

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/
MANAGEMENT/COMMERCIAL PRACTICE, NOVEMBER – 2020**

ENGINEERING MATHEMATICS – I

[Maximum Marks: 75]

[Time: 2.15 Hours]

PART-A

(Answer **any three** questions in one or two sentences. Each question carries 2 marks)

- I. 1. Evaluate $3\sin \pi/6 - 4\cos^3 \pi/3$.
2. In ΔABC , $a = 5 \text{ cm}$, $b = 8 \text{ cm}$, $C = 60^\circ$ find 'c'.
3. Prove that in ΔABC , $abc = 4R\Delta$.
4. Find $\frac{dy}{dx}$ if $y = x^3 \tan x$.
5. Find the rate of change of area of a circle w.r.to its radius. (3 x 2 = 6)

PART-B

(Answer **any four** of the following questions. Each question carries 6 marks)

- II 1. Find the value of $\tan 15^\circ$ without using tables and show that $\tan 15^\circ + \cot 15^\circ = 4$.
2. Express $\sqrt{3}\cos x + \sin x$ in the form $R\sin(x + \alpha)$ where ' α ' is acute.
3. Prove that $\sin 20^\circ \sin 40^\circ \sin 80^\circ = \frac{\sqrt{3}}{8}$.
4. Solve ΔABC given $a = 4 \text{ cm}$, $b = 5 \text{ cm}$, $c = 7 \text{ cm}$.
5. Differentiate 'sinx' by the method of first principles.
6. The displacement of a body is given by $S = 3\cos 4t + 5\sin 4t$. Show that acceleration varies as its displacement.
7. Find the maximum volume of a cone whose slant height is 'l' cm. (4 x 6 = 24)

PART-C

(Answer **any of the three units** from the following. Each full question carries 15 marks)

UNIT – I

- III (a) Prove that $(\cot A - 1)^2 + (\cot A + 1)^2 = 2\operatorname{cosec}^2 A$. (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. (5)
(c) If $\sin A = -4/5$ and A lies in third quadrant, find all other trigonometric functions. (5)

OR

- IV (a) If $\sin A = 8/17$, $\sin B = 3/5$, A, B are acute angles, find $\sin (A-B)$ and $\cos (A+B)$. (5)
- (b) Prove that $\frac{\operatorname{cosec} A}{\operatorname{cosec} A - 1} + \frac{\operatorname{cosec} A}{\operatorname{cosec} A + 1} = 2 \sec^2 A$. (5)
- (b) Prove that $\frac{\cos(90+A) \sec(360+A) \tan(180-A)}{\sec(A-720) \sin(540+A) \cot(A-90)} = 1$. (5)

UNIT - II

- V (a) Prove that $\frac{\sin A + \sin 3A + \sin 5A}{\cos A + \cos 3A + \cos 5A} = \tan 3A$. (5)
- (b) Show that $a(b^2 + c^2) \cos A + b(c^2 + a^2) \cos B + c(a^2 + b^2) \cos C = 3abc$. (5)
- (c) Solve $\triangle ABC$, given $a = 5 \text{ cm}$, $b = 8 \text{ cm}$, $C = 30^\circ$. (5)

OR

- VI (a) Prove that $\sin 33^\circ + \cos 63^\circ = \cos 3^\circ$. (5)
- (b) Prove that $\cot A - \cot 2A = \operatorname{cosec} 2A$. (5)
- (c) Prove that $2(b \cos A + c \cos B + a \cos C) = a^2 + b^2 + c^2$. (5)

UNIT - III

- VII (a) Evaluate $\lim_{x \rightarrow 4} \frac{x^3 - 64}{x^2 - 16}$. (5)
- (b) Find $\frac{dy}{dx}$, if $x = a(\Theta + \sin \Theta)$, $y = a(1 - \cos \Theta)$. (5)
- (c) If $y = A \cos px + B \sin px$ (A, B, p are constant), show that $\frac{d^2 y}{dx^2}$ is proportional to 'y'. (5)

OR

- VIII (a) Find the derivative of $\tan x$ using quotient rule. (5)
- (b) If $x^3 + y^3 = 3axy$, find $\frac{dy}{dx}$. (5)
- (c) If $y = x^2 \sin x$, prove that $x^2 y'' - 4xy' + (x^2 + 6)y = 0$. (5)

UNIT - IV

- IX (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) Find the equation of tangent and normal to the curve $y = 3x^2 + x + 2$ at $(1, 2)$ (5)
- (c) The deflection of a beam is given by $S = 2x^3 - 9x^2 + 12x$. Find the maximum deflection. (5)

OR

- X (a) If S denotes the displacement of a particle at time ' t ' seconds 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)
- (b) An open box is to be made out of a square sheet of side 12cm by cutting of 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) The perimeter of a rectangle is 100m . Find the sides when the area is maximum. (5)