Jharkhand University of Technology, Ranchi

Diploma 1st Semester Examination, 2024 (NEP-2024)

Subject : Engineering Mathematics **Subject Code : BSC 101**

Time Allowed : 3 Hours **Full Marks : 70**

Answer in your own words.
Answer any five *questions.* Question No. 1 *is compulsory.*
Marks are given in the right margin.

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1. Choose the correct answer in the following: 2×7=14

(i) If A is a 2×2 matrix such that $|A| = 5$ and $|A| \neq 0$ then the value of $|4A|$ is

(a) 20 (b) 25

(c) 80 (d) None of these

(ii) If A and B are invertible square matrices of the same order then $(AB)^{-1} =$?

(a) AB^{-1} (b) $A^{-1}B^{-1}$

(c) $B^{-1}A$ (d) $B^{-1}A^{-1}$

(iii) Find the slope of a line whose inclination is 60°.

(a) $\sqrt{3}$ (b) $\frac{1}{\sqrt{3}}$

(c) 1 (d) None of these

(iv) The equation of the line that makes intercepts at 2 and –3 on the x-axis and y-axis respectively is represented as

(a) $2x - 3y = 6$ (b) $x - 2y = 3$

(c) $3x - 2y = 6$ (d) None of these

(v) If $\sin x = \frac{1}{6}$ then $\sin 3x$ can be expressed as

(a) $\frac{1}{2}$ (b) $\frac{13}{27}$

(c) $\frac{12}{27}$ (d) None of these

(vi) The first order derivative of $\log_3 x$ is

(a) $\log 3$ (b) $\frac{1}{x}$

(c) $\frac{1}{x(\log 3)}$ (d) None of these

(vii) Find the value of the integral $\int \frac{\sin 2x}{\sin x}\, dx$.

(a) $2\sin x + c$ (b) $2\cos x + c$

(c) $\frac{1}{2}\sin x + c$ (d) $\frac{1}{2}\cos x + c$

2. (a) Prove that $\begin{vmatrix} 1 & b+c & b^2+c^2 \\ 1 & c+a & c^2+a^2 \\ 1 & a+b & a^2+b^2 \end{vmatrix} = (a-b)(b-c)(c-a)$.

(b) Solve the system of equations $x + y + z = 6; 2x + 3y - z = 5; 6x - 2y - 3z = -7$ using Cramer's rule. 7+7

3. (a) Find the equation of the line passing through the point (–2, –4) and perpendicular to the line $3x - y + 5 = 0$.

(b) Reduce the equation $\sqrt{3}x + y + 2 = 0$ to intercept form and find the intercepts on the axes. 7+7

4. (a) Find the values of all trigonometric functions of 120°.

(b) Prove that: $\cos\alpha + \cos\beta + \cos\gamma + \cos(\alpha+\beta+\gamma) = 4\cos\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\beta+\gamma}{2}\right)\cos\left(\frac{\gamma+\delta}{2}\right)$. 7+7

5. (a) Find the second order derivative of $e^{2x}\cos 3x + x^4$.

(b) Obtain the local maxima or local minima of $f(x) = x^3 - 6x^2 + 9x + 15$. Also find the local maximum or local minimum values of $f(x)$. 7+7

6. (a) Evaluate: $\int_{-a}^{a} \sqrt{\frac{a-x}{a+x}}\, dx$.

(b) Calculate the area bounded by the parabola $y^2 = 4ax$ and its latus rectum. 7+7

7. Write short notes on *any four*: 3.5×4=14

(a) Inverse of a matrix

(b) Collinear points

(c) ASTC diagram

(d) Stationary points

(e) Integration by parts

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