

FIRST SEMESTER DIPLOMA EXAMINATION IN ENGINEERING /
TECHNOLOGY — OCTOBER, 2015

ENGINEERING MATHEMATICS – I

(Common for all branches except DCP and CABM)

[Time : 3 hours]

(Maximum marks : 100)

PART—A

(Maximum marks : 10)

Marks

I Answer all questions. Each question carries 2 marks.

1. Evaluate $3\sin 30 - 4\cos^3 60$.
2. If $\tan x = 0.38$, find the value of $\tan 2x$ without using table.
3. In $\triangle ABC$, $a = 12\text{cm}$, $b = 13\text{cm}$, $c = 60^\circ$ find C.
4. Evaluate $\lim_{x \rightarrow 0} \frac{cx + d}{ax + b}$.
5. Find the rate of change of area of a circle with respect to its radius. (5x2=10)

PART—B

(Maximum marks : 30)

II Answer any five questions from the following. Each question carries 6 marks.

1. (a) Prove that $\frac{\sec \theta}{\sec \theta + 1} + \frac{\sec \theta}{\sec \theta - 1} = 2\operatorname{cosec}^2 \theta$.
(b) If $\cos \theta = \frac{1}{2}$, θ lies in first quadrant, find $3\sin \theta - 4\tan \theta$.
2. Find the value of $\tan 75$ without using tables and show that $\tan 75 + \cot 75 = 4$.
3. Show that $\sin 10 \sin 50 \sin 70 = \frac{1}{8}$.
4. Differentiate x'' with respect to x by the method of first principles.
5. If $y = x + \frac{1}{x}$, prove that $x^2 y'' + xy' = y$.
6. The displacement of a body is given by $x = 3\cos 4t + 5\sin 4t$. Show that acceleration varies as the distance.
7. A cylindrical can open at one end is to have a volume of $64\pi \text{ cm}^3$. Find the radius and height of the cylinder such that the metal used is minimum. (5x6=30)



PART— C

(Maximum marks : 60)

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

UNIT - I

- III (a) Evaluate $\sin 780 \cos 390 + \sin(-300) \cos 330$. 5
- (b) An aeroplane starts from a place and flies 1000m along a straight line at 45° to the horizontal. Find the horizontal distance described. 4
- (c) If $\cos A = \frac{3}{5}$, $\tan B = \frac{5}{12}$, A and B are acute angles find $\sin(A+B)$ and $\cos(A+B)$. 6

OR

- IV (a) Express $\sqrt{3} \cos x + \sin x$ in the form $R \sin(x + \alpha)$. 5
- (b) Evaluate $\sin^3 \frac{\pi}{3} \cos^2 \frac{\pi}{4} \tan \frac{\pi}{6}$. 4
- (c) Prove that $\frac{1 + \sin A}{\cos A} = \frac{\cos A}{1 - \sin A}$ 3
- (d) If $\theta = 45^\circ$, verify that $\cos 2\theta = \cos^2 \theta - \sin^2 \theta$. 3

UNIT - II

- V (a) Find the value of $\cos \frac{A}{2}$ and $\sin \frac{A}{2}$. Given $\sin A = 0.75$ 5
- (b) Prove that $\sin 50^\circ - \sin 70^\circ + \cos 80^\circ = 0$. 5
- (c) Solve $\triangle ABC$, given $a = 87\text{cm}$, $b = 53\text{cm}$, $c = 70^\circ$. 5

OR

- VI (a) Prove that $\frac{\sin A + \sin 3A + \sin 5A}{\cos A + \cos 3A + \cos 5A} = \tan 3A$. 5
- (b) Show that $a(b^2 + c^2) \cos A + b(c^2 + a^2) \cos B + c(a^2 + b^2) \cos C = 3abc$. 4
- (c) Find the area of a triangle having $a = 4\text{cm}$, $b = 5\text{cm}$, $c = 7\text{cm}$. 3
- (d) In $\triangle ABC$, $A = 45^\circ$, $B = 60^\circ$, $a = 5\text{cm}$, find b . 3

UNIT - III

- VII (a) Evaluate :

- (i) $\lim_{x \rightarrow 3} \frac{x^3 - 27}{x^4 - 81}$ (ii) $\lim_{\theta \rightarrow \frac{\pi}{2}} \frac{\cos \theta}{\frac{\pi}{2} - \theta}$ (4+4=8)
- (b) Find $\frac{dy}{dx}$, if $xy = c$. 3
- (c) Find $\frac{dy}{dx}$, if $x = a(\theta - \sin \theta)$ and $y = a \sin \theta$. 4

OR



VIII (a) Find $\frac{dy}{dx}$, if :

(i) $y = \frac{\sin 2x}{x}$

(ii) $y = x^2 \cos x^2$

(3+3=6)

(b) If $y = a \sin mx$, prove that $y'' = m^2 y = 0$.

5

(c) If $x^3 + y^3 = 3axy$, find $\frac{dy}{dx}$

4

UNIT - IV

IX (a) Find the equations of tangent and normal to the curve $y = 3x^2 + x + 2$ at (1, 2).

5

(b) The deflection of a beam is given by $S = 2x^3 - 9x^2 + 12x$. Find the maximum deflection.

5

(c) A balloon is spherical in shape. Gas is escaping from it at the rate of 10cc/second. Find the rate at which its radius is shrinking when the radius is 15 cm.

5

OR

X (a) A circular plate of radius 3 inches expands when heated at the rate of 2 inches/second. Find the rate at which area of the plate is increasing at the end of 3 seconds.

5

(b) An open box is to be out of a square sheet of side 12cm by cutting off equal squares at each corner and turning up the sides. What size of the square sheet should be cut in order that the volume of the box may be maximum.

5

(c) If S denotes the displacement of a particle at time t second and $S = 2t^3 - 9t^2 + 12t + 6$ find the value of ' t ' when the acceleration is zero. Find the velocity at that time.

5