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(REVISION — 2015) Signature ....

FIRST SEMESTER DIPLOMA EXAMINATION IN ENGINEERING/ TECHNOLOGY — OCTOBER/NOVEMBER, 2016

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 $(\sin A + \cos A)^2 = 1 + 2 \sin A \cos A$.
2. If $\sin A = {}^3/_5$ and A is acute find $\sin 3A$.
3. Prove that in triangle ABC, $abc = 4R\Delta$
4. Find $\frac{dy}{dx}$ if $y = e^x \log x$
5. Find the velocity and acceleration at time t, of a particle moving according as $s = 5t^3 - 2t^2 + 9t + 1$. (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 'α' is acute.
2. Prove that $\cos 20° \cos 40° \cos 80° = \frac{1}{8}$.
3. Prove that $R(a^2 + b^2 + c^2) = abc(\cot A + \cot B + \cot C)$
4. Differentiate '$\cos x$' by the method of first principles.
5. Find $\frac{dy}{dx}$ if $x^2y^2 = x^3 + y^3 + 3xy$.
6. Find the equation to the tangent and normal to the curve $y = \sqrt{25 - x^2}$ at (4, 3)
7. Prove that $\sin A + \sin\left(\frac{2\pi}{3} + A\right) + \sin\left(\frac{4\pi}{3} + A\right) = 0$.

(5×6 = 30)

Marks

PART — C

(Maximum marks : 60)

(Answer *one* full question from each unit. 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) If $\sin\theta = \frac{-24}{25}$ and θ is in the fourth quadrant, calculate the value of

$$\frac{30\cos\theta - 7\tan\theta}{3\cos\theta - \sin\theta}$$ 5

(c) Prove that $2\tan 10° + \tan 40° = \tan 50°$ 5

Or

IV (a) Prove that $\sqrt{\frac{1-\sin\theta}{1+\sin\theta}} = \sec\theta - \tan\theta$ 4

(b) If $\cos A = \frac{-12}{13}$, $\cot B = \frac{24}{7}$ and A is in II quadrant and B is in quadrant I, find $\sin(A+B)$ and $\cos(A-B)$. 6

(c) The horizontal between two towers is 50m and the angle of depression of the first tower as seen from the second which is in 150m height is 60°. Find the height of the first tower. 5

Unit – II

V (a) Prove that $\frac{\sin A + \sin 3A + \sin 5A}{\cos A + \cos 3A + \cos 5A} = \tan 3A$. 5

(b) Prove that $\cot A - \cot 2A = \operatorname{cosec} 2A$. 5

(c) Solve ΔABC given a = 4cm, b = 5cm, c = 7cm 5

Or

VI (a) Prove that $\frac{\sin 3A}{\sin A} + \frac{\cos 3A}{\cos A} = 4\cos 2A$ 5

(b) Prove that $\cos 3A + \cos 5A + \cos 9A + \cos 17A = 4\cos 4A\cos 6A\cos 7A$. 4

(c) Two angles of a triangular plot of land are $53°17'$ and $67°09'$ and the side between them is measured to be 100cm. How many metres of fencing is required to fence the plot. 6

Marks

Unit – III

VII (a) Evaluate : $\underset{x \to 4}{\text{Lt}} \dfrac{x^3 - 64}{x^2 - 16}$ 4

(b) Find $\dfrac{dy}{dx}$ if : (i) $y = \dfrac{\sin^{-1}\sqrt{x}}{x^3}$

(ii) $x = a(\theta - \sin\theta)$; $y = a(1 - \cos\theta)$ (3+3=6)

(c) If $y = A\cos px + B\sin px$ (A, B, p are constants),

show that $\dfrac{d^2y}{dx^2}$ is proportional to 'y'. 5

Or

VIII (a) Evaluate : $\underset{x \to 0}{\text{Lt}} \dfrac{1 - \cos 2x}{x^2}$ 3

(b) Find $\dfrac{dy}{dx}$ if $y = (x^2 + 1)^{10} \sec^5 x$ 3

(c) Using quotient rule, find the derivative of 'tanx'. 3

(d) If $y = a\cos(\log x) + b\sin(\log x)$ show that $x^2\dfrac{d^2y}{dx^2} + x\dfrac{dy}{dx} + y = 0$. 6

Unit – IV

IX (a) Find the velocity and acceleration at time t = 4 secs. of a body whose displacement s metre related to time 't' seconds is given by the equation $s = \dfrac{1}{2}t^2 + \sqrt{t}$ 6

(b) A circular plate of radius 3 inches expands when heated at the rate of 2 inch/sec. Find the rate at which the area of the plate is increasing at the end of 3 secs. 4

(c) Find the maximum and minimum values of $2x^3 - 3x^2 - 36x + 10$. 5

Or

X (a) A balloon is spherical in shape. Gas is escaping from it at the rate of 20 cc/sec. How fast is the surface area shrinking when the radius is 15cm. 5

(b) For what values of 'x' is the tangent to the curve $\dfrac{x}{x^2 + 1}$ parallel to the x-axis. 5

(c) An open box is to be made out of a square sheet of side 18cm, 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