



C16-A/AA/BM/CH/CHST/AEI/MNG/  
MET/TT/IT/PCT—102

6002

BOARD DIPLOMA EXAMINATION, (C-16)  
MARCH/APRIL—2018  
FIRST YEAR (COMMON) EXAMINATION

ENGINEERING MATHEMATICS—I

Time : 3 hours ]

[ Total Marks : 80

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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. Resolve

$$\frac{3x}{(x-2)(x-1)}$$

into partial fractions.

2. If  $A = \begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$ , then show that  $A^2 - 4A - 7I = O$ , where  $I$  is the identity matrix and  $O$  is the null matrix.

3. If  $A = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 3 & 4 \\ 5 & 6 & x \end{pmatrix}$  and  $\det A = 45$ , then find the value of  $x$ .

4. If  $A = B = 45^\circ$ , then show that  $(1 + \tan A)(1 + \tan B) = 2$ .

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5. If  $x = \frac{1}{2\cos\theta}$ , then show that  $x^2 = \frac{1}{2\cos 2\theta}$ .
6. Express the complex number  $\sqrt{3} + i$  in modulus-amplitude form.
7. Find the distance from the origin to the straight line  $3x + 4y + 5 = 0$ .
8. Find the equation of the straight line passing through the point  $(3, -4)$  and parallel to the line  $3x - y - 31 = 0$ .
9. Evaluate :
- $$\lim_{x \rightarrow 0} \frac{3x - \sin 3x}{x^3}$$
10. Find the derivative of  $\log[\log(\log x)]$  with respect to  $x$ .

**PART—B**

10×5=50

- Instructions :** (1) Answer *any five* questions.  
(2) Each question carries **ten** marks.  
(3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. (a) If  $A = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ , then find  $A^{-1}$ .

(b) Solve the equations  $3x + y + z = 3$ ,  $2x + 2y + 5z = 1$  and  $x + 3y + 4z = 2$  by Cramer's rule.

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12. (a) Prove that

$$\frac{\sin 8A}{\cos 8A} - \frac{\sin 6A}{\cos 6A} = \tan 7A$$

(b) If  $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \pi/2$ , then prove that  $xy + yz + zx = 1$ .

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13. (a) Solve  $\cos^{-1} \sqrt{3} \sin^{-1} x = 1$

(b) In a  $\triangle ABC$ , if  $A = 60^\circ$ , then prove that

$$\frac{c}{a} \frac{b}{c} = \frac{b}{a} = 1$$

14. (a) Find the centre and radius of the circle  $x^2 + y^2 - 6x - 4y - 12 = 0$ .

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

15. (a) Differentiate  $e^{\tan^{-1} x}$  with respect to  $\tan^{-1} x$ .

(b) If  $y = \sqrt{\log x} \sqrt{\log x} \sqrt{\log x} \dots$ , then find  $\frac{dy}{dx}$ .

16. (a) If  $x = a(\cos t - t \sin t)$  and  $y = a(\sin t + t \cos t)$ , then find  $\frac{d^2y}{dx^2}$ .

(b) If  $u = \tan^{-1} \frac{x^3 - y^3}{x - y}$ , then prove that

$$x \frac{du}{dx} - y \frac{du}{dy} = \sin 2u$$

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

(b) A circular metal plate expands by heat so that its radius is increasing at the rate  $0.02$  cm/sec. At what rate its area is increasing when the radius is  $20$  cm?

18. (a) A right circular cylinder is inscribed in a sphere of radius  $R$ . Show that the volume of the cylinder is maximum when its height is  $\frac{2R}{\sqrt{3}}$ .

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

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