TEACHING PLAN: COMPLEX ANALYSIS

SCHOOL: (SOBAS) SCHOOL OF BASIC AND APPLIED SCIENCE		**ACADEMIC SESSION: 2023 - 2024**	**FOR STUDENTS' BATCH: B.Sc VIth Sem.**
1	**Course No.**	MA 303	
2	**Course Title**	**COMPLEX ANALYSIS**	
3	**Credits**	**2**	
4	**Learning Hours**	Per week two lectures Total hours; 28	
5	**Course Objective**	1. Master the concepts of functions of a complex variable, including stereographic projection of complex numbers. 2. Understand continuity and differentiability principles in complex functions, focusing on analytic functions and Cauchy-Riemann equations. 3. Explore harmonic functions and orthogonal systems, preparing for mappings by elementary functions. 4. Develop proficiency in complex integration techniques, including line integrals and fundamental theorems like Cauchy's and Morera's.	
6	**Course Outcomes**	After completing the course, the students will be able to:The importance of group in algebra. 1. Gain proficiency in understanding the functions of a complex variable and their applications, including stereographic projection of complex numbers. 2. Develop the ability to analyze the continuity and differentiability of complex functions, with a focus on understanding analytic functions and the Cauchy-Riemann equations. 3. Explore the properties of harmonic functions and their relationship to orthogonal systems, laying the foundation for understanding mappings by elementary functions such as translation and rotation. 4. Acquire knowledge and skills in complex integration techniques, including line integrals and the application of fundamental theorems such as Cauchy's integral formula and Morera's theorem.	
7	**Outline syllabus:**		

7.01	**Paper Code**	**Unit**	**Introduction**	**Page Numbers[1]**	**Lectures**
7.02	**Paper Code. MA 303 Unit I**	(a)	1. Function of a complex variable, Stereographic projection of complex numbers	1.1 to 1.11	1,2
		(b)	2. Continuity and differentiability of complex functions, Analytic functions	2.1 to 2.15	3,4
		(c)	3. Cauchy-Riemann equations, Harmonic functions, Orthogonal system	3.1 to 3.16	5,6,7
7.03	**Paper Code. MA 303 Unit II**	(a)	1. Conformal Mappings	**3.17 to 3.30**	**8,9,10**
		(b)	2. Mobius transformations, Fixed points	**3.31 to 3.35**	**11,12**
		(c)	3. Mappings by elementary functions: Translation, rotation	**4.1 to 4.50**	**13,14**
7.04	**Paper Code. MA 303 Unit III**	(a)	1. Complex integration techniques, including line integrals.	**5.1 to 5.13**	**15,16**
		(b)	2. Fundamental theorems such as Cauchy's integral formula, Morera's theorem, and Liouville's theorem.	**6.1 to 6.25**	**17,18, 19**

		(c	3. Understanding Taylor and Laurent series.	**6.26 to 6.30**	**20,21**
7.05	**Paper Code. MA 303 Unit IV**	(a)	1. Singularities and zeros of an analytic function,	**7.1 to 7.17**	**22,23**
		(b)	2. Rouche's theorem, Fundamental theorem of algebra,	**7.18 to 7.30**	**24,25, 26**
		(c)	3. Analytic continuation..	**8.1 to 8.13**	**27,28**

8	**Course Evaluation**	
8.1	**Attendance**	5%
8.2	**Homework**	4 Assignments, 5%
8.3	**Quizzes**	2Quizzes, 5%
8.4	**Projects**	1 Project, 5%
8.5	**Presentation**	1 Presentation, 5%
8.2	**MTE**	20%
8.3	**End-term examination: 60%**	
9	**Text Books & References**	
9.1	**Text book**	1. 1. Complex Analysis, Jeevansons publication 2. I.N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi
9.2	**References**	1. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal : Basic Abstract Algebra (2nd edition) 2. VivekSahai and VikasBist : Algebra, NKarosa Publishing House. 3. J.B. Gallian: Abstract Algebra, Narosa Publishing House.
9.3	**Video References**	1. https://youtu.be/2aLV4N7vd8U 2. mathonline.wikidot.com/...structures-fields-rings-and-groups 3. users.metu.edu.tr/matmah/Graduate-Algebra-Solution 4. www.ring-group.com

QUESTION BANK

[Q.1]

a) If z_1, z_2 are any complex number then
$(|z_1 + z_2|)^2 + (|z_1 - z_2|)^2 = 2\{(z_1)^2 + (z_2)^2$ interpret the result

b) The equation of any straight line passing through the origin and making an angle α with the real axis is
$Z = re^{i\alpha}$ where r is any real parameter.

c) Find the moduli and argument of

$$\frac{1-i}{1+i}$$

d) Define the ordinary points

e) What is mapping

f) Find the fixed point and the normal form

$W = \frac{z}{2-z}$

[Q.2] If P,Q,R are points of a fix $z_1, z_2, z_1 + z_2$ respectively ,
show that OPQR is a parallelogram.
If $U = \frac{sin2x}{cosh2y+cos2x}$, find the corresponding analytical function F(Z)=U+iV.

[Q.3] Find the bilinear transformation that maps the point 0,-i, -1 into the point i ,1,0.

[Q.4] Evaluate $\int_0^{\Pi/2} logsinxdx$

[Q.5] Evaluate $\int_0^{\Pi} .\Theta sin^8\Theta cos^4\Theta d\Theta$

[Q.6] Show that the function $e^{-1/z2}$ has no singularities

[Q.7] Find the area of the segment cut off from the parabola $x^2 = 8y$ by the line x- 2y+8=0.
Evaluate $\int_{e^{\cdot}} \frac{e\hat{}z}{z-2} dx$ where e is the circle