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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)
## OCT/NOV—2016
## 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) Answer should be brief and straight to the point and shall not exceed *five* simple sentences.

**1.** Simplify $m - [n - [2n - (3n - (5n - m))]] - 3n$ by removing the brackets.

**2.** Find the quotient and remainder when $2x - 3$ is divided by $5x - 7$.

**3.** Resolve

$$\frac{7x - 11}{(x - 1)(x - 2)}$$

into partial fractions.

**4.** Express $\sqrt{3} - i$ in the modulus amplitude form.

**5.** Prove that $\cos\theta\,\cos(60-\theta)\cos(60+\theta)=\frac{1}{4}\cos 3\theta$.

**6.** If $A+B+C=180º$, show that

$$\tan\frac{A}{2}\tan\frac{B}{2}+\tan\frac{B}{2}\tan\frac{C}{2}+\tan\frac{C}{2}\tan\frac{A}{2}=1$$

**7.** Find the perpendicular distance from the point $(5, -7)$ to the line $3x+5y+7=0$.

**8.** Find the centre and radius of the circle

$$25x^2+25y^2-20x+30y-12$$

**9.** Find the derivative of $x^3\log x$ w.r.t. $x$.

**10.** Find

$$\underset{\theta\to 0}{\text{Lt}}\ \frac{\tan a\theta}{\sin b\theta}$$

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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.

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

**11.** *(a)* If

$$A=\begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$$

Find $A^2$.

*(b)* Solve the equations

$$x+2y+3z=6$$
$$2x+4y+z=7$$
$$3x+2y+9z=14$$

using Cramer's rule.

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**12.** *(a)* Solve $2\cos^2\theta - 3\cos\theta + 1 = 0$.

   *(b)* In any $ABC$, show that $\sum \dfrac{\sin A}{a} = \dfrac{3}{2R}$.

**13.** *(a)* Show that
$$\frac{\sin 17A + \sin 7A}{\cos 17A + \cos 7A} = \tan 12A$$

   *(b)* Show that
$$\tan^{-1}\frac{2}{3} + \cot^{-1}\frac{4}{3} = \tan^{-1}\frac{17}{6}$$

**14.** *(a)* Find the equation of parabola whose axis is parallel to $X$-axis and passing through the points $(-2, 1)$, $(1, 2)$ and $(-1, 3)$.

   *(b)* Find the centre, vertices, eccentricity, foci, equations of directrices and lengths of latus rectum of the ellipses represented by the equation $4x^2 + 9y^2 = 36$.

**15.** *(a)* Find the equation to the rectangular hyperbola with focus $(3, 4)$ and directrix $4x + 3y + 1 = 0$.

   *(b)* Find the centroid of the tetrahedron whose vertices are $(-9, 2, 4), (-3, 1, 2), (4, 6, 7), (8, 2, 0)$.

**16.** *(a)* If
$$y = \frac{(x-a)(x-b)}{(x+a)(x+b)}$$
Find $\dfrac{dy}{dx}$.

   *(b)* If
$$u = \log(x + y + z)$$
Show that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} + z\dfrac{\partial u}{\partial z} = 1$.

**17.** *(a)* Find the volume of the largest right circular cone that can be inscribed in a sphere of radius $R$.

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   *(b)* Time of oscillation of a simple pendulum of variable length $l$ is given by $T = 2\pi\sqrt{\dfrac{l}{g}}$. If the length is increased by 4%, find the approximate percentage increase in its time of oscillation where $g$ is constant.

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**18.** *(a)* Find the angle between the curves $y^2 = 4x$ and $x - y = 1$ at any point of intersection.

*(b)* A circular plate of metal expands by heat so that its radius increases at the rate of $0 \cdot 01$cm/sec. At what rate is the surface increasing when the radius is 2 cm?

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