3E1101

Roll No. _____

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B. Tech. III - Sem. (Main / Back) Exam., Dec. 2019

BSC Aeronautical Engineering

3AN2-01 Advanced Engineering Mathematics-I

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

Time: 3 Hours **Maximum Marks: 120**

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.

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 material is permitted during examination. (Mentioned in form No. 205)

1. Scientific Calculator 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 State fundamental theorem of finite difference calculus.

Q.2 Write Trapezoidal formulas for integration.

Q.3 Apply Picard's method to find the first approximate solution of the problem $\frac{dy}{dx} = \frac{x^2}{1+y^2}$, with $y(0) = 0$.

Q.4 Write the Newton – Raphson's formula for transcendental equation.

Q.5 What are the existence condition for Laplace Transform?

Q.6 State convolution theorem for inverse Laplace Transform.

Q.7 Define Fourier Transform.

Q.8 Write down the formula for inverse sine transform.

Q.9 Find z – Transform of unit impulse function $\delta n = \begin{cases} 1 & , n = 0 \\ 0 & , n \neq 0 \end{cases}$

Q.10 Find Z $\{a^n\}$

PART – B

(Analytical/Problem solving questions) **[5×8=40]**

Attempt any five questions

Q.1 The area of a circle of diameter d is given for the following values of d –

d	80	85	90	95	100
Area	5062	5674	6362	7088	7854

Find approximate value for the area of circles of diameter 82 and 91.

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

(a) Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule and

(b) Trapezoidal rule.

Hence obtain the value of π by result obtained from (i) and (ii) taking six intervals.

Q.3 Use Regula Falsi method to find a real root of the equation

$x \log_{10} x - 1.2 = 0$ Correct to five places of decimal.

Q.4 Find the Laplace Transform of-

(a) $t e^{at} \sin at$

(b) $\frac{1}{t}(\cos at - \cos bt)$

Q.5. Apply convolution theorem to evaluate $L^{-1}\left\{\frac{1}{s^2(s^2-a^2)}\right\}$

Q.6 Find the Fourier sine and cosine transform of $f(x) = e^{-x}$, $x \geq 0$. Also show that $\int_0^\infty \frac{x \sin mx}{x^2+1} dx = \frac{\pi}{2} e^{-m}, m > 0.$

Q.7 Find $z^{-1}\left[\frac{z^2}{(z-\alpha)(z-\beta)}\right]$ by convolution theorem.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[4×15=60]**

Attempt any four questions

Q.1 Use Newton's divided difference formula to find the value of f(8) and f(15) from the following data -

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

Q.2 Use, Runge – kutta method to find the approximate value of y for x = 0.4, if $\frac{dy}{dx} = x + y^2$, given that y = 1 when x = 0, taking h = 0.2.

Q.3 Solve by Laplace Transformation method –

$(D^2 - 3D + 2)x = 1 - e^{2t}$, $x(0) = 1$, $x'(0) = 0$

Q.4 Using Fourier sine transform solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, $x > 0, t > 0$, subject to the condition $u(0, t) = 0$

$$u(x, 0) = \begin{cases} 1 & \text{when } 0 < x < 1 \\ 0 & \text{when } x \geq 1 \end{cases}$$

It may by assumed that $u(x, t)$ is bounded, also u and $\frac{\partial u}{\partial x}$ approach zero as $x \to \infty$.

Q.5 Find $z\{\cos n\theta\}$ and $z\{\sin n\theta\}$.
