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I Semester Diploma Examination, April/May-2016

ENGINEERING MATHEMATICS – I

Time : 3 Hours]

[Max. Marks : 100

- Note :** (i) Answer any 10 questions from Section – A, any 8 questions from Section – B and any 5 questions from Section – C.
(ii) Each question carries 3 marks in Section – A
(iii) Each question carries 5 marks in Section – B
(iv) Each question carries 6 marks in Section – C

SECTION – A

1. If $A = \begin{pmatrix} 2 & -1 \\ 3 & -4 \end{pmatrix}$, find $A^T - A$.

2. If $A = \begin{pmatrix} 5 \\ 0 \\ -1 \end{pmatrix}$, $B = (2 \ 3 \ 4)$, then find AB .

3. If $A = \begin{pmatrix} 2 & 1 \\ 0 & -5 \end{pmatrix}$, find A^{-1} .

4. If $\vec{a} = i + j + k$, $\vec{b} = 2i + 3j + 4k$, find magnitude of $2\vec{a} + 3\vec{b}$.

5. If $\vec{a} = 5i + 3j + k$, $\vec{b} = 2i - j + 3k$, find $\vec{a} \times \vec{b}$.

6. A coin is tossed twice. What is the probability that at least one tail occurs.

7. Find the value of $\sin(-840^\circ)$.8. Find the value of $\cos(75^\circ)$.9. If $\tan A = 1/3$, $\tan B = 1/2$. Find $\tan(A + B)$.10. Prove that $\sin(2A) = 2\sin A \cos A$.**BETA CONSOLE!**3
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11. Prove that $\frac{\sin A + \sin B}{\cos A - \cos B} = -\cot\left(\frac{A+B}{2}\right)$. 3
12. Express $(3 + 4i)^{-1}$ in the $a + ib$ form. 3
13. Evaluate $\lim_{x \rightarrow \infty} \left(\frac{x^2 + x + 1}{2x^2 - 3x - 4} \right)$. 3
14. Evaluate $\lim_{\theta \rightarrow 0} \left(\frac{\sin 2\theta}{\sin 3\theta} \right)$. 3

SECTION - B

1. Solve the equations $\frac{2}{x} + \frac{3}{y} = 1$, $\frac{3}{x} - \frac{4}{y} = 2$. Using Cramer's rule. 5
2. Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 2 & -1 \\ -3 & 1 \end{bmatrix}$. 5
3. Find the projection of $\vec{a} = i + 2j + 3k$ on $\vec{b} = 3i - 5j + k$. 5
4. If $\vec{a} = 3i + 2j - 4k$, $\vec{b} = i - 2j + 5k$ are two sides of a triangle, find its area. 5
5. If the vectors $\lambda i + 5j - 6k$ and $7i + 2j + 4k$ are orthogonal, find λ . 5
6. Prove that $\frac{1}{\log_3^{60}} + \frac{1}{\log_4^{60}} + \frac{1}{\log_5^{60}} = 1$. 5
7. Prove that $\frac{\sin(180^\circ - A) \cdot \cos(360^\circ - A) \cdot \tan(180^\circ + A)}{\cos(270^\circ + A) \cdot \sin(90^\circ + A) \cdot \cot(270^\circ - A)} = 1$. 5
8. Prove that $\sin(A+B) \cdot \sin(A-B) = \cos^2 B - \cos^2 A$. 5
9. Prove that $\tan A + \cot A = 2\operatorname{cosec}(2A)$. 5
10. Prove that $\sin 40^\circ + \sin 20^\circ - \cos 10^\circ = 0$. 5
11. Evaluate $\lim_{x \rightarrow 1} \left(\frac{x^2 + x - 2}{x^2 - 1} \right)$. 5

SECTION - C

1. If the matrix $A = \begin{bmatrix} x & 2 & -1 \\ 2 & 5 & x \\ -1 & 2 & x \end{bmatrix}$ is singular, find the value of x . 6
2. Find the inverse of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 3 \end{bmatrix}$. 6
3. A force $\vec{F} = 2\mathbf{i} + \mathbf{j} - 2\mathbf{k}$ acting on particle at $(3, 2, 2)$ displaces it to the point $(1, 3, -1)$, find the work done. 6
4. A family has two children. What is the probability that both the children are boys given that at least one of them is a boy? 6
5. If $\sec \theta = 17/8$ and $270^\circ < \theta < 360^\circ$, find the value of $\frac{15 \operatorname{cosec} \theta - 8 \tan \theta}{17 \cos \theta + 15 \operatorname{cosec} \theta}$. 6
6. Prove that $\cos 20^\circ \cdot \cos 40^\circ \cdot \cos 60^\circ \cdot \cos 80^\circ = \frac{1}{16}$. 6
7. Express complex number $(1 + i)$ in the polar form. 6
8. Evaluate $\lim_{x \rightarrow 2} \left[\frac{x^2 - 4}{\sqrt{x+2} - \sqrt{3x+2}} \right]$. 6

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