COMMON –102

7002

BOARD DIPLOMA EXAMINATION, (C-20)

FEBRUARY/MARCH —2022

DAE - 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.

(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

1. If $A = \{-2,-1,0,1,2\}$ and $f : A \to B$ is a function such that $f(x) = x^2 + x + 1$, then find the range of f.

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

3. If $A = \begin{pmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & 2 & 1 \\ 1 & 2 & 3 \end{pmatrix}$, then find $3B - 2A$.

4. Show that $\dfrac{\cos 36° + \sin 36°}{\cos 36° - \sin 36°} = \tan 81°$.

5. Prove that $\dfrac{\sin 2\theta}{1 - \cos 2\theta} = \cot\theta$.

6. Find the real and imaginary parts of the complex number $(3 + 4i)(2 - 3i)$.

7. Find the distance between the parallel lines $2x + 3y + 5 = 0$ and $2x + 3y + 9 = 0$.

8. Evaluate $\lim_{x\to 3} \dfrac{x^3 - 27}{x - 3}$.

9. Find the derivative of $x^3 + 6x^2 + 12x - 13$.

10. If $y = 4x^2 - 8x + 2$, find $\dfrac{d^2y}{dx^2}$.

PART—B

8×5=40

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

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

(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. *(a)* Find the adjoint and inverse of the matrix $\begin{pmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{pmatrix}$.

(OR)

(b) Solve the system of linear equations

$3x + y + 2z = 3$, $2x - 3y - z = -3$, $x + 2y + z = 4$ using Cramer's rule.

12. *(a)* Prove that $\cos A + \cos(120 + A) + \cos(120 - A) = 0$.

(OR)

(b) Prove that $\tan^{-1}\left(\dfrac{1}{7}\right) + \tan^{-1}\left(\dfrac{1}{13}\right) = \tan^{-1}\left(\dfrac{2}{9}\right)$.

13. *(a)* Solve $\cos\theta + \sin\theta = \sqrt{2}$.

(b) In any ΔABC, Show that $\sin A + \sin B + \sin C = \dfrac{s}{R}$.

14. *(a)* Find the equation of the circle with (1,2) and (–2,3) as the two ends of its diameter and find its centre and radius.

(OR)

(b) Find the equation of the conic whose focus is (1,–1), directrix is $x - y + 3 = 0$ and eccentricity is 1/2.

15. *(a)* Find $\frac{dy}{dx}$, if $x^2 + y^2 + 2gx + 2fy + c = 0$, where g, f, c are constants.

(OR)

(b) If $u(x, y, z) = \log(x + y + z)$, then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = 1$.

PART—C

10×1=10

Instructions : (1) Answer the following question.

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

16. Find the lengths of the tangent, normal, sub-tangent and sub-normal for the curve $y = x^2 + 2x + 1$ *at* $(1, 4)$.

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