Course Learning Syllabus (// includes Learning Outcomes & Learning Plan & Assessment Plan)

Course Code	18MAB102T	Course Name	ADVANCED CALCULUS AND COMPLEX ANALYSIS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	18MAB101T	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.	Level of Thinking (Bloom)
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:	Learning
CO-1 :	Apply multiple integrals in solving problems in Science and Engineering.	4
CO-2 :	Analyze vector differentiation and vector integration and related Theorems	4
CO-3 :	Apply Laplace Transforms techniques in solving Engineering problems	4
CO-4 :	Extend their knowledge in Fundamentals of analytic functions	4
CO-5 :	Utilize Complex integrals and Power series in solving Engineering problems	4
CO-6 :	Apply the transform techniques and Integral techniques in Science and Engineering problems	4

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
3	3	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-

		Learning Unit / Module 1	Learning Unit / Module 2	Learning Unit / Module 3	Learning Unit / Module 4	Learning Unit / Module 5
Duration (hour)		12	12	12	12	12
S-1	SLO-1	Evaluation of double integration Cartesian and plane polar coordinates	Review of vectors in 2,3 dimensions ,	Laplace Transformsof standard functions	Definition of Analytic Function – Cauchy Riemann equations	Cauchy's integral formulae - Problems
	SLO-2	Evaluation of double integration of plane polar coordinates	Gradient, divergence,	Transformsproperties	Cauchy Riemannequations	Cauchy's integral formulae- Problems
S-2	SLO-1	Evaluation of double integration of plane polar coordinates	curl – Solenoidal	Transforms of Derivatives and Integrals	Properties of analytic function functions	Cauchy's integral formulae- Problems
	SLO-2	Evaluation of double integration of plane polar coordinates	Irrotational fields	Transform of derivatives and integrals	Determination of analytic function using – Milne-Thomson's method	Taylor's expansionswith simple problems
S-3	SLO-1	Evaluation of double integral by changing of order of integration	Vector identities (without proof) –Directional derivatives	Initial value theorems (without proof) and verification for some problems	Determination of analytic function using – Milne-Thomson's method	Taylor's expansionswith simple problems
	SLO-2	Evaluation of double integral by changing of order of integration	Line integrals	Final value theorems (without proof) and verification for some problems	Determination of analytic function using – Milne-Thomson's method	Laurent's expansions with simple problems
S-4	SLO-1	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 7	Problem solving using tutorial sheet 10	Problem solving using tutorial sheet 13
	SLO-2	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutrial sheet 7	Problem solving using tutorial sheet 10	Problem solving using tutorial sheet 13
S-5	SLO-1	Evaluation of double integral by changing of order of integration	Line integrals	Inverse Laplace transforms using partial fractions	Conformal mappings: magnification	Laurent's expansions with simple problems
	SLO-2	Area as a double integral (Cartesian)	Surface integrals	Inverse Laplace transforms using Partial fractions	Conformal mappings rotation	Singularities
S-6	SLO-1	Area as a double integral (Cartesian)	Surface integrals	Inverse Laplace transforms section shfting theorem	Conformal mappings:inversion	Types of Poles andResidues
	SLO-2	Area as a doubleintegral (polar)	Volume Integrals	LT using Convolution theorem -problems only	Conformal mappings:inversion	Types of Poles andResidues
S-7		Area as a double integral (polar)	Green's theorem (without proof)	LT using Convolution theorem -problems only	Conformal mappings: reflection	Cauchy's residue theorem (without proof)
	SLO-2	Triple integration in Cartesian coordinates	Green's theorem (without proof)	LT using Convolution theorem -problems only	Conformal mappings: reflection	Contour integration: Unit circle

S-8	SLO-1	Problem solving using tutorial sheet 2	Problem solving using tutorial sheet 5	Problem solving using tutorial sheet 8	Problem solving using tutorial sheet 11	Problem solving using tutorial sheet 14
	SLO-2	Problem solving using tutorial sheet 2	Problem solving using tutorial sheet 5	Problem solving using tutorial sheet 8	Problem solving using tutorial sheet 11	Problem solving using tutorial sheet 14
S-9	SLO-1	Conversion from Cartesian to polar in double integrals	Gauss divergence theorem (without proof), verification	LT of periodic functions - problems only	bilinear transformation	Contour integration: Unit circle
	SLO-2	Conversion from Cartesian to polar in double integrals	Gauss divergence theorem (without proof applications to parallelepiped	LT of periodic functions - problems only	bilinear transformation	Contour integration: Unit circle
S-10	SLO-1	Triple integration in Cartesian coordinates	Gauss divergence theorem (without proof applications to parallelepiped	Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficient only	bilinear transformation	Contour integration: semicircular contour
	SLO-2	Triple integration in Cartesian coordinates	Stoke's theorems (without proof) – Verification	Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficient only	bilinear transformation	Contour integration: semicircular contour
S-11	SLO-1	Triple integration in Cartesian coordinates	Stoke's theorems (without proof) – Applications to cubes	Solution of Integral equation involving convolution type	Cauchy's integral theorem (without proof)	Contour integration: semicircular contour
	SLO-2	Area of triple Integral	Stoke's theorems (without proof) – Applications to parallelepiped only	Solution of Integral equation involving convolution type	Cauchy's integral theorem applications	Contour integration: semicircular contour
S-12	SLO-1	Problem solving using tutorial sheet 3	Problem solving using tutorial sheet 6	Problem solving using tutorial sheet 9	Problem solving using tutorial sheet 12	Problem solving using tutorial sheet 15
	SLO-2	Application of Multiple integral in engineering	Application of Line and Volume Integrals in engineering	Application of Laplace Transform in engineering	Application of Bilinear Transformation and Cauchy Integral in engineering	Application Contour integration in engineering

	REFERENCE BOOKS/OTHER READING MATERIAL
	Text Book
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

	Learning Assessment										
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
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 %	

 # CA – 3 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,
SLO – Session Learning Outcome

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Signature of course coordinator

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Signature of HOD