

FIRST SEMESTER DIPLOMA EXAMINATION IN ENGINEERING/
TECHNOLOGY—MARCH, 2013

TECHNICAL MATHEMATICS –I
(Common - Except DCP and CABM)

[Time : 3 hours

(Maximum marks : 100)

Marks

PART—A

I Answer *all* questions. Each question carries 2 marks.

(a) If $\begin{vmatrix} 3x & 7 \\ 2 & 8 \end{vmatrix} = 0$, find the value of x .

(b) If $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$ $B = \begin{bmatrix} 3 & -3 \\ 0 & 1 \end{bmatrix}$ find $2A - 3B$.

(c) If ${}^n C_{10} = {}^n C_{15}$, find n .

(d) Evaluate $\cos\theta$ and $\tan\theta$, if $\sin\theta = \frac{1}{2}$.

(e) Find the slope of the line whose inclination to the x - axis is 45° . (5x2=10)

PART—B

II Answer *any five* questions. Each question carries 6 marks.

(a) If $A = \begin{bmatrix} 3 & 1 & -1 \\ 0 & 1 & 2 \end{bmatrix}$ show that $A A^T$ is symmetric.

(b) Solve using determinants, $3x + y - z = 3$, $-x + y + z = 1$, $x + y + z = 3$.

(c) Find the fourth term in the expansion of $(3x - y^2)^5$.

(d) Prove that $\sin\theta + \sin 3\theta + \sin 5\theta + \sin 7\theta = 4 \cos\theta \cos 2\theta \sin 4\theta$.

(e) Prove that $\frac{\sin 3\theta}{\sin \theta} + \frac{\cos 3\theta}{\cos \theta} = 4 \cos 2\theta$.

(f) Find the equation of the line passing through the points $(2, -1)$ and $(-6, 3)$. Also find the slope of the line.

(g) Find the value of k so that the following lines are concurrent.

$5x + 2y - 4 = 0$, $2x + ky + 11 = 0$, $3x - 4y - 18 = 0$. (5x6=30)

PART—C

(Answer *one* full question from each unit. Each question carries 15 marks.)

UNIT – I

- III (a) If $A = \begin{bmatrix} 2 & 3 \\ 0 & 1 \end{bmatrix}$ and I unit matrix of same order then find $A^3 - 3A^2 + 2A + I$. 5
- (b) If $A = \begin{bmatrix} 5 & 3 \\ 2 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 7 & 5 \\ 4 & 3 \end{bmatrix}$, show that $(AB)^{-1} = B^{-1} A^{-1}$. 5
- (c) Find x, if $\begin{vmatrix} 2 & x & 3 \\ 4 & 1 & 2 \\ 0 & 1 & 1 \end{vmatrix} = \begin{vmatrix} x & 2 \\ 2 & 3 \end{vmatrix}$ 5

OR

- IV (a) If $A = \begin{bmatrix} 1 & 2 \\ 4 & 9 \end{bmatrix}$, $B = \begin{bmatrix} 4 & 1 \\ 6 & -5 \end{bmatrix}$, show that $(A + B)^T = A^T + B^T$. 4
- (b) Find k, if the following system of equations are consistent :
 $x + y + 1 = 0$, $x + 2y + 1 = 0$, $2x + 3y + k = 0$. 5
- (c) Solve by finding the inverse of the coefficient matrix, the equations :
 $x + y + z = 1$, $2x + 2y + 3z = 6$, $x + 4y + 9z = 3$. 6

UNIT – II

- V (a) If ${}^{20}C_r = {}^{20}C_{r+2}$, find r. 4
- (b) Find the middle term of $(x^2 + 3/x)^{20}$. 5
- (c) Prove that $\frac{\tan 45^\circ - \tan 30^\circ}{1 + \tan 45^\circ \tan 30^\circ} = 2 - \sqrt{3}$. 6

OR

- VI (a) Expand $(3x - y/2)^4$ binomially. 5
- (b) Find the constant term in the expansion of $(\sqrt{x} + 2/x^2)^{10}$. 6
- (c) Prove that $\sec^2\theta + \operatorname{cosec}^2\theta = \sec^2\theta \operatorname{cosec}^2\theta$. 4

UNIT – III

- VII (a) In ΔABC , prove $\Sigma a (\sin B - \sin C) = 0$. 5
- (b) Prove that $\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ = 1/16$. 5
- (c) Show that $\sin 120^\circ \cos 330^\circ + \cos 240^\circ \sin 330^\circ = 1$. 5

OR

- VIII (a) Express $3\cos\theta + 4\sin\theta$ in the form $R \sin(\theta + \alpha)$, where α is acute. 4
- (b) Prove $\sin(A + B) \sin(A - B) = \sin^2 A - \sin^2 B$. 5
- (c) In any $\triangle ABC$, show that $(b+c) \sin A/2 = a \cos \frac{(B-C)}{2}$. 6

UNIT - IV

- IX (a) Solve $\triangle ABC$. Given $a = 5\text{m}$, $B = 30^\circ$, $c = 8\text{m}$. 6
- (b) Find the slope and intercepts of the line $3x + 4y = 12$. 4
- (c) Find k so that the lines $kx + 2y - 10 = 0$, $2x - 4y + 15 = 0$, are :
- (i) Perpendicular to each other
- (ii) Parallel to each other. 5

OR

- X (a) Solve $\triangle ABC$ using Napier's formula :
Given, $a = 87\text{cm}$, $b = 53\text{cm}$, $C = 70^\circ$. 5
- (b) Find the equation to the line passing through the point of intersection of $x - y + 1 = 0$, and $2x - 3y + 2 = 0$, and perpendicular to $x + y - 6 = 0$. 5
- (c) A line passes through $(-6, 3)$. The x -intercept of the line is 3 times its y -intercept. Find the equation of the line. 5

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