SRM VALLIAMMAI ENGEINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203.

(An Autonomous Institution)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING & ELECTRONICS AND INSTRUMENTATION ENGINEERING

QUESTION BANK

IV SEMESTER

MA3423 – APPLIED MATHEMATICS FOR ELECTRICAL AND INSTRUMENTATION ENGINEERING

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SRM VALLIAMMAI ENGEINEERING COLLEGE

DEPARTMENT OF MATHEMATICS

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SUBJECT : MA3423 – APPLIED MATHEMATICS FOR ELECTRICAL AND INSTRUMENTATION ENGINEERING

SEM / YEAR:IV / II year EEE & E&I

UNIT I - ORDINARY DIFFERENTIAL EQUATIONS
Higher order linear differential equations with constant coefficients – Method of variation of parameters.

Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome
PART – A				
1.	Solve$(D^2+5D+6)y=0$.	BTL-2	Understanding	CO 1
2	Solve$(D^2+7D+12)y=0$.	BTL-2	Understanding	CO 1
3	Solve $(D^2+3D+2)y$	BTL-2	Understanding	CO 1
4	Solve$(D-1)^2y=0$	BTL-2	Understanding	CO 1
5	Find the complementary function of $y''-4y'+4y=0$.	BTL-1	Remembering	CO 1
6	Find the solution $(D^2+2D+1)y$	BTL-2	Understanding	CO 1
7.	Solve$(D^2+1)y=0$.	BTL-2	Understanding	CO 1
8.	Solve $(D^2+a^2)y=0$	BTL-2	Understanding	CO 1
.9	Solve $(D^4+D^3+D^2)y=0$	BTL-2	Understanding	CO 1
10	Solve$(D^4-1)y=0$.	BTL-2	Understanding	CO 1
11	Find the complementary function of$(D^2+4)y=sin2x$.	BTL-1	Remembering	CO 1
12	Estimate the P.I of $(D^3+3\,D^2+3D+1)y=e^{-x}$.	BTL-1	Remembering	CO 1
13	Solve $(D^3-6D^2+11D-6)y$	BTL-1	Remembering	CO 1
14.	Find the particular Integral for$(D^2-2D+1)y=2e^x$.	BTL-2	Understanding	CO 1
15.	Estimate the P.I of $(D^2-4D+4)y=e^{2x}$	BTL-1	Remembering	CO 1
16.	Find the P.I of $(D^2+4D+5)y=e^{-2x}$	BTL-1	Remembering	CO 1
17.	Estimate the P.I of$(D^2+5D+4)y=sin2x$.	BTL-2	Understanding	CO 1
18.	Find the P.I of$(D^2+1)y=cos2x$	BTL-1	Remembering	CO 1
19.	Find the P.I of$(D^2+2)y=x^2$	BTL-1	Remembering	CO 1
20.	Find the P.I. of $(D-a)^2y=e^{ax}\,sinx$	BTL-1	Remembering	CO 1
21.	Describe method of variation of parameter	BTL-1	Remembering	CO 1
22.	Write the Wronskian in method of variation of parameter	BTL-1	Remembering	CO 1
23.	Write the value of P in finding particular integral in solving ODE using method of variation of parameter	BTL-1	Remembering	CO 1
24.	Write the value of Q in finding particular integral in solving ODE using method of variation of parameter	BTL-1	Remembering	CO 1
25.	Write the formula for finding particular integral in solving ODE using method of variation of parameter	BTL-1	Remembering	CO 1
PART – B				
1.(a)	Analyze the solution of $(D^3-6D^2+11D-6)y=e^{-2x}+e^{-3x}$	BTL-4	Analyzing	CO1

1.(b)	Analyze the solution of $(D^2+2D+2)y = e^{-2x} + cos2x$.	BTL-4	Analyzing	CO1
2(a)	Analyze the solution of $(D^3-1)y = e^{2x}$.	BTL-4	Analyzing	CO1
2(b)	Analyze the solution of$(D^2+4)\ y\ = cos2x$+sin3x.	BTL-4	Analyzing	CO1
3(a)	Analyze the solution of $(2D^3-D^2+4D-2)y = e^x$	BTL-4	Analyzing	CO1
3(b)	Analyze the solution of$(D^2+3D+2)y = sin3x$.	BTL-4	Analyzing	CO1
4(a)	Analyze the solution of $(4D^2+4D-3)y = e^{2x}$	BTL-4	Analyzing	CO1
4(b)	Analyze the solution of $(D^2+4)y = sin3x + \cos 2x$.	BTL-4	Analyzing	CO1
5(a)	Analyze the solution of $(D^2+1)y = sinx\ \sin 2x$.	BTL-4	Analyzing	CO1
5(b)	Analyze the solution of $(D^2-6D+9)y = 2x^2-x+3$	BTL-4	Analyzing	CO1
6(a)	Analyze the solution of $(D^2-2D+5)y = e^x\ cos2x$	BTL-4	Analyzing	CO1
6(b)	Analyze the solution of $(D^2-4D+4)y = e^{-4x} + 5cos3x$	BTL-4	Analyzing	CO1
7(a)	Analyze the solution of $(D^2+5D+4)y = 4e^{-x} + x$	BTL-4	Analyzing	CO1
7(b)	Analyze the solution of $(D^2+4D+3)y = e^{-x}sinx$	BTL-4	Analyzing	CO1
8(a)	Analyze the solution of $(D^2+2D+1)y = e^{-x}x^2$	BTL-4	Analyzing	CO1
8(b)	Analyze the solution of $(D^2+4)y = x^2 \cos 2x$.	BTL-4	Analyzing	CO1
9(a)	Analyze the solution of $(D^2+4D-12)y = (x-1)e^{2x}$	BTL-4	Analyzing	CO1
9(b)	Analyze the solution of $(D^2+1)y = xcosx$	BTL-4	Analyzing	CO1
10	Apply method of variation of parameters to solve $y" + y = tanx$	BTL-3	Applying	CO1
11.	Apply method of variation of parameters to solve $(D^2+a^2)y = tanax$	BTL-3	Applying	CO1
12	Apply method of variation of parameters to solve $y" + y = cotx$	BTL-3	Applying	CO1
13.	Apply method of variation of parameters to solve $(D^2+a^2)y = secax$	BTL-3	Applying	CO1
14.	Using the method of variation of parameter solve $(D^2-6D+9)\ y\ = \frac{e^{3x}}{x^2}$	BTL-3	Applying	CO1
15.	Using the method of variation of parameter solve $(D^2+2D+1)y = \frac{e^{-x}}{x^2}$	BTL-3	Applying	CO 1
16.	Solve the differential equation $y" - 2y' + 2y = e^x tanx$ by method of variation of parameters	BTL-3	Applying	CO 1
17.	Apply method of variation of parameters to solve $(D^2+a^2)y = cosecax$	BTL-3	Applying	CO 1
18.	Apply method of variation of parameters to solve $(D^2+1)y = secx$	BTL-3	Applying	CO 1

UNIT – II APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS:
Solution of ODE related to electric circuits, motion of a particle in a resisting medium and simple harmonic motion.

Q.No.	**Question**	**Bloom's Taxonomy Level**	**Competence**	**Course Outcome**
	PART – A			
1.	State Law of Natural growth or decomposition.	BTL-2	Understanding	CO 2

2.	State Law of cooling of bodies	BTL-2	Understanding	CO 2
3.	Define Kirchoff's Law.	BTL-2	Understanding	CO 2
4.	What are the fundamental assumptions for Electric Circuits	BTL-1	Remembering	CO 2
5.	Define L-R-C circuit	BTL-2	Understanding	CO 2
6.	Draw the L-R-C circuit.	BTL-1	Remembering	CO 2
7.	Write the differential equations satisfied by the current and charge in an inductive circuit	BTL-1	Remembering	CO 2
8.	Write the differential equations satisfied by the current and charge in an capacitive circuit	BTL-1	Remembering	CO 2
9.	Write down three different forms of the differential equation of motion of a particle which is projected vertically upwards in a resisting medium, in which resistance is proportional to the n^{th} power of its velocity.	BTL-1	Remembering	CO 2
10.	Define limiting velocity of a particle in a resisting medium and write down its value for a medium (kv^n)	BTL-2	Understanding	CO 2
11.	Define simple harmonic motion	BTL-2	Understanding	CO 2
12.	Write down the equation of motion of a particle executing SHM?	BTL-2	Understanding	CO 2
13.	If a particle executes SHM, write down the expressions for its displacement from the mean position.	BTL-2	Understanding	CO 2
14.	If a particle executes SHM, write down the expressions for its velocity t from the mean position.	BTL-2	Understanding	CO 2
15.	If a particle executes SHM , what is the period of oscillations	BTL-2	Understanding	CO 2
16.	Write down the form of the equation of motion of a particle that executes damped free oscillations.	BTL-1	Remembering	CO 2
17.	Write down the form of equation of motion of a particle that executes forced oscillations with damping	BTL-1	Remembering	CO 2
18.	A simply supported beam of span 'L' is subjected to a point load 'W' at the center. What is the deflection at the center?	BTL-1	Remembering	CO 2
19.	In a cantilever beam, where is the slope and deflection is maximum?	BTL-1	Remembering	CO 2
20.	Solve the differential equation $\frac{d^2x}{dt^2} = -kmx$ where , $n^2 = km$.	BTL-1	Remembering	CO 2
21.	Assume an object weighing 2 lb stretches a spring 6 in. Find the equation of motion if the spring is released from the equilibrium position with an upward velocity of 16 ft/sec. What is the period of the motion?	BTL-1	Remembering	CO 2
22.	What is the differential equation of the simple harmonic motion given by x=Acos (nt+α) ?	BTL-2	Understanding	CO 2
23.	Write the equation that represents a simple harmonic motion? The displacement of the system from the equilibrium position is x at time t and α is a positive constant.	BTL-2	Understanding	CO 2
24.	What is the time period of the simple harmonic motion represented by the equation $\frac{d^2x}{dt^2} + \alpha x = 0$?	BTL-2	Understanding	CO 2
25.	The equation of simple harmonic motion of a particle is $\frac{d^2x}{dt^2} +$	BTL-2	Understanding	CO 2

	$0.2\frac{dx}{dt} + 35x = 0$. What is its time period approximately?			
PART –B				
1	Show that the frequency of free vibrations in a closed electrical circuit with inductance L and capacity C in series $\frac{30}{\pi\sqrt{LC}}$ per minute.	BTL-2	Understanding	CO 2
2	The charge q on the plate of a capacitor of an electric circuits with circuit elements L, R and C is given by $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{c} = Esinwt$. If the circuit is turned to resonance so that $LCw^2=1$, $CR^2 < 4L$ and with initial conditions q = 0,$\frac{dq}{dt}$ = 0 at t=0. Show that $q = \frac{E}{Rw}\left[e^{\frac{-RT}{2L}}\left\{cospt + \frac{R}{2LP}sinpt\right\} - coswt\right]$ where $p^2 = \frac{1}{LC} - \frac{R^2}{4L}$	BTL-2	Remembering	CO 2
3	A circuit consist of an inductance of 0.05 henrys a resistance or 5 ohms and a condenser of capacitance 4 x 10^{-4} farad. If Q= I =0 at time t=0, find Q(t), I(t) when there is an alternating emf 200cos100t.	BTL-4	Analyzing	CO 2
4	Solve $L\frac{di}{dt}$ + Ri = E with the initial condition when t=0, i =1. E is a constant.	BTL-3	Applying	CO 2
5	The differential equation for a circuit in which self inductance L and capacitance C neutralize each other is $L\frac{d^2i}{dt^2} + \frac{i}{c}$ = 0. Find the current i as a function of t.	BTL-4	Analyzing	CO 2
6	The charge q on the plate of a condenser satisfies the differential equation L, $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{c} =$ 0 and q(0) =Q, q'(0) =0. Show that if $CR^2 < 4L$, q = $Qe^{-at}\left(coswt + \frac{\alpha}{w}sinwt\right)$, where $\alpha = \frac{R}{2L}$ and $w^2 = \frac{4L-cR^2}{4L^2C}$	BTL-4	Analyzing	CO 2
7	In an LRC circuit the impressed voltage is 400cos250t volts. Find the current in the circuit when t = 0.001 second, if L =1 henry, R= 400 ohms and c = 0.16 x 10^{-4} farad and the initial charge and current are zero.	BTL-3	Applying	CO 2
8.	For an electric circuit with L = 0.05 henry, R = 20 ohms, c = 100 x 10^{-6} farad, the applied emf is 100 volts. Compute the charge q at time t. If initially q=0 and i=0	BTL-4	Analyzing	CO 2
9	An electric circuit consists of an inductance of 0.1 henry, a resistance of 20 ohms and a condenser of capacitance 25 microfarads (25×10^{-6} farad). Find the charge and the current I at any time t given that q= 0.05 coulomb and i=0 at t=0.	BTL-4	Analyzing	CO 2
10	The differential equation of motion of a particle, which executes forced oscillations without damping is $\frac{d^2x}{dt^2} + k^2x = k^2asinnt$. Find the displacement x of the particle at time t, when $n \neq k$ given that the particle starts from rest from the origin initially.	BTL-4	Analyzing	CO 2
11.	The differential equation of motion of a particle, which executes forced oscillations with damping is $\frac{d^2x}{dt^2} + k\frac{dx}{dt} + n^2x = n^2asinnt$ (k<2n). If the particle starts from rest the origin initially, find the displacement of the particle at time t.	BTL-3	Applying	CO 2

12.	A stretched elastic horizontal string has one end fixed and a particle of mass m attached to the other. Find the equations of motion of particle given that the natural length of the string is l and e its elongation due to a weight mg.	BTL-4	Analyzing	CO 2
13.	The differential equation of motion of a particle, which executes forced oscillations without damping is $\frac{d^2x}{dt^2} + k^2x = k^2 asinnt$. Find the displacement x of the particle at time t, when n = k given that the particle starts from rest from the origin initially.	BTL-3	Applying	CO 2
14.	A particle is projected with velocity V directly away from a fixed point at a distance b from it. If the acceleration be **μ** times the distance from the fixed point and is always directed towards the fixed point, find the amplitude of the SHM.	BTL-4	Analyzing	CO 2
15.	A particle is executing a Simple Harmonic Motion about the origin 0, from which the distance x of the particle is measured. Initially $x = 20$ and velocity = 0 and the equation of motion is $\ddot{x} + x = 0$; Solve for x and find period and amplitude	BTL-3	Applying	CO 2
16.	Assume an object weighing 2 lb stretches a spring 6 in. Find the equation of motion if the spring is released from the equilibrium position with an upward velocity of 16 ft/sec. What is the period of the motion?	BTL-4	Analyzing	CO 2
17.	A body weighing 20 kg is hung from a spring. A pull of 40 kg weight will stretch the spring by 10 cm. The body is pulled down by 20 cm below the static equilibrium position and then released. Find the displacement of the body from its equilibrium position at time t seconds, the maximum velocity and the period of oscillation.	BTL-3	Applying	CO 2
18.	A particle of mass m lying on a smooth horizontal table is attached to two elastic strings whose natural lengths are l_1 and l_2 and moduli $\lambda_1$and λ_2 respectively. The other ends of the strings are fixed to two points on the table at a distance greater than $l_1 + l_2$. Show that if the particle vibrates in the line of the string, its period will be $2\pi \sqrt{\frac{m}{\left(\frac{\lambda_1}{l_1}+\frac{\lambda_2}{l_2}\right)}}$	BTL-4	Analyzing	CO 2

UNIT – III ANALYTIC FUNCTIONS

Analytic functions- Necessary and sufficient conditions for analyticity in Cartesian coordinates – properties – Harmonic conjugates-Construction of analytic function

Q.No.	**Question**	**Bloom's Taxonomy Level**	**Competence**	**Course Outcome**
	PART – A			
1.	Define analytic function.	BTL-2	Understanding	CO 3
2.	Identify the constants a,b,c if $f(z) = x + ay + i(bx + cy)$ is analytic.	BTL-2	Understanding	CO 3
3.	State function of a complex variable.	BTL-2	Understanding	CO 3

4.	State necessary and sufficient condition for Cartesian coordinates in Cauchy-Riemann Equation	BTL-1	Remembering	CO 3
5.	Show that $\|z\|^2$ is not analytic at any point.	BTL-2	Understanding	CO 3
6.	Show that an analytic function in a region R with constant modulus is constant.	BTL-1	Remembering	CO 3
7.	Show that $u = 2x - x^3 + 3xy^2$ is harmonic and determine its harmonic conjugate.	BTL-1	Remembering	CO 3
8.	If f(z) is an analytic function whose real part is constant, Point out f(z) is a constant function	BTL-1	Remembering	CO 3
9.	Test the analyticity of the function $f(z) = e^{-z}$	BTL-2	Understanding	CO 3
10.	Examine if f(z)=z^3 is analytic ?	BTL-1	Remembering	CO 3
11.	Define entire function	BTL-2	Understanding	CO 3
12.	State Cauchy Riemann equations in polar coordinates	BTL-1	Remembering	CO 3
13.	Define harmonic functions	BTL-2	Understanding	CO 3
14.	Identify the constants a,b,c if $f(z) = x - 2ay + i(bx - cy)$ is analytic.	BTL-1	Remembering	CO 3
15.	Test the analyticity of w = sinz	BTL-2	Understanding	CO 3
16.	Discuss the analyticity of the function f(z) =1/z	BTL-1	Remembering	CO 3
17.	Determine whether the function $2xy+i(x^2-y^2)$ is analytic or not?	BTL-1	Remembering	CO 3
18.	Discuss the analyticity of the function f(z) = coshz	BTL-2	Understanding	CO 3
19.	Find where the function ceases to be analytic f(z) = $\frac{z^2-4}{z^2+1}$	BTL-1	Remembering	CO 3
20.	Identify the real and imaginary parts of $f(z) = 2z^3 - 3z$.	BTL-2	Understanding	CO 3
21.	Write the Milne Thomson method formula f(z) if u is given.	BTL-1	Remembering	CO 3
22.	Prove that sinhz is analytic	BTL-2	Understanding	CO 3
23.	Check whether w = $\bar{z}$ is analytic everywhere?	BTL-1	Remembering	CO 3
24.	Write the Milne Thomson method formula f(z) if v is given.	BTL-1	Remembering	CO 3
25.	Test the analyticity of the function $f(z) = e^z$	BTL-2	Understanding	CO 3
	PART –B			
1.	Describe the real and imaginary parts of an analytic function w = u+iv satisfy the Laplace equation in two dimension. via $\nabla^2 u = 0$ *and* $\nabla^2 u = 0$.	BTL-2	Understanding	CO 3
2.	Given that u + v $= \frac{sin2x}{cosh2y - cos2x}$, Estimate the analytic function whose real part is u.	BTL-2	Remembering	CO 3
3.	Estimate the analytic function w=u + iv if $u = e^x(xcosy - ysiny)$.	BTL-3	Applying	CO 3
3.	If w = f(z) is analytic then Show that $\left(\frac{\partial^2}{\partial x^2}\right) + \left(\frac{\partial^2}{\partial y^2}\right)$ log$\|f(z)\|^2$= 0.	BTL-3	Applying	CO 3
4.	Estimate the analytic function f(z) = u+ iv given the imaginary part is v= x^2 - y^2+ $\frac{x}{x^2+y^2}$.	BTL-4	Analyzing	CO 3
5.	If f (z) is a regular function of z, Show that	BTL-3	Applying	CO 3

	$\nabla^2 \lvert f(z)\rvert^2 = 4\lvert f'(z)\rvert^2$.			
6.	Test whether w =$\frac{z}{1-z}$ maps the upper half of the z – plane to the upper half of the w-plane and also find the image of the unit circle of the z- plane.	BTL-4	Analyzing	CO 3
7.	Show that the function u(x,y)= $3x^2y + 2x^2 - y^3 - 2y^2$ is harmonic . Fins also the conjugate harmonic function v.	BTL-3	Applying	CO 3
8.	If f (z) = u + iv is an analytic function of z, then formulate that $\nabla^2[\log\lvert f'(z)\rvert] = 0$.	BTL-4	Analyzing	CO 3
9.	Point out that $\nabla^2 \lvert \text{Re } f(z)\rvert^2 = 2\lvert f'(z)\rvert^2$	BTL-3	Applying	CO 3
10.	Describe an analytic function with constant modulus is constant.	BTL-4	Analyzing	CO 3
11.	If f(z) = u +iv is an analytic function then prove that u and v are both harmonic functions.	BTL-3	Applying	CO 3
12.	Determine the analytic function w = u +iv if u = x^3-$3xy^2+3x^2-3y^2+1$	BTL-3	Applying	CO 3
13.	Show that the function are harmonic and find harmonic conjugate functions u = ½ log (x^2+y^2)	BTL-4	Analyzing	CO 3
14.	Show that the function are harmonic and find harmonic conjugate functions v= sinhxcosy	BTL-3	Applying	CO 3
15.	Show that the function are harmonic and find harmonic conjugate functions u = e^xcosy	BTL-3	Applying	CO 3
16.	If u-v = $(x-y)(x^2+4xy+y^2)$ and f(z) = u+iv is an analytic function of z = x+iy, find f(z) interms of z.	BTL-3	Applying	CO 3
17.	Find the regular function f(z) whose imaginary part is given by 6xy-5x+3	BTL-3	Applying	CO 3
18.	Find the regular function f(z) whose real part is given by e^xcosy	BTL-4	Analyzing	CO 3

UNIT – IV CONFORMAL MAPPING

Conformal mapping – Mapping by functions w = z + c, w = cz, w=1/z – Bilinear Transformation

Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome
	PART – A			
1.	Define conformal mapping.	BTL-1	Remembering	CO 4
2.	Give the image of the circle $\lvert z\rvert = 3$ under the transformation w = 5z.	BTL-1	Remembering	CO 4
3.	Under the transformation $w = \frac{1}{z}$ give the image of the circle $\lvert z - 1\rvert = 1$ in the complex plane	BTL-1	Remembering	CO 4
4.	Explain that a bilinear transformation has at most 2 fixed points.	BTL-1	Remembering	CO 4
5.	Find the fixed points of the transformation $w = \frac{z-1}{z+1}$	BTL-1	Remembering	CO 4

6.	Evaluate the image of hyperbola $x^2 - y^2 = 1$ under the transformation $w = \frac{1}{z}$	BTL-1	Remembering	CO 4
7.	Formulate the critical points of the transformation $w = z + \frac{1}{z}$	BTL-1	Remembering	CO 4
8.	Formulate the bilinear transformation which maps the points z = 0,-i,-1 into w = i,1,0 respectively.	BTL-2	Understanding	CO 4
9.	Identify the invariant point of the bilinear transformation $w = \frac{2z+6}{z+7}$	BTL-2	Understanding	CO 4
10.	Estimate the invariant points of the transformation $w = \frac{6z-9}{z}$	BTL-2	Understanding	CO 4
11.	Estimate the invariant point of the bilinear transformation $w = \frac{1+z}{1-z}$	BTL-1	Remembering	CO 4
12.	Give the image of the circle $\|z\| = 2$ under the transformation w = 3z.	BTL-2	Understanding	CO 4
13.	Under the transformation $w = \frac{1}{z}$ give the image of the circle $\|z-2\| = 2$ in the complex plane.	BTL-2	Understanding	CO 4
14.	Find the image of 2z +y -3 = 0 under the transformation w = z+2i	BTL-2	Understanding	CO 4
15.	Find the image of the region y >1 under the transformation w = (1-i)z	BTL-2	Understanding	CO 4
16.	Give the image of the circle $\|z\| = 3$ under the transformation w = 3z.	BTL-1	Remembering	CO 4
17.	Determine the image of 1<x<2 under the mapping w = 1/z	BTL-1	Remembering	CO 4
18.	Define cross ratio of four points	BTL-1	Remembering	CO 4
19.	Define Invariant points of Bilinear Transformation.	BTL-1	Remembering	CO 4
20.	Define Isogonal mapping	BTL-1	Remembering	CO 4
21.	Obtain the invariant points of the transformation w = $2 - \frac{2}{z}$	BTL-1	Remembering	CO 4
22.	Find the fixed points of w = $\frac{2z-5}{z+4}$	BTL-1	Remembering	CO 4
23.	Find the fixed points of w = $\frac{3z-4}{z-1}$	BTL-1	Remembering	CO 4
24.	Find the invariant points of w = z^3	BTL-2	Understanding	CO 4
25.	Find the invariant points of w = iz^2	BTL-1	Remembering	CO 4
PART –B				
1	Identifythe image of the infinite strip $\frac{1}{4} \leq y \leq \frac{1}{2}$ under the transformation w = 1/z .	BTL-3	Applying	CO 4
2.	Point out the bilinear transformation that maps the point $z_1 = 1, z_2 = i, z_3$ =-1 into the points $w_1 = i, w_2 = 0, w_3 = -i$ respectively.	BTL-4	Analyzing	CO 4

3.	Give the bilinear transformation which maps z=1,0,-1 into w=0,-1,∞ respectively. What are the invariant points of the transformation?	BTL-3	Applying	CO 4
4.	Determine the region R' of the w plane into which R is mapped under the transformation w = z +(1-2i) bounded by the lines x = 0, y=0, x=2, y=1.	BTL-3	Applying	CO 4
5.	Consider the transformation w = 2z and determine the region R' of the w plane into which the triangular region R enclosed by the lines x =0, y =0, x+y=1 in the z plane is mapped under the map.	BTL-3	Applying	CO 4
6.	Draw the image of the square whose vertices are at (0,0), (1,1),(0,1), (1,0) in the z plane under the transformation w = (1+i)z	BTL-3	Applying	CO 4
7.	Find the image of the region bounded by (0,0),(1,0),(1,2),(0,2)by the transformation w = (1+i)z +2-i. Sketch the image.	BTL-4	Analyzing	CO 4
8.	Show that the transformation w = 1/z maps a circle in z plane to a circle in a w plane or to a straight line if the circle in z plane passes through the origin.	BTL-3	Applying	CO 4
9.	Find the image of $\|z-3i\|$ = 3 under the mapping w = 1/z	BTL-3	Applying	CO 4
10.	Find the image of $\|z-1\|$ = 1 under the mapping w = 1/z	BTL-4	Analyzing	CO 4
11.	Find the image of the half plane x >c when c>0 under the transformation w = 1/z	BTL-3	Applying	CO 4
12.	Find the image of $\|z-2i\|$ = 2 under the mapping w = 1/z	BTL-3	Applying	CO 4
13.	Find the bilinear transformation which maps the points z = 0, -1,i onto w = i, 0, ∞. Also find the image of the unit circle $\|z\|$=1	BTL-3	Applying	CO 4
14.	Determine the bilinear transformation which maps z = 0,1, ∞ onto i, -1, -i respectively.	BTL-4	Analyzing	CO 4
15.	Find a bilinear transformation which maps the points i, -i,1of the z plane into 0,1, ∞ of the w plane respectively.	BTL-3	Applying	CO 4
16	Show that w = $\frac{i-z}{i+z}$ maps the real axis of the z plane into the circle $\|w\|$ = 1	BTL-4	Analyzing	CO 4
17	Show that the transformation w = i$\left(\frac{1-z}{1+z}\right)$ transforms the circle $\|z\|$=1	BTL-3	Applying	CO 4
18.	Prove that w = $\frac{z}{1-z}$ maps the upper half of the z plane onto the upper half of the w plane. What is the image of the circle $\|z\|$=1 under the transformation?	BTL-4	Analyzing	CO 4

UNIT – V COMPLEX INTEGRATION

Cauchy's integral theorem – Cauchy's integral formula – Singularities – Residues – Cauchy's Residue theorem –Applications of circular contour (with poles NOT on real axis)

Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome
	PART – A			
1.	State Cauchy's integral theorem.	BTL-1	Remembering	CO 5
2.	Define isolated singularity	BTL-1	Remembering	CO 5

3.	Identify the type of singularity of function $Sin\left(\frac{1}{1-z}\right)$.	BTL-2	Understanding	CO 5
4.	State Cauchy's residue theorem	BTL-1	Remembering	CO 5
5.	State Cauchy's integral formula	BTL-2	Understanding	CO 5
6.	Identify the value of $\int_C e^z dz$, where C is |z| = 1?	BTL-2	Understanding	CO 5
7.	Estimate the residue of the function $f(z)=\frac{4}{z^3(z-2)}$ at a simple pole.	BTL-1	Remembering	CO 5
8.	Calculate the residue at z =0 of $f(z)=\frac{1-e^z}{z^3}$.	BTL-2	Understanding	CO 5
9.	Calculate the residue of the function $f(z)=\frac{4}{z^3(z-2)}$ at a simple pole.	BTL-2	Understanding	CO 5
10.	Determine the residues at poles of the function $f(z)=\frac{z+4}{(z-1)(z-2)}$.	BTL-2	Understanding	CO 5
11.	Expand the principal part and residue at the pole of the function $f(z)=\frac{2z+3}{(z+3)^2}$	BTL-1	Remembering	CO 5
12.	Evaluate $\oint_C \frac{z+2}{z} dz$ $where\, C\, is\, the\, circle\, \|z\|=2$ in the z – plane.	BTL-2	Understanding	CO 5
13.	Evaluate $\frac{1}{2\pi i}\int_C \frac{z^2+5}{z-3} dz$ $where\, C\, is\, \|z\|=4$ using Cauchy's integral formula.	BTL-1	Remembering	CO 5
14.	Integrate $\int_C \frac{dz}{z+4}$ where C is the circle |Z|=2.	BTL-1	Remembering	CO 5
15.	Integrate $\int_C \frac{e^z}{z-1} dz\ if\ C\ is\ \|z\| = 2.$	BTL-2	Understanding	CO 5
16.	Estimate the value of $\int_C (x^2-y^2+2ixy)dz$, where C is |z| = 1?	BTL-2	Understanding	CO 5
17.	Integrate $\int_C \frac{(2z^2+5)dz}{(z+2)^3(z^2+4)}$ where C is the square with vertices at 1+i,2+i,2+2i,1+2i	BTL-2	Understanding	CO 5
18.	Evaluate $\oint_c \frac{e^{-z}}{z+1} dz$ where C is the circle |Z|=2.	BTL-1	Remembering	CO 5
19.	Integrate $\int_C \frac{\cos zdz}{z}$	BTL-2	Understanding	CO 5

20.	Define essential singularity	BTL-2	Understanding	CO 5
21.	Discuss singularity of f(z) = $sin\frac{1}{1-z}$ at z=1	BTL-2	Understanding	CO 5
22.	Discuss the nature of singularity of f(z) = $\frac{z-sinz}{z^3}$ at z = 0.	BTL-2	Understanding	CO 5
23.	Determine the poles of f(z) = $\frac{1}{z^4+1}$	BTL-1	Remembering	CO 5
24.	Determine the poles of f(z) = $\frac{1+e^z}{sinz+zcosz}$	BTL-2	Understanding	CO 5
25.	Define singularity of a function.	BTL-1	Remembering	CO 5
	PART –B			
1.	Using contour integration estimate $\int_{-\infty}^{\infty}\frac{x^2dx}{(x^2+a^2)(x^2+b^2)}$, a> 0, b > 0.	BTL-2	Understanding	CO 5
2.	Estimate $\int_0^{\infty}\frac{dx}{(x^2+a^2)^2},(a>0)$ Using Contour Integration.	BTL-2	Remembering	CO 5
3.	Apply Cauchy's integral formula solve $\int_C\frac{\cos\pi z^2+\sin\pi z^2}{(z-1)(z-2)}dz$ where C is the circle |z | = 3.	BTL-3	Applying	CO 5
4.	Using Cauchy's residue theorem give the value of $\int_{\|z\|=2}\frac{3z^2+z-1}{(z^2-1)(z-2)}dz$,	BTL-3	Applying	CO 5
5.	Apply Cauchy's residue theorem, Calculate the value of $\int_{\|z\|=3}\frac{\cos\pi z^2+\sin\pi z^2}{(z+1)(z+2)}dz$,	BTL-4	Analyzing	CO 5
6.	Evaluate $\int_0^{2\pi}\frac{d\theta}{a+b\sin\theta}$, a > |b|, Using Contour Integration.	BTL-3	Applying	CO 5
7.	Using Cauchy's integral formula calculate $\int_C\frac{z+4}{z^2+2z+5}dz$ where C is the circle (i) |z + 1 + i| = 2 (ii) |z + 1 - i| = 2.	BTL-4	Analyzing	CO 5
8.	Point out the poles of $\frac{z^2}{(z-1)^2(z+2)}$ and hence evaluate $\int_{\|z\|=3}\frac{z^2}{(z-1)^2(z+2)}dz$.	BTL-3	Applying	CO 5
9.	Formulate $\int_{\|z\|=4}\frac{e^z}{(z^2+\pi^2)^2}dz$, using Cauchy's residue theorem.	BTL-4	Analyzing	CO 5
10.	Evaluate $\int_C\frac{z^2dz}{(z-1)^2(z+2)}\ where\ C\ is\ \|z\|=3.$	BTL-3	Applying	CO 5

11.	Formulate $\int_0^{2\pi} \frac{d\theta}{13+5\sin\theta}$, using the method of contour integration.	BTL-4	Analyzing	CO 5
12.	If f(a) = $\int_C \frac{3z^2+7z+1}{(z-a)} dz$ where C is the circle |z | = 2, Identify f(3), f(1), $f'(1-i)$, $f''(1-i)$.	BTL-3	Applying	CO 5
13.	Evaluate $\int_0^{2\pi} \frac{1+2\cos\theta}{5+4\cos\theta} d\theta$, using the method of contour integration	BTL-3	Applying	CO 5
14.	Using Cauchy's integral formula calculate $\int_C \frac{4-3z}{z(z-1)(z-2)} dz$ where C is the circle |z | = 3/2	BTL-4	Analyzing	CO 5
15.	Using Cauchy's integral formula calculate $\int_C \frac{2z+1}{(z^2+z)} dz$ where C is the circle |z | = 1/2	BTL-3	Applying	CO 5
16.	Determine the poles of the following function and residue at each pole f(z) = $\frac{z^2}{(z-1)(z-2)^2}$	BTL-3	Applying	CO 5
17.	Evaluate $\int \frac{12z-7}{(z-1)^2(2z+3)} dz$ over the region c where c is |z | = 2 using Cauchy residue theorem	BTL-3	Applying	CO 5
18.	Estimate $\int_{-\infty}^{\infty} \frac{dx}{(x^2+1)^2}$, Using Contour Integration.	BTL-3	Applying	CO 5

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