Reg.No.:

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN

[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]

Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

**Question Paper Code: 20018**

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – JAN. / FEB. 2026

Second Semester

Computer Science and Engineering

U23MA202 – COMPLEX ANALYSIS AND ORDINARY DIFFERENTIAL EQUATIONS

(Common to All)

(Regulation 2023)

Time: Three Hours | Maximum: 100 Marks

Answer ALL the questions

| Knowledge Levels (KL) | K1 – Remembering | K3 – Applying | K5 - Evaluating |
|---|---|---|---|
| | K2 – Understanding | K4 – Analyzing | K6 - Creating |

## PART – A

(10 x 2 = 20 Marks)

| Q.No. | Questions | Marks | KL | CO |
|---|---|---|---|---|
| 1. | Show that $\|z\|^2$ is not analytic at any point. | 2 | K1 | CO1 |
| 2. | Find the invariant points of the transformation $w=\dfrac{2z+6}{z+7}$. | 2 | K2 | CO1 |
| 3. | Evaluate $\int_c \dfrac{z}{(z-1)^3}dz$ *where C is* $\|z\|=2$. Using Cauchy's Integral formula. | 2 | K1 | CO2 |
| 4. | State Taylor series formula about $z = a$. | 2 | K1 | CO2 |
| 5. | Prove that $\nabla\left(r^n\right)=nr^{n-2}\vec{r}$. | 2 | K1 | CO3 |
| 6. | State Greens theorem. | 2 | K1 | CO3 |
| 7. | Find the particular integral of $(D-2)^2y=e^{2x}$. | 2 | K1 | CO4 |
| 8. | Transform $(x^2D^2+xD+1)y=0$ into differential equation with constant coefficients where $D=\dfrac{d}{dx}$. | 2 | K2 | CO4 |
| 9. | Find the Laplace transform of $f(t)=\dfrac{1-e^{-t}}{t}$. | 2 | K1 | CO5 |
| 10. | State initial and final value theorems on Laplace transforms. | 2 | K1 | CO5 |

# PART – B

(5 x 16 = 80 Marks)

| Q.No. | | Questions | Marks | KL | CO |
|---|---|---|---|---|---|
| 11. | a) | (i) If $f(z)$ is analytic (regular) function, prove that $\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)\lvert f(z)\rvert^2 = 4\lvert f'(z)\rvert^2$ | 8 | K5 | CO1 |
| | | (ii) Find image of $\lvert z-2i\rvert = 2$ under the transformation $w=\frac{1}{z}$. | 8 | K3 | CO1 |
| | | (OR) | | | |
| | b) | (i) Find the bilinear transformation which maps the points $z=\infty, i, 0$ onto $w=0,-i,\infty$. | 8 | K5 | CO1 |
| | | (ii) Find the analytic function whose real part is, $\frac{Sin\,2x}{(Cos\,h\,2y - Cos\,2x)}$. | 8 | K5 | CO1 |
| 12. | a) | (i) Using Cauchy's integral formula, evaluate $\int_c \frac{z+4}{z^2+2z+5}dz$ *where C is* $\lvert z+1-i\rvert = 2$. | 8 | K5 | CO2 |
| | | (ii) Evaluate $f(z)=\frac{1}{(z+1)(z+3)}$ in Laurent's series valid for the regions $\lvert z\rvert > 3$ *and* $1 < \lvert z\rvert < 3$. | 8 | K5 | CO2 |
| | | (OR) | | | |
| | b) | (i) Using Cauchy's Residue theorem, evaluate $\int_c \frac{z^2+2}{z^2+4}dz$ *where C is* $\lvert z-i\rvert = 2$. | 8 | K5 | CO2 |
| | | (ii) Prove that $\int_0^{2\pi}\frac{d\theta}{5-4\sin\theta}=\frac{2\pi}{3}$ by contour integration. | 8 | K5 | CO2 |
| 13. | a) | Verify Stokes theorem for $\vec{F}=(x^2+y^2)\,\vec{i}-2xy\,\vec{j}$ taken around the rectangle bounded by the lines $x=\pm a, y=0, y=b$. | 16 | K5 | CO3 |
| | | (OR) | | | |
| | b) | Verify Gauss divergence theorem for $\vec{F}=4xz\,\vec{i}-y^2\,\vec{j}+yz\,\vec{k}$ over the cube bounded by x=0,x=1,y=0,y=1,z=0,z=1. | 16 | K5 | CO3 |
| 14. | a) | (i) Solve $(D^2+6D+8)y=e^{-2x}+\cos^2 x$. | 8 | K3 | CO4 |
| | | (ii) Solve $(x^2D^2-xD+1)y=\left[\frac{\log x}{x}\right]^2$. | 8 | K3 | CO4 |

(OR)

| | | | | | |
|---|---|---|---|---|---|
| | b) | (i) Solve $(D^2+4)y = \sec 2x$ by the method of variation of parameters. | 8 | K3 | CO4 |
| | | (ii) Solve $(3x+2)^2 \frac{d^2y}{dx^2} + 3(3x+2)\frac{dy}{dx} - 36y = 3x^2 + 4x + 1$. | 8 | K3 | CO4 |
| 15. | a) | (i) Find the Laplace transform of the following triangular wave function given by $f(t) = \begin{cases} t & , 0 < t < \pi \\ 2\pi - t & , \pi < t < 2\pi \end{cases}$ With $f(t+2\pi) = f(t)$. | 8 | K5 | CO5 |
| | | (ii) Apply Convolution theorem to evaluate $L^{-1}\left[\frac{s}{(s^2+a^2)^2}\right]$. | 8 | K3 | CO5 |

(OR)

| | | | | | |
|---|---|---|---|---|---|
| | b) | (i) Using Laplace transform solve the differential equation $y'' + 9y = \cos 2t$ *where* $y(0) = 1, y\left(\frac{\pi}{2}\right) = -1$. | 8 | K5 | CO5 |
| | | (ii) Find $L[te^{-t}\sin 3t]$ and $L\left[\frac{e^{-at} - e^{-bt}}{t}\right]$ | 8 | K5 | CO5 |