

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  $\alpha$  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  $10\text{cc/sec}$ . How fast is the surface area shrinking, when the radius is  $15\text{cm}$ .

(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 : I.  $\frac{x^3 - 64}{x^2 - 16}$  as  $x \rightarrow 3$  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  $x = a(\cos t + 1 \sin t)$ ,  $y = a(\sin t - \cos t)$ , 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  $12 \text{ cm/sec}^2$ . 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  $40 \text{ cm}$ . Prove that the maximum volume is obtained. When the radius is equal to the length? 5