

TH-1- ENGINEERING MATHEMATICS - III

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1 & 2
Figures in the right hand margin indicates marks

1. Answer **All** questions

2 x 10

- Define the rank of a matrix. Find the rank of the matrix $\begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$
- Find the complementary function if the roots of the auxiliary equation are 0, -2, -2, -2.
- Derive a partial differential equation for the following:
 $z = xy + f(x^2 + y^2)$
- Define gamma function. Evaluate $\Gamma(-\frac{1}{2})$.
- Define Numerical Integration and state Trapezoidal rule.
- Define even and odd functions with example.
- Find Laplace Transform of $\sin^2 t$.
- Find the value of Fourier co-efficient ' a_0 ' if
 $f(x) = x + x^2$ in $(-\pi, \pi)$
- Evaluate $\Delta(\tan^{-1} x)$
- Change into $a + ib$ form $\frac{2i}{3+4i}$

2. Answer **Any Six** Questions

6 x 5

- Find the real roots of the equation
 $x^3 - 3x + 1 = 0$
By Newton's Raphson method correct to two decimal places.
- Find the Particular Integral (P.I) of the differential equation

$$\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + y = x e^x \sin x$$

c. Show that

$$L(t \cos at) = \frac{s^2 - a^2}{(s^2 + a^2)^2}$$

- Express $f(x) = |x|$ as a Fourier series in $-\pi < x < \pi$
- Use Lagrange's Interpolation formula to fit a polynomial to the given data:

x	0	1	3
f(x)	1	3	55

f. Find the square root of $-8 + \sqrt{-1}$

g. Using Simpson's $\frac{1}{3}$ rd rule and taking $h = 1$, evaluate

$$\int_0^6 \frac{dx}{1+x}$$

3 a. Investigate for what value of λ and μ the simultaneous equations $x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + \lambda z = \mu$ have 7

(i) No solution

(ii) a unique solution

(iii) an infinite number of solution

b. $(1 - \omega + \omega^2)^5 + (1 + \omega - \omega^2)^5 = 32$ 3

4 a. Obtain the Fourier series for $f(x) = \begin{cases} -k & \text{if } -\pi < x < 0 \\ k & \text{if } 0 < x < \pi \end{cases}$ 5

b. Find the Laplace transform of $\frac{\sin 2t}{t}$ 5

5 a. Obtain the fourier series of $f(x)$ defined by 7

$$f(x) = \begin{cases} 0, & -\pi < x < 0 \\ x^2, & 0 < x < \pi \end{cases}$$

b. Estimate the missing term in the following table : 3

X:	0	1	2	3	4
Y:	2	4	10		78

6 a. $x^2(y - z)p + y^2(z - x)q = z^2(x - y)$ 7

b. Determine the rank of the matrix: 3

$$\begin{bmatrix} 1 & 0 & 1 \\ -1 & 1 & 0 \\ 0 & -1 & 1 \end{bmatrix}$$

7 a. Find the inverse Laplace transform of 5

$$\frac{3s + 7}{s^2 - 2s - 3}$$

b. Using Trapezoidal rule and taking $h = \frac{1}{2}$, evaluate 5

$$\int_0^2 \frac{dx}{1+x}$$

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7 a. Find the inverse Laplace transform of 5

$$\frac{3s + 7}{s^2 - 2s - 3}$$

b. Using Trapezoidal rule and taking $h = \frac{1}{2}$, evaluate 5

$$\int_0^2 \frac{dx}{1+x}$$

III- SEM ELECT/ETC/AE&I/EEE/E&IC/E&M/ELECT(PT)/2019(W)/ (New)

Th. 1 ENGINEERING MATHEMATICS III

Full Marks: 80

Time : 3 Hours

Answer any Five Questions including Q No. 1 & 2

Figures in the right hand margin indicates marks

1. Answer ALL the questions.

a) Find $(1 + w^2 - w)^3 + (1 - w^2 + w)^3$.

2x10

b) Find the rank of the matrix $\begin{bmatrix} 1 & 3 \\ 2 & 6 \end{bmatrix}$.

c) Find the C.F. of $(D^2 + 3)y = e^{2x}$.

d) Form the P.D.E. from $z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$, by eliminating arbitrary constant.

e) Find $L(e^{-2t} \sin t)$.

f) Find a_0 for $f(x) = e^{-x}$ in the interval $0 < x < 2\pi$.

g) Find the period of $\sin 3x$.

h) Find $\Delta^2(ab^x)$ where $h = 1$.

i) Find the 2nd approximation to the root corrected upto two decimal places of $x^3 - 5x + 1 = 0$ by bisection method in $[2, 3]$.

j) Find $\int_0^2 x^2 dx$ using trapezoidal rule taking $h=1$.

5x6

Answer any SIX questions.

2.

a) Find the values of λ and μ for which the following system of equations

$$2x + 3y + 4z = 2$$

$$3x + 4y - 2z = 5$$

$$4x + 6y + \lambda z = \mu \text{ have i) no solution, ii) infinite solutions, and iii) unique solution.}$$

b) Solve $\frac{d^2y}{dx^2} + 2y = e^x \cos 2x$

c) Solve the P.D.E. $(x^2 - y^2 - z^2)p + 2xyq = 2xz$.

d) Find $L^{-1}\left(\frac{(3s+1)}{(s+1)(s^2+1)}\right)$.

e) Find the square root of $-5 + 12i$.

f) Use Lagrange's interpolation formula to fit a polynomial to the data

$$x : 3 \quad 2 \quad 1 \quad -1$$

$$y : 3 \quad 12 \quad 15 \quad -21$$

g) Find the Fourier co-efficient a_0 and a_n for $f(x) = \begin{cases} -\pi & -\pi < x < 0 \\ x & 0 < x < \pi \end{cases}$

3.

a) If $x + \frac{1}{x} = 2\cos\theta$, then prove that $x^n + \frac{1}{x^n} = 2\cos n\theta$.

5

b) Find the fourier coefficient b_n for $f(x) = x^3$ in $-\pi < x < \pi$.

5

4.

a) Find the root of the equation $3x^3 - 9x^2 + 8 = 0$ by Newton-Raphson method correct upto 3 decimal places.

5

b)

Find $L\left(\frac{e^{2t}\sin 3t}{t}\right)$.

5.

a) Using Newton's backward difference interpolation formula find the value of $f(1.6)$.

5

x :	1	1.4	1.8	2.2
y :	3.49	4.82	5.96	6.5

5

b)

Solve $(D^2 + 3D + 2)y = 4\cos^2 x$

6.

a) Obtain the Fourier series for $f(x) = \begin{cases} -x & -\pi < x < 0 \\ x & 0 \leq x < \pi \end{cases}$

5

and show that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$

5

b)

Find $L^{-1}\left(\log\left(\frac{s+1}{s-1}\right)\right)$

7.

a) Find $\int_0^5 \frac{1}{4x+5} dx$ using Simpson's 1/3 rule using 10 subintervals.

5

b)

Find $L(e^{-t}\sin^2 3t)$.

5

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ENGG. MATHEMATICS-III

(Code – BST-301)

Full Marks : 70

Time : 3 hours

Answer any five questions

Figures in the right-hand margin indicate marks

1. (a) Determine the rank of the matrix : 2

$$\begin{bmatrix} 1 & 0 & 1 \\ -1 & 1 & 0 \\ 0 & -1 & 1 \end{bmatrix}$$

- (b) Find the Laplace transform of $(e^{at} - \cos bt)/t$. 5

- (c) Solve : $(D^2 + 4)y = e^x \sin^2 x$. 7

(Turn Over)

(2)

2. (a) Find the Fourier co-efficient a_0 for obtaining a Fourier series for $f(x) = e^{-x}$, $0 < x < 2\pi$. 2

- (b) Find a root of $x^3 - x - 11 = 0$, using bisection method. 5

- (c) Solve : $x(y^2 - z^2)p + y(z^2 - x^2)q - z(x^2 - y^2)r = 0$. 7

3. (a) Find the complementary function of $(D^2 - 2D + 2)y = \sin 3x$. 2

- (b) Find the inverse Laplace transform of $\log\left(\frac{1+S}{S}\right)$. 5

- (c) Express $f(x) = |x|$ as a Fourier series in $-\pi < x < \pi$. 7

4. (a) Form the partial differential equation by eliminating arbitrary functions from $Z = f\left(\frac{y}{x}\right)$. 2

(3)

(b) Evaluate :

$$\int_0^4 e^x dx,$$

using Simpson's $\frac{1}{3}$ rd rule, taking $h = 1$. 5

(c) Solve the following equation by the transform method :

$$y'' - 3y' + 2y = e^{3x}, y(0) = 1 \text{ \& } y'(0) = 0. 7$$

5. (a) Solve : 2

$$p - q = z.$$

(b) Find a Fourier sine series to represent $f(x) = x$ in $0 < x < \pi$. 5

(c) Find the cube root of 41 using Newton-Raphson method. 7

6. (a) Evaluate : http://www.sctevtonline.com 2

$$\Delta \tan^{-1} \left(\frac{n-1}{n} \right)$$

(b) Solve :

$$\frac{d^2 y}{dx^2} + 16y = x \sin 3x. 5$$

(4)

(c) Find the inverse Laplace transform of

$$\frac{S}{(S-3)(S^2+4)}.$$

7. (a) Find :

$$L \left\{ \frac{1}{\sqrt{t}} \right\}.$$

(b) Solve :

$$xp - yq = y^2 - x^2.$$

(c) Investigate for what values of λ and μ the simultaneous equations

$$x + y + z = 6, x + 2y + 3z = 10,$$

$$x + 2y + \lambda z = \mu$$

have (i) no solution

(ii) a unique solution

(iii) an infinite number of solution. 7