

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/
MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2018

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. Find the value of $\tan^2 60 + \tan^2 45$.
2. If $\tan \theta = 3$, find $\sin 2\theta$.
3. Find the area of a triangle given, $b = 3\text{cm}$, $c = 2\text{cm}$ and $A = 30^\circ$.
4. Evaluate $\lim_{x \rightarrow 3} \frac{x^2 + 9}{x + 3}$
5. For what values of x , the function $x^2 - 5x + 6$ is increasing ? (5×2 = 10)

PART — B

(Maximum marks : 30)

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

1. Find the value of $\tan 75$, without using tables and show that $\tan 75 + \cot 75 = 4$.
2. The horizontal distance between two towers is 60 m and the angle of depression of the first tower as seen from the second which is in 150 m height is 30° . Find the height of the first tower.
3. Prove that $\cos \frac{\pi}{8} + \cos \frac{3\pi}{8} + \cos \frac{5\pi}{8} + \cos \frac{7\pi}{8} = 0$
4. Solve $\triangle ABC$, given $a = 4\text{cm}$, $b = 5\text{cm}$, $c = 7\text{cm}$.
5. Find the second derivative of $x^2 \log x$.
6. Differentiate 'sin x' by the method of first principles.
7. If S denotes the displacement of a particle at the time 't' seconds and $S = t^3 - 6t^2 + 8t - 4$.
 - (i) Find the time when the acceleration is 12cm/sec^2 .
 - (ii) The velocity at that time. (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 the third quadrant and B lies in the 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 $\frac{1 + \sin A}{\cos A} = \frac{\cos A}{1 - \sin A}$ 5
- (b) Express $\sqrt{3} \sin x + \cos x$ in the form of $R \sin(x + \alpha)$ where α is acute. 5
- (c) Prove that $\sin(A + B) \sin(A - B) = \sin^2 A - \sin^2 B$. 5

UNIT — II

- V (a) Prove that $\frac{\sin 3A - \sin A}{\cos 3A + \cos A} = \tan A$ 5
- (b) Prove that $\cos 80 \cos 60 \cos 40 \cos 20 = 1/16$ 5
- (c) Show that $a(b^2 + c^2) \cos A + b(c^2 + a^2) \cos B + c(a^2 + b^2) \cos C = 3abc$ 5

OR

- VI (a) Prove that $\frac{\cot A - \tan A}{\cot A + \tan A} = \cos 2A$ 5
- (b) Show that $\sin 40 - \sin 80 + \sin 20 = 0$ 5
- (c) Two angles of a triangular plot of land are 53° and 67° and the side between them is measured to be 100cm. How many meters of fencing is required to fence the plot? 5

UNIT — III

- VII (a) Evaluate (i) $\lim_{x \rightarrow \infty} \frac{3x + 5}{x - 2}$ (ii) Evaluate $\lim_{x \rightarrow 3} \frac{x^2 - 9}{x - 3}$ (3 + 2)
- (b) Find $\frac{dy}{dx}$ if (i) $x = at^2$, $y = 2at$.
(ii) $y = \frac{\sin 2x}{1 + \cos 2x}$ (3 + 2)
- (c) If $y = a \sin x + b \cos x$. Prove that $\frac{d^2y}{dx^2} + y = 0$ 5

OR

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|---|-------|
| VIII (a) Find the derivative of 'sec x' using quotient rule. | 5 |
| (b) Find $\frac{dy}{dx}$ if (i) $y = \log(\sin\sqrt{x})$ (ii) $y = (x^3 + 3) \tan^{-1} x$ | (3+2) |
| (c) If $ax^2 + by^2 + 2gx + 2fy + c = 0$, find $\frac{dy}{dx}$ | 5 |

UNIT — IV

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| IX (a) Find the equation to the tangent and normal to the curve $y = x^2 + 2x - 3$ at (2,5). | 5 |
| (b) A circular plate of radius 3 inches expands when heated at the rate of 2 inches/second. Find the rate at which the area of the plate is increasing at the end of 3 seconds. | 5 |
| (c) The deflection of a beam is given by $y = 2x^3 - 9x^2 + 12x$. Find the maximum deflection. | 5 |

OR

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| 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 x - axis. | 5 |
| (b) A balloon is spherical in shape. Gas is escaping from it at the rate of 10 cc/sec. How fast is the surface area shrinking when the radius is 15 cm ? | 5 |
| (c) The perimeter of a rectangle is 100 m. Find the sides when the area is maximum. | 5 |
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