ARSD College, University of Delhi

Lesson Plan

Course Name : B.Sc. (H) Mathematics						
Semester	**Course Code**	**Course Title**	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Credit (C)**
IV		Riemann Integration & Series of Functions	3	1		6
Teacher/Instructor(s)		MONU KUMAR				
Session		2021				

Course Objective:

To understand the integration of bounded functions on a closed and bounded interval and its extension to the cases where either the interval of integration is infinite, or the integrand has infinite limits at a finite number of points on the interval of integration.

Course Learning Outcomes: The course will enable the students to:

i) Learn about some of the classes and properties of Riemann integrable functions, and the applications of the Fundamental theorems of integration.
ii) Know about improper integrals including, beta and gamma functions.
iii) Learn about Cauchy criterion for uniform convergence and Weierstrass M-test for uniform convergence.
iv) Know about the constraints for the inter-changeability of differentiability and integrability with infinite sum.

Lesson Plan:

Unit No.	Learning Objective	Lecture No.	Topics to be covered
1.		1-6	Definition of Riemann integration, Inequalities for upper and lower Darboux sums, Necessary and sufficient conditions for the Riemann integrability
		7-10	Definition of Riemann integration by Riemann sum and equivalence of the two definitions, Riemann integrability of monotone functions and continuous functions, Properties of Riemann integrable functions,
		11-15	Definitions of piecewise continuous and piecewise monotone functions and their Riemann integrability, intermediate value theorem for integrals,
		16-18	Fundamental theorems (I and II) of calculus, and the integration by parts.

2.		19-21	Improper integrals of Type-I, Type-II and mixed type,
		22-24	Convergence of beta and gamma functions, and their properties.
3.		25-28	Pointwise and uniform convergence of sequence of functions
		29-32	Theorem on the continuity of the limit function of a sequence of functions
		33-36	Theorems on the interchange of the limit and derivative, and the interchange of the limit and integrability of a sequence of functions.
		37-38	Pointwise and uniform convergence of series of functions, Theorems on the continuity,derivability and integrability of the sum function of a series of functions,
		39-42	Cauchy criterion and the Weierstrass M-test for uniform convergence.

Evaluation Scheme:

No.	Component	Duration	Marks
1.	Internal Assessment		25
	• Quiz		
	• Class Test		
	• Attendance		
	• Assignment		
2.	End Semester Examination	3 hr	75

Details of the Course

Unit	Contents	Contact Hours
1	Definition of Riemann integration, Inequalities for upper and lower Darboux sums, Necessary and sufficient conditions for the Riemann integrability, Definition of Riemann integration by Riemann sum and equivalence of the two definitions, Riemann integrability of monotone functions and continuous functions, Properties of Riemann integrable functions, Definitions of piecewise continuous and piecewise monotone functions and their Riemann integrability, intermediate value theorem for integrals, Fundamental theorems (I and II) of calculus, and the integration by parts.	18
2	Improper integrals of Type-I, Type-II and mixed type, Convergence of beta and gamma functions, and their properties.	6

3	Pointwise and uniform convergence of sequence of functions, Theorem on the continuity of the limit function of a sequence of functions, Theorems on the interchange of the limit and derivative, and the interchange of the limit and integrability of a sequence of functions. Pointwise and uniform convergence of series of functions, Theorems on the continuity, derivability and integrability of the sum function of a series of functions, Cauchy criterion and the Weierstrass M-test for uniform convergence.	18
	Total	**42**

Suggested Books:

Sl. No.	**Name of Authors/Books/Publishers**	**Year of Publication/Reprint**
1	Bartle, Robert G., & Sherbert, Donald R. (2015). *Introduction to Real Analysis* (4thed.). Wiley India Edition. Delhi. .	2015
2	Denlinger, Charles G. (2011). *Elements of Real Analysis*. Jones & Bartlett (StudentEdition). First Indian Edition. Reprinted 2015.	2011,2015
3	Ghorpade, Sudhir R. & Limaye, B. V. (2006). *A Course in Calculus and RealAnalysis*. Undergraduate Texts in Mathematics, Springer (SIE). First Indian reprint.	2006
4	Ross, Kenneth A. (2013). *Elementary Analysis*: *The Theory of Calculus* (2nd ed.).Undergraduate Texts in Mathematics, Springer.	2013

Mode of Evaluation:	Internal Assessment / End Semester Exam