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Total Page No. : 4

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41N0706/41N0801

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B.TECH. IV SEM MAIN EXAM

AUGUST-2023

ELECTRICAL AND ELECTRONICS  
ENGINEERING

(4EX3-06) - ADVANCED ENGINEERING  
MATHEMATICS-II

COMMON TO EX, EE, EC, EI

Time : 3 Hours]

[Max. Marks : 70

[Min Passing Marks :

**Instructions to Candidates :** Part – A : Short answer type questions (up to 25 words)

10 × 2 marks = 20 marks. All ten questions are compulsory.

Part – B: Analytical/Problem Solving questions 5 × 4 marks = 20 marks. Candidates have to answer 5 questions out of 7.

Part – C: Descriptive/Analytical/Problem Solving questions 3 × 10 marks = 30 marks. Candidates have to answer 3 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 NIL

2 NIL

**PART A**

Q. 1. Find the Laplace transform of  $\cos^2 t$ . [2]

Z-470

(1)

P.T.O.

- Q. 2. State linearity property of inverse Laplace transform. [2]
- Q. 3. Define Fourier cosine and Fourier sine transform. [2]
- Q. 4. State shifting property for Fourier transform. [2]
- Q. 5. Define z-transform and give the region of convergence of z-transform. [2]
- Q. 6. Find z-transform of  $u(n) = \begin{cases} 1, & n \geq 0 \\ 0, & n < 0 \end{cases}$  [2]
- Q. 7. Define analytic function. [2]
- Q. 8. Define harmonic function and prove that  $u = e^x \cos y$  is harmonic. [2]
- Q. 9. State Cauchy Theorem. [2]
- Q. 10. Define Zeros and poles of analytic functions. [2]

### PART B

- Q. 1. Find the Laplace transform of : [4]

$$f(t) = t.e^{at} \cos bt$$

- Q. 2. Find the inverse Laplace transform of : [4]

$$\frac{2s+3}{(s+1)(s^2+1)}$$

- Q. 3. Find the Fourier sine and Cosine transform of : [4]

$$f(x) = \begin{cases} x, & 0 < x \leq 1 \\ 2-x, & 1 < x < 2 \\ 0, & x \geq 2 \end{cases}$$

- Q. 4. Determine the analytic function by Milne-Thomson's method of : [4]

$$u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 2x + 1$$

$$(2) \quad \underline{v = 3x^2 - 6xy + 2y^2 + 2x + 1}$$

Z-470

Q. 5. Evaluate  $\int_C \frac{\cos \pi z}{z^2 - 1} dz$  around the rectangle with vertices  $2 \pm i$  and  $-2 \pm i$ . [4]

Q. 6. Find the z-transform of  $u_n = na^n$  and  $n > 0$ . [4]

Q. 7. Find the residues of the function : [4]

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

at their poles.

### PART C

Q. 1. Use Laplace transform to solve the differential equation : [10]

$$y''(t) + 9y(t) = \cos 2t; \text{ with } y(0) = 1, y\left(\frac{\pi}{2}\right) = -1.$$

Q. 2. Find the Fourier transform of

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

Also evaluate :

$$\int_0^{\infty} \left( \frac{x \cos x - \sin x}{x^3} \right) \cos\left(\frac{x}{2}\right) dx$$

[10]

Q. 3. Prove that the function

$$f(z) = \begin{cases} \frac{x^3(1+i) - y^3(1+i)}{x^2 + y^2}, & z \neq 0 \\ 0, & z = 0 \end{cases}$$

[10]

satisfies C-R equations at origin but  $f'(0)$  does not exist.

[10]

Q. 4. Evaluate  $\int_0^{2\pi} \frac{d\theta}{a + b \sin \theta}$  for  $a > |b|$ .

[10]

Q. 5. Find the inverse z-transform of

(10)

$$F(z) = \frac{1}{(z-3)(z-2)}$$

if:

- (i)  $|z| < 2$
- (ii)  $2 < |z| < 3$
- (iii)  $|z| > 3$ .

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