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Roll No.:

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/311001/311101**

Total No. of Pages.: 04

B.Tech. III Sem Main/Back Exam 2022-23

Aeronautical Engineering

**(3AN2-01) – Advanced Engineering Mathematics-I
Common Aeronautical, Agriculture, Ceramic, Civil,
ECE, EIC, ME, Mechtronics**

Time :3Hours

Maximum Marks:120

Min. Passing Marks:

Instructions to Candidates:

Part – A: Short answer questions (up to 25 words) 10 * 2 marks = 20 marks. All ten questions are compulsory.

Part – B: Analytical/Problem Solving questions 5 * 8 marks = 40 marks. Candidates have to answer 5 questions out of 7.

Part – C: Descriptive/Analytical/Problem Solving questions 4 * 15 marks = 60 marks. Candidates have to answer 4 questions out of 5.

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

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

1 _____

2 _____

PART-A

Q.1. Define the forward and backward operator and

Prove that $\nabla\Delta = \Delta - \nabla$

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- Q.2. Write Gauss's backward interpolation formula.
- Q.3. State Second Shifting theorem for Laplace transform.
- Q.4. Write inversion formula for fourier sine and fourier cosine transform.
- Q.5. State convolution theorem for z-transform.
- Q.6. Find the Laplace transform of Heaviside unit step function.
- Q.7. Write the formula for Regula-falsi-method.
- Q.8. Write the formula for Trapezoidal rule in numerical integration.
- Q.9. Write formula for modified Euler's method to solve ordinary differential equations.
- Q.10. State change of scale property for z-transform.

PART-B

Q.1 Evaluate : $\int_0^1 \frac{dx}{1+x^2}$ by using

- (i) Simpson's 1/3 rule
 (ii) Simpson's 3/8 rule
- Q.2. Employ Euler's method to solve:

$$\frac{dy}{dx} = \frac{y^2 - x}{y^2 + x}, \text{ given } y = 1, x = 0$$

Q.3. Use Lagrange's interpolation formula to find y for $x = 2$, given that

x	0	1	3	4
y	5	6	50	105

Q.4. Find $L^{-1} \left\{ \frac{2s^2 - 4}{(s+1)(s-2)(s-3)} \right\}$

Q.5. Find the fourier transform of the function

$$f(x) = \begin{cases} 1 & , |x| < a \\ 0 & , |x| > a \end{cases}$$

- Q.6. Find the z-transform of $u_n = na^n, n \geq 0$
- Q.7. If $f(t)$ be a periodic function with period $T > 0$, then prove that

$$\mathcal{L}\{f(t)\} = \frac{\int_0^T e^{-st} f(t) dt}{1 - e^{-sT}}$$

PART-C

Q.1. A Slider in a machine moves along a fixed straight rod. Its distance x (cm) along the rod is given below for various values of time t (sec):

t	0	0.1	0.2	0.3	0.4	0.5	0.6
x	30.28	31.43	32.98	33.54	33.97	33.48	32.13

Evaluate :

(i) $\frac{dx}{dt}$ for $t = 0.1$

(ii) $\frac{d^2x}{dt^2}$ for $t = 0.5$

Q.2. Use Milne's Predictor corrector method to obtain $y(0.4)$ for the following differential equation:

$$\frac{dy}{dx} = 2e^x - y, \text{ given that}$$

x	0	0.1	0.2	0.3
y	2	2.01	2.04	2.09

Q.3. (a) Find the Laplace transform of

$$\mathcal{L}\left\{\frac{\sin t}{t}\right\}$$

(b) Use Laplace transform to solve the differential equations-

$$(D^2 + 3D + 2)y(t) = 1, \quad y(0) = 0, \quad y'(0) = 0$$

Q.4. Find the inverse Z- transform of

$$f(z) = \frac{z}{(z-1)(z-2)}$$

(i) $|z| < 1$

(ii) $1 < |z| < 2$

(iii) $|z| > 2$

Q.5. Find the Fourier sine and cosine transform of
 $f(x) = e^{-x}$

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