PRACTICE PAPER 21

Time allowed: 45 minutes **Maximum Marks: 200**

General Instructions:

(*i*) The examination will consist of **Objective Type with Multiple Choice Questions (MCQs)**.
(*ii*) **Section A** consists of 15 questions. All are **compulsory**.
(*iii*) **Section B (B1)** consists of 35 questions, out of which **25 questions** are to be attempted.
(*iv*) Each question carries 5 marks.
(*v*) There is **negative marking** of one mark for every incorrect answer.
(*vi*) Use of calculator and log tables is not permitted.

Section–A

Choose the correct option:

1. If $[m \ \ n]\begin{bmatrix} m \\ n \end{bmatrix} = [25]$ and $m < n$, then (m, n) is equal to

(*a*) (2, 3) (*b*) (3, 4) (*c*) (4, 3) (*d*) None of these

2. The value of $\begin{vmatrix} 265 & 240 & 219 \\ 240 & 225 & 198 \\ 219 & 198 & 181 \end{vmatrix}$ is

(*a*) 0 (*b*) 1 (*c*) –1 (*d*) None

3. The inverse of the matrix $\begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix}$ is

(*a*) $\begin{bmatrix} 4 & 1 \\ -3 & 2 \end{bmatrix}$ (*b*) $\begin{bmatrix} 4/11 & 1/11 \\ -3/11 & 2/11 \end{bmatrix}$ (*c*) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ (*d*) $\begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix}$

4. If $f(x) = e^{x^2}$ then $f'(x)$ is equal to

(*a*) $2e^{x^2}(1+2x^2)$ (*b*) $e^{x^2}(1+2x^2)$ (*c*) $2e^{x^2}(1+2x)$ (*d*) $e^{x^2}(1+2x)$

5. The interval in which the function f given by $f(x) = x^2 e^{-x}$ is strictly increasing, is

(*a*) $(-\infty, \infty)$ (*b*) $(-\infty, 0)$ (*c*) $(2, \infty)$ (*d*) $(0, 2)$

6. The anti derivative of $\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)$ equals

(*a*) $\frac{1}{3}x^{1/3} + 2x^{1/2} + C$ (*b*) $\frac{2}{3}x^{2/3} + \frac{1}{3}x^2 + C$ (*c*) $\frac{2}{3}x^{3/2} + 2x^{1/2} + C$ (*d*) $\frac{3}{2}x^{3/2} + \frac{1}{2}x^{1/2} + C$

7. $\int \frac{(\sin^2 x - \cos^2 x)}{\sin^2 x \cos^2 x}\, dx$ is equal to

(a) $\tan x + \cot x + C$ (b) $\tan x + \text{cosec}\, x + C$ (c) $-\tan x + \cot x + C$ (d) $\tan x + \sec x + C$

8. $\int e^x \left(\frac{1-x}{1+x^2}\right)^2 dx$ is equal to

(a) $\frac{e^x}{1+x^2} + C$ (b) $\frac{-e^x}{1+x^2} + C$ (c) $\frac{e^x}{(1+x^2)^2} + C$ (d) $\frac{-e^x}{(1+x^2)^2} + C$

9. $\int_1^{\sqrt{3}} \frac{dx}{1+x^2}$ is equal to

(a) $\frac{\pi}{3}$ (b) $\frac{2\pi}{3}$ (c) $\frac{\pi}{6}$ (d) $\frac{\pi}{12}$

10. The area enclosed by the circle $x^2 + y^2 = 2$ is equal to

(a) 4π sq. units (b) $2\sqrt{2}\pi$ sq. units (c) $4\pi^2$ sq. units (d) 2π sq. units

11. The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^2 = x \sin\left(\frac{dy}{dx}\right)$ is

(a) 1 (b) 2 (c) 3 (d) not defined

12. The integrating factor of differential equation $\cos x \frac{dy}{dx} + y \sin x = 1$ is

(a) $\cos x$ (b) $\tan x$ (c) $\sec x$ (d) $\sin x$

13. Corner points of the feasible region determined by the system of linear constraints are (0, 3), (1, 1) and (3, 0). Let $Z = px + qy$, where $p, q > 0$. Condition on p and q so that the minimum of Z occurs at (3, 0) and (1, 1) is

(a) $p = 2q$ (b) $p = \frac{q}{2}$ (c) $p = 3q$ (d) $p = q$

14. Let X denote the number of time tail appear in n tosses of a fair coin. If $P(X = 1)$, $P(X = 2)$ and $P(X = 3)$ are in AP, then the value of n is

(a) 9 (b) 2 (c) 7 (d) none of these

15. A coin is tossed 10 times, probability that on the 10th throw to observe 5th head is

(a) ${}^9C_5 \times \frac{1}{2^5}$ (b) $\frac{{}^9C_4}{2^{10}}$ (c) $\frac{{}^9C_5}{2^9}$ (d) none of these

Section–B (B1)

16. Let A be the finite set containing n distinct elements. The number of relations that can be defined on A is

(a) 2^n (b) n^2 (c) 2^{n^2} (d) 2^{n-1}

17. If * is a binary operation on set Z of integers $a * b = 3a - b$ the 2 * 3

(a) 2 (b) 4 (c) 3 (d) None of these

18. Let R be the relation defined on the set N of natural numbers by the rule $x R y$ iff $x + 2y = 8$, then domain of R is

(a) {2,4,8} (b) {2,4,6} (c) {2,4,6,8} (d) {1,2,3,4}

19. If $f : R \to R$ be defined by $f(x) = \frac{1}{x}, \forall x \in R$. Then f is

(a) One - One (b) Onto (c) Bijective (d) f is not defined

20. If $f : R \to R$ be defined by $f(x) = 3x^2 - 5$ and $g : R \to R$ by $g(x) = \frac{x}{x^2+1}$, then gof is

(a) $\frac{3x^2-5}{9x^4-30x^2+26}$ (b) $\frac{3x^2-5}{9x^4-6x^2+26}$ (c) $\frac{3x^2}{x^4+2x^2-4}$ (d) $\frac{3x^2}{9x^4+30x^2-2}$

21. **Which of the following is the principal value branch of $\cos^{-1} x$?**

(*a*) $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$ (*b*) $(0, \pi)$ (*c*) $[0, \pi]$ (*d*) $(0, \pi) - \left\{\frac{\pi}{2}\right\}$

22. **If $3 \tan^{-1}x + \cot^{-1}x = \pi$, then x is equal to**

(*a*) 0 (*b*) 1 (*c*) -1 (*d*) $\frac{1}{2}$

23. **The value of $\sin^{-1}\left[\cos\left(\frac{33\pi}{5}\right)\right]$ is**

(*a*) $\frac{3\pi}{5}$ (*b*) $\frac{-7\pi}{5}$ (*c*) $\frac{\pi}{10}$ (*d*) $\frac{-\pi}{10}$

24. **The domain of the function $\cos^{-1}(2x-1)$ is**

(*a*) $[0, 1]$ (*b*) $[-1, 1]$ (*c*) $(-1, 1)$ (*d*) $[0, \pi]$

25. **If $A = \begin{bmatrix} i & 0 \\ 0 & -i \end{bmatrix}, B = \begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$, where $i = \sqrt{-1}$, then the correct relation is**

(*a*) $A + B = 0$ (*b*) $A^2 = B^2$ (*c*) $A - B = 0$ (*d*) $A^2 + B^2 = 0$

26. **Which is true about matrix multiplication?**

(*a*) It is commutative (*b*) It is associative (*c*) Both (*a*) and (*b*) (*d*) None of these

27. **The value of $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 3A - B$ then the values of A and B are**

(*a*) $A = 2abc, B = a+b+c$ (*b*) $A = 0, B = a^2+b^2+c^2$ (*c*) $A = 3abc, B = a+b+c$ (*d*) $A = abc, B = a^3+b^3+c^3$

28. **If A is an invertible matrix of order 3 and $|A| = 5$, then $|adj\ A|$ is**

(*a*) 5 (*b*) -5 (*c*) 25 (*d*) 0

29. **The function $f : R \to R$ given by $f(x) = -|x-1|$ is**

(*a*) continuous as well as differentiable at $x = 1$ (*b*) not continuous but differentiable at $x = 1$

(*c*) continuous but not differentiable at $x = 1$ (*d*) neither continuous nor differentiable at $x = 1$

30. **The function $f(x) = [x]$, where $[x]$ denotes the greatest integer function, is continuous at**

(*a*) 4 (*b*) -2 (*c*) 1 (*d*) 1.5

31. **Differential coefficient of $\sec(\tan^{-1} x)$ w.r.t. x is**

(*a*) $\frac{x}{\sqrt{1+x^2}}$ (*b*) $\frac{x}{1+x^2}$ (*c*) $x\sqrt{1+x^2}$ (*d*) $\frac{1}{\sqrt{1+x^2}}$

32. **If $y = \log\sqrt{\tan x}$, then the value of $\frac{dy}{dx}$ at $x = \frac{\pi}{4}$ is**

(*a*) 0 (*b*) 1 (*c*) $\frac{1}{2}$ (*d*) ∞

33. **$f(x) = x^x$ has a stationary point at**

(*a*) $x = e$ (*b*) $x = \frac{1}{e}$ (*c*) $x = 1$ (*d*) $x = \sqrt{e}$

34. **$\int \frac{dx}{\sqrt{9x - 4x^2}}$ is equal to**

(*a*) $\frac{1}{9}\sin^{-1}\left(\frac{9x-8}{8}\right) + C$ (*b*) $\frac{1}{2}\sin^{-1}\left(\frac{8x-9}{9}\right) + C$

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(*c*) $\frac{1}{3}\sin^{-1}\left(\frac{9x-8}{8}\right)+C$ (*d*) $\frac{1}{2}\sin^{-1}\left(\frac{9x-8}{9}\right)+C$

35. $\int\frac{dx}{e^x+e^{-x}}$ **is equal to**

(*a*) $\tan^{-1}(e^x)+C$ (*b*) $\tan^{-1}(e^{-x})+C$ (*c*) $\log(e^x-e^{-x})+C$ (*d*) $\log(e^x+e^{-x})+C$

36. The value of $\int_{-\pi/2}^{\pi/2}(x^3+x\cos x+\tan^5 x+1)\,dx$ **is**

(*a*) 0 (*b*) 2 (*c*) π (*d*) 1

37. The area of the region bounded by the curve $x = y^2$, y-axis and the line $y = 3$ and $y = 4$ is

(*a*) $\frac{37}{3}$ sq. units (*b*) $\frac{33}{7}$ sq. units (*c*) $\frac{5}{9}$ sq. unit (*d*) 0

38. The solution of $\frac{dy}{dx}+y=e^{-x};\ y(0)=0$ **is**

(*a*) $y=e^x(x-1)$ (*b*) $y=xe^{-x}$ (*c*) $y=xe^{-x}+1$ (*d*) $y=(x+1)e^{-x}$

39. The solution of differential equation $\frac{dy}{dx}=\frac{1+y^2}{1+x^2}$ **is**

(*a*) $y=\tan^{-1}x$ (*b*) $y-x=k(1+xy)$ (*c*) $x=\tan^{-1}y$ (*d*) $\tan(xy)=k$

40. The unit vector in the direction of the sum of the vectors $\vec{a}=2\hat{i}-\hat{j}+2\hat{k}$ **and** $\vec{b}=-\hat{i}+\hat{j}+3\hat{k}$ **is**

(*a*) $\frac{1}{\sqrt{26}}\hat{i}+\frac{5}{\sqrt{26}}\hat{k}$ (*b*) $\frac{1}{\sqrt{3}}\hat{i}-\frac{5}{\sqrt{26}}\hat{k}$ (*c*) $\frac{1}{\sqrt{10}}\hat{i}+\frac{1}{\sqrt{20}}\hat{k}$ (*d*) $\frac{1}{\sqrt{32}}\hat{i}-\frac{5}{\sqrt{3}}\hat{k}$

41. The magnitude of vector $6\hat{i}+2\hat{j}+3\hat{k}$ **is**

(*a*) 5 (*b*) 7 (*c*) 12 (*d*) 1

42. If $|\vec{a}|=8, |\vec{b}|=3$ **and** $|\vec{a}\times\vec{b}|=12$, **then value of** $\vec{a}\cdot\vec{b}$ **is**

(*a*) $6\sqrt{3}$ (*b*) $8\sqrt{3}$ (*c*) $12\sqrt{3}$ (*d*) None of these

43. The projection of vector $\vec{a}=2\hat{i}-\hat{j}+\hat{k}$ **along** $\vec{b}=\hat{i}+2\hat{j}+2\hat{k}$ **is**

(*a*) $\frac{2}{3}$ (*b*) $\frac{1}{3}$ (*c*) 2 (*d*) $\sqrt{2}$

44. The coordinates of the foot of the perpendicular drawn from the point (2, 5, 7) on the x-axis are given by

(*a*) (2, 0, 0) (*b*) (0, 5, 0) (*c*) (0, 0, 7) (*d*) (0, 5, 7)

45. P is the point on the line segment joining the points (3, 2, –1) and (6, 2, –2). If x co-ordinate of P is 5, then its y co-ordinate is

(*a*) 2 (*b*) 1 (*c*) –1 (*d*) –2

46. If a line makes angles $\frac{\pi}{2}, \frac{3\pi}{4}$, **and** $\frac{\pi}{4}$ **with x, y, z axes, respectively, then the direction cosines are**

(*a*) $\pm(1,1,1)$ (*b*) $\pm\left(0,\frac{-1}{\sqrt{2}},\frac{1}{\sqrt{2}}\right)$ (*c*) $\pm\left(\frac{1}{3},\frac{1}{3},\frac{1}{3}\right)$ (*d*) $\pm\left(\frac{1}{\sqrt{3}},\frac{-1}{\sqrt{3}},\frac{-1}{\sqrt{3}}\right)$

47. If the plane $2x - 3y + 6z - 11 = 0$ makes an angle $\sin^{-1}\alpha$ with x-axis, then the value of α is

(*a*) $\frac{\sqrt{3}}{2}$ (*b*) $\frac{\sqrt{2}}{3}$ (*c*) $\frac{2}{7}$ (*d*) $\frac{3}{7}$

48. If $P(B)=\frac{3}{5}, P(A/B)=\frac{1}{2}$ **and** $P(A\cup B)=\frac{4}{5}$, **then** $P(A\cup B)'+P(A'\cup B)$ **is equal to**

(*a*) $\frac{1}{5}$ (*b*) $\frac{9}{5}$ (*c*) $\frac{7}{2}$ (*d*) 1

49. If two events are independent, then

(*a*) they must be mutually exclusive.

(*b*) the sum of their probabilities must be equal to 1.

(*c*) Both (*a*) and (*b*) are correct.

(*d*) None of the above is correct.

50 If A and B are two events such that $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$ and $P(A/B) = \frac{1}{4}$, then $P(A' \cap B')$ is equals to

(*a*) $\frac{1}{12}$ (*b*) $\frac{3}{4}$ (*c*) $\frac{1}{4}$ (*d*) $\frac{3}{16}$