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BOARD DIPLOMA EXAMINATION, (C–16)
OCTOBER—2020
DEEE—FIRST YEAR EXAMINATION

ENGINEERING MATHEMATICS—I

Time : 3 hours] [*Total Marks* : 80

PART—A 3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

1. Resolve $\dfrac{3x-1}{(x-2)(x-3)}$ into partial fractions.

2. If $A = \begin{bmatrix} 2 & 4 \\ -1 & k \end{bmatrix}$ and $A^2 = 0$, then find the value of k

3. Find the determinant of the matrix $\begin{bmatrix} 3 & 1 & 1 \\ 1 & -1 & 2 \\ 1 & 2 & -1 \end{bmatrix}$

4. Prove that $\tan(45° + A) \cdot \tan(45° - A) = 1$

5. If $\cos\theta = \dfrac{4}{5}$, then find $\cos 2\theta$ and $\sin 2\theta$

6. Find the conjugate of the complex number $\dfrac{1 + 8i}{5 - 2i}$

7. Find the value of x if the slope of the line joining the points $(5, 6)$ and $(x, -7)$ is 7.

8. Find the point of intersection of the lines $x + 3y - 6 = 0$ and $y - 3x = 7$.

9. Evaluate $\lim\limits_{x \to 3} \left(\dfrac{x^3 - 27}{x^2 - 9} \right)$

10. Find the derivative of $x\, e^x \cos x$ with respect to x.

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PART—B   10×5=50

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Instructions : (1) Answer *any* **five** questions.

                (2) Each question carries **ten** marks.

11. Solve the equations

$$3x + y + z = 3, \ 2x + 2y + 5z = -1 \ \text{ and } \ x - 3y - 4z = 2$$

using matrix inversion method.

12. *(a)* Prove that $\dfrac{\cos A - \cos 3A - \cos 5A + \cos 7A}{\sin A - \sin 3A + \sin 5A - \sin 7A} = \tan 2A$

   (b) Show that $\sin^{-1}\left(\dfrac{2x}{1 + x^2} \right) + \cos^{-1}\left(\dfrac{1 - y^2}{1 + y^2} \right) = 2\tan^{-1}\left(\dfrac{x + y}{1 - xy} \right)$

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

   (b) In a $\triangle ABC$, prove that $c \cos^2\left(\dfrac{A}{2} \right) + a \cos^2\left(\dfrac{C}{2} \right) = s$

14. *(a)* Find the equation of the circle with (0, 1) and (3, 0) as end points of a diameter.

(b) Find the center, vertices, eccentricity, foci and length of latus rectum of the ellipse

$$\frac{x^2}{16} + \frac{y^2}{36} = 1$$

15. *(a)* Differentiate $\sin^{-1}\left(2x\sqrt{1-x^2}\right)$ with respect to $\sin^{-1} x$

(b) Find $\dfrac{dy}{dx}$, if $y = x^{x^{x^{\cdots\infty}}}$

16. *(a)* If $x = a\cos\theta, y = b\sin\theta$, then find $\dfrac{d^2y}{dx^2}$

(b) Verify Euler's theorem for the function

$$u(x,y,z) = x^3y + y^3z + z^3x$$

17. *(a)* Find the lengths of tangent, normal, sub-tangent and sub-normal to the curve $y = x^2 + 2x - 1$ at the point (1, 2).

(b) A circular metal expands by heat so that is radius increases at the rate of 0·5 cm/sec. Find the rate of increase of its area when the radius is 10 cm.

18. *(a)* A wire of length 50 cm is cut into two parts which are bent in the form of a square and circle. Find the least value of the sum of the areas so formed.

(b) A circular plate expands when heated from a radius 5 cm to 5·03 cm. Find the approximate percentage error in its area. Also find the percentage error in its circumference.

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