Course Code	21MAB102T	Course Name	Advanced Calculus and Complex Analysis	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	21MAB101T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR)	The purpose of learning this course is to:	Learning
CLR-1:	Determine the Double and triple Integrals and its applications in Science and Engineering.	
CLR-2:	Gain Knowledge in interpretation of Vector differentiation and Vector integration which relates Line Integral, Green 's, Stoke' s and Gauss Divergence theorem.	
CLR-3:	Identify the techniques of Laplace Transforms and Inverse Laplace transforms and extend them in the problems of Science and Engineering.	
CLR-4:	Construct analytic functions, discuss Conformal mapping and Bilinear Transformation in Engineering problems	
CLR-5:	Evaluate Complex integrals and Power series using various theorems	
CLR-6:	Analyze the transform techniques and Integral techniques in Science and Engineering.	

Course Outcomes (CO):	At the end of this course, learners will be able to:	Blooms Level (1-6)	Program Outcomes (PO) 1	2	3	4	5	6	7	8	9	10	11	12
			Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning
CO-1:	Apply multiple integrals in solving problems in Science and Engineering.	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-2:	Analyze vector differentiation and vector integration and related Theorems	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-3:	Apply Laplace Transforms techniques in solving Engineering problems	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-4:	Extend their knowledge in Fundamentals of analytic functions	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-5:	Utilize Complex integrals and Power series in solving Engineering problems	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-6:	Apply the transform techniques and Integral techniques in Science and Engineering problems	4	3	3	-	-	-	-	-	-	-	-	-	-

Unit-1: Integral calculus

Evaluation of double integration Cartesian and plane polar coordinates-Evaluation of double integration of plane polar coordinates - Evaluation of double integral by changing of order of integration- Area as a double integral (Cartesian)- Area as a double integral (polar)- Triple integration in Cartesian coordinates- Triple integration in Cartesian coordinates- Area of triple Integral

Unit-2: Vector calculus

Review of vectors in 2,3 dimensions- Gradient, divergence- curl – Solenoidal- Irrotational fields- Vector identities- (without proof) – Directional derivatives- Line integrals- Surface integrals- Volume Integrals- Green's theorem (without proof) verification- Gauss divergence theorem (without proof), verification- Gauss divergence theorem (without proof) applications to cubes- Gauss divergence theorem (without proof applications to parallelepiped- Stoke's theorems (without proof) – Verification - Stoke's theorems (without proof) – Applications to cubes- Stoke's theorems (without proof) – Applications to cubes- Stoke's theorems (without proof) – Applications to parallelepiped only

Unit-3: Laplace transforms

Laplace Transforms of standard functions- Transforms properties - Transforms of Derivatives and Integrals- Initial value theorems (without proof) and verification for some problems - Final value theorems (without proof) and verification for some problems- Inverse Laplace transforms using Partial fractions- Inverse Laplace transforms section shifting theorem- LT using Convolution theorem (problems only)- LT of periodic functions -problems only - Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficient only- Solution of Integral equation and integral equation involving convolution type

Unit-4: Analytic functions

Definition of Analytic Function – Cauchy Riemann equations - Cauchy Riemann equations- Properties of analytic function functions- Determination of analytic function using – Milne-Thomson's method- Conformal mappings: magnification, rotation, inversion reflection , Bilinear transformation- Cauchy's integral theorem (without proof)- Cauchy's integral theorem applications

Unit-5: Complex integration

Cauchy's integral formulae and Problems-Taylor's expansions with simple problems- Laurent's expansions with simple problems- Singularities- Types of Poles and Residues- Cauchy's residue theorem (without proof)- Contour integration: Unit circle , Semi circular

Learning Resources	1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006. 2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010. 3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008 4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010 5. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint, 2002 ***6.*** N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper as specified in regulation

Learning Assessment

Blooms Level of Thinking		***Continuous Learning Assessment 50% weightage***				***Final Examination 50% weightage***
		CLA– 1 (10%)	***CLA – 2 (15%)***	***CLA– 3 (15%)***	***CLA-4 (10%)***	
Level 1	***Remember***	***20 %***	***20 %***	***20 %***	***20 %***	***20 %***
Level 2	***Understand***	***20%***	***20%***	***20%***	***20%***	***20%***
Level 3	***Apply***	***30%***	***30 %***	***30 %***	***30 %***	***30 %***
Level 4	***Analyze***	***30%***	***30%***	***30%***	***30%***	***30%***
Level 5	***Evaluate***	***-***	***-***	***-***	***-***	***-***
Level 6	***Create***	***-***	***-***	***-***	***-***	***-***
	Total	***100%***	***100%***	***100%***	***100%***	***100%***

Course Designers

a) Experts from Industry	**b) Experts from Higher Technical Institutions**	**c) Internal Experts**
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