VIT
Vellore Institute of Technology

Vellore – 632014, Tamil Nadu, India
DEPARTMENT OF MATHEMATICS
SCHOOL OF ADVANCED SCIENCES
FALL SEMESTER 2022-2023

CONTINUOUS ASSESSMENT TEST – I

Programme Name & Branch	: B. Tech
Course Code	: BMAT201L
Course Name	: Complex Variables and Linear Algebra
Slot	: A1+TA1+TAA1
Date of Exam	: 28-08-2022
Duration	**: 90 minutes** **Max. Marks : 50**

General instruction(s): Answer all the questions

Q. No	Question	Marks	Course Outcome (CO)	Bloom's Taxonomy (BL)
1.	Find the analytic function $f(z)=u+iv$ if $2u + v = e^x(cosy - siny)$ and also find the functions u and v	10	CO1	BL2
2.	Verify whether the equation $\psi(x, y) = \frac{-y}{x^2+y^2}$ can represent the path of electric current flow in an electric field. If so, find the complex potential and the equation of the potential lines.	10	CO1	BL3
3.	Find the image of the region bounded by the lines $1 \le x \le 2$ under the transformation $w = \frac{1}{z}$. Also show the regions graphically.	10	CO2	BL3
4.	Determine the bilinear transformation that maps the points $1, i, -1$ in z-plane into the points $2, i, -2$ respectively in w-plane. Also find its invariant points.	10	CO2	BL3
5.	Expand $f(z) = \frac{z-1}{z+1}$ in Taylor's series about $z = 0$ and $z = 1$.	10	CO3	BL1

Abhraind Mitra

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CONTINUOUS ASSESSMENT TEST – I

Programme Name & Branch	: B. Tech	
Course Code	: BMAT201L	
Course Name	: Complex Variables and Linear Algebra	
Slot	: A2+TA2+TAA2	
Date of Examination	: 28-08-2022	
Duration	**: 90 minutes**	**Max. Marks : 50**

General instruction(s): Answer all the questions

Q. No	Question	Marks
1.	Find the analytic function $f(z)=u+iv$ if $3u + 2v = y^2 - x^2 + 16xy$ and also find the functions u and v.	10
2.	Verify whether the equation $\psi = e^{-x}[2xycosy - (x^2 - y^2)siny]$ can represent the path of electric current flow in an electric field. If so, find the complex potential and the equation of the potential lines.	10
3.	Find the image of the region of the w-plane bounded by the circle $x^2 + y^2 - 6x = 0$ in the z-plane under the transformation $w = \frac{1}{z}$.	10
4.	Determine the bilinear transformation that maps the points 0; 1; i; in z-plane into the points 1+i; -i; 2-i respectively in w-plane. Also find its invariant points.	10
5.	Expand $f(z) = \frac{1}{z^2-z-6}$ in Taylor's series about (i) the point $z = 1$ and (ii) the point $z = 2$.	10

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CONTINUOUS ASSESSMENT TEST – I

Programme Name & Branch	: B. Tech
Course Code	: BMAT201L
Course Name	: Complex Variables and Linear Algebra
Slot	: B2+TB2+TBB2
Date of the Examination	: 29-08-2022
Duration	**: 90 minutes** **Max. Marks** : 50

General instruction(s): Answer All The Questions

Q. No	Question	Marks	Course Outcome (CO)	Bloom's Taxonomy (BL)
1.	Construct an analytic function whose real part is $u = \dfrac{\sin 2x}{\cosh 2y - \cos 2x}$.	10	CO1	BL3
2.	In the two dimensional fluid flow, the stream function is given by $\psi(x, y) = e^{x^2 - y^2} \sin 2xy$. Find the complex potential function $f(z) = \phi + i\psi$ and hence find the velocity potential function $\phi(x, y)$.	10	CO1	BL3
3.	Find the image of the region bounded by the lines $x = 2$, $x = 4$ in the z-plane under the transformation $w = z^2$.	10	CO2	BL3
4.	Determine the bilinear transformation that maps the points $1-2i$, $2+i$, $2+3i$ in z-plane into the points $2+2i$, $1+3i$, 4 respectively in w-plane.	10	CO2	BL3
5.	Expand $f(z) = \dfrac{1}{z^2 - z - 6}$ as a Taylor's series about $z = 1$ and $z = -1$.	10	CO3	BL1

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SCHOOL OF ADVANCED SCIENCES

FALL SEMESTER 2022-2023

CONTINUOUS ASSESSMENT TEST – I

Programme Name & Branch	: B.Tech. & ALL
Course Code	: BMAT201L
Course Name	: Complex Variables and Linear Algebra
Slot	: C1+TC1+TCC1
Date of the Examination	: 30-Aug-2022
Duration	**: 90 minutes** **Max. Marks : 50**

General instruction(s): Answer ALL questions (5x10=50 Marks)

1. Check whether the following functions can be the real parts of an analytic function $f(z) = u + iv$.

   a) $u = x^3 - y^3$
   b) $u = x^2 - y^2 + y$

   If so, determine the analytic function $f(z)$.

2. In a two dimensional fluid flow, if $\phi(x,y) = x^4 + y^4 - 6x^2y^2$ represents the velocity potential, find the corresponding stream function and also the complex potential.

3. Determine the region of the $w-$ plane into which the region bounded by the lines $x = 1$, $y = 1$, $x + y = 1$ is mapped by the transformation $w = z^2$.

4. If the points $\{0, 1, -2\}$ in the $z-$plane are mapped onto the points $\{-\frac{1}{2}, 0, \infty\}$ in the $w-$ plane respectively, then

   a) Find the corresponding bilinear transformation $w = f(z)$.
   b) Find the invariant points of this transformation.
   c) Find the image of the region $0 < x < \infty, 0 < y < \infty$ under this transformation.

5. Express the function $f(z) = \frac{1}{(z+1)(z+2)^2}$ in Taylor series about

   a) the origin,
   b) the point $z = 1$.

   Indicate the region of validity in each case.

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DEPARTMENT OF MATHEMATICS
SCHOOL OF ADVANCED SCIENCES
FALL SEMESTER 2022-2023

CONTINUOUS ASSESSMENT TEST – I

Programme Name & Branch : **B.Tech. (All branches)**

Course Code : BMAT201L
Course Name : Complex Variables and Linear Algebra
Slot : C2+TC2+TCC2
Date of the Examination : 30.8.22
Duration : **90 minutes** **Max. Marks : 50**

Answer all the Questions (5*10=50)

Q. No	Question	Marks	Course Outcome (CO)	Bloom's Taxonomy (BL)
1.	Examine whether the given function $\cos x \cosh y$ can be the real part of an analytic function $f(z)$. If so, find its conjugate and also the analytic function $f(z) = u + iv$.	10	1	BL2
2.	Prove that $u(x,y) = x^2 - y^2$ and $v(x,y) = \frac{y}{x^2+y^2}$ are harmonic functions and Examine whether $f(z) = u + iv$ is not analytic.	10	1	BL3
3.	Show that the transformation $w = \frac{2z+3}{z-4}$ transforms circle $x^2 + y^2 - 4x = 0$ into a straight line $4u + 3 = 0$.	10	2	BL3
4.	Find the bilinear transformation which maps $z = 0$ onto $w = -i$ and has -1 and 1 as the invariant points. Also show that under this transformation the upper half of the z-plane maps onto the interior of the unit circle in the w-plane.	10	2	BL3
5.	Find the Taylor's series for $f(z) = \frac{e^z}{1-z}$ about $z = 0$. Give the radius of convergence.	10	3	BL1

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