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

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

into partial fractions.

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

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

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

5. If $x \quad \frac{1}{x} \quad 2\cos$ , then show that $x^2 \quad \frac{1}{x^2} \quad 2\cos 2$ .

6. Express the complex number $\sqrt{3} \quad i$ in modulus-amplitude form.

7. Find the distance from the origin to the straight line $3x \quad 4y \quad 5 \quad 0$.

8. Find the equation of the straight line passing through the point $( \; 3, \quad 4)$ and parallel to the line $3x \quad y \quad 31 \quad 0$.

9. Evaluate :

$$\lim_{x \quad 0} \frac{3x \quad \sin 3x}{x}$$

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 $A \quad \begin{matrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{matrix}$ , then find $A^{\;\,1}$.

*(b)* Solve the equations $3x \quad y \quad z \quad 3$, $2x \quad 2y \quad 5z \quad\; 1$ and $x \quad 3y \quad 4z \quad 2$ by Cramer's rule.

12. *(a)* Prove that

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

*(b)* If $\tan^{\;\,1} x \quad \tan^{\;\,1} y \quad \tan^{\;\,1} z \quad /2$, then prove that $xy \quad yz \quad zx \quad 1$.

**13.** *(a)* Solve $\cos \quad \sqrt{3}\sin \quad 1$

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

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

**14.** *(a)* Find the centre and radius of the circle $x^2 \quad y^2 \quad 6x \quad 4y \quad 12 \quad 0$.

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

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

*(b)* If $y \quad \sqrt{\log x \quad \sqrt{\log x \quad \sqrt{\log x \quad \ldots}}}$, then find $\frac{dy}{dx}$.

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

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

$$x\frac{u}{x} \quad y\frac{u}{y} \quad \sin 2u$$

**17.** *(a)* Find the lengths of the tangent, normal, sub-tangent and subnormal to the curve $y \quad x^3 \quad 2x^2 \quad 4$ 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 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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