

FIRST SEMESTER DIPLOMA EXAMINATION IN
ENGINEERING/TECHNOLOGY – APRIL, 2017

ENGINEERING MATHEMATICS – I

(Common to all Diploma Programmes)

[Time : 3 hours

(Maximum marks : 100)

PART – A

(Maximum marks : 10)

Marks

I Answer all questions. Each question carries 2 marks.

1. Evaluate $\lim_{x \rightarrow 3} \frac{x^3 - 27}{x - 3}$
2. If $\tan A = 3/4$ and A is acute, find $\sin 2A$.
3. In a triangle ABC , $A = 45^\circ$, $B = 60^\circ$, $a = 5\text{cm}$. Find b .
4. Evaluate $4 \sin^3 60^\circ - 3 \cos 30^\circ$.
5. Find the slope of the curve $y = 3x^2 + x - 2$ at $(1, 2)$. (5×2 = 10)

PART – B

(Maximum marks : 30)

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

1. Express $\sqrt{3}\cos x + \sin x$ in the form $R \sin(x + \alpha)$ where α is acute.
2. If $A + B = 45^\circ$, show that $(1 + \tan A)(1 + \tan B) = 2$.
3. Show that $\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ = \frac{1}{16}$.
4. Differentiate 'sin x' by method of first principles.
5. If $y = x^2 \sin x$ prove that $x^2 y'' - 4xy' + (x^2 + 6)y = 0$.
6. The distance S metres travelled by a particle is given by $S = ae^{nt} + be^{-nt}$ where t represents the time. Show that the acceleration varies as the distance.
7. A balloon is spherical in shape. Gas is escaping from it at the rate of 10cc/sec. How fast is the surface area shrinking, when the radius is 15cm.

(5×6 = 30)

PART - C

(Maximum marks : 60)

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

UNIT - I

- III (a) Prove that $\frac{\operatorname{cosec} \theta}{\operatorname{cosec} \theta - 1} + \frac{\operatorname{cosec} \theta}{\operatorname{cosec} \theta + 1} = 2 \sec^2 \theta$ 5
- (b) If $\tan A = 3/4$, $\sin B = 5/13$. A lies in third quadrant and B lies in second quadrant. Find $\sin(A - B)$ and $\cos(A + B)$. 5
- (c) Evaluate $\cos 570 \sin 510 - \sin 330 \cos 390$. 5

OR

- IV (a) Prove that $\sin(\pi/3 + A) - \sin(\pi/3 - A) = \sin A$. 5
- (b) If $\tan x = 7/24$ and x is in 3rd quadrant. Find the value of $3 \sin x - 4 \cos x$. 4
- (c) Find the value of $\tan 75$ without using tables and show that $\tan 75 + \cot 75 = 4$. 6

UNIT - II

- V (a) Prove that $\frac{(\sin 2A + \sin 5A - \sin A)}{\cos 2A + \cos 5A + \cos A} = \tan 2A$. 5
- (b) Show that $\frac{1 + \cos 2A}{\sin 2A} = \cot A$ and deduce the value of $\cot 15$. 5
- (c) Solve triangle ABC, given $a = 4\text{cm}$ $b = 5\text{cm}$ $c = 7\text{cm}$. 5

OR

- VI (a) Prove that $\frac{\sin 3A}{\sin A} - \frac{\cos 3A}{\cos A} = 2$. 5
- (b) Show that $\cos 55 + \cos 65 + \cos 175 = 0$. 5
- (c) Prove that $R(a^2 + b^2 + c^2) = abc(\cot A + \cot B + \cot C)$. 5

UNIT - III

- VII (a) Evaluate : $\lim_{x \rightarrow 3} \frac{x^3 - 64}{x^2 - 16}$ 4
- (b) Find $\frac{dy}{dx}$, if (i) $y = \log \sin \sqrt{x}$ (ii) $\frac{(x^2 \sec x)}{(x^2 + 3)}$ 6
- (c) If $x = a(\cos t + t \sin t)$ $y = a(\sin t - t \cos t)$, find $\frac{dy}{dx}$ 5

OR

- VIII (a) Find $\frac{dy}{dx}$ if: (i) $y = \cot^5(x^2)$ (ii) $\frac{\sin(\log x)}{x}$ 6
- (b) Find $\frac{dy}{dx}$, if $x^2 y^2 = x^3 + y^3 + 3xy$. 5
- (c) Find the derivative of $\cot x$ using quotient rule. 4

UNIT - IV

- IX (a) Find the equations to the tangent and normal to the curve $y = \cos x$ at $x = \pi/6$. 5
- (b) If S denotes the displacement of a particle at the time t secs and $S = t^3 - 6t^2 + 8t - 4$, find the time when the acceleration is 12 cm/sec^2 . Find the velocity at that time. 5
- (c) The deflection of a beam is given by $y = 2x^3 - 9x^2 + 12x$. Find the maximum deflection. 5

OR

- X (a) Find the values of x for which the tangent to the curve $y = \frac{x}{(1-x)^2}$ will be parallel to the (i) X axis, (ii) Y axis 5
- (b) A spherical rubber bladder of radius 3" has air pumped into it. If the radius increases at a uniform rate of 1" per minute, find the rate at which the volume is increasing at the end of 3 minutes. 5
- (c) The sum of the diameter and length of an open cylindrical vessel is 40cm. Prove that the maximum volume is obtained. When the radius is equal to the length? 5