

**Subject Code: 02MA0501**
**Subject Name: CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS**
**M.Sc. Year – II (Sem-III)**

**Objective:** The main aim is to make students familiar with extrema of functional through calculus of variations and integral equations.

**Credits Earned:** 5 Credits

**Course Outcomes:** After completion of this course, student will be able to

- Solve isoperimetric problems of standard types.
- Solve simple IVP and BVP by using calculus of several variable
- Solve integral equations of several types.

**Teaching and Examination Scheme**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal (I)	Viva (V)	Term work (TW)	
4	2	-	5	50	30	20	25	25	150

**Contents:**

Unit	Topics	Contact Hours
1	<b><u>Calculus of Variations:</u></b> Introduction, Euler's equation, Problem of Geodesics, Isoperimetric problems, Notion of extrema in functions and functionals	15
2	<b><u>Integral equations:</u></b> Introduction and basic examples, Conversion of Volterra equation to ODE, Conversion of IVP AND BVP to integral equations, Verification of solution, Integral equations involving convolution, Abel's Integral equations, Integro-Differential equations	15
3	<b><u>Fredholm Integral Equations:</u></b> Fredholm equation with separable kernels, Hilbert Schmidt theorem, Solutions to Fredholm Integral Equations	15

4	<b>Sturm Liouville's Equation:</b> Bessel's Equation, Laguerre's Equation, Hermite's Equation, Sturm Liouville Equation	<b>15</b>
<b>Total Hours</b>		<b>60</b>

**Recommended Books:**

1. Calculus of Variations by I. M. Gelfand and S. V. Fomin, Prentice Hall. Inc., 1963
2. Linear integral equations, theory and technique, by Ram P.Kanwal, 1971
3. Linear Integral equations, William Vernon Lovitt, Dover Publication Inc.,Newyork, 2005[Reissued]
4. Integral equations and their applications, M. Rahman, WIT Press, Boston, 2007
5. Calculus of Variations, Lev D. Elsgole, Dover Publication Inc.,Newyork, 2007

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

**Instructional Method:**

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

**Supplementary Resources:**

1. [https://en.wikipedia.org/wiki/Integral\\_equation](https://en.wikipedia.org/wiki/Integral_equation)
2. <http://nptel.ac.in/courses/111104025/>
3. <http://mathworld.wolfram.com/IntegralEquation.html>