University of Sargodha

Nida

M.A/M.Sc Part-I / Composite, 1[st]-A/2015

Mathematics: III Complex Analysis & Differential Geometry

Maximum Marks: 100 **Time Allowed: 3 Hours**

Note: Objective part is compulsory. Attempt four questions from subjective part.

	Objective Part	
Q. 1	Give short answers.	20
(i)	Define harmonic function.	
(ii)	How a multiply connected region can be made simply connected.	
(iii)	Define inverse of the curve.	
(iv)	Define locus of a point.	
(v)	State the 1st consequence of Cauchy's Fundamental theorem.	
(vi)	Define removable singularity.	
(vii)	Define helix and write the necessary condition for a curve to be helix.	
(viii)	Define rectifying plane.	
(ix)	Evaluat $(\vec{t'} \times \vec{n'})$.	
(x)	Define 1st order magnitudes.	
	(Subjective Part)	
	Note: Attempt any four questions.	
Q. 2	(a)Prove that for the function $f(z) = \sqrt{\lvert xy \rvert}$ is not analytic at the origin although Cauchy Riemann equations are satisfied at the origin.	10
	(b)Prove that the function $U(x, y) = \sin x \cosh y$ is harmonic and find the analytic function.	10
Q.3	(a) Prove that $e^z = 1$ if and only if $z = 2k\pi i$	10
	(b) State and prove Cauchy's inequality theorem.	10
Q.4	State and prove Taylor's theorem.	20
Q. 5	(a) Evaluate the integral $$\int_c \frac{dz}{(Z-1)(Z-2)}$$ where C is a circle $\lvert Z-2 \rvert = \frac{1}{2}$ by using residue theorem.	10
	(b) Show that the principal normals at consecutive points do not intersect unless $\tau = 0$.	10
Q. 6	(a) Prove that under transformation $W = \frac{1}{Z-1}$ the circle $\lvert z \rvert = 2$ in Z-plane is mapped into a circle $3(U^2+V^2) = 2U+1$ in W-plane.	10
	(b) prove that the edge of regression for osculating developable is curve itself.	10
Q. 7	(a) Show that the differential equation of the orthogonal projection of the family of curves $P\delta U + Q\delta V = 0$ is given by $$(EQ - FP)dU + (FQ - GP)dV = 0$$ where p and Q are functions of U and V.	10
	(b) For the surface $$x = a(u+v), \quad y = b(u-v), \quad z = f(u),$$ Find first order and second order magnitudes.	10