University of Kerala

Discipline	Mathematics				
Course Code	UK2DSCMAT111				
Course Title	Differential and Integral Calculus				
Type of Course	DSC				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical	Total Hours per week
	4	3	-	2	5
Pre-requisites	1. Integral of elementary functions 2. Vectors				
Course Summary	This course enable the students to find the integrals and know about the vector valued functions				

Detailed Syllabus

Module	Unit	Contents	Hrs
I		**Differentiation**	**9**
	1	Limits, one-sided limits, relations between one-sided and two-sided limits, The derivative function	
	2	Introduction to Techniques of Differentiation, The Product and Quotient Rules, Derivatives of Trigonometric Functions	
	Chapter 1 1.1 Chapter 2 Sections 2.1, 2.2, 2.3, 2.4, 2.5 of Text [1]		
II		**Chain rule**	**9**
	3	The Chain Rule, Implicit Differentiation *(Chapter 2 Sections 2.6, 2.7 of Text 1)*	
	4	Derivatives involving Exponential and logarithmic functions *(Chapter 6 Section 6.2 of Text 1)*	
	Chapter 2 Sections 2.6, 2.7, Chapter 6 section 6.1, 6.2 of Text [1]		

Module	Unit	Contents	Hrs
III	**Definite Integral**		**9**
	5	Integration by Substitution, The Definite Integral	
	6	Evaluating Definite Integrals by Substitution	
	Chapter 4: Sections 4.3, 4.5, 4.9 of Text [1]		
IV	**Evaluation of Integrals**		**9**
	7	Integration by Parts *(Chapter 7: Section 7.2 of Text [1])*	
	8	Integrating Trigonometric Functions *(Chapter 7 Section 7.3 of Text 1)*	
	Chapter 7: Sections 7.2, 7.3 of Text [1]		
V	**Suggestions for teacher designed topic**		**9**
	For internal assessment examinations only.		
	9	Computing limits Continuity Tangent lines Rate of change Exponential and logarithmic functions Integration Trigonometric Substitutions	
	These topics can be found on Chapter 1: Section 1.2, 1.5, Chapter 2: Section 2.1, Chapter 6: Section 6.1, Chapter 7: Section 7.4 of Text [1]		

Topics for Practical sessions – 30 hours

1. Introducing the SAGEMATH interface, SAGE cell server; basic arithmetic involving operators $+, -, /$, exponentiation; functions like `sin, cos, tan,e,log, sqrt`, constant π
   Ref: P1, or section 2.3 of P2

2. Defining and using lists, dictionaries, sets, and accessing elements in lists and dictionaries
   Ref: section 5.1, 5.3, 5.4 of P3

3. Defining variables using `var`, defining polynomials, polynomial functions, evaluating them
   Ref: P3 or section 1.4 of P4

4. Computing two sided limits of various functions
   Ref : Section 2.2 of P4

5. Computing one sided limits of various functions
   Ref : Section 2.2 of P4

6. `diff` command to find derivatives of standard functions, polynomials
   Ref: Section 3.1 of P4

7. Using `integrate` command to compute indefinite integrals
   Ref : Section 3.3.4 of P2

8. Using `integrate` command to compute definite integrals
   Ref : Section 3.3.4 of P2

9. Sketching graphs of curves using `plot`
   Ref : Section 6.1 of P2

10. Sketching tangent lines of curves at specific points using `plot`
    Ref : Section 3.1.1 of P4

Problems for the practical examination

1. Demonstrate the basic arithmetic
2. Demonstrate using standard trigonometric, log, exponential functions, their evaluation
3. Defining and accessing lists
4. Defining and accessing dictionaries
5. Define polynomials of various order, evaluate them
6. Define functions, and evaluate two-sided limits
7. Define functions, and evaluate one-sided limits
8. Demonstrate the plot command with various options (line style, color, thickness etc)
9. Define functions, find their derivatives
10. Computing indefinite and definite integrals of standard functions (trigonometric, log, e, polynomials)

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. H Anton, I Bivens, S Davis, *Calculus*, 10^{th} Edition, John Wiley & Sons, 2012.

References

1. Joel Hass, Maurice D. Weir, *Thomas' Calculus Early Transcendentals*, 12^{th} Edition, Addison-Weseley Publishing Company, 2004.
2. J Stewart, *Calculus with Early Transcendental Functions*, 7^{th} Edition, Cengage India Private Limited, 2008.
3. G B Thomas, R L Finney, *Calculus*, 9^{th} Edition, Addison-Weseley Publishing Company, 2004.

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

E-resourses

1. https://www.geogebra.org/m/z3jEUrvv
2. https://www.geogebra.org/m/ngfvakga
3. https://www.geogebra.org/m/AzVR5uU7
4. https://www.geogebra.org/m/yyu2my9w

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	Understand the concept of limit, differentiation	PSO 1	U	F, C	L	
CO 2	Describe derivative of a function and learn its physical interpretation through various examples.	PSO 2, 4	Ap, An	P	L	
CO 3	Understand the concept of integration	PSO 1	U	F, C	L	
CO 4	Describe the integral of a function and learn its physical interpretation through various examples	PSO 2	Ap	P	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	-	-	-	-	-	-	-
CO2	-	3	2	3	-	-	-	3	2	-	-	-	-	-
CO3	3	-	-	-	-	-	3	-	-	-	-	-	-	-
CO4	-	3	3	-	-	-	3	2	-	-	-	-	-	-

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

Assessment Rubrics

- Quiz/Assignment/Discussion/Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics

	Internal Examination	Assignment	Project Evaluation	End Semester Exam
CO1	✓			✓
CO2	✓	✓		✓
CO3	✓			✓
CO4	✓	✓		✓