C14–A/AA/AEI/BM/CH/CHST/
C/CM/EC/EE/CHPP/CHPC/CHOT/
PET/M/RAC/MET/MNG/
IT/TT/PCT–**102**

4002

BOARD DIPLOMA EXAMINATION, (C–14)
SEPTEMBER/OCTOBER - 2020
FIRST YEAR (COMMON) 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 $\dfrac{3x}{(x-2)(x+1)}$ into partial Fractions.

2. If $A = \begin{bmatrix} 1 & 3 \\ 2 & 1 \end{bmatrix}$, find A^2.

3. Prove that

$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ b+c & c+a & a+b \end{vmatrix} = 0$$

4. If $A + B = 45°$, prove that $(1 + \tan A)(1 + \tan B) = 2$.

5. Prove that $\cos^4 A - \sin^4 A = \cos 2A$.

6. Find the multiplicative inverse of $2 + 3i$.

7. Find the intercepts made by the line $13x + 7y + 11 = 0$ on the coordinate axes.

8. Find the equation of the circle with centre at $(-1, 2)$ and having radius 2 units.

9. Evaluate

$$\underset{x \to 0}{\text{Lt}} \, \frac{\sqrt{1 + x} - \sqrt{1 - x}}{2x}$$

10. Differentiate $\dfrac{2x + 3}{5x - 2}$ 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. *(a)* Find the adjoint of the matrix

$$A = \begin{bmatrix} 2 & -2 & 4 \\ 2 & 3 & 2 \\ -1 & 1 & -1 \end{bmatrix}$$

(b) Solve

$$x + \ y + \ z = 6$$
$$x + 2y + 3z = 14$$
$$x + 4y + 9z = 36$$

by Gauss-Jordan method.

12. *(a)* If $A + B + C = 180°$

Prove that $\cos 2A + \cos 2B - \cos 2C = 1 - 4 \sin A \sin B \cos C$.

(b) If $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \pi$, prove that $x + y + z = xyz$.

13. *(a)* Solve

$$\cos \theta + \sqrt{3 \sin \theta} = 1$$

(b) In any triangle *ABC*, prove that

$$a \cos A + b \cos B + c \cos C = \frac{2\Delta}{R}$$

14. *(a)* Find the equation of the parabola with focus at $(3,1)$ and directrix is $x + y + 1 = 0$.

(b) Find the ecentricity of the ellipse whose latus rectum in equal to half of the length of major axis.

15. *(a)* Evaluate

$$\frac{d}{dx}\left(\cos^{-1}\left(\frac{1 - x^2}{1 + x^2} \right) \right)$$

(b) If

$$y = x^{\tan x}, \text{ find } \frac{dy}{dx}.$$

16. *(a)* If $y = \sin(\log x)$, prove that $x^2 y_2 + xy_1 + y = 0$.

(b) If $z = \log(e^x + e^y)$, show that

$$\frac{dz}{dx} + \frac{dz}{dy} = 1$$

17. *(a)* Find the lengths of tangent, normal, subtangent and subnormal to the curve $x^2 - y^2 = 9$ at the point (5,4).

(b) A particle is moving along a straight line according to the law $S = 2t^3 - 3t^2 + 15t + 18$, ($t$ in sec, S is distance). Find its velocity when its acceleration is zero.

18. *(a)* The sum of two numbers is 24. Find the numbers when the sum of their squares is minimum.

(b) The radius of a spherical baloon is increased by 0·1%. Find the approximate percentage increase in its volume.

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