

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/  
MANAGEMENT/COMMERCIAL PRACTICE, APRIL – 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. Prove that  $(\sin A + \cos A)^2 = 1 + 2 \sin A \cos A$ .
2. Find the value of  $3 \sin 15^\circ - 4 \sin^3 15^\circ$ .
3. Find the area of a Triangle given,  $b=3\text{cm}$ ,  $c= 2 \text{ cm}$  and  $A=30^\circ$ .
4. Evaluate  $\lim_{x \rightarrow 4} \frac{x^2+16}{x+4}$ .
5. Find  $\frac{dy}{dx}$  if  $y = x \cos x$ .

(3 x 2 =6)

**PART-B**

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

II

1. Find the value of  $\tan 75^\circ$ , without using tables and show that  $\tan 75^\circ + \cot 75^\circ = 4$
2. Prove that  $\cos 20^\circ \cdot \cos 40^\circ \cdot \cos 60^\circ \cdot \cos 80^\circ = \frac{1}{16}$ .
3. If  $\tan A = \frac{m}{m+1}$ ,  $\tan B = \frac{1}{2m+1}$ ,  $A$  and  $B$  are acute angles. Prove that  $A + B = 45^\circ$ .
4. Solve  $\Delta ABC$  given  $A = 35^\circ$ ,  $B = 68^\circ$  and  $c = 25 \text{ cm}$ .
5. Differentiate  $\cos x$  by the method of first principles.
6. Find  $\frac{dy}{dx}$  if  $x^3 + y^3 = 3axy$ .
7. Find the equation to the tangent and normal to the curve  $y = 3x^2 - 1$  at  $(2,11)$ .

(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  $\frac{1+\sin A}{\cos A} = \frac{\cos A}{1-\sin A}$  5 marks  
(b) If  $r \sin(\theta + \alpha) = 3 \cos \theta + 4 \sin \theta$ , find the value of  $r$ . 5 marks  
(c) Prove that  $\sin(A + B) \cdot \sin(A - B) = \sin^2 A - \sin^2 B$ . 5 marks

OR

- IV. (a) Prove that  $\frac{\sqrt{1-\sin \theta}}{\sqrt{1+\sin \theta}} = \sec \theta - \tan \theta$ . 5 marks  
(b) If  $\tan A = 3/4$ ,  $\sin B = 5/13$ , find  $\sin(A + B)$  and  $\cos(A + B)$ . 5 marks  
(c) The horizontal distance between two towers is 60m and the angle of depression of the first tower as seen from the second which is in 150m height is  $30^\circ$ . Find the height of the first tower. 5 marks

#### UNIT- II

- V. (a) Prove that  $\cos 55^\circ + \cos 65^\circ + \cos 175^\circ = 0$ . 5 marks  
(b) Prove that  $2(bc \cos A + ca \cos B + ab \cos C) = a^2 + b^2 + c^2$ . 5 marks  
(c) Show that  $\sin 40 - \sin 80 + \sin 20 = 0$ . 5 marks

OR

- VI. (a) prove that  $\frac{\sin 3A}{\sin A} + \frac{\cos 3A}{\cos A} = 4 \cos 2A$ . 5 marks  
(b) Show that  $\sin 33 + \cos 33 = \cos 3$ . 5 marks  
(c) Two angles of a triangular plot of land are  $53^\circ 17'$  and  $67^\circ 9'$  and the side between them is measured to be 100m. How many meters of fencing is required to fence the plot? 5 marks

UNIT- III

- VII. (a) Evaluate  $\lim_{x \rightarrow 5} \frac{x^3 - 125}{x^2 - 25}$  4 marks
- (b) Find  $\frac{dy}{dx}$  if (i)  $x = at^2, y = 2at$  (ii)  $y = (x^2 + 1)^{10} \sec 5x$  (3+3=6 marks)
- (c) If  $ax^2 + by^2 + 2gx + 2fy + c = 0$ , find  $\frac{dy}{dx}$ . 5 marks

OR

- VIII. (a) Evaluate  $\lim_{x \rightarrow \infty} \frac{x^2 + 2x - 5}{3x^3 - 5x + 1}$ . 5 marks
- (b) Find the derivative of  $y = \cot x$  using quotient rule. 5 marks
- (c) If  $y = a \cos x + b \sin x$ , show that  $y'' + y = 0$ . 5 marks

UNIT- IV

- IX. (a) Prove that a rectangle of fixed perimeter has its maximum area when it becomes a square. 5 marks
- (b) Find the velocity and acceleration at time  $t=4$  seconds of a body whose displacement 'S' covered in time 't' seconds is given by  
 $S = 2t^2 + 3t - 2$ . 5 marks
- (c) Find the maximum and minimum values of  $y = 2x^3 - 3x^2 - 36x + 10$ . 5 marks

OR

- X. (a) An open box is to be made out of a square sheet of side 18 cm, by cutting off equal squares at each corner and turning up the sides. What size of the squares should be cut in order that the volume of the box may be maximum? 5 marks
- (b) Find the values of 'x' for which tangent to the curve  $y = \frac{x}{(1-x)^2}$  will be parallel to the x-axis. 5 marks
- (c) A balloon is spherical in shape. Gas is escaping from it at the rate of 10cc per second. How fast is the surface area shrinking when the radius is 15 cm? 5 marks