

SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)

Affiliated to the University of Mumbai

Programme: Science Mathematics (Minor) Theory Course Code: SMAT111MN Practical Course Code: SMAT111MNP

Syllabus for the Academic Year 2023-2024 based on the National Education Policy 2020



PROGRAMME SPECIFIC OUTCOMES					
1	The learner will be able to use logical and critical thinking abilities in problem solving and develop the habit of self-learning by the end of the course.				
2	The learner will be able to create and apply quantitative models that emerge in business, social science, and other areas.				
3	The learner will be able to analyse the mathematical outcomes and use them to solve numerous issues that arise in various areas of mathematics and associated disciplines.				
4.	The learner will be able to identify trends and make a distinction between the problems' core components and non-essential ones.				
5.	The learner will be able to utilise technological expertise to address certain theoretical and applied issues in mathematics and other fields.				
6.	The learner will be able to convert verbally supplied information into a mathematical form, choose and use the proper mathematical formulas or techniques to process the information, and then make the necessary conclusion.				
7.	The learner will be able to recognise the relationships between different areas of mathematics and the connections between mathematics and other disciplines.				



SOPHIA COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS & STATISTICS

COURSE DETAILS FOR MINOR:

	SEMESTER 1	SEMESTER 2	
TITLE	CALCULUS-1	Introduction	
TYPE OF COURSE DSC/DSE	DSC	DSC	
CREDITS	4	4	

Programme: Science	Semester – 1		
Mathematics Minor			
Course Title: Calculus-1	Course Code: SMAT111MN		
COURSE OBJECTIVES:			

To enable the learner to

- 1. Become familiar with the fundamental properties of the real number system and its subsets, which form the basis of real analysis.
- 2. Have a thorough understanding of functions, a key building block of all sciences, and the ability to assess a function's properties and draw its graph.
- 3. Comprehend the ideas of a function's limit and continuity, and to use the many results of limits to find solutions to issues.

COURSE OUTCOMES:

At the end of the course the learner will be able to

- 1. Recall the meanings of the terms supremum, infimum, bounded sets, neighbourhoods, interior points, limit points, intervals, and their attributes.
- 2. Understand order relation in IR and compute supremum and infimum of a subset of IR.
- 3. Comprehend and apply the various results and properties of R.
- 4. Understand the concept of functions in R,their characteristics and plot the graphs of the standard functions' domains and ranges.
- 5. Define the limit of a function and to gauge if the function is continuous or not.



6. Understand the algebra of limits, continuous functions, and differentiable functions; express the property of intermediate value; and use it to identify function solutions.

Lectures per week (1 Lecture is 60 minutes)		3			
Total number of Hours in a Semester			45		
Credits				3	
Evaluation Sy	ystem	Semester End	2	50 marks	
		Examination	Hours		
		Internal Assessment			50 marks
		REAL NUMBER SYSTE	<u>M:</u>		
	1.1	Real number system R a	nd order pro	operties	
UNIT 1		of R, Absolute values and	d its propert	ies	15 hours
	1.2	AM-GM inequality, Cauch	ny-Schwarz		
		inequality, Intervals and r	neighbourhc	ods,	
		Hausdorff property.			-
	1.3	Bounded sets, I.u.b and g	g.l.b, l.u.b. a	xiom	
		and its consequences, Ai	rchimedean	. f	
		property and its application	ons, density	OT	
		SVSTEMS:	UNIDER		
UNIT Z	0.1	Definitions – Function domain and range of			15 hours
	2.1	a function direct image a	nd inverse	imade	15 hours
		of a function f. bounded f			
		function, surjective function			
		function, composite of two			
		defined), inverse of a bije	ctive function	òn.	
	2.2	Graphs of some standard	functions s	such as	
		Ixl; e ^x ; log x; ax ² +bx+c; 1/	/x, x ⁿ (n ≥3);	sin x;	
		cos x; tan x; x sin(1/x); x	² sin(1/x), s	step	
		functions over suitable in			
		LIMITS AND CONTINUE	<u>IY:</u>		
UNIT 3		Definition and examples	of limit of o		
	3.1	function left-hand-limit ri	iaht_hand_lir	nit	15 hours
		uniqueness of limit if it ex	nii, a of		
		limits limit of composite f	function sar	ndwich	
		theorem, non-existence of			
	3.2	Continuity of a real value			
		in terms of limits, examp			
		real valued function at en	d points of	domain.	



	Algebra	of	conti	nuou	S	functio	ons,
	Discontinu	ous and c	functio	ns, Ldisc	exan	nples	of
	Terriovable	anue	SSEIIIIa	i uisc	Ununu	iity.	
3.3	Intermedia	te v	/alue	theor	em	and	its
	application	s, Bo	Izano-W	/eiers	strass	theor	em;
	Continuity	on clo	osed and	d bou	nded	interva	als.

Main Reference:

- 1. T. M. Apostol, Calculus Volume I, Wiley & Sons (Asia) Pte. Ltd.
- 2. James Stewart, Calculus, Third Edition, Brooks/cole Publishing Company, 1994.
- 3. Ajit Kumar-S. Kumaresan, A Basic Course in Real Analysis, CRC Press, 2014.

Additional Reference Books:

- 1. R. R. Goldberg, Methods of Real Analysis, Oxford and IBH, 1964.
- 2. K.G. Binmore, Mathematical Analysis, Cambridge University Press, 1982.
- 3. R.G. Bartle- D.R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 1994.
- 4. Richard Courant-Fritz John, A Introduction to Calculus and Analysis, Volume I, Springer.
- 5. Ghorpade, Sudhir R.- Limaye, Balmohan V., A Course in Calculus and Real Analysis, Springer International Ltd, 2000.
- 6. G.B. Thomas and R. L. Finney, Calculus and Analytic Geometry, Ninth Edition, Addison Wesley, 1998.

Suggested List of Practicals (CALCULUS I) - 1 Credit (COURSE CODE: SMAT111MNP)

- 1. Absolute value of real numbers
- 2. Application of Archimedean property, intervals, neighbour-hood.
- 3. Consequences of l.u.b. axiom, infimum and supremum of sets.
- 4. Functions.
- 5. Limits, finding the Left- and Right-hand limit of the function
- 6. Continuous and discontinuous functions.
- 7. Applications of Intermediate Value theorem and Bolzano's theorem.

ASSESSMENT DETAILS:



I. Internal Assessment (IA): 50 marks

- IA is a separate head of passing.
- A learner should get a minimum of 20 marks out of 50 to be declared PASS in the course.
- 2 activities of 25 marks each
- An additional 25-mark activity will be held ONLY for those who missed any one or both of the 2 activities, due to valid reasons.
- If the learner does not get 20 marks out of 50, the learner will have to appear for the IA ATKT.

II. Semester End Examination (SEE): 50 marks

- SEE is a separate head of passing.
- A learner should get a minimum of 20 marks in SEE to be declared PASS in the course.
- All units of the syllabus will be covered in SEE and will be given equal weightage.
- An additional SEE will be held for those who are absent, due to valid reasons, for the main/regular SEE.
- If the learner does not get 20 marks out of 50, the learner will have to appear for the SEE ATKT.







PROGRAMME SPECIFIC OUTCOMES					
1	The learner will be able to use logical and critical thinking abilities in problem solving and develop the habit of self-learning by the end of the course.				
2	The learner will be able to create and apply quantitative models that emerge in business, social science, and other areas.				
3	The learner will be able to analyse the mathematical outcomes and use them to solve numerous issues that arise in various areas of mathematics and associated disciplines.				
4.	The learner will be able to identify trends and make a distinction between the problems' core components and non-essential ones.				
5.	The learner will be able to utilise technological expertise to address certain theoretical and applied issues in mathematics and other fields.				
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COURSE DETAILS FOR MINOR:

	SEMESTER 1	SEMESTER 2
TITLE	CALCULUS-1	CALCULUS-2
TYPE OF COURSE DSC/DSE	DSC	DSC
CREDITS	4	4

Programme: Science	Semester – 2			
Mathematics Minor				
Course Title: Calculus-2	Course Code: SMAT211MN			
COURSE OBJECTIVES:				
To enable the learner to				
4. To develop in the learner, an understanding of the	e concepts of derivative of a function.			
5. To impart knowledge of the methods of finding the function.	e higher order derivative of the given			
6. To enable the learner understands the application	ns of the derivative of a function.			
7. To develop an understanding of the concepts and	d applications of Mean Value theorems			
COURSE OUTCOMES:				
At the end of the course the learner will be able to				
7. The learner can find the derivative of a function of	n the set of real numbers.			
8. The learner will be able to find the higher order de	erivatives of the functions			
The learner will be able to apply the various concepts of differentiation on the functions to find the nature of the function.				
10. The learner will be able to apply the concepts of Mean Value theorems and find the approximate value of the function at a certain point.				
Lectures per week (1 Lecture is 60 minutes)	3			
Total number of Hours in a Semester	45 Theory and 30 hours Practical			
Credits	3 (theory)			



Evaluation System		Semester End	2	,	50 marks
		Examination	Hours		
		Internal Assessment			50 marks
	1 1	Differentiation of real valued			
UNIT 1	1.1	 i. Definition of differentiation at a point of an open interval, examples of differentiable and non-differentiable functions, relation between continuity and differentiability. ii. Algebra of differentiable functions. Chain rule, Derivative of inverse functions, Implicit differentiation iii. Higher order derivatives, Leibnitz rule for 			15 hours
UNIT 2	2.1	 higher order derivatives. <u>Applications of differentiation</u> Increasing and decreasing functions, definition of local maximum and local minimum, stationary points, first and second derivative test, examples Graph of functions using first and second derivatives, concave functions, points of inflection. Geometric Interpretation of Derivatives-applications such as rate of change in area and volume 			15 hours
UNIT 3	3.1	 Mean Value Theorems and their Applications : Rolle's theorem, Lagrange's and Cauchy's mean value theorems, applications and examples. Taylor's theorem and its applications. iii. L-hospital's rule without proof, examples of indeterminate forms 			15 hours

Main Reference:

- 1. James Stewart, Calculus, Third Edition, Brooks/cole Publishing Company, 1994.
- 2. G.B. Thomas and R. L. Finney, Calculus and Analytic Geometry, Ninth Edition, AddisonWesley.
- 3. Ajit Kumar, S. Kumaresan, A Basic Course in Real Analysis, CRC Press, 2014.

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- 3. R.G. Bartle- D.R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 1994.
- 4. Richard Courant-Fritz John, A Introduction to Calculus and Analysis, Volume I, Springer.
- 5. Ghorpade, Sudhir R.- Limaye, Balmohan V., A Course in Calculus and Real Analysis, Springer International Ltd, 2000.

Suggested List of Practicals (CALCULUS 2) - 1 Credit (COURSE CODE: SMAT211MNP)

- 1. Differentiability of a function
- 2. Higher order derivatives, Leibnitz theorem.
- 3. Maxima, Minima and points of inflections
- 4. L'Hospitals Rule
- 5. Mean value theorems and its applications.
- 6. Applications of Taylor's theorem and Taylor's polynomials.

ASSESSMENT DETAILS:

III. Internal Assessment (IA): 50 marks

- IA is a separate head of passing.
- A learner should get a minimum of 20 marks out of 50 to be declared PASS in the course.
- 2 activities of 25 marks each
- An additional 25-mark activity will be held ONLY for those who missed any one or both of the 2 activities, due to valid reasons.
- If the learner does not get 20 marks out of 50, the learner will have to appear for the IA ATKT.

IV. Semester End Examination (SEE): 50 marks

- SEE is a separate head of passing.
- A learner should get a minimum of 20 marks in SEE to be declared PASS in the course.
- All units of the syllabus will be covered in SEE and will be given equal weightage.
- An additional SEE will be held for those who are absent, due to valid reasons, for the main/regular SEE.



SOPHIA COLLEGE (AUTONOMOUS) If the learner does not get 20 marks out of 50, the learner will have to appear for the SEE ATKT. •

