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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/C09-PET-102/C09-TT-102/C09-RAC-**102**

3002

BOARD DIPLOMA EXAMINATION, (C-09)

OCT/NOV—2015

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. Find the quotient and remainder, when $6x^3 - 19x^2 - x + 29$ is divided by $2x - 3$.

2. If $x - \frac{1}{x} = 3$, then find the value of $x^2 - \frac{1}{x^2}$.

3. Resolve $\frac{3x + 1}{(x - 2)(x + 3)}$ into partial fractions.

4. Given that $\tan A = \frac{5}{6}$ and $\tan B = \frac{1}{11}$, prove that $A + B = \frac{\pi}{4}$.

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5. Prove that

$$\frac{1 - \cos 2}{\sin 2} = \cot$$

6. If $z = 3 - 4i$, then calculate the value of $z\bar{z}$ and $z - \bar{z}$.

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

8. Find the equation of the circle with centre at (2, -3) and radius 4.

9. Find :

$$\lim_{x \rightarrow 4} \frac{x - 4}{x^3 - 64}$$

10. Find $\frac{d}{dx}$, if $x = a \cos t$ and $y = b \sin t$

PART—B

10×5=50

Instructions : (1) Answer *any five* questions.

(2) Each question carries **ten** marks.

11. (a) Solve the equations

$$\begin{aligned} 3x + y + 2z &= 3 \\ 2x + 3y + z &= 3 \\ x + 2y + z &= 4 \end{aligned}$$

using Cramer's rule.

(b) Prove that

$$\begin{vmatrix} a & b & c \\ a + b & b + c & c + a \\ b + c & c + a & a + b \end{vmatrix} = a^3 + b^3 + c^3 - 3abc$$

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12. (a) In $\triangle ABC$, prove that

$$\sin 2A + \sin 2B + \sin 2C = 4 \sin A \cos B \cos C$$

(b) Prove that

$$\tan^{-1} \frac{1}{3} + \cot^{-1}(7) = \tan^{-1} \frac{1}{2}$$

13. (a) Solve : $4 \cos^2 \theta + 6 \sin^2 \theta = 0$

(b) Solve the $\triangle ABC$ with $a = 2$, $c = \sqrt{6}$ and $C = 60^\circ$.

14. (a) Find the equation of the parabola with focus $(3, -4)$ and vertex $(3, -2)$.

(b) Find the eccentricity, foci, length of latus rectum and directrices of the ellipse $25x^2 + 16y^2 = 1600$.

15. (a) Find the equation of rectangular hyperbola whose focus is $(2, 3)$ and directrix is the line $3x - 4y = 5$.

(b) Find the perimeter and centroid of the triangle formed by the points $(2, 3, 7)$, $(4, 1, 7)$ and $(5, 11, 3)$.

16. (a) Find $\frac{dy}{dx}$, if

$$y = \sin x^{\sin x^{\sin x^{\sin x^{\dots}}}}$$

(b) If

$$u = \tan^{-1} \frac{x^2 + y^2}{x - y}$$

prove that $x \frac{u}{x} + y \frac{u}{y} = \frac{1}{2} \sin 2u$

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- 17.** (a) Find the angle between the curves $x^2 + y^2 = 8$ and $x^2 = 2y$.
- (b) The displacement(s) of a particle is given at any time t by the relation $s = 2t^3 - 15t^2 + 36t - 70$. Find its (i) initial velocity, (ii) time when velocity is zero.
- 18.** (a) Find the two positive numbers x and y such that $x + y = 35$ and x^2y^5 is maximum.
- (b) If the radius of a spherical balloon is increased by 0.2%, find the approximate percentage increase in volume.
