

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BTECH
BRANCH: BIOTECHNOLOGY

SEMESTER : I
SESSION : MO/2023

SUBJECT: BE001 FOUNDATION OF ENGINEERING MATHEMATICS

TIME: 3 HOURS

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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|---|---------|----|
| Q.1(a) If Vector $A = 2i-4j-7k$; $B = i-j+3k$; $C = 5i-8k$ and $D = 2i+3j-9k$.
Compute $(2B - C).(A \times D)$ | [5] 3 | 4 |
| Q.1(b) Find the Eigen values and Eigen vectors for the following matrix,
$A = \begin{bmatrix} 2 & 2 \\ 5 & -1 \end{bmatrix}$ | [5] 2 | 4 |
| Q.2(a) Find the distance of the point $(-4, -6)$ from the line $-4x + 3y - 24 = 0$.
Find the angle between the following two lines.
$-4x + 3y = 8$ and $x - 6y = -6$ | [5] 4,2 | 4 |
| Q.2(b) Find the general solution (x) of the equation $2\cos^2 x + \cos x - 1 = 0$ | [5] 1,2 | 4 |
| Q.3(a) Find limits for, $\lim_{x \rightarrow 2} \frac{x^2 - 3x + 2}{x - 2}$;
Differentiate, $y = x^5 \cos x$ | [5] 4 | 3 |
| Q.3(b) Find maxima or minima for following function, $y = 4x^3 - 12x$ | [5] 3 | 4 |
| Q.4(a) Determine:
$\int_0^{\frac{\pi}{2}} \sin^4 x \, dx$ | [5] 4 | 4 |
| Q.4(b) Evaluate:
$\int \sin^2 x \cos^2 x \, dx$ | [5] 4 | 5 |
| Q.5(a) If $x = a \sin(\omega t + b)$; Prove that
$\frac{d^2 x}{dt^2} + \omega^2 x = 0$ | [5] 5 | 4 |
| Q.5(b) The number of bacteria in a culture grow at a rate proportional to N. Initially, the value of N = 100 and increased to 332 in 1 hr. What will be the value of N after 1.5 hrs? | [5] 5 | 5 |