

QUESTION BANK ON ENGINEERING MATHEMATICS-III

(FOR ELECTRICAL ENGINEERING BRANCH)



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Engineering Mathematics – III Question Bank

Complex Numbers

Short answer question.

1. Write in a+ib form $\frac{2-3i}{2+4i}$
2. Find the argument and modulus of the complex number $3+i5$
3. Find the real part and imaginary part of a+ib
4. Find the complex conjugate of $2-8i$
5. $(2+3i)+(3-4i)=$ _____
6. $(5+4i)(2-5i)=$ _____

Long answer type question

1. Find the square root of $2+i3$
2. If $z = (\cos\theta + i \sin\theta)$, show that $z_n + \frac{1}{z_n} = 2 \cos n\theta$ and $z_n - \frac{1}{z_n} = i2 \sin n\theta$
3. If $1, w, w^2$ are the cube root of unity then prove that $(1 + w - w^2)^6 + (1 - w + w^2)^6 = 128$
4. If $1, w, w^2$ are the cube root of unity then prove that
$$(1 + w)(1 + w^2)(1 + w^4) \dots (1 + w)^{2^{11}} = 1$$
5. If $1, w, w^2$ are the cube root of unity then prove that then $(1 + w)^3 - (1 + w^2)^3 = 0$

Rank of a matrix

Short answer type questions

1. Define upper triangular matrix with an example.
2. Define row reduced echelon form of a matrix.
3. Define Rouché's theorem.

4. Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 1 \\ 1 & 2 & 0 \end{bmatrix}$

5. Define rank of a matrix.

Long answer type question

1. Solve $x+2y-z=3$;

$$3x-y+2z=1;$$

$$2x-2y+3z=2$$

2. For what value of γ and μ do the system of equations $x+y+z=6$

$$x+2y+3z=10$$

$$x+2y+\gamma=\mu$$

have i) no solution ii) unique solution iii) infinite solutions

3. Solve the system of linear equation.

$$x-y+z=0$$

$$x+2y-z=0$$

$$2x+y+3z=0$$

4. Test the consistency of the linear equation $5x+3y+7z=4$;

$$3x+26y+2z=13;$$

$$7x+2y+10z=5$$

Differential Equation

Short answer type questions.

1. Define a differential equation.
2. Find the order and degree of the differential equation $\frac{dy}{dx} + x^2 = 1; \frac{d^2y}{dx^2} = \sqrt{3 + \frac{dy}{dx}}$
3. Find the differential equation of the family of curves $y = e^x(A\cos x + B \sin x)$
4. Define homogenous differential equation with an example.
5. Define non-homogenous differential equation with an example.
6. Define linear differential equation with an example.
7. Solve $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$
8. Solve $(D - 2)^2y = e^{2x}$
9. Define a partial differential equation.
10. Form the partial differential equation $z = ax + by + a^2 + b^2$
11. Form the partial differential equation $z = f(x^2 - y^2)$

Long answer type question.

1. Solve $\frac{d^3y}{dx^3} + y = 0$
2. Solve $\frac{d^3y}{dx^3} + 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} + 6y = 0$
3. Solve $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 3x = \sin t$
4. Solve $(D^2 - 2D + 2)y = e^x \sin x$
5. Solve $(D^2 + 3d + 2)y = x^2$
6. Solve $p\sqrt{x} + q\sqrt{y} = \sqrt{z}$
7. Solve $x(y - z)p + y(z - x)q = z(x - y)$
8. Solve $x^2(y - z)p + y^2(z - x)q = z^2(x - y)$
9. Solve $x(y^2 - z^2)p + y(z^2 - x^2)q = z(x^2 - y^2)$

Laplace Transformation

1. Find the inverse laplace transform of $\frac{s}{(s^2+4)^2}$.
2. Find laplace Transformation of $\{ e^{4t} + 5 \}$
3. Find laplace Transformation of $L\{\cos(2t) + 7 \sin(2t)\}$
4. Find laplace Transformation of $L(t^2 + 4t + 2)e^{3t}$
5. Find laplace Transformation of $L(6 e^{5t} \cos(2t) - e^{7t})$
6. Find laplace Transformation of $e^{5t}(\cos 3t)$

Numerical Methods

1. Determine the root of the given equation $x^2 - 3 = 0$ for $x \in [1, 2]$ by using bisection method.
2. Determine the root of the given equation $3x^2 - 5x - 2 = 0$ by using bisection method.
3. Using Bisection method find the root of $\cos(x) - x \cdot e^x = 0$ with $a = 0$ and $b = 1$.
4. Determine the root of the given equation $x^2 - \log x = 0$ for $x \in [1, 2]$
5. Use Newton Raphson Method to find the root of the given equation $x^3 - 7x^2 + 8x - 3 = 0$.
6. Use Newton Raphson Method to find the root of the given equation $x^3 - 3x - 5 = 0$

Finite difference and interpolation

1. Construct a forward difference table for the following data

x	0	10	20	30
y	0	0.174	0.347	0.518

2. Construct a forward difference table for $y = f(x) = x^3 + 2x + 1$ for $x = 1, 2, 3, 4, 5$

3. By constructing a difference table and using the second order differences as constant, find the sixth term of the series 8, 12, 19, 29, 42, ...

4. Find (i) Δe^{ax} (ii) $\Delta^2 e^x$ (iii) $\Delta \log x$

5. Using Newton's forward interpolation formula find the cubic polynomial.

x	0	1	2	3
$f(x)$	1	2	1	10

6. Find $f(2.8)$ from the following table.

x	0	1	2	3
$f(x)$	1	2	11	34

7. Using interpolation estimate the output of a factory in 1986 from the following data

Year	1974	1978	1982	1990
Output in 1000 tones	25	60	80	170

8. Use the Trapezoidal Rule with $n=6$ to approximate

$$\int_0^{\pi} \sin x \, dx$$

9. Approximate the integral using the Trapezoidal Rule with $n=2$ subintervals

$$\int_0^1 x^3 \, dx$$

10. Approximate the integral of $f(x) = e^x$ on $[0, 10]$ using the trapezoidal rule

11. Approximate the integral of $f(x) = x^2$ on the interval $[0, 2]$ using the Simpson's $1/3^{\text{rd}}$ rule.

12. Use Simpson's Rule with $n=4$ to approximate the integral

$$\int_0^8 \sqrt{x} \, dx$$

Fourier Series

1. Explain periodic function with examples.
2. State Dirichlet's conditions for a function to be expanded as a Fourier series.
3. 10. Write the formulae for Fourier constants for $f(x)$ in the interval $(-p, p)$.
4. If $f(x) = x^2 - x^4$ is expanded as a Fourier series in $(-l, l)$, find the value of b_n
5. Obtain the sine series for unity in $(0, \pi)$.
6. Find the Fourier series $f(x) = x + x^2$ in $(-\pi, \pi)$