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+1 MODEL EXAMINATION

PART III – MATHEMATICS

[English Version]

Time allowed: 2 ½ Hours] **[Maximum Marks: 90**

PART-A

Note: (i) All questions are compulsory.
(ii) Each question carries one mark.
(iii) Choose the most suitable answer from the given four alternatives. **20 x 1 = 20**

1. The product of the matrices $\begin{bmatrix}7 & 5 & 3\end{bmatrix}\begin{bmatrix}7\\3\\2\end{bmatrix}$ is equal to

   (1) [70] (2) [49] (3) [15] (4) 70

2. The value of $\begin{vmatrix}1 & 1 & 1\\2x & 2y & 2z\\3x & 3y & 3z\end{vmatrix}$ is

   (1) 1 (2) xyz (3) x + y + z (4) 0

3. If $\vec{a}=2\vec{i}+\vec{j}-8\vec{k}$ and $\vec{b}=\vec{i}+3\vec{j}-4\vec{k}$ then the magnitude of $\vec{a}+\vec{b}=$

   (1) 13 (2) 13/3 (3) 3/13 (4) 4/13

4. Sum of the squares of direction sine is

   (1) 0 (2) 1 (3) 2 (4) 3

5. If $\frac{ax}{(x+2)(2x-3)}=\frac{2}{x+2}+\frac{3}{2x-3}$ then a =

   (1) 4 (2) 5 (3) 7 (4) 8

6. The number of triangles can be formed by joining the vertices of a hexagon is

   (1) 24 (2) 20 (3) 15 (4) 48

7. If a, b, c are in A.P. as well as in G.P then

   (1) $a = b \neq c$ (2) $a \neq b = c$ (3) $a \neq b \neq c$ (4) $a = b = c$

8. If $a_n = n^2.3^{-n}$ then the fifth term is

   (1) $\frac{25}{243}$ (2) $\frac{16}{81}$ (3) $\frac{1}{3}$ (4) $\frac{4}{9}$

9. When $h^2 = ab$ the angle between pair of straight lines $ax^2+2hxy+by^2=0$ is

   (1) $\frac{\pi}{4}$ (2) $\frac{\pi}{6}$ (3) $\frac{\pi}{2}$ (4) 0°

10. Which of the following point lies inside the circle $x^2+y^2-4x+2y-5=0$

(1) (5, 10) (2) (-5, 7) (3) (9, 0) (4) (1, 1)

11. The product s(s-a) (s-b) (s-c) is equal to

(1) Δ (2) Δ^2 (3) 2Δ (4) $\frac{\Delta}{s}$

12. If tan θ= 0 then θ is

(1) $(2n+1)\frac{\pi}{2}$ (2) $\frac{\pi}{3}$ (3) nπ (4) $\frac{\pi}{6}$

13. The range of the function sin x is

(1) [-1, 1] (2) [0, 1] (3) $(-\infty, \infty)$ (4) $(0, \infty)$

14. The value of $\lceil 2.5 \rceil$ is

(1) 2 (2) 3 (3) 4 (4) 5

15. $\lim_{x \to 0} \frac{2^x - 3^x}{x}$ is

(1) $\log\left(\frac{3}{2}\right)$ (2) $\log\left(\frac{2}{3}\right)$ (3) log 2 (4) log 3

16. If $y = x^2$ then y_3 is

(1) 1 (2) 2 (3) $2x$ (4) 0

17. $\int \frac{e^x}{e^x + 1} dx$

(1) $\frac{1}{2}x + c$ (2) $\frac{1}{2}\left(\frac{e^x}{1+e^x}\right)^2 + c$ (3) $\log(e^x+1) + c$ (4) $x + e^x + c$

18. $\int e^x \cos 2x$ is

(1) $\frac{e^x}{5}(\cos 2x + 2\sin 2x) + c$ (2) $\frac{e^x}{5}(2\cos x + \sin 2x) + c$

(3) $\frac{e^x}{5}(\cos 2x - 2\sin 2x) + c$ (4) $\frac{e^x}{5}(2\cos x - \sin 2x) + c$

19. Given P (A) = 0.50, P (B) = 0.40 and P (A $\cap$ B) =0.20 then $P(A/\overline{B})$ =

(1) 0.50 (2) 0.40 (3) 0.70 (4) 0.10

20. If P (A) = 0.35, P (B) = 0.73 and $P(A \cap B) = 0.14$. Then $P(\overline{A} \cup \overline{B}) =$

(1) 0.94 (2) 0.06 (3) 0.86 (4) 0.14

PART-B

II. Answer any 7 of the following questions. Question no: 30 is compulsory: **7 x 2 =14**

21. Solve for x if $\begin{vmatrix} x & 5 \\ 7 & x \end{vmatrix} + \begin{vmatrix} 1 & -2 \\ -1 & 1 \end{vmatrix} = 0$

22. If D is the mid- point of the side of BC of a triangle ABC, prove that $\overrightarrow{AB} + \overrightarrow{AC} = 2\overrightarrow{AD}$

23. If nP_4 =360, find the value of n.

24. If the two straight lines 2x - 3y +9 =0, 6x + ky + 4 = 0 are parallel, find *k*.

25. Simplify: cos(-1050°)

26. If $f, g : R \to R$ defined by $f(x) = x+1$ and g(x) = x^2 then find (gof) (3)

27. Find $\frac{dy}{dx}$ if y = x^3-6x^2 + 7 x + 6

28. Evaluate: $\int \tan^2 x dx$

29. If A and B are two independent events such that P(A $\cup$ B) = 0.6 , P(A) = 0.2,find P(B)

30. Prove that $\frac{1}{2}\log\frac{1+x}{1-x} = x + \frac{x^3}{3} + \frac{x^5}{5} + ...$

PART-C

III. Answer any 7 questions of the following. Question no: 40 is compulsory. **7 x 3 = 21**

31. If the position vectors of P and Q are $\vec{i} + 3\vec{j} - 7\vec{k}$ and $5\vec{i} - 2\vec{j} + 4\vec{k}$, find $\overrightarrow{PQ}$ and determine its direction cosines.

32. Evaluate: $\left(\sqrt{2}+1\right)^5 + \left(\sqrt{2}-1\right)^5$

33. If the 5th and 12th terms of a H.P are 12 and 5 respectively, find the 15th term.

34. Show that if one of the angles between pair of straight lines
$ax^2 + 2hxy + by^2 = 0$ is 60° then (a+3b) (3a+b) =$4h^2$

35. Prove that $\frac{1+\sin\theta-\cos\theta}{1+\sin\theta+\cos\theta} = \tan\frac{\theta}{2}$

36. Solve: $\frac{x-1}{4x+5} < \frac{x-3}{4x-3}$

37. Find the derivatives of the functions: $y = \tan^{-1}(\cot x) + \cot^{-1}(\tan x)$

38. Integrate: $\frac{\sqrt{\tan x}}{\sin x \cos x}$

39. An integer is chosen at random from the first fifty positive integers. What is the probability that the integer chosen is a prime or multiple of 4.

40. If A = $\begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix}$, show that $A^2 - 5A - 14\,I = O$ where I is the unit of matrix of order 2.

PART- D

IV. Answer all questions of the following: **7 x 5 = 35**

41. Prove by factor method $\begin{vmatrix} b+c & a-c & a-b \\ b-c & c+a & b-a \\ c-b & c-a & a+b \end{vmatrix} = 8abc$

(OR)

State and prove the medians of triangle are concurrent.

42. If $\tan\alpha = \frac{1}{3}$ and $\tan\beta = \frac{1}{7}$ show that $2\alpha + \beta = \frac{\pi}{4}$

(OR)

Prove that cos (A–B) = cosA cosB + SinA SinB

43. Resolve into partial fractions: $\frac{x^2+x+1}{x^2+2x+1}$

(OR)

If a, b, c are in H.P., prove that $\frac{b+a}{b-a} + \frac{b+c}{b-c} = 2$

44. Find the equation of the circle passing through the points (1, 0) ,(0, -1) and (0, 1)

(OR)

The equation of the sides of a triangle are x+2y= 0, 4x+3y =5 and 3x + y= 0. Find the co-ordiantes of the orthocentre of the triangle.

45. Prove that $\lim_{\theta \to 0} \frac{\sin\theta}{\theta} = 1$

(OR)

Differentiate: $\cot^{-1}\left[\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right]$

46. Integrate: $\sqrt{\frac{1+x}{1-x}}$

(OR)

Evaluate: $\int_2^5 (3x^2+4)dx$

47. For a student the probability of getting admission in IIT is 60% and probability of getting admission in Anna University is 75%. Find the probability that (i) getting admission in only one of these (ii) getting admission in atleast one of these.

(OR)

If x is real, prove that $\frac{x}{x^2-5x+9}$ lies between $-\frac{1}{11}$ and 1.