University of Kerala

Discipline	Mathematics				
Course Code	UK4VACMAT201				
Course Title	Mathematics in Nature				
Type of Course	VAC				
Semester	IV				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours per week
	3	3			3
Pre-requisites	Basic concepts in Mathematics				
Course Summary	This course explores two fascinating mathematical concepts: the golden ratio and fractals. Both concepts are prevalent in various fields, including mathematics, art, architecture, and nature. Through this course students will be able to gain a deeper appreciation for the beauty and complexity inherent in mathematical patterns and structures.				

Detailed Syllabus

Module	Unit	Contents	Hrs
I	**Introduction to Golden Ratio**		**9**
	1	Introduction - Chapter 1 of Text [1].	
	2	Basic Properties of Golden Ratio - Chapter 2 of Text [1]	
II	**Golden Ratio and Fibonacci Numbers**		**9**
	3	Fibonacci Numbers - Chapter 5 of Text [1].	
	4	Lucas numbers and generalized Fibonacci numbers- Chapter 6 of Text [1].	
III	**Fractals**		**9**

Module	Unit	Contents	Hrs
	5	Introduction - Section 11.0 of Text [2]	
	6	Countable and Uncountable Sets - Section 11.1 of Text [2]	
	7	Cantor Sets - Section 11.2 of Text [2]	
IV	**Different Dimensions**		**9**
	8	Dimension of Self-similar Fractals - Section 11.3 of Text 2	
	9	Box Dimension - Section 11.4 of Text [2]	
V	**Topics suggested for the teacher designed module**		**9**
	10	Continued Fractions and Rational Approximations - Chapter 7 of Text [1].	
	11	Pointwise and Correlation Dimension - Section 11.5 of Text [2]	

Textbooks

1. Richard A, Dunlap, *The Golden Ratio and Fibonacci Numbers*, World Scientific Publishing Co. Pte. Ltd. 5 Toh Tuck Link, Singapore, 2003.

2. Steven H. Strogatz, *Nonlinear Dynamics and Chaos - With Applications to Physics, Chemistry, Biology and Engineering*, Second Edition, CRC Press Taylor and Francis Group 6000 Broken Sound Parkway, 2018.

References

1. Barnsley M F, *Fractals Everywhere* , Dover Publication, Newyork,3rd Edition, 2012.

2. Coxetcr H.S.M., *Introduction to Geometry*, Witey, New York, 1961.

3. Falconer K.J, *The Geometry of Fractal Sets* ,Cambridge University Press, Cambridge, 1986.

4. Holden, A. 1971 *Shapes, Space and Symmetry*, Columbia University Press, New York, 1971.

5. Kenneth Falconer, *Fractal Geometry Mathematical Foundation and Application*, Third edition, Wiley, 2014.

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 Golden ratio	PSO1	U	F, C	L	
CO 2	Understand the concept of Fractals	PSO1	U	F , C	L	
CO 3	Identify instances of the Golden Ratio and fractals in natural and man-made phenomena	PSO3, PSO4, PSO6, PO6	Ap, An, E, C	F, C, M	L	
CO 4	Construct mathematical models of phenomena exhibiting the Golden Ratio and fractal patterns	PSO3, PSO4, PSO6, PO6	Ap, An, E, C	F, C, M	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	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	3	-	2	-	-	-	-	-	2	-	-
CO4	-	-	3	3	-	2	-	-	-	-	-	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	✓			✓