ARSD College, University of Delhi

Model Course Handout/Lesson Plan

Course Name:		B.Sc. (Physical Sciences/ Mathematical Sciences)				
Semester	**Course Code**	**Course Title**	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Credit (C)**
I	DSC	Topics in Calculus	3	1	0	4
Teacher/Instructor(s)		Prashant Kumar				
Session		**2022-23**				

Course Objectives:

The primary objective of this course is to:

1) Introduce the basic tools of calculus which are helpful in understanding their applications in many real-world problems.

2) Understand/create various mathematical models in everyday life.

Course Learning Outcomes:

The students who take this course will be able to:

1) Understand continuity and differentiability in terms of limits and graphs of certain functions.
2) Describe asymptotic behaviour in terms of limits involving infinity.
3) Use of derivatives to explore the behaviour of a given function locating and classify its extrema and graphing the function.
4) Apply the concepts of asymptotes, and inflexion points in tracing of cartesian curves.
5) Compute the reduction formulae of standard transcendental functions with applications.

Lesson Plan:

Unit No.	Learning Objective	Lecture No.	Topics to be Covered
1	Limits, Continuity and Differentiability	1	Limits
		2	Limit of a function
		3	Limits using ϵ-δ definition
		4	Infinite limits
		5	Continuity

		6	Types of Discontinuities
		7	Differentiability of a function
		8	Examples related to Differentiability
		9	Relationship between Continuity & Differentiability
		10	Successive Differentiation
		11	Calculation of n^{th} derivatives
		12	Leibnitz Theorem
		13	Partial Differentiation
		14	Homogenous Functions
		15	Euler's Theorem on homogeneous functions
2	Mean Value Theorems and its Applications	16	Rolle's Theorem
		17	Examples of Rolle's Theorem
		18	Lagrange's Mean Value Theorem
		19	Examples of Lagrange's Mean Value Theorem
		20	Cauchy Mean Value Theorem
		21	Example of Cauchy Mean Value Theorem
		22	Taylor Theorem
		23	Lagrange and Cauchy Form of Remainder
		24	Convergent Sequences and Series
		25	Taylor's Series
		26	Maclaurin's Series Expansion of e^x, $\sin x$ and $\cos x$
		27	Maclaurin's Series Expansion of $\log(1+x)$ and $(1+x)^m$
		28	Indeterminate Forms $(0/0, \infty/\infty)$
		29	Indeterminate Forms $(0 \cdot \infty, \infty - \infty)$
		30	Indeterminate Forms $(0^0, 1^\infty, \infty^0)$
3	Tracing of Curves and Reduction Formulae	31	Asymptotes (parallel to axes)
		32	Asymptotes (oblique)
		33	Concavity and Inflection Points
		34	Singular points
		35	Nature of singular points
		36	Tangents at the origin
		37	Curve tracing
		38	Graph in Polar Coordinates
		39	Reduction formulae for $\int \sin^n(x)dx$, $\int \cos^n(x)dx$
		40	Reduction formulae for $\int \sin^n(x)\cos^m(x)dx$
		41	Applications of Reduction formulae
		42	Revision and Test

Evaluation Scheme:

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

Details of the Course:

Unit	Content	Contact Hours
1	**Continuity and Differentiability** Limit of a function, ε- δ definition of a limit, Infinite limits, Continuity and types of discontinuities; Differentiability of a function, Successive differentiation: Calculation of the n^{th} derivatives, Leibnitz theorem; Partial differentiation, Euler's theorem on homogeneous functions.	18
2	**Mean Value Theorems and its Applications** Rolle's theorem, Mean value theorems and applications to monotonic functions and inequalities; Expansion of functions: Taylor's theorem, Taylor's series, Maclaurin's series expansion of e^x, $\sin x$, $\cos x$, $\log(1+x)$ and $(1+x)^m$; Indeterminate forms.	
3	**Tracing of Curves and Reduction Formulae** Asymptotes (parallel to axes and oblique), Concavity and inflexion points, Singular points, Tangents at the origin and nature of singular points, Curve tracing (cartesian and polar equations). Reduction formulae for $\int \sin^n(x)dx$, $\int \cos^n(x)dx$ and $\int \sin^n(x)\cos^m(x)dx$ and their applications.	15
	Total	**42**

Suggested Books:

S. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
1	Anton, Howard, Bivens, Irl, & Davis, Stephen (2013). *Calculus* (10th ed.). Wiley IndiaPvt. Ltd. New Delhi. International Student Version. Indian Reprint	2016
2	Prasad, Gorakh, *Differential Calculus* (19th ed.), Pothishala Pvt. Ltd. Allahabad	2016

Mode of Evaluation:

Internal Assessment/End Semester Exam