R22 Regulation *Subject code:4B3BA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech III Semester Supplementary Examinations, June 2026

COMPLEX ANALYSIS AND VECTOR CALCULUS

(Common to EEE & ECE)

Maximum Marks: 60 Date:09.06.2026 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

All the following questions carry equal marks (10X1M=10 Marks)		Marks	CO	BTL
1.a)	Write Cauchy-Riemann equations in Cartesian Form.	1M	1	L2
b)	Find the analytic function whose real part is x^2-y^2.	1M	1	L4
c)	Expand f(z) = sinz in Taylor's series about $z = \frac{\pi}{4}$.	1M	2	L3
d)	State Cauchy's integral formula.	1M	2	L1
e)	How do you find the residue at a simple pole ?	1M	3	L2
f)	Explain the process of evaluating an improper integral.	1M	3	L2
g)	Find the greatest value of the directional derivative of the function $f = x^2yz^3$.	1M	4	L5
h)	Define gradient of scalar point function.	1M	4	L1
i)	Define the Surface integral.	1M	5	L1
j)	State Stoke's theorem.	1M	5	L2

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
2	Show that $v(x,y) = -\sin x \sinh y$ is harmonic. Find the conjugate harmonic of v and find an analytic function $f = u + iv$.	10M	1 1	L2
	OR			
3	a) Show that $u(x,y) = e^x \cos y$ is harmonic. b) Determine the analytic function whose real part is $u(x,y) = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$.	5M 5M	1 1	L4 L4
4	a) Evaluate $\int_0^{1+i} Z^2 dz$ along $y = x^2$. b) Evaluate $\int_C \frac{z^3 e^{-z}}{(z-1)^3} dz$, where C is $\lvert z-1\rvert = \frac{1}{2}$ by using Cauchy's integral formula.	5M 5M	2 2	L5 L5
	OR			

5	a) Find Taylor's series expansion of $f(z) = \frac{2z^3+1}{z^2+z}$ about the point $z = i$. b) Obtain the Laurent's series expansion of $f(z) = \frac{e^z}{z(1-3z)}$ about $z = 1$.	5M 5M	2 2	L3 L3
6	Find the residue of $f(z) = \frac{z^3}{(z-1)^2(z-2)(z-3)}$ at its poles. Also evaluate $\oint_C f(z)dz$ where C is the circle $\|Z\| = \frac{1}{2}$.	10M	3	L5
	OR			
7	By integrating around a unit circle, evaluate $\int_0^{2\pi} \frac{1}{5+4cos\theta}\, d\theta$.	10M	3	L5
8	If $\bar{a}$ is a constant vector, prove that $curl\left(\frac{\bar{a}\times\bar{r}}{r^3}\right) = -\frac{\bar{a}}{r^3} + \frac{3\bar{r}}{r^5}(\bar{a}.\bar{r})$.	10M	4	L3
	OR			
9	Find constants a, b, c so that the vector $\bar{A} = (x + 2y + az)\bar{\imath} + (bx - 3y - z)\bar{\jmath} + (4x + cy + 2z)\bar{k}$ is irrotational. Also find φ such that $\bar{A} = \nabla\emptyset$.	10M	4	L5
10	Verify Green's theorem $\oint(3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the region bounded by $y = \sqrt{x}$ and $y = x^2$.	10M	5	L3
	OR			
11	Verify Gauss divergence theorem for $\bar{F} = x^2\bar{\imath} + y^2\bar{\jmath} + z^2\bar{k}$, over the cube formed by the planes $x = 0, x = a, y = 0, y = b, z = 0, z = c$.	10M	5	L3