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C16-COMMON-102**6002****BOARD DIPLOMA EXAMINATION, (C-16)****JANUARY/FEBRUARY—2022****FIRST YEAR (COMMON) EXAMINATION****ENGINEERING MATHEMATICS - I**

Time : 3 hours]

[Total Marks : 80

PART—A $3 \times 10 = 30$

- Instructions :** (1) Answer **all** questions.
(2) Each question carries **three** marks.

1. Resolve $\frac{1}{(x-1)(x-2)}$ into partial fractions.
2. If $A = \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 3 \\ 1 & 3 \end{bmatrix}$, then find $A+B$ and $A-B$.
3. If $A = \begin{bmatrix} -1 & 1 \\ 1 & 2 \end{bmatrix}$, then find Adjoint of A .
4. Show that $\frac{\cos^2 A}{\sin^2 A} = \frac{\cot A}{2}$.
5. Show that $\sin 70^\circ \cos 10^\circ - \cos 70^\circ \sin 10^\circ = \frac{\sqrt{3}}{2}$.
6. Find the modulus of $z = -1 - 3i$.
7. Find the slope of line joining two-points $(1, 0)$ and $(0, 2)$.

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8. Find x and y intercepts of the straight line $\frac{x}{2} + \frac{y}{3} = 1$.

9. Evaluate $\lim_{\theta \rightarrow 0} \frac{\sin m\theta}{\tan n\theta}$.

10. If $y = e^x + \log x + x$, then find $\frac{dy}{dx}$.

PART—B

$10 \times 5 = 50$

- Instructions :** (1) Answer **any five** questions.
 (2) Each question carries **ten** marks.

- 11.** (a) Solve the following system of linear equations by using Cramer's rule :

$$3x + y + 2z = 3, \quad 2x - 3y - z = -3 \quad \text{and} \quad x + 2y + z = 4$$

(b) If $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 1 & 3 \\ 4 & 1 & 8 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 1 & 0 \\ 2 & -3 & 1 \\ 1 & 1 & -1 \end{bmatrix}$ show that $(A + B)^T = A^T + B^T$.

12. (a) Show that $\frac{\sin A + \sin 2A + \sin 3A}{\cos A + \cos 2A + \cos 3A} = \tan 2A$.

(b) Show that $\tan^{-1}\left(\frac{1}{2}\right) - \tan^{-1}\left(\frac{1}{3}\right) = \frac{\pi}{4}$.

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13. (a) Solve $2\sin^2 \theta + \sin \theta - 1 = 0$.

(b) In a ΔABC , show that $(b - c)\sin A + (c - a)\sin B + (a - b)\sin C = 0$.

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14. (a) Find the equation of the circle having (4,2) and (1,5) as the extremities of the diameter.

- (b) Find the eccentricity, foci, length of major and minor axes,

vertices of an ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$.

15. (a) If $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \dots \infty}}}$ times, then find $\frac{dy}{dx}$.

- (b) If $y = \sin^{-1}(3x - 4x^3)$, then find $\frac{dy}{dx}$.

16. (a) If $x = at^2$ and $y = 2at$, then find $\frac{dy}{dx}$.

- (b) If $u = x^3 + y^3$, then find $\frac{\partial^2 u}{\partial x^2}$ and $\frac{\partial^2 u}{\partial y^2}$.

17. (a) Find the lengths of tangents, normal, sub-tangent and sub-normal to the curve $y = x^3$ at (1,1).

- (b) Find the maximum and minimum values of $4x^3 - 18x^2 + 24x - 7$.

18. (a) If $s = t^2 - 4t + 3$ then find the velocity and acceleration when $t = 4$ secs, s is displacement.

- (b) If the radius of a spherical balloon is increased by 0.1%, then find the approximate increase in its volume.

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