C.V. Raman Global University
Bhubaneswar - 752 054 (Odisha)

Department of Mathematics

SUBJECT: MATHEMATICS-I

Course Code	MA101
Teaching Hours/Week (L-P-T-E)	(3-0-1-0)
Credits	03
Total Contact Hours	42+14

Course objectives:

1) To explain the asymptotes and curvature of a curve given in Cartesian and polar form.
2) To explain the limit and examine continuity and differentiability of a function of more than one variable.
3) To explain how to calculate the gradients, divergence, curl and directional derivatives of functions of several variables along with the physical interpretation.
4) To explain the integral problems involving line, double, volume and surface integrals and beta gamma integrals and their applications in mechanics.,
5) To explain how to solve periodic functions as a (Fourier) series of sine and cosine functions, find Fourier transform and inverse Fourier transforms of some functions.

Module – 1 (9 hrs.)

Differential Calculus: Limit, Continuity and Differentiability of Functions of One Variable, Mean Value Theorems [Rolle's Theorem, Cauchy and Lagrange's Mean Value Theorems], Asymptotes [Cartesian and Polar forms], Curvature [Cartesian and Polar forms].

Module – 2 (9 hrs.)

Functions of two and more variables and Special Functions: Functions of two or more several variables: limit, continuity and differentiability, homogenous functions and Euler's theorem, higher order partial derivatives and Taylor's series, maximum and minimum values, beta, gamma functions and error functions.

Module – 3 (7 hrs.)

Vector Differential Calculus: Derivatives of vector valued functions, vector equations of curves, tangents of a curve, gradient, directional derivative, divergence and curl, line and double integrals.

Module – 4 (8 hrs.)

Vector Integral Calculus: Green's theorem, Surface integrals, Volume integrals, Gauss Divergence theorem and Stokes theorem.

Module-5 (9 hrs.)

Fourier series and Fourier transforms: Fourier series, Fourier expansion of functions of any period, even and odd functions, half range expansion, Fourier transform and Fourier integral.

Course outcomes:

After going through this course the student will be able to

CO1: determine asymptotes and curvature of a curve given in Cartesian, polar form and apply mean value theorems to solve problems.

CO2: apply limit and examine continuity and differentiability of a function of more than one variable.

CO3: calculate the gradients, divergence, curl and directional derivatives of functions of several variables along with the physical interpretation.

CO4: analyze the integral problems involving line, double, volume and surface integrals and beta gamma integrals and their applications in mechanics.

CO5: represent periodic functions as a Fourier series of sine and cosine functions, find Fourier transform and inverse Fourier transforms of some functions.

Text Books:

T1. "Advanced Engineering Mathematics, Erwin Kreyszig, John Willy and Sons, 8th Edition, 1999.

Chapters: 8(8.4, 8.5, 8.9 – 8.11), 9(9.1-9.2, 9.4 – 9.9), 10(10.1 – 10.4, 10.8 – 10.10).

T2. "Differential Calculus", Shanti Narayan and P.K. Mittal, S. Chand, 15th Edition, 2005.

Chapters: 3,4, 8(8.1 – 8.5), 9(9.1-9.4, 9.6), 11(11.5, 11.6, 11.8, 11.11), 14(14.1 – 14.4), 15(15.1 – 15.5, 15.8).

T3. "Higher Engineering Mathematics", B.V. Ramana, The McGraw-Hill, 8th Edition, 2008.

Chapter: 11(11.1, 11.2).

Reference Books:

R1. "Higher Engineering Mathematics", B. S. Grewal, Khanna Publishers, 43rd Edition, 2014.

R2. "Text Book of Differential Calculus", G. Prasad, Pothisala, 17th Edition, 2006.

R3. "Text Book of Integral Calculus", G. Prasad, Pothisala, 14th Edition, 2004.

Open Sources:

1. Dr. Sanjeev Kumar and Dr. S.K. Gupta, "Multivariable Calculus", NPTEL - IIT Roorkee. https://archive.nptel.ac.in/courses/111/107/111107108/
2. Prof. James McKernan, "Calculus of Several Variables", MITOPENCOURSEWARE- https://ocw.mit.edu/courses/18-022-calculus-of-several-variables-fall-2010/

COURSE OUTCOME:

Outcome	At the end of the course, the learner will be able to	Bloom's Level	Expected proficiency percentage	Expected Attainment percentage
CO-1	determine asymptotes and curvature of a curve given in Cartesian, polar form and apply mean value theorems to solve problems.	**2, 3**	**70%**	**65%**
CO-2	apply limit and examine continuity and differentiability of a function of more than one variable.	**2**	**70%**	**60%**
CO-3	calculate the gradients, divergence, curl and directional derivatives of functions of several variables along with the physical interpretation.	**2**	**70%**	**65%**

CO-4	analyze the integral problems involving line, double, volume and surface integrals and beta gamma integrals and their applications in mechanics.	**2**	**70%**	**60%**
CO-5	represent periodic functions as a Fourier series of sine and cosine functions, find Fourier transform and inverse Fourier transforms of some functions.	**2, 3**	**60%**	**50%**

MAPPING OF COURSE OUTCOME ONTO PROGRAM OUTCOME (CO –PO MAPPING)

Course Outcome	PO1-**Engineering knowledge**	PO2- **Problem analysis**	PO3-**Design/development of solutions**	PO4-**Conduct investigations of complex problems**	PO5-**Modern tool usage**	PO6-**The engineer and society**	PO7-**Environment and sustainability**	PO8-**Ethics**	PO9-**Individual and team work**	PO10-**Communication skill**	PO11-**Project management and finance**	PO12 **Life-long learning**
CO-1	3	3	1	1	1	1	1	-	-	-	-	1
CO-2	3	3	1	1	1	1	1	-	-	-	-	1
CO-3	3	3	1	1	1	1	1	-	-	-	-	1
CO-4	3	3	1	1	1	1	1	-	-	-	-	1
CO-5	3	3	2	2	1	2	1	-	2	-	-	1

Course utilization Plan / Lesson Plan

Module No	**Module Name**	**Required contact Hours**	**COs addressed**	**References book Used**
Module-1	**Differential Calculus**	**9**		
	Limit and Continuity of Functions of One Variable	1	1	1-2
	Differentiability of Functions of One Variable,	1	1	1-2
	Mean Value Theorems [Rolle's Theorem,	1	1	1-2
	Cauchy and Lagrange's Mean Value Theorems],	1	1	1-2
	Asymptotes to Curves in Cartesian Form	1	1	1-2
	Asymptotes to Curves in Cartesian Form (Cont.)	1	1	1-2
	Asymptotes to Curves in Polar Form	1	1	1-2
	Curvature [Cartesian forms]	1	1	1-2
	Curvature [Polar forms]	1	1	1-2
Module-2	**Functions of two and more variables and Special Functions**	**9**		

	Limit of Functions of two variables	1	2	1-3
	Continuity of Functions of two variables	1	2	1-3
	Differentiability of Functions of two variables	1	2	1-3
	Homogenous functions and Euler's theorem	1	2	1-3
	Higher order partial derivatives and Taylor's series	1	2	1-3
	Maximum and minimum values	1	2	1-3
	Beta function	1		
	Gamma functions	1		
	Error functions	1		1-3
MODULE-3	**Vector Differential Calculus**	7		
	Derivatives of vector valued functions, , , , and,.	1	3	1-2
	Vector equations of curves, Tangents of a curve, gradient	1	3	1-2
	Tangents of a curve, gradient, Directional derivative	1	3	1-2
	Divergence and Curl	1	3	1-2
	Line integral	1	3	1-2
	Line integral Cond.	1	3	1-2
	Double integrals	1	3	1-2
MODULE-4	**Vector Integral Calculus**	**8**		
	Green's theorem	1	4	1,3
	Surface integrals	1	4	1,3
	Surface integrals (Continued.)	1	4	1,3
	Volume integrals	1	4	1,3
	Gauss Divergence theorem	1	4	1,3
	Gauss Divergence theorem (Continued)	1	4	1,3
	Stokes theorem	1	4	1,3
	Stokes theorem (Continued)	1	4	1,3
MODULE-5	**Fourier series and Fourier transforms**	**9**		
	Fourier series of functions of any period	1	5	1
	Fourier series of functions of any period (Contd.)	1	5	1
	Even and Odd functions	1	5	1
	Half range expansion	1	5	1
	Fourier transform	1	5	1
	Fourier transform (Contd.)	1	5	1
	Fourier transform (Contd.)	1	5	1
	Fourier integral	1	5	1
	Fourier integral (Contd.)	1	5	1
	TOTAL	**42 HOURS**		

Learning Assessments

Bloom's Level of Cognitive Task		Teacher Assessment / Formative Assessment (50 %)				Summative Assessment (50 %)
		Quiz (10%)	Assignment (10%)	Experiential learning (10%)	Mid Sem (20%)	End Sem (50%)
Level-1	Remember	40%	40%	40%	40%	30%
	understand					
Level-2	Apply	60%	40%	60%	60%	50%
	Analyze					
Level-3	Evaluate		20%			20%
	Create					
Total		100%	100%	100%	100%	100%

***NOTE: Experiential Learning: class test/simulation project/survey paper/ case study presentation/team project**

Course Prepared By: Prof. Hemant Kumar Mandal, Asst. Professor, Mathematics, CGU-Odisha
Course Verified By: Prof. Kamal Lochan Mahanta, Associate Professor, Mathematics, CGU-Odisha