

**First Year B.Sc (MRT) Degree Regular/Supplementary Examinations
March 2024**

Mathematics

Time: 3 Hours

Total Marks: 100

- Answer all questions to the point neatly and legibly • Do not leave any blank pages between answers • Indicate the question number correctly for the answer in the margin space
- Answer all parts of a single question together • Leave sufficient space between answers
- Draw table/diagrams/flow charts wherever necessary.
- The use of a simple calculator is allowed, but using scientific calculator or sharing any calculator is strictly prohibited under any circumstance.

Essay**(2x20=40)**

- (a) If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2000 individuals more than two will get a bad reaction.
(b) Find the Fourier transform of $f(x) = \begin{cases} e^{-ax} & x > 0 \\ 0 & x < 0 \end{cases}$ where $a > 0$
- (a) Find $\frac{dy}{dx}$ if (i) $x = a(\theta + \sin\theta)$, $y = a(1 - \cos\theta)$ (ii) $y = \frac{e^x}{\sin x}$
(b) Find the vector triple product of $\vec{a}, \vec{b}, \vec{c}$ where $\vec{a} = 6\hat{i} + 3\hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + 4\hat{k}$, $\vec{c} = 5\hat{i} + 7\hat{j} + 3\hat{k}$

Short notes:**(8x5=40)**

- Using the principle of mathematical induction prove that $(1+x)^n \geq 1+nx$ for all natural number n , where $x > -1$
- The sum of three numbers in geometric progression is 35 and their product is 1000, Find the numbers
- Find the area of the triangle with vertices (2,7), (1,1), (10,8)
- Show that $\sin^{-1}(2x\sqrt{1-x^2}) = 2\sin^{-1}x$, $-\frac{1}{\sqrt{2}} \leq x \leq \frac{1}{\sqrt{2}}$
- Find $\lim_{x \rightarrow 3} \frac{x^3-27}{x-3}$
- Find the cube root of unity
- Find the correlation coefficient between x and y

x	2	4	5	6	8	11
y	18	12	10	8	7	5

10. Solve $\frac{dy}{dx} = e^{2x+3y}$

Answer briefly:

(10x2=20)

11. If $A = \begin{bmatrix} 3 & 2 & 0 \\ 4 & 1 & -1 \\ 1 & 2 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 1 & 3 \\ 2 & 1 & 1 \\ -1 & 5 & -3 \end{bmatrix}$ find $3A - 4B$

12. Find the value of $5C_2$

13. Find the value of $\sin 15^\circ$

14. Find divergence of the vector $\vec{v}$ where $\vec{v} = xyz\hat{i} + 3x^2y\hat{j} + (xz^2 - y^2z)\hat{k}$ at the point (2,1,1)

15. Solve $\cos x = \frac{1}{2}$

16. Find the modulus and amplitude of $1 + \sqrt{3}i$

17. If a random variable has Poisson distribution such that $P(1) = P(2)$ find $P(4)$

18. Evaluate $\int_1^3 x^2 dx$

19. Find $\vec{a} \cdot \vec{b}$ if $\vec{a} = 3\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} + 2\hat{j} - 5\hat{k}$

20. Find the coefficient of x^5 in $(x + 3)^8$
