Curriculum Plan (EVEN SEM 2025): B.Sc. (H) Mathematics III Year (Semester VI)
Paper: DSC-Complex Analysis

Dr. Tajender Kumar Assistant Professor Department of Mathematics Kalindi College (University of Delhi) Delhi- 110008 Mobile: +91 7417837644 **E- mail**: tajenderkumar@kalindi.du.ac.in		**Marks Distribution**	**Theory**	90 Marks
			Practical	40 Marks
			Internal Assessment	Assignments 12 Marks
				Home Exams/ 12 Marks Class Test
				Attendance 6 Marks
		Classes Assigned	**Lectures**	3 per week (**Theory**)
			Lab	2 per week

References		1. Brown, James Ward, & Churchill, Ruel V. (2014). Complex Variables and Applications (9th ed.). McGraw-Hill Education. New York.	
	Beginning/1st week with 3 days 02nd Jan. - 11th Jan.	**Topics** Make a geometric plot to show that the n^{th} roots of unity are equally spaced points that lie on the unit circle $C_1(0) = \{z: \lvert z \rvert = 1\}$ and form the vertices of a regular polygon with n sides, for $n = 4, 5, 6, 7, 8$.	
	2nd week 13th Jan. – 18th Jan	Find all the solutions of the equation $z^3 = 8i$ and represent these geometrically.	

	3rd week 20th Jan. – 25th Jan.	Write parametric equations and make a parametric plot for an ellipse centered at the origin with horizontal major axis of 4 units and vertical minor axis of 2 units. Show the effect of rotation of this ellipse by an angle of $\frac{\pi}{6}$ radians and shifting of the centre from (0,0) to (2,1), by making a parametric plot.	
	4th week 27th Jan. – 01st Feb.	Show that the image of the open disk $D_1(-1-i) = \{z: \lvert z+1+i \rvert < 1\}$ under the linear transformation $w = f(z) = (3-4i) + 6 + 2i$ is the open disk: $D_5(-1+3i) = \{w: \lvert w+1-3i \rvert < 5\}$.	
	5th week 03rd Feb.- 08th Feb.	Show that the image of the right half plane $Re(z) = x > 1$ under the linear transformation $w = f(z) = (-1+i) - 2 + 3i$ is the half plane $v > u + 7$, where $u = Re(w)$ etc. Plot the map.	
	6th week 10th Feb. – 15th Feb.	Show that the image of the right half plane $A = \{z: Re(z) \geq 1\}$ under the mapping $w = f(z) = \frac{1}{z}$ is the closed disk: $\overline{D_1(1)} = \{w: \lvert w-1 \rvert \leq 1\}$ in the w- plane.	
	7th week 17th Feb. – 22nd Feb.	Make a plot of the vertical lines $x = a$, for $a = -1, -\frac{1}{2}, \frac{1}{2}, 1$ and the horizontal lines y= b, for b= $-1, -\frac{1}{2}, \frac{1}{2}, 1$. Find the plot of this grid under the mapping $w = f(z) = \frac{1}{z}$.	
	8th week 24th Feb. – 01st Mar.	Find a parametrization of the polygonal path $C = C_1 + C_2 + C_3$ from $-1+i$ to $3-i$, where C_1 is the line from: $-1+i$ to -1 , C_2 is the line from: -1 to $1+i$ and C_3 is the line from $1+i$ to $3-i$. Make a plot of this path.	
	9th week 03rd Mar.– 08th Mar.	Plot the line segment $'L'$ joining the point $A = 0$ to $B = 2 + \frac{\pi}{4}i$ and give an exact calculation of $\int_C e^z dz$.	

	10th week 17th March. – 22th Mar.	Evaluate $\int_C \frac{1}{(z-2)} dz$, where C is the upper semicircle with radius 1 centered at $z = 2$ oriented in a positive direction.	
	11th week 24th Mar. – 29th Mar.	Show that $\int_{C_1} z\,dz = \int_{C_2} z\,dz = 4 + 2i$ where C_1 is the line segment from $-1 - i$ to $3 + i$ and C_2 is the portion of the parabola $x = y^2 + 2y$ joining $-1 - i$ to $3 + i$. Make plots of two contours C_1 and C_2 joining $-1 - i$ to $3 + i$.	
	12th week 31st Mar. – 05th Apr.	Use ML inequality to show that $\left\| \int_C \frac{1}{z^2+1} dz \right\| \leq \frac{1}{2\sqrt{5}}$ where C is the straight line segment from 2 to 2+i. While solving, represent the distance from the point z to the points i and $-i$, respectively, i.e. $\|z - i\|$ and $\|z + i\|$ on the complex plane $\mathbb{C}$.	
	13th week 07th Apr. – 12th Apr.	Find and plot three different Laurent series representations for the function $f(z) = \frac{3}{2+z-z^2}$, involving powers of z.	
	14th week 14th Apr. – 19th Apr.	Locate the poles of $f(z) = \frac{1}{5z^4+26z^2+5}$ and specify their order, and Locate the zeros and poles of $g(z) = \frac{\pi \cot(\pi z)}{z^2}$ and determine their order. Also justify that $\mathrm{Res}(g, 0) = -\frac{\pi^2}{3}$	
	15th week with 2 Days 21st Apr. – 29th Apr.	Evaluate $\int_{C_1^+(0)} exp\left(\frac{2}{z}\right) dz$, where $C_1^+(0)$ denotes the circle $\{z: \|z\| = 1\}$. with positive orientation. Similarly evaluate $\int_{C_1^+(0)} \frac{1}{z^4+z^3-2z^2} dz$.	
Dispersal of classes, preparation leave and practical examination begin- 30 April, 2025.			