ARSD College, University of Delhi

Model Course Handout/Lesson Plan

Course Name : BSc hons Maths						
Semester	**Course Code**	**Course Title**	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Credit (C)**
I	32351101	BMATH101: Calculus	4	0	0	4
Teacher/Instructor(s)		Anant Tiwari				
Session		Odd Sem.2022				

Course Objective:

The primary objective of this course is to introduce the basic tools of calculus and geometric properties of different conic sections which are helpful in understanding their applications in planetary motion, design of telescope and to the realworld problems. Also, to carry out the hand on sessions in computer lab to have a deep conceptual understanding of the above tools to widen the horizon of students' selfexperience.

Course Learning Outcomes:

This course will enable the students to:

- *i) Learn first and second derivative tests for relative extrema and apply the knowledge in problems in business, economics and life sciences.*
- *ii) Sketch curves in a plane using its mathematical properties in the different coordinate systems of reference.*
- *iii) Compute area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas.*
- *iv) Understand the calculus of vector functions and its use to develop the basic principles of planetary motion.*

Lesson Plan:

Unit No.	Learning Objective	Lecture No.	Topics to be covered
1	*Unit 1: Derivatives for Graphing and Applications*	*1-4*	*The first-derivative test for relative extrema, Concavity and inflection points, Secondderivative test for relative extrema, Curve sketching using first and second derivative tests.*
		5-8	*Limits to infinity and infinite limits, Graphs with asymptotes, Vertical tangents and cusps, L'Hôpital's rule.*
		9-12	*Applications of derivatives in business, economics and life sciences. Higher order derivatives and Leibniz rule for higher order derivatives for the product of two functions.*
2	*Unit 2: Sketching and Tracing of Curves*	*13-16*	*Parametric representation of curves and tracing of parametric curves (except lines in $\mathbb{R}3$), Polar coordinates and the relationship between Cartesian and polar coordinates.*

		17-24	*Tracing of curves in polar coordinates. Techniques of sketching conics: parabola, ellipse and hyperbola.*
		25-28	*Reflection properties of conics, Rotation of axes, Second degree equations and their classification into conics using the discriminant.*
3	*Unit 3: Volume and Area of Surfaces*	*29-36*	*Volumes by slicing disks and method of washers, Volumes by cylindrical shells, Arc length, Arc length of parametric curves.*
		37-40	*Area of surface of revolution; Hyperbolic functions.*
		41-44	*Reduction formulae, and to obtain the iterative formulae for the integrals of the form:.*
4	Unit 4: Vector Calculus and its Applications	*45-48*	*Introduction to vector functions and their graphs, Operations with vector functions, Limits and continuity of vector functions, Differentiation and tangent vectors.*
		49-52	*Properties of vector derivatives and integration of vector functions; Modeling ballistics and planetary motion, Kepler's second law.*
		53-56	*Unit tangent, Normal and binormal vectors, Curvature.*

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	*The first-derivative test for relative extrema, Concavity and inflection points, Secondderivative test for relative extrema, Curve sketching using first and second derivative tests; Limits to infinity and infinite limits, Graphs with asymptotes, L'Hôpital's rule; Applications in business, economics and life sciences; Higher order derivatives, Leibniz rule.*	*12 hr*
2	*Parametric representation of curves and tracing of parametric curves (except lines in $\mathbb{R}$), Polar coordinates and tracing of curves in polar coordinates; Techniques of sketching conics, Reflection properties of conics, Rotation of axes and second degree equations, Classification into conics using the discriminant.*	*16 hr*
3	*Volumes by slicing disks and method of washers, Volumes by cylindrical shells, Arc length, Arc length of parametric curves, Area of surface of revolution; Hyperbolic functions; Reduction formulae.*	*16 hr*
4	*Introduction to vector functions and their graphs, Operations with vector functions, Limits and continuity of vector functions, Differentiation and integration of vector functions; Modeling ballistics and planetary motion, Kepler's second law; Unit tangent, Normal and binormal vectors, Curvature.*	*12 hr*
	Total	***56***

Suggested Books:

Sl. No.	***Name of Authors/Books/Publishers***	***Year of Publication/ Reprint***
1.	*Anton, Howard, Bivens, Irl, & Davis, Stephen (2013). Calculus (10th ed.). John Wiley & Sons Singapore Pte. Ltd. Indian Reprint (2016) by Wiley India Pvt. Ltd. Delhi.*	*2013/2016*
2.	*Prasad, Gorakh (2016). Differential Calculus (19th ed.). Pothishala Pvt. Ltd. Allahabad.*	*2016*
3.	*Strauss, Monty J., Bradley, Gerald L., & Smith, Karl J. (2007). Calculus (3rd ed.). Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Delhi. Indian Reprint 2011.*	2011
4.	*Thomas, Jr. George B., Weir, Maurice D., & Hass, Joel (2014). Thomas' Calculus (13th ed.). Pearson Education, Delhi. Indian Reprint 2017.*	2014/2017

Mode of Evaluation:	*Internal Assessment / End Semester Exam*