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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/ COMMERCIAL PRACTICE, APRIL-2022

A22 - 07435

ENGINEERING MATHEMATICS - I

[Maximum marks: 100]

PART – A

Maximum marks : 10

I (Answer *all* the questions in one or two sentences. Each question carries 2 marks)

- 1. Prove that $\cos^2 A \sin^2 A = 1 2 \sin^2 A$.
- 2. If $\cos A = \frac{4}{5}$ and A is acute, find $\cos 3A$
- 3. Find the area of the triangle ABC, given b = 3cm, c = 2cm, $A = 30^{\circ}$.
- 4. If $y = x \tan x$, Find $\frac{dy}{dx}$
- 5. Find the velocity and acceleration at time 't' of a particle moving according to $s = t^2 - 3t + 1.$ (5 x 2 = 10)

PART – B

Maximum marks : 30

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

- 1. Express $4 \cos \theta + 3 \sin \theta$ in the form $R \sin(\theta + \alpha)$. Where α is acute.
- 2. Prove that $\cos 20.\cos 40.\cos 80 = \frac{1}{8}$
- 3. Prove that in any triangle ABC, $R(a^2 + b^2 + c^2) = abc(\cot A + \cot B + \cot C)$
- 4. Differentiate $\cos x$ by the method of first principles.
- 5. Find $\frac{dy}{dx}$ if $x^2 + y^2 = 25xy$.
- 6. Find the equation to the tangent and normal to the curve $x^2 + y^2 = 25$ at (3,-4).
- 7. Prove that $\cos 570^{\circ} \sin 510^{\circ} -\sin 330^{\circ} \cos 390^{\circ} = 0.$

PART – C

Maximum marks : 60

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

UNIT –I

III. (a) Prove that $\frac{\cos\theta}{1+\sin\theta} + \frac{1+\sin\theta}{\cos\theta} = 2 \sec \theta$



(Time: 3 Hours)

 $(5 \times 6 = 30)$

(5)



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(5)

(b) If
$$\sin A = \frac{8}{17}$$
, $\sin B = \frac{3}{5}$; A,B are acute, find $\sin (A - B)$ and $\cos (A + B)$ (5)

OR

IV.(a) Prove that
$$\frac{cosec A}{cosec A-1} + \frac{cosec A}{cosec A+1} = 2 \sec^2 A$$
 (5)

(b) If
$$\sin A = \frac{2}{5}$$
 and A is acute, find $\sin 2A$ and $\cos 2A$. (5)

(c) Show that $\tan 75^0 + \cot 75^0 = 4$ without using tables.

UNIT-II

(a) Prove that $\frac{\sin A + \sin 3A + \sin 5A}{\sin 4 + \sin 2A} = \tan 2A$	(5)
V. (a) Prove that $\frac{1}{\cos A + \cos 3A + \cos 5A} = \tan 3A$	(3)
(b) Prove that $\sin\theta + \sin 3\theta + \sin 5\theta + \sin 7\theta = 4 \cos \theta \cdot \cos 2\theta \cdot \sin 4\theta$.	(5)
(c) Solve $\triangle ABC$, given $a = 2cm$, $b = 3cm$ and $c = 4cm$.	(5)

OR

VI. (a) Prove that $\sin 50^{\circ} - \sin 70^{\circ} + \sin 10^{\circ} = 0$.	(5)
(b) Prove that $\cos 55^0 + \cos 65^0 + \cos 175^0 = 0$	(5)
(c) Solve $\triangle ABC$, given $a = 5$ cm, $b = 8$ cm and $C = 30^{\circ}$.	(5)

UNIT-III

VII. (a) Evaluate (i)
$$\lim_{x \to 0} \frac{\sin 3x \cdot \cos x}{x}$$
 (ii) $\lim_{x \to \infty} \frac{3x^2 - x + 1}{2x^2 + 2x - 1}$ (3+3=6)

(b) If
$$x = a \sec \theta$$
; $y = b \tan \theta$, find $\frac{dy}{dx}$ (4)

(c) If
$$y = Ae^{nx} + Be^{-nx}$$
, A,B are constants, show that $\frac{d^2y}{dx^2} - n^2y = 0.$ (5)

OR

VIII.(a) Evaluate (i)
$$\lim_{x \to 0} \frac{1 - \cos x}{x^2}$$
 (ii) $\lim_{x \to 1} \frac{x^3 - 1}{x - 1}$ (4+2 = 6)

(b) If
$$y = \log(\sec x - \tan x)$$
, show that $\frac{dy}{dx} = -\sec x$. (4)

(c) If
$$y = a \sin mx$$
, Prove that $\frac{d^2y}{dx^2} + m^2y = 0$ (5)



UNIT-IV

IX	(a)	Find the equations of tangent and normal to the curve $y = 3x^2 + x + 2$ at (1,2).	(5)
	(b)	A circular patch of oil spreads out on water, the area is growing at the rate of 6cm^2 per	
		minute. How fast is the radius increasing when the radius is 2 cms?	(5)
	(c)	Prove that a rectangle of fixed perimeter has its maximum area when it becomes	
		a square	(5)
		OR	
X.	(a)	The distance travelled by a particle moving along a straight line is given by	
		$S = 2t^3 - 9t^2 + 12t + 6$. Find the value of 't' when the acceleration is zero.	(5)
	(b)	The radius of a circular plate is increasing in length at 0.1 cm/sec when heated. What	
		is the rate at which the area is increasing when the radius is 12 cm.	(5)

(c) The deflection of a beam is given by $y = 2x^3 - 9x^2 + 12x$, find the maximum deflection. (5)
