

1312**Code : 15SC01M**Register
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I Semester Diploma Examination, Nov./Dec. 2017**ENGINEERING MATHEMATICS – I****Time : 3 Hours |****| Max. Marks : 100**

- Note :**
- (i) Answer any **10** questions from Section A, **8** questions from Section B and **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. Find AB if $A = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 6 \\ 7 & 8 \end{bmatrix}$.

2. Find $A^T + B^T$ if $A = \begin{bmatrix} 1 & 5 \\ 3 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 5 \\ 2 & 8 \end{bmatrix}$.

3. Find the characteristic equation of the matrix $A = \begin{bmatrix} 2 & 0 \\ 6 & 3 \end{bmatrix}$.

4. Evaluate $i^{98} + i^{72}$.

5. Show that $\tan 225^\circ + \cot 135^\circ = 0$.

6. Show that

$$\sqrt{2} \cdot \sin (45^\circ + A) = \sin A + \cos A.$$

7. Show that

$$\cos (A + B) + \cos (A - B) = 2 \cos A \cos B.$$

8. If $\sin \theta = \frac{3}{5}$ then find the value of $\sin 2\theta$.

9. Show that $\cos 2\theta = 2\cos^2\theta - 1$.

10. Evaluate $\lim_{\theta \rightarrow 0} \left(\frac{1 - \cos 2\theta}{\theta^2} \right)$.

11. Evaluate $\lim_{x \rightarrow \infty} \left(\frac{5x^2 + 3x}{7x^2 + 2x} \right)$.

12. Find the unit vector of \vec{a} if $\vec{a} = 3\mathbf{i} + 4\mathbf{j} + \mathbf{k}$.

13. If $\vec{OA} = 2\mathbf{i} - 3\mathbf{j}$ and $\vec{OB} = 8\mathbf{i} + 5\mathbf{j}$ then find $|\vec{AB}|$.

14. A coin is tossed twice, what is the probability that atleast one tail occurs ?

SECTION - B

15. Find the inverse of the matrix $A = \begin{bmatrix} 5 & 2 \\ 3 & 6 \end{bmatrix}$.

16. Solve for x and y by Cramer's rule :

$$4x - 5y = -2$$

$$5x - 4y = 2$$

17. Show that

$$\sin^2\left(\frac{\pi}{4}\right) + \sin^2\left(\frac{3\pi}{4}\right) + \sin^2\left(\frac{5\pi}{4}\right) + \sin^2\left(\frac{7\pi}{4}\right) = 2$$

without using calculator or tables.

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18. Prove that

$$\frac{\operatorname{cosec}(360^\circ + \theta)}{\sec(180^\circ - \theta)} \cdot \frac{\cos(360^\circ + \theta)}{\cos(90^\circ + \theta)} = \cot^2 \theta.$$

19. Show that

$$\sin 3\theta = 3 \sin \theta - 4 \sin^3 \theta.$$

20. Show that

$$\left(\frac{\sin 88^\circ + \sin 2^\circ}{\cos 88^\circ + \cos 2^\circ} \right) + \frac{2 \cos 60^\circ}{\sin 90^\circ} = 2.$$

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21. Evaluate

$$\lim_{x \rightarrow 1} \frac{x^2 + 5x - 6}{x^2 - 3x + 2}$$



22. Find the projection of the Vector \vec{b} on the Vector \vec{a} if $\vec{a} = 2\mathbf{i} + \mathbf{j} - 2\mathbf{k}$ and $\vec{b} = 3\mathbf{i} + 5\mathbf{j} + \mathbf{k}$.



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23. Find $|\vec{a} \times \vec{b}|$ if $\vec{a} = 3\mathbf{i} - 2\mathbf{j} + \mathbf{k}$ and $\vec{b} = \mathbf{i} + 3\mathbf{j} - \mathbf{k}$.

24. Find the unit vector perpendicular to both \vec{a} and \vec{b} , if $\vec{a} = 4\mathbf{i} - \mathbf{j} + 5\mathbf{k}$ and $\vec{b} = -2\mathbf{i} + 2\mathbf{j} - 3\mathbf{k}$.

25. Show that $2 \log \frac{16}{15} + \log \frac{25}{24} - \log \frac{32}{27} = 0$.

[Turn over]

SECTION – C

26. Solve for y and z by Cramer's Rule.

$$6x - 5y + 2z = 3$$

$$5x + y - 2z = 4$$

$$x + y + 3z = 5$$

27. Verify Cayley – Hamilton theorem for the Matrix $A = \begin{bmatrix} 3 & 7 \\ 1 & 2 \end{bmatrix}$.

28. Express the complex number $z = -\sqrt{3} + i$ in polar form.

29. Show that $\cos 20^\circ \cdot \cos 40^\circ \cdot \cos 80^\circ = \frac{1}{8}$.

30. Prove that

$$\lim_{\theta \rightarrow 0} \left(\frac{\sin \theta}{\theta} \right) = 1 \text{ when } \theta \text{ is in radians.}$$

31. Find $\cos \theta$ if θ is the angle between the Vectors $\vec{a} = 3\mathbf{i} - 2\mathbf{j} + 5\mathbf{k}$ and $\vec{b} = 2\mathbf{i} + 3\mathbf{j} + \mathbf{k}$.

32. If $\sec \theta = \frac{17}{8}$ and $270^\circ < \theta < 360^\circ$, find the value of $\frac{15 \operatorname{cosec} \theta - 8 \tan \theta}{17 \cos \theta + 15 \operatorname{cosec} \theta}$.

33. A family has two children. What is the probability that both the children are boys given that atleast one of them is boy ?
