

TED (15) – 1002

(REVISION — 2015)

Reg. No. ....

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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/  
MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2017

ENGINEERING MATHEMATICS – I

[Time : 3 hours

(Maximum marks : 100)

PART — A

(Maximum marks : 10)

Marks

I Answer all questions. Each question carries 2 marks.

1. Prove that  $(1 + \cos A)(1 - \cos A) = \sin^2 A$
2. Find the value of  $3\sin 15^\circ - 4\sin^3 15^\circ$
3. Find  $\frac{dy}{dx}$  if  $y = x^3 \tan x$ .
4. Find the rate of change of volume  $V$  with respect to the side of a cube.
5. Find the area of triangle ABC given  $B = 3\text{cm}$ ,  $C = 2\text{cm}$  and  $A = 30^\circ$

(5×2 = 10)

PART — B

(Maximum marks : 30)

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

1. Prove that  $\left(\frac{\tan\theta + \sec\theta - 1}{\tan\theta - \sec\theta + 1}\right) = \frac{1 + \sin\theta}{\cos\theta}$
2. If  $\tan A = \frac{m}{m+1}$ ,  $\tan B = \frac{1}{2m+1}$  A and B are acute angles.  
Prove that  $A + B = 45^\circ$
3. Prove that  $\sin 20^\circ \cdot \sin 40^\circ \cdot \sin 80^\circ = \frac{\sqrt{3}}{8}$
4. Prove that  $R(a^2 + b^2 + c^2) = abc(\cot A + \cot B + \cot C)$  where R is radius of circumcircle.
5. Differentiate  $x^n$  by method of first principles.
6. A particle moves such that the displacement from a fixed point 'o' is always given by  $S = 5\cos(nt) + 4\sin(nt)$  where  $n$  is a constant. Prove that the acceleration varies as its displacement  $S$  at the instant.
7. Find the equation to the tangent and normal to the curve  $y = 3x^2 + x - 2$  at  $(1, 2)$ .

(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  $\left(\frac{1 + \sin A}{\cos A}\right) = \left(\frac{\cos A}{1 - \sin A}\right)$  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
- (c) If  $\sin A = \frac{-4}{5}$  and  $A$  lies in third quadrant, find all other trigonometric functions. 5

OR

- IV (a) If  $\cos A = 3/5$ ,  $\tan B = 5/12$ ,  $A$  and  $B$  are acute angles, find the values of  $\sin(A + B)$  and  $\cos(A - B)$ . 6
- (b) Prove that  $\frac{\tan 45 - \tan 30}{1 + \tan 45 \tan 30} = 2 - \sqrt{3}$  4
- (c) Express  $5 \sin x - 12 \cos x$  in the form  $R \sin(x - \infty)$  5

## UNIT — II

- V (a) Prove that  $\sin 33 + \cos 63 = \cos 3$  5
- (b) Show that  $(a-b) \cos \frac{C}{2} = c \sin \frac{A-B}{2}$  5
- (c) Solve triangle ABC, given  $a = 2\text{cm}$   $b = 3\text{cm}$   $c = 4\text{cm}$  5

OR

- VI (a) Prove that  $\cos \frac{\pi}{8} + \cos \frac{3\pi}{8} + \cos \frac{5\pi}{8} + \cos \frac{7\pi}{8} = 0$  5
- (b) Prove that  $2 [b \cos A + c \cos B + a \cos C] = a^2 + b^2 + c^2$  5
- (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 150m. How many metres of fencing is required to fence the plot ? 5

## UNIT — III

- VII (a) Evaluate  $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - 1}{x}$  4
- (b) Find  $\frac{dy}{dx}$ , if (i)  $y = \frac{\cot 11x}{(x^3 - 1)^2}$  (ii)  $(x^2 + 1)^{10} \sec^5 x$  (3+3)
- (c) If  $x = a(\theta + \sin \theta)$   $y = a(1 - \cos \theta)$  find  $\frac{dy}{dx}$  5

OR

Marks

- VIII (a) Find the derivative of  $\cot x$  using quotient rule. 5
- (b) If  $y = \sin^{-1} x$  prove that  $(1-x^2) \frac{d^2y}{dx^2} - x \frac{dy}{dx} = 0$  5
- (c) If  $x$  and  $y$  are connected by the relation  $ax^2 + 2hxy + by^2 = 0$  find  $\frac{dy}{dx}$ . 5

## UNIT — IV

- IX (a) Show that all the points on the curve  $x^3 + y^3 = 3axy$  at which the tangents are parallel to the  $x$ -axis lie on the curve,  $ay = x^2$ . 5
- (b) A spherical balloon is inflated by pumping 25cc of gas per second. Find the rate at which the radius of the balloon is increasing when the radius is 15 cm. 5
- (c) The deflection of a beam is given by  $y = 4x^3 + 9x^2 - 12x + 2$ . Find the maximum deflection. 5

OR

- X (a) Prove that a rectangle of fixed perimeter has its maximum area when it becomes a square. 5
- (b) A circular patch of oil spreads out on water, the area growing at the rate of 6 sq.cm per minute. How fast is the radius increasing when the radius is 2cms.? 5
- (c) The distance travelled by a moving body is given by  $S = 2t^3 - 9t^2 + 12t + 6$ . Find the time when the acceleration is zero. 5