

GEN12 Engineering Mathematics - I

GEN12
GEL13
GEI3

415

REG. NO

OCTOBER 2021

Time: Three hours

Maximum Marks: 75

- Note:
1. Answer ALL the questions in PART-A (1 mark each)
 2. Answer any ONE question from each unit in PART-B (2 marks each)
 3. Answer any ONE question from each unit in PART-C (12 marks each)
 4. The question paper contains TWO Pages.

PART-A (1x5=5)

1. If $A = \begin{pmatrix} 2 & 3 \\ -1 & 4 \end{pmatrix}$, $B = \begin{pmatrix} 5 & 0 \\ 3 & 6 \end{pmatrix}$, find $A+B$.
2. Find the value of $i^2+i^3+i^4$.
3. Convert $\frac{2\pi}{5}$ into degree measure.
4. Evaluate: $\lim_{x \rightarrow 0} \frac{\sin 7x}{9x}$.
5. If $u = e^{x^2+y^2}$ P.T. $\frac{du}{dx} = 2xu$

PART-B (2x5=10)

UNIT-I

6. Find the adjoint of $A = \begin{bmatrix} 2 & 3 & 4 \\ 1 & 2 & 3 \\ -1 & 1 & 2 \end{bmatrix}$
7. Find the general term in the expansion of $(x + 2y)^3$.

UNIT-II

8. Find real and imaginary parts of $\frac{7+2i}{2-3i}$
9. If $X = \cos\theta + i\sin\theta$, find $x^m + \frac{1}{x^m}$.

UNIT-III

10. Prove that $\frac{\sin 2A}{1+\cos 2A} = \tan A$
11. If $\sin\theta = \frac{1}{3}$, find $\sin 3\theta$.

UNIT-IV

12. Find $\frac{dy}{dx}$ if $y = \tan x$.
13. Find $\frac{dy}{dx}$ if $x^2 \sin y = C$.

UNIT-V

14. If $y = ae^x + be^{-x}$ prove that $y_2 = y$
15. Show that $u = x^3 - x^2y + xy^2$ is a homogeneous function.

UNIT-I

16.

a) Find the inverse of $\begin{pmatrix} 1 & 2 & -1 \\ 3 & 8 & 2 \\ 4 & 9 & 1 \end{pmatrix}$.

b) Solve the equations $x+2y-z=-1$, $3x+8y+2z=28$ and $4x+9y-z=14$ by Cramer's rule.

17.

a) Find the Eigen values and Eigen vectors of the matrix $\begin{pmatrix} 2 & -2 & 2 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{pmatrix}$.

b) Find the coefficient of x^{30} in the expansion of $(x^4 + \frac{1}{x^6})^{15}$

UNIT-II

18.

a) Express the complex number $\frac{1+3\sqrt{3}i}{\sqrt{3}+2i}$ in polar form.

b) Prove that $\left(\frac{\cos\theta+i\sin\theta}{\sin\theta-i\cos\theta}\right)^4 = 1$.

19.

a) Solve: $x^7+x^4+x^3+1=0$.

b) Two impedances $z_1 = 10+6j$ and $z_2 = 8-12j$ are connected in parallel across 200 volts, 50 cycles per seconds A.C mains. Calculate the magnitude of the current in each branch and magnitude of the total current in the circuit.

UNIT-III

20.

a) Find the values of all trigonometric functions of θ if $\cos\theta = \frac{-1}{2}$ and θ lies in III quadrant.

b) Point A (9, 12) rotates around the origin O in a plane through 60° in the anticlockwise direction to new position B. find the co-ordinates of the point B.

21.

a) Prove that $(\cos\alpha - \cos\beta)^2 + (\sin\alpha - \sin\beta)^2 = 4\sin^2\left(\frac{\alpha-\beta}{2}\right)$.

b) Show that $\sin^{-1}\left(\frac{3}{5}\right) + \sin^{-1}\left(\frac{8}{17}\right) = \sin^{-1}\left(\frac{77}{85}\right)$

UNIT-IV

22.

a) Evaluate: $\lim_{x \rightarrow 2} \frac{x^3-8}{x^4-16}$

b) Find $\frac{dy}{dx}$ if (i) $y = (1+\sin x) \cos x$, (ii) $y = \frac{1+\cos x}{1-\cos x}$

23.

a) (i) Find $\frac{dy}{dx}$ if $y = \tan^{-1}\left(\frac{3x-x^3}{1-3x^2}\right)$

(ii) Find $\frac{dy}{dx}$ if $x = \cos^3 t$, $y = \sin^3 t$

b) (i) Find $\frac{dy}{dx}$ if $y = x e^x \log x$

(ii) Differentiate x^3 with respect to $x \log x$

UNIT-V

24.

a) If $y = x^2 \cos x$ prove that $x^2 \frac{d^2y}{dx^2} - 4x \frac{dy}{dx} + (x^2+6)y = 0$

b) Find the radius of curvature for $y^2 = 4x$ at (1, 1).

25.

a) If $u = x^3+y^3+3xy^2$ then prove that $x \frac{du}{dx} + y \frac{du}{dy} = 3u$.

b) Show that the functions $u = x^2+y^2+z^2$, $v = x+y+z$ and $w = xy+yz+zx$ are dependent.
