C09–A–102/C09–AA–102/C09–AEI–102/C09–BM–102/
C09–C–102/C09–CM–102/C09–CH–102/C09–CHPC–102/
C09–CHPP–102/C09–CHOT–102/C09–CHST–102/
C09–EC–102/C09–EE–102/C09–IT–102/C09–M–102/
C09–MET–102/C09–MNG–102/ C09–PET–102/
C09–TT–102/C09–RAC–**102**

3002

BOARD DIPLOMA EXAMINATION, (C–09)

MARCH/APRIL—2017

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. If $x - \dfrac{1}{x} = 2$, find the values of $x^2 - \dfrac{1}{x^2}$.

2. Express $x^2 - 4x - 21$ in the form $X^2 - A^2$.

3. Resolve $\dfrac{5x - 6}{(x - 2)(1 - x)}$ into partial fractions.

4. Show that $\tan(45 + \theta).\tan(45 - \theta) = 1$.

5. Find the modulus and amplitude of $\sqrt{3} - i$.

6. Show that $\dfrac{\cos 3\theta + \sin 3\theta}{\cos\theta - \sin\theta} = 1 + 2\sin 2\theta$.

7. Find the equation of the straight line passing through the point $(1, 2)$ and parallel to the line $3x + 4y + 5 = 0$.

8. Find the centre and radius of the circle $x^2 + y^2 - 6x + 8y + 1 = 0$.

9. Find $\lim\limits_{\theta \to 0} \dfrac{1 - \cos 2\theta}{\theta^2}$.

10. If $x = a\cos\theta,\; y = b\sin\theta$, find $\dfrac{dy}{dx}$.

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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 inverse of the matrix $\begin{pmatrix} 1 & 2 & 2 \\ 1 & 3 & 0 \\ 0 & 2 & 1 \end{pmatrix}$.

     (b) Show that

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

12. *(a)* Show that

$$\frac{\cos 7A + \cos 5A + \cos 3A + \cos A}{\sin A + \sin 3A + \sin 5A + \sin 7A} = \cot 4A$$

     (b) Show that

$$\sin^{-1}\frac{3}{5} + \sin^{-1}\frac{5}{13} = \cos^{-1}\frac{33}{65}$$

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

(b) In any $\triangle ABC$ if $A = 60°$, then show that $\dfrac{b}{c+a} + \dfrac{c}{a+b} = 1$.

14. *(a)* Find the vertex, focus, equation of the directrix and the length of latus rectum of the parabola $y^2 - 4x - 4y + 16 = 0$.

(b) Find the equation of the ellipse whose focus is $(0, 0)$, eccentricity is $\dfrac{1}{2}$ and directrix is $x + y + 1 = 0$.

15. *(a)* Find the equation of the hyperbola whose foci are $(6, 4)$ and $(-4, 4)$ and eccentricity is 2.

(b) Show that the points $(-2, 4, 1)$, $(-1, 5, 5)$, $(2, 2, 5)$ and $(1, 1, 1)$ form a square.

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

(b) A circular plate of metal when heated such that its radius increases at the rate of 0·02 cm/sec. At what rate its area increases when the radius is 20 cm?

17. *(a)* If $x^2 + y^2 - 6x - 3y + 1 = 0$, find $\dfrac{dy}{dx}$.

(b) Find the derivative of $\tan^{-1} \dfrac{2x}{1 - x^2}$ with respect to x.

18. *(a)* Find the maximum and minimum values of $4x^3 - 9x^2 - 12x + 1$.

(b) If there is an error of 1% in measuring the side of a square plate, find the percentage error in its area.

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