



C09-CHOT-102/C09-M-102

3040

BOARD DIPLOMA EXAMINATION, (C-09)

OCT/NOV—2013

DME—FIRST YEAR EXAMINATION

ENGINEERING MATHEMATICS—I

Time : 3 hours]

[Total Marks : 80

PART—A

- Instructions :** (1) Answer **all** questions.
(2) Each question carries **three** marks.
(3) Answer should be brief and straight to the point and shall not exceed *five* simple sentences.

1. If $x = \frac{1}{x}$, find the value of $x^3 - \frac{1}{x^3}$.

2. Rationalise the denominator of $\frac{\sqrt{5} - \sqrt{3}}{\sqrt{5} + \sqrt{3}}$.

3. Resolve $\frac{4}{(x-2)(x-5)}$ into partial fractions.

4. If $A + B + C = 180^\circ$, prove that
 $\tan A + \tan B + \tan C = \tan A \tan B \tan C$

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5. Show that $\frac{\cot \tan}{\cot \tan} = \cos 2$.
6. Find the modulus of $\frac{7 - 24i}{3 - 4i}$.
7. Find the equation of the straight line passing through the point (2, -5) and perpendicular to the line $7x - 2y - 1 = 0$.
8. Find the equation of the point circle with centre (7, -9).
9. Evaluate $\lim_{x \rightarrow 0} \frac{\sin px}{\sin qx}$.
10. Differentiate $e^{6x} \log x$.

PART—B

- Instructions :** (1) Answer *any five* questions.
(2) Each question carries **ten** marks.
(3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. (a) Using Laplace's expansion, evaluate

$$\begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix}$$

- (b) Find the adjoint of

$$\begin{bmatrix} 1 & 2 & 1 \\ 3 & 2 & 3 \\ 1 & 1 & 2 \end{bmatrix}$$

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12. (a) If $A + B + C = 180^\circ$, show that

$$\sin 2A + \sin 2B + \sin 2C = 4 \sin A \sin B \sin C$$

(b) Prove that $\tan^{-1} \frac{1}{7} + \tan^{-1} \frac{1}{13} = \cot^{-1} \frac{9}{2}$.

13. (a) Solve $4 \cos^2 \theta - 6 \sin^2 \theta = 0$.

(b) In any $\triangle ABC$, show that $2bc \cos A = a^2 - b^2 - c^2$.

14. (a) Find the vertex, focus and directrix of the parabola $(y - 2)^2 = 8(x - 1)$.

(b) Find the equation of the ellipse which passes through the points $(7, 2)$ and $(3, 4)$ with axes as coordinate axes.

15. (a) Find the equation of the rectangular hyperbola whose focus is $(3, 4)$ and directrix is $4x - 3y - 1 = 0$.

(b) Find the perimeter and centroid of the triangle formed by the points $(2, 3, 7)$, $(-4, 1, 0)$, $(-5, -11, 3)$.

16. (a) Find $\frac{dy}{dx}$, if $x = a(\sin \theta)$, $y = a(1 - \cos \theta)$.

(b) If $y = \sqrt{x} + \sqrt{x} + \sqrt{x} + \dots$ to ∞ , show that $\frac{dy}{dx} = \frac{1}{2y - 1}$.

17. (a) For any curve, show that $\frac{\text{subnormal}}{\text{subtangent}} = \frac{\text{length of normal}^2}{\text{length of tangent}}$.

(b) When a cube is heated, all its edges increase at the rate of 0.5 cm/min . When one of its edges is 8 cm long, find the rate at which its surface and volume increase.

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- 18.** (a) Show that the square has the smallest perimeter of all the rectangles of given area.
- (b) The radius of a sphere is found by measurement to be 10 cm with a possible error of 0.2. Find the proportional error in the estimated value of (i) its surface area and (ii) its volume.

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