



R20 Regulation **Subject code: 3B3DA**
TKR COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech III Semester Supplementary Examinations, February 2024
COMPLEX ANALYSIS & VECTOR CALCULUS
(ECE)

Maximum Marks: 70

Date: 16.02.2024 Duration: 3 hours

- Note:**
1. This question paper contains two parts A and B.
 2. Part A is compulsory which carries 20 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

All the following questions carry equal marks (10X2M=20 Marks)		CO	Bloom Tx
1	Find a function w such that $w = u + i v$ is analytic given $u = x^4 - 6x^2y^2 + y^4$	CO1	L1
2	Find 'k' such that $f(x, y) = x^3 + 3kxy^2$ is harmonic.	CO1	L1
3	Find the Taylor's series expansion of e^z about $z = 3$.	CO2	L1
4	What is the Principal part of Laurent's theorem	CO2	L1
5	Find the zeros and its orders of $f(z) = (z - 2)^3(z - 3)^2$	CO3	L1
6	Define Contour Integration?	CO3	L1
7	Find the normal vector to the surface $x^2y + 2xz = 4$ at the point $(2, -2, 3)$.	CO4	L1
8	Prove that $\text{curl grad } \phi = 0$.	CO4	L2
9	Define surface integral?	CO5	L1
10	What is the Geometrical difference between Stoke's theorem and Green's theorem.	CO5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)			
11	a) Derive the C- R equations in polar form. b) Show that $u(x, y) = e^x \cos y$ is harmonic and find its harmonic conjugate $v(x, y)$, also the analytic function.	5M 5M	CO1 L3
OR			
12	If $f(z) = u + i v$ is an analytic function of z and if $u - v = e^x(\cos y - \sin y)$, find $f(z)$ in terms of z .	10 M	CO1 L3
13	Find the Laurent's expansion of $f(z) = \frac{1}{z^2 - 4z + 3}$ for $1 < z < 3$	10M	CO2 L3
OR			
14	(a) State and prove Cauchy's integral theorem (b) Find the poles and residues at each pole of $f(z) = \frac{1 - e^z}{z^4}$.	5M 5M	CO2 L3

15	Evaluate the integrals $\int_c \frac{z-3}{z^2+2z+5} dz$ where 'c' is the circle given by $ z + 1 - i = 2$	10M	CO3	L5
	OR			
16	Use the method of contour integration to evaluate $\int_0^\infty \frac{dx}{x^4+a^4}$ dx.	10M	CO3	L3
17	Prove that if $\vec{r}$ is the position vector of any point in space, then $r^n \vec{r}$ is irrotational	10M	CO4	L3
	OR			
18	a) Prove that $\text{div}(\phi \vec{a}) = (\text{grad} \phi) \cdot \vec{a} + \phi \text{div} \vec{a}$. b) Prove that $\nabla \times (\nabla \times \vec{a}) = \nabla(\nabla \cdot \vec{a}) - \nabla^2 \vec{a}$.	5M 5M	CO4	L3
19	Verify Gauss divergence theorem for $F = x^3 \vec{i} + y^3 \vec{j} + z^3 \vec{k}$ taken over Cube bounded by $x = y = z = 0$ and $x = y = z = a$	10M	CO5	L3
	OR			
20	Verify Greens theorem in the plane for $\int_c (x^2 - xy^3) dx + (y^2 - 2xy) dy$ where c is a square with vertices	10M	CO5	L3