R22 Regulation *Subject code:* **4B3BA**

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech III Semester Regular/Supplementary Examinations, December 2024

COMPLEX ANALYSIS AND VECTOR CALCULUS

(Common to EEE & ECE)

Maximum Marks: 60 Date:02.12.2024 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

	Part-A	CO	Bloom Tx
All the following questions carry equal marks	(10X1M=10 Marks)		
1.a)	Write the Cauchy Riemann Equations in Cartesian and Polar form?	1	LI
b)	Define Analytic & Harmonic Functions.	1	LI
c)	State Laurent 's Theorem.	2	L2
d)	Write about generalized Cauchy integral formula?	2	L1
e)	Find the poles of CotZ.	3	L2
f)	Write the Cauchy residue theorem?	3	L1
g)	If r = xi +yj+zk then evaluate ∇r^2.	4	L1
h)	Find a unit normal to the surface $x^3 + y^3 + 3xyz = 3$ at the point (1, 2,-1)	4	L2
i)	State Gauss theorem.	5	L1
j)	State Stoke's theorem.	5	L1

	Part-B	CO	Bloom Tx
Answer All the following questions.	(5X10M=50Marks)		
2	(a) Analyze the concepts of analyticity to derive the necessary condition for f(z) to be analytic in Cartesian Coordinates. [5M]	1	L4
	(b) If $f(z)= u + iv = \frac{1}{z}$. Show that the curves $u=c_1$ and $v=c_2$ intersect Orthogonally [5M]		L2
	OR		
3	(a) Evaluate f(z) = u+iv, given that $u+ v= \frac{Sin2x}{Cosh2y - Cos2x}$ [5M]	1	L4
	(b) Show that $u(x,y) = x^3-3xy^2$ is harmonic and find its harmonic conjugate. [5M]		L2
4	(a) Evaluate the Laurent expansion of $\frac{1}{(z^2-4z+3)}$ for $1<\|z\|<3$ [5M]	2	L5
	(b) Evaluate f (z)= cos z about $z=\pi i$ in Taylor's series. [5M]		L5

	OR		
5	Evaluate $\int_c \frac{z-3}{z^2+2z+5}dz$ Where C is $\lvert z+1-i\rvert = 2$ using Cauchy's Integral formula. [10M]	2	L5
6	Evaluate the Poles of f(z)= $\frac{z^2}{(z-1)(z-2)^2}$ and also find the residues at these poles. [10M]	3	L5
	OR		
7	Evaluate $\int_c \frac{z-1}{(z+1)^2(z-2)}dz$ Where C is $\lvert z-i\rvert = 2$ using Cauchy's Residue theorem. [10M]	3	L5
8	(a) Apply the concept of vector differentiation and show that the vector $\bar{F}$ = (x+3y) $\bar{\imath}$ +(y -3z) $\bar{\jmath}$+(x-2z) $\bar{k}$ is solenoidal and also find $\bar{F}.curl\bar{F}$ [5M] (b) Apply the concept of vector differentiation and show that $div(r^n\bar{r}) = (n+3)r^{-n}$ [5M]	4	L3 L3
	OR		
9	Apply the concept of vector differentiation and show that $\nabla^2(r^n) = n(n+1)r^{n-2}$ [10M]	4	L3 L3
10	Estimate the work done in a moving particle in the force field F= $3x^2i+(2xz-y)j+zk$ along the straight line from (0,0,0) to (2,1,3) [10M]	5	L5
	OR		
11	Test whether Gauss divergence theorem is true for $\vec{F}=(x^3-yz)\vec{i}+(y^2-zx)\vec{j}+(z^2-x)\vec{k}$ over the rectangular parallelepiped $0 \le x \le a, 0 \le y \le b, 0 \le z \le c$ [10M]	5	L5