

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI

COURSE PLAN (November 2024 – April 2025)

Department	: Mathematics
Name/s of the Faculty	: Dr. A. Josephine Lissie (3 hours) and Dr. S. Sarah Surya (2 hours)
Course Title	: Calculus of Variation and Integral Equations
Course Code	: 23MT/PE/CI15
Shift	: I

COURSE OUTCOMES (COs)

COs	Description	CL
CO1	recall the basic concepts of integration and ordinary differential equations, in particular, initial value problems and boundary value problems	K1
CO2	appreciate the concepts of the theory of variation in problems and identify the different types of integral equations	K2
CO3	apply suitable techniques to find the solution of maxima and minima of a functional and an integral equation	K3
CO4	analyse the solutions of functional of various types and integral equations	K4
CO5	evaluate by choosing an appropriate method for variational problems and integral equations and obtain suitable solutions to real life situations	K5

Week	Unit No.	Content	Cognitive Level	Teaching Hours	COs	Teaching Learning Methodology	Assessment Methods
Nov 18 – 25, 2024 (Day Order 1-6)	1, 3	Unit 1: Variation in Problems with Fixed Boundaries 1.1 Variation and its Properties 1.2 Euler's Equation Unit 3: Integral Equations 3.1 Abel's Problem	K1- K5	3+2	CO1-5	Lecture and problem solving	Questioning
Nov 26- Dec 3, 2024 (Day Order 1 to 6)	1, 3	Unit 1: Variation in Problems with Fixed Boundaries 1.3 Functional of the Form $\int_{x_0}^{x_1} F(x, y, y', \dots, y^{(n-1)}, y^{(n)}) dx$ 1.4 Functional Dependent on Higher-Order Derivatives Unit 3: Integral Equations 3.2 Integral Equation 3.3 Kernels	K1- K5	3+2	CO1-5	Lecture and problem solving	Questioning
Dec 4-11, 2024 (Day Order 1 to 6)	1, 3	Unit 1: Variation in Problems with Fixed Boundaries	K1- K5	3+2	CO1-5	Lecture and problem solving	Third Component – Problem solving (15 marks)

		1.4 Functional Dependent on Higher- Order Derivatives 1.5 Functional Dependent on the Functions of Several Independent Variables Unit 3: Integral Equations 3.4 Classification of Integral Equation					
Dec 12-19, 2024 (Day Order 1 to 6)	1, 3	Unit 1: Variation in Problems with Fixed Boundaries 1.6 Variational Problems in Parametric Form 1.7 Some Applications Unit 3: Integral Equations 3.5 Solution of an Integral Equation	K1- K5	3+2	CO1-5	Problem solving	Questioning
Dec 20, 2024 (Day Order 1)	1	Unit 1: Variation in Problems with Fixed Boundaries 1.7 Some Applications	K1- K5	1+0	CO1-5	Lecture and Problem solving	Quiz
Jan 3 – 7, 2025 (Day Order 3 to 6)	2, 3	Unit 2: Variational Problems with Moving Boundaries	K1- K5	2+1	CO1-5	Lecture and problem solving	Slip Test

		2.1 An Elementary Problem with Moving Boundaries Unit 3: Integral Equations 3.5 Solution of an Integral Equation					
Jan 8 – 17, 2024 (Day Order 1 to 6)	2, 3	Unit 2: Variational Problems with Moving Boundaries 2.2 The Moving-Boundary Problem for a Functional of the Form $\int_{x_0}^{x_1} F(x, y, z, y', z') dx$ Unit 3: Integral Equations Solution of Fredholm Integral Equations of the Second Kind 3.6 Characteristic Value and Characteristic Function	K1- K5	3+2	CO1-5	Group discussion	Quiz
Jan 18 - 23, 2025	C.A. Test – I (Portions: Unit 1 & part of Unit 3)						

Jan 24 -31, 2025 (Day Order 1 to 6)	2, 3	Unit 2: Variational Problems with Moving Boundaries 2.3 Extremals with Corners Unit 3: Integral Equations 3.7 Solution of Homogeneous Fredholm Integral Equation of the Second Kind with Separable Kernel	K1- K5	3+2	CO1-5	Lecture and problem solving	Slip Test
Feb 3-8, 2025 (Day Order 1 to 6)	2, 4	Unit 2: Variational Problems with Moving Boundaries 2.4 One-Sided Variations 2.5 Isoperimetric Problems Unit 4: Solution of Fredholm Integral Equations of the Second Kind 4.1 Orthogonality of Two Functions	K1- K5	3+2	CO1-5	Lecture and problem solving	Third Component – Seminar (15 marks)
Feb 10– 18, 2025 (Day Order 1 to 4)	2, 4, 5	Unit 2: Variational Problems with Moving Boundaries 2.5 Isoperimetric Problems	K1- K5	3+1	CO1-5	Presentation	Questioning

		Unit 5: Applications to Ordinary Differential Equations 5.1 Initial Value Problems Unit 4: Solution of Fredholm Integral Equations of the Second Kind 4.1 Orthogonality of Two Functions					
Feb 19- 26, 2025 (Day Order 1-6)	5, 4	Unit 5: Applications to Ordinary Differential Equations 5.1 Initial Value Problems 5.2 Boundary Value Problems Unit 4: Solution of Fredholm Integral Equations of the Second Kind 4.2 Orthogonality of Eigen functions	K1- K5	3+2	CO1-5	Lecture and problem solving	Questioning
Feb 27- Mar 6, 2025 (Day Order 1 to 6)	5, 4	Unit 5: Applications to Ordinary Differential Equations 5.2 Boundary Value Problems 5.3 Dirac Delta Function Unit 4: Solution of Fredholm Integral	K1- K5	3+2	CO1-5	Lecture and problem solving	Third Component – Quiz (20 marks)

		Equations of the Second Kind 4.3 Iterated Kernel & Resolvent Kernel					
Mar 7 – 11, 2025 (Day Order 1 to 3)	5, 4	Unit 5: Applications to Ordinary Differential Equations 5.3 Dirac Delta Function Unit 4: Solution of Fredholm Integral Equations of the Second Kind 4.3 Iterated Kernel & Resolvent Kernel	K1- K5	2+1	CO1-5	Lecture and problem solving	Questioning
Mar 12 –17, 2025	C.A. Test – II (Portions: Parts of Units 2, 4 & 5)						
Mar 18 – 20, 2025 (Day 4 to 6)	5, 4	Unit 5: Applications to Ordinary Differential Equations 5.4 Green’s Function Approach Unit 4: Solution of Fredholm Integral Equations of the Second Kind 4.4 Solution of Fredholm Integral Equation of the Second Kind by Successive Substitution	K1- K5	1+1	CO1-5	Lecture and problem solving	Slip Test

<p>Mar 21 - 28, 2025 (Day Order 1 to 6)</p>	<p>5, 4</p>	<p>Unit 5: Applications to Ordinary Differential Equations 5.4 Green's Function Approach Unit 4: Solution of Fredholm Integral Equations of the Second Kind 4.4 Solution of Fredholm Integral Equation of the Second Kind by Successive Substitution</p>	<p>K1- K5</p>	<p>3+2</p>	<p>CO1-5</p>	<p>Lecture and problem solving</p>	<p>Questioning</p>
<p>Mar 29- April 2, 2025 (Day Order 1 to 3) (2+1)</p>	<p>REVISION</p>						

.