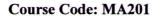
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# APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third semester B.Tech degree examinations (S) September 2020



### Course Name: LINEAR ALGEBRA AND COMPLEX ANALYSIS

Max. Marks: 100 Duration: 3 Hours

## PART A

Answer any two full questions, each carries 15 marks

Marks

1 a) Find out and give reason whether f(z) is continuous at z = 0

(7)

$$f(z) = \begin{cases} \frac{Re\ z}{1 - |z|}, z \neq 0\\ 0, z = 0 \end{cases}$$

- b) Determine a so that  $u = e^{-\pi x} cosay$  is harmonic and then find the harmonic (8) conjugate.
- 2 a) Determine the region of the w-plane into which the triangle formed by x = (7)1, y = 1 and x + y = 1 is mapped under the transformation  $w = z^2$ 
  - b) Check whether  $f(z) = e^z$  is analytic everywhere. (8)
- 3 a) Find the image of  $-\frac{1}{2} \le x \le \frac{1}{2}$ ,  $-\pi < y < \pi$  under  $w = e^z$  (7)
  - b) Find the linear fractional transformation that maps 0,1,2 onto 1,  $\frac{1}{2}$ ,  $\frac{1}{3}$  (8)

#### PART B

## Answer any two full questions, each carries 15 marks

- 4 a) Evaluate  $\int_0^{4+2i} \bar{z} dz$  along the curve given by  $z = t^2 + it$  (7)
  - b) Evaluate  $\int_C \frac{2z-1}{z^2-z} dz$  along the curve C: |z| = 3 using Cauchy's integral formula. (8)
- Find the Laurent's series expansion of  $f(z) = \frac{1}{z^2 + 3z + 2}$  in the region 1 < |z| < 2
  - b) Find all singularities and the corresponding residues (i)  $\frac{8}{1+z^2}$  (ii) tanz (8)
- 6 a) Evaluate  $\int_C \frac{e^z}{\cos \pi z} dz$  where c is the unit circle|z|=1 using Residue Theorem. (7)
  - b) Evaluate  $\int_0^{2\pi} \frac{d\theta}{2 + \cos \theta}$  (8)

### PART C

### Answer any two full questions, each carries 20 marks

7 a) Solve by Gauss elimination (8) 5x - 6y + 4z = 15, 7x + 4y - 3z = 19, 2x + y + 6z = 46

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- b) Find the rank of  $\begin{bmatrix} 6 & 0 & -2 & 0 \\ 0 & -1 & -1 & 5 \\ 2 & -1 & -1 & 0 \end{bmatrix}$  (6)
- c) Let  $V = \{(v_1, v_2, v_3) \in R^3 : 3v_2 + v_3 = 2\}$ . Is V a vector space under the usual operations in  $R^3$ ?
- 8 a) Find the eigen values and eigen vectors of  $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$  (10)
  - b) Is the matrix  $A = \frac{1}{9} \begin{bmatrix} -8 & 4 & 1 \\ 1 & 4 & -8 \\ 4 & 7 & 4 \end{bmatrix}$  orthogonal? (5)
  - c) Check whether  $\{(2,0,0,7), (2,0,0,8), (2,0,0,9), (2,0,1,0)\}$  are linearly (5) independent in  $\mathbb{R}^4$
- 9 a) Diagonalize  $\begin{bmatrix} -19 & 7 \\ -42 & 16 \end{bmatrix}$  (8)
  - b) Transform to principal axis and find what kind of conic section is given by the quadratic form  $4x^2 + 12xy + 13y^2 = 16$

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