Mahatma Gandhi University

Kottayam

Programme						
Course Name	**Applied Mathematical Methods**					
Type of Course	**DSC C**					
Course Code	**MG4DSCMAT202**					
Course Level	**200-299**					
Course Summary	This Mathematics minor course complements and enhances the undergraduate programmes by enabling the students to apply various numerical methods to solve problems, to find Fourier Series Expansions and Laplace transforms of different functions and to solve Partial differential Equations.					
Semester	**4**	**Credits**			**4**	
Course Details	**Learning Approach**	Lecture	Tutorial	Practicum	Others	Total Hours
		3	0	1	0	**75**
Pre- requisites, If any	Differentiation, Partial differentiation and integration					

COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domains	PO No:
	Upon the successful completion of the course, the student will be able to		
1	Apply appropriate numerical methods to solve algebraic and transcendental equations.	A	1
2	Find Fourier Series expansion of different types of functions.	A	3
3	Determine Laplace transforms and inverse Laplace transforms of functions	A	2

4	Solve Partial Differential Equations	E	2
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	CO No:	Hours
1		**Numerical Methods**		
	1.1	Algebraic and Transcendental Equations, Bisection Method and Method of False Position	1	15
	1.2	Iteration Method	1	
	1.3	Newton - Raphson Method	1	
		Problems (Practicum)	1	
	Text 1: Chapter 2 – Sections: 2.1 to 2.5. (Excluding Generalized Newton's Method) **Theorems - Statements only**			
2		**Fourier Series**		
	2.1	Fourier Series of functions with period 2π	2	20
	2.2	Fourier Series of functions with any period $2L$	2	
	2.3	Fourier Series of even and odd functions,	2	
		Problems (Practicum)	2	
	Text 2: Chapter 11 – Sections: 11.1 to 11.3 (Excluding half range series) **Theorems - Statements only**			
3		**Laplace Transforms**		
	3. 1	Laplace Transforms and Inverse Laplace Transforms	3	**20**
	3. 2	Properties of Laplace Transforms	3	
	3. 3	Laplace Transforms of derivatives and integrals	3	

	3.4	Differentiation and Integration of Laplace transforms	3	
		Problems (Practicum)	3	
	Text 2: Chapter 6 – Sections: 6.1, 6.2 & 6.6 (Excluding solution of ODEs) Theorems - Statements only			
4		**Partial Differential Equations**		
	4.1	Methods of solution of $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$	4	20
	4.2	Partial Differential Equations, Origin of First Order Partial Differential Equations	4	
	4.3	First Order Linear Partial Differential Equations	4	
		Problems (Practicum)	4	
	Text 3: Chapter 1 – Section: 3; Chapter 2 – Sections:1, 2 &4 Theorems - statement only			
5	**Teacher Specific Contents** *(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)* **This content will be evaluated internally**			

Practicum
Practicum is designed to provide supervised practical application of theoretical knowledge and skills. **I**t's purpose is to encourage creativity and develop Problem solving skills. **T**he practicum component is to be done in the classroom under the strict guidance of the teachers.

A minimum of 30 problems is to be solved, and a handwritten copy of the solutions should be kept in the department.

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		III	2	2	2	**6**
		IV	2	2	1	**5**
		Total no of questions	**8**	**8**	**6**	**22**
		Number of questions to be answered	**5**	**5**	**3**	**13**
		Total Marks	**10**	**30**	**30**	**70**

TEXT BOOKS:

1. Sastry, S. S. *Introductory methods of Numerical Analysis,5th edition, PHI Learning Private Limited, 2013.*
2. Kreyszig, Erwin. *Advanced Engineering Mathematics*, ninth edition, Wiley, India, 2006.
3. Sneddon, Ian N. *Elements of Partial Differential Equations*. 1st ed. McGraw-Hill. 1957

SUGGESTED READING:

1. Sastry, S.S. *Engineering Mathematics Volume 1*, 4th edition PHI, 2008.
2. Grewal, B. S., *Higher Engineering Mathematics*, 42nd Edition, Khanna Publishers
3. Muray R Spiegel. *Advanced Calculus, Schaum's Outline series, 2010.*
4. Jain, M. K., Iyengar, S. R. K., & Jain R. K. Numerical Methods for *Scientific and Engineering Computation,* 6th edition*,* New Age International Publishers. Delhi, 2012.

SOME SUGGESTIONS FOR TEACHER SPECIFIC CONTENTS:

- Proofs of theorems from Modules I, II, III and IV
- Errors in numerical computations, Generalized Newton's method
- Fourier half range series
- Solution of ordinary differential equations using Laplace Transforms
- Integral surfaces passing through a given curve

	Mahatma Gandhi University **Kottayam**
Programme	
Course Name	**Mathematical Tools for Computing**
Type of Course	**DSC C**
Course Code	**MG4DSCMAT203**
Course Level	**200-299**
Course Summary	This course provides a comprehensive introduction to discrete mathematics and algorithms, covering topics such as number theory, cryptography, Boolean algebra, logic gates, relations, tree structures and graph theory. Practical implementation involves coding tree traversal, depth-first search and breadth-first search algorithms using a programming language. Students gain both theoretical insights and hands -on experience applicable across computer science domains.

Semester	4	**Credits**			**4**	
Course Details	**Learning Approach**	Lecture	Tutorial	Practicum	Others	Total Hours
		3	0	1	0	**75**
Pre- requisites, If any	Basic understanding of integers and divisibility, basic algebraic operations, set theory and set operations and basic graph theory concepts.					

COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domains	PO No:
	Upon the successful completion of the course, the student will be able to		
1	Understand the fundamental concepts of number theory, including prime numbers and divisibility and Apply congruence in various mathematical scenarios and recognize its applications in Hashing and Cryptography.	A	1,2

2	Analyze the truth tables and logical operations associated with each type of logic gates.	An	1,2
3	Understand and apply relations & partial orders in different areas in computer science	A	1,2
4	Apply tree traversal algorithm, depth-first search algorithm and breadth-first search algorithm to solve real world problems.	E	1,2
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	CO No:	Hours
1		**Number Theory & Cryptography**		
	1.1	Divisibility and modular arithmetic:- Division, Division algorithm, Modular arithmetic, Congruence and Basic properties of congruence.	1	**17**
	1.2	Primes and Greatest common divisor:- Primes, Fundamental theorem of arithmetic (statement and problems only), Greatest common divisors and least common multiples, Euclidean algorithm, g.c.d as linear combination	1	
	1.3	Applications of Congruences:- Hashing function, Pseudorandom Numbers Cryptography:- Classical Cryptography, Caesar Cipher	1	
		Problems (Practicum)	1	
	Text 1: Chapter 4 – Sections: 4.1, 4.3, 4.5 (check digits excluded) & 4.6 (public key cryptography excluded)			
2		**Boolean Algebra**		

	2.1	Boolean functions	2	**13**
	2.2	Representing of Boolean functions Sum of Products (SOP)	2	
	2.3	Logic gates	2	
		Problems (Practicum)	2	
	Text 1: Chapter 12 – Sections: 12.1 to 12.3 (Adders excluded)			
3		**Relations & Partial orders**		
	3.1	Relations & properties	3	**20**
	3.2	Representing relations	3	
	3.3	Equivalence relation	3	
	3.4	Partial ordering & Hasse Diagrams	3	
		Problems (Practicum)	3	
	Text 1: Chapter 9 – Sections: 9.1, 9.3, 9.5 & 9.6 (9.6.1 & 9.6.3 only)			
4		**Trees**		
	4.1	Introduction to trees :- Trees, Properties of trees (without proof) Applications of trees :- Binary search trees, Prefix codes and Huffman coding	4	**25**
	4.2	Tree traversal :- Traversal algorithms, Infix, Prefix and postfix notations	4	
	4.3	Spanning trees :- Introduction, Depth-first search algorithm (BFS), Breadth--first search algorithms (DFS)	4	
	4.4	Minimum spanning trees:- Algorithms for minimum spanning trees- Kruskal's algorithm and Prim's algorithm	4	
		Problems (Practicum)	4	

	Text 1: Chapter 11 – Sections: 11.1 (trees as models excluded), 11.2 (game trees excluded) 11.3, 11.4 & 11.5
5	**Teacher Specific Contents** *(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)* **This content will be evaluated internally**

Practicum
Practicum is designed to provide supervised practical application of theoretical knowledge and skills. **I**t's purpose is to encourage creativity and develop Problem solving skills. **T**he practicum component is to be done in the classroom under the strict guidance of the teachers. **A** minimum of 30 problems is to be solved, and a handwritten copy of the solutions should be kept in the department.

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)**		
	Direct instruction: Lecture Method, Tutorial ,Brainstorming Lectures, Explicit Teaching Interactive instructions: Active Cooperative Learning, Library Work and Group Discussion, Peer Learning, Authentic Learning		
Assessment Types	**MODE OF ASSESSMENT**		
	A	**Continuous Comprehensive Assessment (CCA) 30 Marks**	
		Components	**Mark Distribution**
		Module Test- I	5 Marks
		Module Test- II	5 Marks
		Module Test- III	5 Marks
		Module Test- IV	5 Marks
		Assignment/Seminar	5 Marks
		Quiz/Viva voce	5 Marks

	B	End Semester Evaluation (ESE) 70 marks			
		Question Pattern **[Maximum Time 2 Hours, Maximum Marks 70]**			
		Module	Part A **2 Marks**	Part B **6 Marks**	Part C **10 Marks**	Total
		I	2	2	1	**5**
		II	2	2	1	**5**
		III	2	2	2	**6**
		IV	2	2	2	**6**
		Total no of questions	**8**	**8**	**6**	**22**
		Number of questions to be answered	**5**	**5**	**3**	**13**
		Total Marks	**10**	**30**	**30**	**70**

TEXT BOOKS:

1. Kenneth H Rosen, *Discrete Mathematics and its Applications (Eighth Edition).* Published by McGraw-Hill Education, 2 Penn Plaza, New York, NY 10121. Copyright c 2019 by McGraw-Hill Education

SUGGESTED READINGS:

1. Burton, David M. Elementary Number theory (Seventh edition), The McGraw Hill companies, 2009.
2. Clifford Stien., Robert L Drysdale., Kenneth Bogart. *Discrete Mathematics for computer scientists*; Pearson Education; Dorling Kindersley India Pvt Ltd.
3. Kenneth A Ross., Charles R.B.Wright., *Discrete Mathematics*; Pearson Education; Dorling Kindersley India Pvt Ltd.
4. Richard Johnsonbaugh. *Discrete Mathematics.* Pearson Education; Dorling Kindersley India Pvt Ltd.

SOME SUGGESTIONS FOR TEACHER SPECIFIC CONTENTS:

- Public Key Cryptography :- The RSA Cryptosystem
- Implement tree traversal algorithm, depth-first search algorithm and breadth-first search algorithm using any suitable programming language.
- Implement Kruskal's algorithm and Prim's algorithm using any suitable programming language.

Mahatma Gandhi University
Kottayam

Programme						
Course Name	**Mathematical Techniques in Business Analytics**					
Type of Course	**DSC C**					
Course Code	**MG4DSCMAT204**					
Course Level	**200 - 299**					
Course Summary	The course aims to equip learners with essential mathematical techniques for business and economic decision making, focusing on interpolation and the applications of linear and non-linear functions.					
Semester	**4**	**Credits**			**4**	
Course Details	**Learning Approach**	Lecture	Tutorial	Practical	Others	Total Hours
		3	0	1	0	**75**
Pre- requisites, If any	Functions, Graphing functions, Basics of differential and integral Calculus					

COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domains	PO No:
	Upon the successful completion of the course, the student will be able to		
1	Understand interpolation and extrapolation and solve problems related to interpolation	A	1, 2
2	Calculate interpolation using Lagrange's interpolation formula and by use of operators	E	1, 2
3	Apply graphs of linear and non - linear functions in business and economics	A	2, 3
4	Apply elementary algebra and calculus in economics and business problems and solve it mathematically	E	2, 3

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	CO NO:	Hours
1		**Interpolation**		
	1.1	Interpolation and Extrapolation	1	**20**
	1.2	Finite Differences and Operators	1	
	1.3	Newton's Forward Interpolation Formula	1	
	1.4	Newton's Backward Interpolation Formula	1	
		Problems (Practicum)	1	
	Text 2 : Chapter 16 – Sections : 16.1 to 16.5			
2		**More on Interpolation**		
	2.1	Central Formula; Lagrange's Interpolation Formula	2	**15**
	2.2	Inverse Interpolation	2	
	2.3	Polynomial Method, Use of Operators	2	
		Problems (Practicum)	2	
	Text 2 : Chapter 16 – Sections : 16.6 to 16.7			
3		**Linear and Non-Linear Functions in Business and Economics**		
	3.1	Applications of Linear Equations in Business and Economics	3	**20**
	3.2	Applications of Linear Functions for Business and Economics	3	
	3.3	Solving Quadratic Equations, Facilitating Nonlinear Graphing	3	
	3.4	Applications of Nonlinear Functions in Business and Economics	3	

		Problems (Practicum)	3	
	Text 1 : Chapter 2 – Section 2.8, Chapter 3 – Sections : 3.4 to 3.7			
4		**Optimization Techniques using Calculus**		
	4.1	Functions of Several Independent Variables	4	**20**
	4.2	Constrained Optimization problems with Lagrange Multipliers	4	
	4.2	Applications of definite integral in consumers' and producers' surplus	4	
		Problems (Practicum)	4	
	Text 1 : Chapter 12 - Section 12.11, Chapter 13 - Sections 13.1 and 13.6			
5	**Teacher Specific Contents** **(This can be either classroom teaching, practical session, field visit etc as specified by the teacher concerned)** **This content will be evaluated internally**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)**		
	Direct Instruction, Brain Storming Approach, Interactive instruction, Group Discussion, Presentation by individual student/ group representatives		
Assessment Types	**MODE OF ASSESSMENT**		
	A	**Continuous Comprehensive Assessment (CCA)**	
		Components	Mark Distribution
		Module Test - I	5 Marks
		Module Test – II	5 Marks
		Module Test – III	5 Marks
		Module Test - IV	5 Marks
		Assignment/ Seminar	5 Marks
		Quiz/ Viva voce	5 Marks
	B	**End Semester Examination (ESE) 70 marks**	
		Question Pattern	

		[Maximum Time 2 Hours, Maximum Marks 70]			
		Module	Part A	Part B	Part C	Total
			2 Marks	**6 Marks**	**10 Marks**	
		I	2	2	2	6
		II	2	1	2	5
		III	2	3	1	6
		IV	2	2	1	5
		Total no of questions	8	8	6	22
		Number of questions to be answered	5	5	3	13
		Total Marks	10	30	30	70

TEXT BOOKS

1. Edward T Dowling, *Mathematical Methods for Business and Economics*, Schaum's Outline Series, McGraw Hill
2. Ram Krishna Ghosh, Suranjan Saha, *Business Mathematics and Statistics(Algebra, geometry and Business Statistics)*, New Central Book Agency (P) Ltd.

SUGGESTED READINGS

1. Taro Yamne, *Mathematics for Economists-An elementary survey,* Prentice -Hall, Inc.
2. Robert Brechner, *Contemporary Mathematics for Business and Consumers,* Fifth Edition
3. Das, N. G., Das, J K. *Business Mathematics and Statistics*, Tata McGraw-Hill (2012).
4. Martin Anthony, Norman Biggs*, Mathematics for economics and finance Methods and Modelling,* Cambridge University Press (2012).

SOME SUGGESTIONS FOR TEACHER SPECIFIC CONTENTS:

- Optimization Problems using graphs