4\sqrt{3}$ (c) $\pm 3\sqrt{5}$ (d) $\pm 6\sqrt{5}$	1
11	The corner points of the shaded feasible region for a Linear Programming Problem are P (0,5), Q (1,5), R (4,2), and S (12,0). The minimum value of the objective function Z=2x+5y occurs at (a) P (b) Q (c) R (d) S	1
12	If A is a square matrix of order 3 × 3 such that $\|A\| = 2$, then the value of $\|adj(adj\ A)\|$ is (a)-16 (b)16 (c)0 (d)2	1

13	Let $A = \begin{bmatrix} 200 & 50 \\ 10 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 50 & 40 \\ 2 & 3 \end{bmatrix}$, then $\|AB\|$ is equal to: (a) 460 (b) 2000 (c) 3000 (d) -7000	1
14	If P(A|B) > P(A), then which of the following is correct: (a)P(B|A) < P(B) (b)P(A ∩ B) < P(A) . P(B) (c)P(B|A) > P(B) (d)P(B|A) = P(B)	1
15	Solution of differential equation $cos\frac{dy}{dx} = a$, $y = 1$ $when$ $x = 0$ is (a)$\cos\left(\frac{y-2}{x}\right) = a$ (b) $\cos\left(\frac{y-1}{x}\right) = a$ (c) $\sin\left(\frac{y-1}{x}\right) = a$ (d) none	1
16	If $y = 7\ sinx + 4\ cosx$, then y_2 is equal to (a) - y (b) y (c) 25y (d) 9y	1
17	The value of $(\hat{\imath} \times \hat{\jmath}).\hat{k} - (\hat{\jmath} \times \hat{k}).\hat{\imath}$ is: (a)0 (b)3 (a) -2 (d)-3	1
18	The length of perpendicular from origin to the line $r = (4\hat{\imath} + 2\hat{\jmath} + 4\hat{k}) + \lambda(3\hat{\imath} + 4\hat{\jmath} - 5\hat{k})$ is (a) 2 (b) $2\sqrt{3}$ (c) 6 (d) 7	1
ASSERTION-REASON BASED QUESTIONS In the following questions (19 & 20), 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 but R is false. d) A is false but R is true.		
19	**Assertion (A):** The principal value of $\cos^{-1}(-\frac{1}{2})$ lies in 2nd quadrant. **Reason (R):** The range of the function $\cos^{-1} x$ is [0,π].	1
20	**Assertion (A):** The three lines with direction cosines 1,0,0; 0,1,0; 0,0,1 are mutually perpendicular. **Reason (R):** Numbers l, m, n represent direction cosines of a line if $l^2 + m^2 + n^2 = 1$.	1
SECTION B ***This section comprises of very short answer type-questions (VSA) of 2 marks each.***		
21	Find the value of $tan^{-1}\left[2sin\left(2cos^{-1}\frac{\sqrt{3}}{2}\right)\right]$ OR Show that the function: $f: N \to N$, given that $f(1) = f(2) = 1$ and $f(x) = x - 1$, for every x>2 is onto but not one-one.	2

22	Find the interval in which $f(x) = \frac{x}{3} + \frac{3}{x}$ is decreasing.	2
23	If with reference to the right handed system of mutually perpendicular unit vectors $\hat{\imath}, \hat{\jmath}$ and $\hat{k}$, $\vec{\alpha} = 3\hat{\imath} - \hat{\jmath}$ and $\vec{\beta} = 2\hat{\imath} + \hat{\jmath} - 3\hat{k}$, then express $\vec{\beta}$ in the form $\vec{\beta} = \overrightarrow{\beta_1} + \overrightarrow{\beta_2}$ where $\overrightarrow{\beta_1}$ is parallel to $\vec{\alpha}$ and $\overrightarrow{\beta_2}$ is perpendicular to $\vec{\alpha}$. Or Show that the line $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-4}{5} = \frac{y-1}{2} = \frac{z}{1}$ intersect. Find their point of intersection.	2
24	If $x = a(\theta - \sin\theta), y = a(1 + \cos\theta)$, find $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{2}$	2
25	Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three vectors such that $\lvert \vec{a} \rvert=1$, $\lvert\vec{b}\rvert=2$ and $\lvert\vec{c}\rvert = 3$. If the projection of $\vec{b}$ along $\vec{a}$ is equal to the projection of $\vec{c}$ along $\vec{a}$; and $\vec{b}$ is perpendicular to $\vec{c}$ then find $\lvert 3\vec{a} - 2\vec{b} + 2\vec{c}\rvert$.	2
SECTION C ***(This section comprises of short answer type-questions (SA) of 3 marks each.)***		
26	Find: $\int e^{2x}\left(\frac{1-sin2x}{1-cos2x}\right)dx$	3
27	A coin is biased so that the head is 3 time as likely to occur as tail . If the coin is tossed twice, find the probability of getting (i) 2 tails (ii) 1 tail (iii) no tail Or 12 cards numbered 1 to 12 (one number on one card) are placed in a box and mixed up thoroughly. Then a card is drawn at random from the box. If it is known that the number on the drawn card is greater than 5, find the probability that the card bears an odd number.	3
28	Evaluate $\int_{-1}^{2}\lvert x^3 - x\rvert dx$ Or Evaluate $\int_0^{\pi}\frac{x\ tanx}{\sec x + \tan x}dx$	3
29	Find the particular solution of the differential equation: - $\frac{dy}{dx} - \frac{y}{x} + \text{cosec}(\frac{y}{x}) = 0$, $y = 0$ *when* $x = 1$ Or Find the particular solution of the differential equation: - $(1 + x^2)dy + 2xy\,dx = sec^2x\,dx$, $y = 1$ when $x = 0$.	3
30	Solve the following linear programming problem graphically: - Maximize z=3x+9y Subject to constraints: - x+3y ≤ 60, x +y ≥ 10, x ≤ y, x ,y ≥0	3

31	Find $\int(\sqrt{tanx}+\sqrt{cotx})\,dx$	3
	SECTION D ***(This section comprises of long answer type-questions (LA) of 5 marks each.)***	
32	Find the area of the region in the first quadrant enclosed by the x-axis , the line y=x, and the circle $x^2+y^2=32$.	5
33	Let f: $R^+ \rightarrow [-9, \infty)$ be a function defined as: f(x) = $5x^2$+ 6x – 9. Show that f(x)is bijective. Or Show that the relation in the set $A=\{x: x\in W, 0\le x\le 12\}$ given by $R=\{(a,b):(a-b)\ is\ a\ multiple\ of\ 4\}$ is an equivalence relation. Also find the equivalence class of element 2.	5
34	Find the co-ordinates of the foot of the perpendicular drawn from the point A(1,8,4) to the line joining B(0,-1,3) and C(2,-3,-1). Or Find the shortest distance between the following two lines $\vec{r}=(1+\lambda)\hat{\imath}+(2-\lambda)\hat{\jmath}+(\lambda+1)\hat{k}$ and $\vec{r}=\left(2\hat{\imath}-\hat{\jmath}-\hat{k}\right)+\mu(2\hat{\imath}+\hat{\jmath}+2\hat{k})$.	5
35	If $=\begin{bmatrix}5 & -1 & 4\\ 2 & 3 & 5\\ 5 & -2 & 6\end{bmatrix}$, find A^{-1} and use it to solve the following system of equations : 5x-y+4z=5 , 2x+3y+5z=2, 5x-2y+6z=-1	5
	SECTION E (This section comprises of 3 case study/passage based questions of 4 marks each with 2 sub-parts. First two case study questions have three sub-parts (i), (ii), (iii) of marks 1, 1, 2 respectively. The third case study question has two sub-parts of 2 marks each.)	
36	**Case-Study 1**The front gate of a building is in the shape of a trapezium as shown below. Its three sides other than base are 10m each. The height of the gate is h meter. On the basis of this information and figure given below answer the following questions:-   	4

	(i)Find the area of gate expressed as a function of x? (ii)Find the positive value of x if $\frac{dA}{dx} = 0$ (iii)What is the maximum area of trapezium OR For the area of trapezium being maximum check whether the sign of $\frac{d^2A}{dx^2}$ is negative or positive. (show your calculation)	
37	**Case-Study 2:** Read the following passage and answer the questions given below. The relation between the heights of the plant (y in cm) with respect to exposure to sunlight is governed by the equation y= $4x - \frac{1}{2}x^2$, where x is the number of days exposed to sunlight.  (i) What is the rate of growth of the plant with respect to sunlight? (ii) What is the number of days it will take for the plant to grow to the maximum height? (iii) What is the maximum height of the plant? Or What will be the height of the plant after 2 days?	4
38	Q.38 **Case-Study 3:** Read the following passage and answer the questions given below. In a factory, machines A, B and C manufacture 25% , 35%, and 40% of the bolts respectively. Of their outputs, 5%, 4% and 2 % are defective bolts respectively. A bolt is drawn at random from the products manufactured.  (i) What is the total probability that the bolt drawn is defective? (ii) What is the probability that it is manufactured by the machine B given that it is defective?	4