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C16-EC/CHPC/PET-102

6028

BOARD DIPLOMA EXAMINATION, (C-16)

SEPTEMBER/OCTOBER - 2020

DECE—FIRST YEAR EXAMINATION

ENGINEERING MATHEMATICS—I

Time : 3 hours]

[Total Marks : 80

PART—A

3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

1. Resolve $\frac{1}{(x-8)(x-11)}$ into partial fractions.

2. If $A = \begin{pmatrix} 2 & 1 \\ 4 & 3 \end{pmatrix}$, then find $A^2 - 2A - 3I$, where I is a unit matrix of order 2.

3. If $A = \begin{pmatrix} 1 & 3 & 2 \\ 2 & 1 & 3 \\ 4 & 3 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 2 & 4 \\ 1 & 3 & 4 \\ 1 & 2 & 3 \end{pmatrix}$, then find $2A - 3B$.

4. If $\tan A = \frac{1}{2}$ and $\tan B = \frac{1}{3}$, then show that $A + B = 45^\circ$.

5. Prove that $\frac{\sin 2}{1 - \cos 2} = \cot$.

6. Find the real and imaginary parts of the complex number

$$\frac{4 - 2i}{1 - 2i}$$

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7. Find the equation of the straight line passing through the points (1, 2) and (3, 4).

8. Find the distance between the two parallel lines $2x + y - 3 = 0$ and $2x + y - 2 = 0$.

9. Evaluate $\lim_{x \rightarrow 5} \frac{x^3 - 125}{x - 5}$.

10. Find $\frac{dy}{dx}$, if $y = \sqrt{1 - \sin 2x}$.

PART—B

10×5=50

Instructions : (1) Answer *any five* questions.

(2) Each question carries **ten** marks.

11. (a) Prove that

$$\begin{vmatrix} a & b & 2c & a & b \\ & c & b & c & 2a \\ & c & a & c & a & 2b \end{vmatrix} = 2(a + b + c)^3$$

(b) Solve the following equations by using matrix inversion method :

$$x + y + z = 6, x + 2y + z = 2 \text{ and } 2x + y + z = 1$$

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12. (a) Prove that $\cos 20^\circ \cos 30^\circ \cos 40^\circ \cos 80^\circ = \frac{\sqrt{3}}{16}$.

(b) Show that

$$\tan^{-1} \frac{2}{7} + \tan^{-1} \frac{1}{4} = \tan^{-1} \frac{15}{26}$$

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13. (a) Solve $2\sin^2 \theta - 3\cos \theta + 3 = 0$.

(b) In any $\triangle ABC$, if $\angle C = 60^\circ$, then prove that

$$\frac{a}{b} + \frac{b}{c} + \frac{c}{a} = 3$$

14. (a) Find the equation of the circle passing through the points $(0, 0)$, $(1, -2)$ and $(2, 0)$.

(b) Find the equation of the Ellipse whose center is the origin, whose axes are the axes of coordinates and which passes through the points $(2, 1)$ and $(1, 3)$.

15. (a) Find $\frac{dy}{dx}$, if $x^3 + y^3 - 3axy = 10$.

(b) Find $\frac{dy}{dx}$, if $x = e^t \cos t$ and $y = e^t \sin t$.

16. (a) If $y = \sin(\log x)$, then prove that $x^2 y_2 - xy_1 - y = 0$.

(b) If $u = \log \frac{x^4 + y^4}{x - y}$, then prove that $x \frac{u}{x} + y \frac{u}{y} = 3$.

17. (a) Find the equation of tangent and normal to the curve $y = x^2 - 2x + 1$ at $(1, 2)$.

(b) A light is hung 8 m directly above a straight horizontal floor. A man of 2 m tall is walking away from the lamp at a rate of 5.4 m/min. Find the rate at which his shadow is lengthening.

18. (a) Find the maximum and minimum values of $2x^3 - 9x^2 + 12x + 15$.

(b) The time T of a complete oscillation of a simple pendulum of length l is given by $T = 2\pi \sqrt{\frac{l}{g}}$, where g is a constant. Show that the approximate percentage error in the calculated value of T corresponding to an error of 4% in the value of l is 2%.

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[Total Marks : 80

PART—A

3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

1. Resolve $\frac{1}{(x-8)(x+1)}$ into partial fractions.

2. If $A = \begin{bmatrix} 2 & 1 \\ -1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -1 \\ 2 & 0 \end{bmatrix}$, then find $3A - 2B$.

3. Evaluate $\begin{vmatrix} 8 & 2 & 5 \\ 2 & -1 & 9 \\ 7 & 4 & 12 \end{vmatrix}$, using Laplace expansion.

4. If $\tan A = \frac{m}{m+1}$ and $\tan B = \frac{1}{2m+1}$, where A and B are acute angles, then find $A + B$.

5. Prove that $\cos x \cdot \cos(60^\circ - x) \cdot \cos(60^\circ + x) = \frac{1}{4} \cos 3x$.

- * 6. Find the real and imaginary parts of the complex number $(1+3i)(2+i)$.
7. Find the slope of a line passing through the points $A(3,-7)$ and $B(2,-5)$ and also find its equation.
8. Find the equation of the straight line passing through the point $(3,-7)$ and parallel to the line $2x+3y+5=0$.
9. Evaluate $\lim_{x \rightarrow 4} \left(\frac{x^3 - 64}{x^2 - 16} \right)$.
10. Find the derivative of $x^7 + 7^x + 7x$ with respect to x .

PART—B

10×5=50

Instructions : (1) Answer *any five* questions.

(2) Each question carries **ten** marks.

11. Solve the equations

$$x - y + z = 2, \quad 2x + 3y - 4z = -4 \quad \text{and} \quad 3x + y + z = 8$$

using matrix inversion method.

12. (a) Prove that, $\cos A + \cos(120^\circ + A) + \cos(120^\circ - A) = 0$.

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(b) If $\cot^{-1}\left(\frac{1}{x}\right) + \cot^{-1}\left(\frac{1}{y}\right) + \cot^{-1}\left(\frac{1}{z}\right) = \frac{\pi}{2}$, then show that $xy + yz + zx = 1$.

13. (a) Solve the equation, $\cot^2 x - 1 = \operatorname{cosec} x$.

(b) In a $\Delta^{le} ABC$ prove that $\sum (a+b)\cos c = 2s$.

- * 14. (a) Find the equation of the circle whose center is at the point $(2, -3)$ and radius is 4 units.

- (b) Find the center, vertices, eccentricity, foci and length of latus rectum of the ellipse

$$\frac{x^2}{9} + \frac{y^2}{36} = 1$$

15. (a) Find $\frac{dy}{dx}$, if $y = \tan^{-1}\left(\sqrt{\frac{1 - \cos 2x}{1 + \cos 2x}}\right)$.

- (b) Find $\frac{dy}{dx}$, if $y = x^{\log x}$.

16. (a) If $y = \sin(\log x)$, then show that $x^2 y_2 + x y_1 + y = 0$.

- (b) If $u(x, y) = \log(xy + y^2)$, then show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 2$.

17. (a) Find the lengths of tangent, normal, sub-tangent and sub-normal to the curve $x^2 + y^2 - 6x - 2y + 5 = 0$, at the point $(2, -1)$.

- (b) A circular metal expands by heat so that its radius increases at the rate of 1.5 cm/sec. Find the rate of increase of its area when the radius is 12 cm.

18. (a) Find the maximum and minimum values of $f(x) = 2x^3 - 9x^2 + 12x + 15$.

- (b) If time and length of a simple pendulum is given by the equation

$$T = 2\pi\sqrt{\frac{l}{g}}$$

where g is constant. Find the approximate percentage error in the calculated value of T corresponding to an error 0.4% in the value of l .

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