3E1206

Roll No. ______________ [Total No. of Pages : 3

3E1206

B.Tech. III-Sem. (Main & Back) Examination, January/February - 2024

Agriculture Engineering

3AG2-01 Advance Engineering Mathematics - I

AN,AG,AE,CE,CR,EC,EI,ME,MH,PT

Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates:

Attempt all Ten questions from Part A, Five questions out of Seven questions from Part B and Three questions out of Five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/ Calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No.205)

PART - A

(Answer should be given up to 25 words only)

(10×2=20)

All questions are compulsory.

1. Show $\Delta^3 y_2 = \nabla^3 y_5$.

2. Show that $\Delta^2 e^x = (e-1)^2 e^x$; interval of differencing being unity.

3. Write the formulae of Trapezoidal rule and simpson 1/3 rule.

4. Using Euler method find the value of y(0.025). Given $\frac{dy}{dx} = x + y + xy; y(0) = 1$ and step size $h = 0.025$.

5. Find the inverse Laplace transform of $\frac{1}{s(s^2+1)}$

6. *If* $L(F(t)) = f(S)$ then find the Laplace Transform of $F'(t)$.

7. Write the formulae of Fourier sine transform and inverse Fourier sine transform.

8. If $F_c[f(x,t)] = \bar{f}(s,t)$ then write $F_c\left[\frac{\partial^2 f(x,t)}{\partial x^2}\right]$

9. State convolution theorem for Z - transform.

10. Find $Z(n)$.

PART - B

(Analytical/Problem solving questions)

Attempt any Five questions. **(5×4=20)**

1. Show $\Delta \tan^{-1}\left(\frac{n-1}{n}\right) = \tan^{-1}\left(\frac{1}{2n^2}\right)$, interval of differencing being unity.

2. The distance covered by an athlete for the 50 meter race is given in the following table.

Time (Seconds)	0	1	2	3	4	5	6
Distance (meters)	0	2.5	8.5	15.5	24.5	36.5	50

Determine the speed of the athlete at t = 5 sec.

3. Find $L(\sin\sqrt{t})$ and hence obtain $L(\cos\sqrt{t}/\sqrt{t})$.

4. Find $\int_0^\infty \left(\frac{e^{-t} - e^{-xt}}{t}\right) dt$

5. Find the Fourier Transform of the following

$$f(x) = \begin{cases} 1 - x^2; & |x| \le 1 \\ 0 & ; |x| > 1 \end{cases}$$

6. Solve the following Integral equation

$$\int_0^\infty f(t)\cos \alpha t \, dt = \begin{cases} 1 - \alpha & 0 \le \alpha \le 1 \\ 0 & , \alpha > 1 \end{cases},$$

7. Use convolution theorem to show that $Z^{-1}\left\{\frac{z(z+1)}{(z-1)^3}\right\} = n^2$

Z^{-}

3E1206

PART - C

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any Three questions. **(3×10=30)**

1. From the following table find $f'(6)$

x	0	2	3	4	6 7	9
f(x)	4	26	58	112	466	922

2. Use Milne's Method to obtain the solution of the equation $\frac{dy}{dx} = x - y^2$ *at* $x = 0.8$ *and at* $x = 1$ given that $y(0) = 0$.

3. Prove $L\left\{\frac{\operatorname{Sin}^2 t}{t}\right\} = \frac{1}{4}\log\left(\frac{S^2+4}{S^2}\right)$ and hence deduce the integral

$$\int_0^\infty \frac{\sin^2 t}{t^2} dt$$

4. Prove $e^{-x}\cos x = \frac{2}{\pi}\int_0^\infty \frac{(\lambda^2+2)\cos\lambda x}{(\lambda^4+4)} d\lambda$

5. Solve the following difference equation by using Z - transform

$$u_{n+2} - u_{n+1} + u_n = n^2 2^n,\ u_0 = u_1 = 0$$