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University of Kerala

Discipline	Mathematics				
Course Code	UK1DSCMAT102				
Course Title	Differentiation, Sequences and Series				
Type of Course	DSC				
Semester	I				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours per week
	4	3	-	2	5
Pre-requisites	1. Differentiation 2. Integration				
Course Summary	This course provides a detailed study of differentiation and convergence of sequence and series				

Detailed Syllabus

Module	Unit	Contents	Hrs
I	**Differentiation**		**9**
	1	Tangent lines and rate of change, The derivative function[Chapter 2 Sections 2.1, 2.2 of Text 1]	
	2	The Chain Rule, Implicit Differentiation [(Chapter 2 Sections 2.6, 2.7 of Text 1]	
II	**Differentiation of exponential and logarithmic functions**		**9**
	3	Exponential and logarithmic functions (review only) [Chapter 6 Section 6.1 of Text 1]	
	4	Derivatives involving Exponential and logarithmic functions [Chapter 6 Section 6.2 of Text 1]	
	5	L'Hˆopital's rule [Chapter 6 Section 6.5 of Text 1]	
III	**Sequences and Series**		**9**
	6	Sequences, their limits, convergence and related theorems (without proof) [Chapter 9 Sections 9.1, 9.2 of Text 1]	

Module	Unit	Contents	Hrs
	7	Infinite series, their convergence and sums, geometric Series and harmonic series [Chapter 9 Section 9.3 of Text 1]	
IV	**Tests for Convergence and Divergence**		**9**
	8	Algebraic properties of infinite series, Integral test, p-series(without proof) [Chapter 9 Section 9.4 of Text 1]	
	9	Comparison test, limit comparison test, Ratio test, Root test [Chapter 9 Section 9.5 of Text 1]	
	10	Alternating Series - Absolute and conditional Convergence, Ratio test for absolute convergence, Power series, Maclaurin and Taylor Polynomials [Chapter 9 Sections 9.6, 9.7 of Text 1]	
V	**Teacher designed module - suggested topics**		**9**
	11	Introduction to Techniques of Differentiation, The Product and Quotient Rules, Derivatives of Trigonometric Functions (review only)	
	12	Tangent lines and limits (review only), One sided limits (review only), Limits at infinity, Infinite limits, Continuity (up to continuity of composite functions)[Chapter 1 Sections 1.1, 1.3, 1.4 and 1.5 of Text 1]	
	13	Maclaurin and Taylor series [Section 6.3 of Text 1]	

Practical sessions – 30 hours

All the topics (including those in the suggestions for the teacher designed module) can be used for practical sessions.

Problems for the practical examination

1. Demonstrate the basic arithmetic operations (+, −, ∗, ^, /)
2. Demonstrate how to use the standard trigonometric, log, exponential functions, and how to evaluate them at given real numbers
3. Define polynomials of various order, evaluate them
4. Define functions, and evaluate one-sided limits
5. Define functions, and evaluate two-sided limits
6. Demonstrate the plot command with various options (line style, color, thickness etc)
7. Define functions, find their derivatives of different orders
8. Defining sequences, printing certian number of terms from it
9. Computing partial sums of series
10. Computing Maclaurin series
11. Computing Taylor polynomials

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A record should be maintained with atleast 7 problems from the above. Each problem in the record must have a description of the problem, algorithm (step by step procedure), commands used, input given and output obtained accordingly. For the ESE, from the list of above 10 problems, the student should be able to answer two selected (from the 7 available in the record) by the examiner.

Textbook

1. Howard Anton, Irl Bivens, Stephens Davis, Calculus 10th Edition ,Wiley, 2012

References

1. G B Thomas, R L Finney, Calculus, 9th Edition, Addison-Weseley Publishing Company, 2004.
2. K. F. Riley, .M. P. Hobson, S. J. Bence, Mathematical Methods for Physics and Engineering, Third Edition, Cambridge University Press, 2006.
3. J Stewart, Calculus with Early Transcendental Functions, 7th Edition, Cengage India Private Limited, 2008.
4. Mary L Boas, Mathematical Methods in Physical Science, 3rd Edition, 2006.

Resources for practical sessions

P1. Sagemath documentation – Introductory Sage Tutorial https://doc.sagemath.org/html/en/prep/Intro-Tutorial.html

P2. Saskia Roos, Michael Jung, *An Introductory Course on Sage, Lecture Notes* https://www.math.uni-potsdam.de/fileadmin/user_upload/An_Introductory_Course_on_Sage.pdf

P3. Sagemath documentation – Symbolic variables https://doc.sagemath.org/html/en/reference/calculus/sage/calculus/var.html

P4. Tuan A. Le, Hieu D. Nguyen, SageMath Advice for calculus https://users.rowan.edu/~nguyen/sage/SageMathAdviceforCalculus.pdf

P5. P. Zimmermann *et al*, Computational Mathematics with SageMath, https://www.sagemath.org/sagebook/english.html

P6. Gregory V. Bard, Sage for Undergraduates http://www.people.vcu.edu/~clarson/bard-sage-for-undergraduates-2014.pdf

P7. Robert A. Beezer, *A First Course in Linear Algebra* http://linear.ups.edu/html/sage.html

P8. Sagemath documentation – Linear Algebra https://doc.sagemath.org/html/en/tutorial/tour_linalg.html

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Course Outcomes

CO No.	Upon completion of the course the graduate will be able to	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L) Tutorial (T)	Practical (P)
CO 1	Calculate the solution of algebraic and transcendental equation using numerical methods	PO 2, PSO1, 2,3	U, Ap	F,C	L	
CO 2	Apply numerical techniques to interpolate data points effectively	PO1, PSO1, 2,3	U, Ap	F,C	L	
CO 3	Apply numerical techniques for differentiation and integration	PO2, PSO1, 2,3	U, Ap	F,C	L	
CO 4	Calculate the solution of ordinary differential equations using numerical methods	PO2, PSO1, 2,3	U, Ap	F,C	L	

(R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create)
(F-Factual, C-Conceptual, P-Procedural, M-Metacognitive)

Mapping of CO with PSOs and POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	-	-	-	-	3	-	-	-	-	-	-
CO2	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	3	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	3	-	-	-	-	-	-

(- -Nill, 1-Slightly/Low, 2-Moderate/Medium, 3-Substantial/High)

Assessment Rubrics

- Quiz/Assignment/Discussion/Seminar
- Midterm Exam

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