

Hall Ticket Number:

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Code No. : 12121 N/O

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD

Accredited by NAAC with A++ Grade

B.E. II-Semester Main & Backlog Examinations, August-2023

Differential Equations and Complex Analysis

(Common to Civil, EEE, ECE & Mech.)

Time: 3 hours

Max. Marks: 60

Note: Answer all questions from Part-A and any FIVE from Part-B

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	If $k \cos x dy + y \sin x dx = 0$ is exact, then find the value of k .	2	1	1	1,12
2.	Solve $y dx - x dy = xy^2 dx$.	2	1	1	1,12
3.	Find the complementary function of $y^{iv} + 2y'' + y = \sin^2 4x$.	2	2	2	1,12
4.	Obtain a particular integral of $2y'' - 7y' + 6y = e^{2x}$.	2	2	2	1,12
5.	Show that $f(z) = e^z$ is not analytic at any point.	2	1	3	1,12
6.	State sufficient conditions for a function to be analytic.	2	1	3	1,12
7.	State Cauchy's theorem.	2	1	4	1,12
8.	Classify the singular points of $f(z) = \frac{1 - \cos z}{z^2}$.	2	2	4	1,12
9.	Find the rank of the matrix $A = \begin{pmatrix} 1 & 0 & 1 \\ 0 & -3 & 0 \\ 1 & 0 & 3 \end{pmatrix}$.	2	1	5	1,12
10.	Determine whether the vectors $(1,2,3), (1,-1,2), (4,5,11)$ are linearly dependent.	2	2	5	1,12
Part-B (5 × 8 = 40 Marks)					
11. a)	Solve $(x^2 + y^2 + 1)dx - 2xy dy = 0$.	4	2	1	1,12
b)	Find the general solution and singular solution of the equation $y' = \log(xy' - y)$.	4	3	1	1,12
12. a)	Solve $y''' + y = \sin x + 2x^3 + 4$.	4	3	2	1,12
b)	In an L-C-R circuit, the charge q on a plate of a condenser is given by $L \frac{d^2 q}{dt^2} + R \frac{dq}{dt} + \frac{q}{C} = E \sin pt$. The circuit is tuned to resonance so that $p^2 = \frac{1}{LC}$. If initially the current i and the charge q are zero, show that for small values of $\frac{R}{L}$, the current in the circuit at time t is given by $\frac{Et}{2L} \sin pt$.	4	3	2	1,12

13. a)	Show that the function $f(z) = z ^2$ is differentiable only at $z=0$ and nowhere else.	4	4	3	1,12
b)	Construct the analytic function whose imaginary part is $v(x, y) = \sinh x \cos y$.	4	2	3	1,12
14. a)	Using Cauchy's integral formula, evaluate $\oint_c \frac{e^z}{(z+1)(z+3)} dz$, where c is the circle $ z =4$.	4	3	4	1,2,12
b)	Find the residue at each pole of $f(z) = \frac{\tan z}{z}$.	4	4	4	1,12
15.	Find the eigenvalues and eigenvectors of the matrix $A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 3 & -1 \\ 0 & -1 & 3 \end{pmatrix}$.	8	3	5	1,2,12
16. a)	Find the orthogonal trajectories of the family of parabolas $y^2 = 4ax$.	4	3	1	1,12
b)	Solve $y'' + y = \sec x$ by the method of variation of parameters.	4	3	2	1,12
17.	Answer any two of the following:				
a)	Prove that $u(x, y) = x^2 - y^2 - 2xy - 2x + 3y$ is harmonic and find its conjugate harmonic function $v(x, y)$.	4	2	3	1,12
b)	Find the Laurent series expansion of $f(z) = \frac{1}{(z-1)(z-2)}$ in the region $0 < z-1 < 1$.	4	2	4	1,12
18.	Verify Cayley-Hamilton theorem for $A = \begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$.	4	1	5	1,2,12

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level - 1	20%
ii)	Blooms Taxonomy Level - 2	30%
iii)	Blooms Taxonomy Level - 3 & 4	50%
