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**C20-EC-CHPC-PET-102****7028****BOARD DIPLOMA EXAMINATION, (C-20)****SEPTEMBER/OCTOBER—2021****DECE - FIRST YEAR 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. If the function  $f$  is defined by  $f(x) = \frac{2x+3}{5}$ , then find the values of (i)  $f(-2)$ , (ii)  $f(0)$  and (iii)  $f(3)$ .
2. Resolve  $\frac{1}{(x+1)(x+3)}$  into partial fractions
3. If  $A = \begin{bmatrix} 2 & 3 & 1 \\ 0 & -1 & 5 \end{bmatrix}$  and  $B = \begin{bmatrix} 1 & 2 & -6 \\ 0 & -1 & 3 \end{bmatrix}$ , then find  $2A - 3B$ .
4. Prove that  $\tan(45 + A) \cdot \tan(45 - A) = 1$
5. Prove that  $\cos 10^\circ \cos 50^\circ \cos 70^\circ = \frac{\sqrt{3}}{8}$

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- 6.** Find the modulus of the complex number  $\left(\frac{3-4i}{5+7i}\right)$ .
- 7.** Find the distance between the two parallel lines  $3x - 4y + 7 = 0$  and  $3x - 4y + 5 = 0$ .
- 8.** Find  $\lim_{x \rightarrow 2} \frac{x^4 - 16}{x - 2}$ .
- 9.** Differentiate  $x \cdot \sec x$  with respect to  $x$ .
- 10.** Differentiate  $\log(1 + \tan^{-1} x)$ .

### PART—B

$8 \times 5 = 40$

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

- 11.** (a) If  $A = \begin{bmatrix} 2 & 7 & 13 \\ 3 & 9 & 4 \\ 1 & 5 & 3 \end{bmatrix}$ , find the adjoint and inverse of the matrix.

**OR**

- (b) Solve the following system of equations using Cramer's Rule :  
 $x + 2y - z = -3$ ,  $3x + y + z = 4$  and  $x - y + 2z = 6$

- 12.** (a) If  $\sin x + \sin y = \frac{3}{4}$  and  $\sin x - \sin y = \frac{2}{5}$ , then prove that

$$8 \cot \frac{x-y}{2} = 15 \cot \frac{x+y}{2}$$

**OR**

- (b) Show that  $\sin^{-1} \frac{3}{5} + \sin^{-1} \frac{8}{17} = \cos^{-1} \frac{36}{85}$

**13.** (a) Solve  $\sin 6\theta \cos 2\theta = \sin 5\theta \cos \theta$

**OR**

(b) In a  $\Delta ABC$ , if  $A = 60^\circ$ , then prove that  $\frac{c}{a+b} + \frac{b}{c+a} = 1$ .

**14.** (a) Find the centre and radius of the circle

$$3x^2 + 3y^2 - 12x + 6y + 11 = 0$$

**OR**

(b) Find the equation of the rectangular hyperbola whose focus is the point  $(1, 2)$  and directrix is the line  $3x + 4y - 5 = 0$ .

**15.** (a) Find the derivative of  $\tan^{-1}\left(\frac{2x}{1-x^2}\right)$  with respect to  $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ .

**OR**

(b) If  $y = \sin(\log x)$ , then show that  $x^2y_2 + xy_1 + y = 0$ .

**PART—C**

$10 \times 1 = 10$

**Instructions :** (1) Answer the following question.

(2) It carries **ten** marks.

**16.** Find the lengths of tangent, normal, sub tangent and subnormal to the curve  $y = x^3 - 2x^2 + 4$  at the point  $(2, 4)$ .



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