



Semester 1

MGU-UGP (HONOURS)

Syllabus



Mahatma Gandhi University

Kottayam

Programme	BSc (Hons) Mathematics					
Course Name	Ground Roots of Mathematics					
Type of Course	DSC A					
Course Code	MG1DSCMAT100					
Course Level	100-199					
Course Summary	<p>This course provides a solid foundation in both mathematical logic and the principles of calculus. Beginning with "Basic Logic", students explore propositional logic, propositional equivalence, predicates, and quantifiers. The course then transitions to "Functions", covering the basics of functions and their graphs, combining functions through shifting and scaling, and introducing inverse functions.</p> <p>The core of the course is dedicated to "Derivatives", where students are introduced to techniques of differentiation without formal proof, higher derivatives, product and quotient rules, derivatives of trigonometric functions using formulas, the chain rule, and implicit differentiation. The focus is on practical applications, preparing students for real-world problem-solving.</p> <p>The course concludes with an exploration of the "Applications of Derivatives", emphasizing the analysis of functions. Topics include determining intervals of increase, decrease, and concavity, identifying relative extrema with geometric implications of multiplicity, applying L'Hôpital's Rule, and addressing indeterminate forms.</p>					
Semester	1	Credits			4	
Course Details	Learning Approach	Lecture	Tutorial	Practicum	Others	Total Hours
		3	0	1	0	75

Pre-requisites, If any	Sets, Set operations and Limits
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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 language of Mathematics and communicate in a proper way.	U	1, 2, 3, 4, 10
2	Understand the geometry of basic functions and their properties.	U	1, 2, 3, 10
3	Analyse the conditions for a function to have an inverse.	An	1, 2, 3
4	Understand and apply the process of differentiation.	A	1, 2, 3, 10
5	Characterize increasing/decreasing functions using their derivatives.	U	1, 2, 3, 10
6	Apply L'Hôpital's rule to evaluate indeterminate forms.	A	1, 2
7	Experience graphing tools in doing and enjoying Mathematics	S	1, 2, 3, 4, 9,10
<i>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</i>			

Syllabus

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	CO No:	Hours
1		Basic Logic		15
	1.1	Propositional Logic	1	
	1.2	Propositional Equivalence	1	
	1.3	Predicates and Quantifiers	1	
		Problems (Practicum)	1	

	Text 2: Chapter 1- Sections: 1.1, 1.3, 1.4		
2	Functions		
	2.1	Set, Set operations, Set identities (Review)	1
	2.2	Functions and their graphs (excluding representing functions numerically)	2
	2.3	Combining Functions: Shifting and scaling Graphs	2,7
	2.4	Inverse Functions	3
		Problems (Practicum)	1, 2, 3, 7
	Text 3: Chapter 1 - Sections: 1.1, 1.2, Chapter 7 - Section: 7.1 (Inverse functions only)		
3	Derivatives		
	3.1	Introduction to Techniques of Differentiation (without proof)	4
	3.2	Higher derivatives, The product and quotient rules	4
	3.3	Derivatives of trigonometric functions (Using formulas only)	4
	3.4	Chain Rule	4
	3.5	Implicit Differentiation	4
		Problems (Practicum)	4
	Text 1: Chapter 2 - Sections: 2.3 to 2.7		
4	Applications of derivatives		
	4.1	Analysis of Functions I: Increase, decrease and concavity	5, 7
	4.2	Analysis of Functions II: Relative extrema	5, 7
	4.3	L'Hôpital's Rule	6
	4.4	Indeterminate forms	6
		Problems (Practicum)	5, 6, 7

	Text 1: Chapter 3 - Sections: 3.1, 3.2 (Geometric implications of multiplicity, Analysis of polynomials excluded), Chapter 6 - Section:6.5
5	<p style="text-align: center;">Teacher Specific Contents</p> <p><i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i></p> <p style="text-align: center;">This content will be evaluated internally</p>

Practicum
<p>Practicum is designed to provide supervised practical application of theoretical knowledge and skills.</p> <p>It's purpose is to encourage creativity and develop Problem Solving Skills.</p> <p>The practicum component is to be done in the classroom under the strict guidance of the teachers.</p> <p>A minimum of 30 problems is to be solved, and a handwritten copy of the solutions should be kept in the department.</p>

Teaching and Learning Approach	Classroom Procedure (Mode of transaction)		
	Lecture, Tutorial and Activity oriented		
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	Part B	Part C	Total
	2 Marks	6 Marks	10 Marks	
I	2	2	1	5
II	2	2	2	6
III	2	2	1	5
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

REFERENCES:

1. Anton, Howard, Irl Bivens, Stephen Davis. *Calculus*. 10th ed. John Wiley & Sons, Inc., 2012.
2. Rosen, Kenneth H. *Discrete Mathematics and Its Applications* (7th ed.). McGraw Hill Publishing Co. New Delhi, 2013. (HONOURS)
3. Thomas, George B., Jr., and Maurice D. Weir. *Thomas' Calculus*. 12th ed. Pearson, 2009.

SUGGESTED READINGS:

Syllabus

1. Hofstadter, Douglas R. *Gödel, Escher, Bach: An Eternal Golden Braid*. Expanded ed. Basic Books, 2007.
2. Copi, Irving M., Carl Cohen. *Introduction to Logic*. 5th ed. Routledge, 2018.
3. Stewart, James. *Calculus: Early Transcendentals*. 10th ed. Cengage Learning, 2023.
4. Thompson, Silvanus P. *Calculus Made Easy*. 5th ed. Dover Publications, 2014.
5. Thomas, George B., Jr., and Maurice D. Weir. *Thomas' Calculus*. 15th ed. Pearson, 2023.

ADVANCED READINGS:

1. Hurley, Patrick J. *A Concise Introduction to Logic*. 11th ed. Wadsworth Publishing, 2018.
2. Copi, Irving M., Carl Cohen. *Symbolic Logic*. 13th ed. W.W. Norton & Company, 2019.
3. Davis, Philip J. *Advanced Calculus*. 7th ed. Wiley-Interscience, 2002.
4. Tu, Loring W. *Introduction to Manifolds*. 3rd ed. Springer, 2012.

SOME SUGGESTIONS FOR TEACHER SPECIFIC CONTENTS:

- Determine the output of a combinatorial circuit constructed using basic logic gates. Also Build a digital circuit produces the required output. (Eg: Build a digital circuit that produces the output $(p \vee \neg r) \wedge (\neg p \vee (q \vee \neg r))$ with input bits p , q and r .
- Determine whether a given function is injective or surjective using horizontal line test.
- Using a graphing calculator, visualize the effect of stretching and scaling (horizontal & vertical) of functions.
- Using a graphing calculator, plot the inverse of graphs and understand the geometric relationship between a graph and its inverse.
- Match the graphs of functions with the graphs of their derivatives. (Eg: Question 23 of section 2.2 in text 3).
- Use a graphing utility to make rough estimates of the locations of all horizontal tangent lines (Eg: Question 49 & 50 of section 2.3 in text 3).
- Use a graphing utility to make rough estimates of the intervals on which $f'(x) > 0$ (Eg: Questions 63 & 64 of section 2.3 in text 3).
- Use the implicit plotting capability of a CAS to graph a curve. (Eg: Question 45 of section 2.7 in text 3), Suggested software: Desmos, GeoGebra etc.



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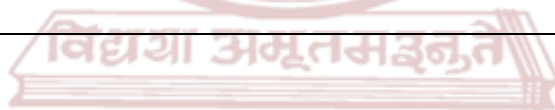
Kottayam

Programme						
Course Name	Mathematics for Competitive Examinations					
Type of Course	MDC					
Course Code	MG1MDCMAT100					
Course Level	100-199					
Course Summary	<p>This competitive exam-focused mathematics course covers crucial topics like number systems, logical reasoning, data analysis, and mathematical measurements. This course explores concepts such as HCF, LCM, fractions, ratio, percentage, and time-related problem-solving, providing comprehensive preparation for various competitive examinations.</p>					
Semester	1	Credits (HONOURS)			3	
Course Details	Learning Approach	Lecture	Tutorial	Practicum	Others	Total Hours
		2	0	1	0	60
Pre-requisites, If any						

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	Develop a solid understanding of various types of	K, U, E	1, 2, 10

	numbers. Master techniques for calculating HCF and LCM and gain proficiency in simplifications, squares and square roots.		
2	Acquire logical reasoning skills by exploring concepts such as ratio, proportion, percentage, and solving problems related to profit, loss and age and apply these principles to real world scenarios.	K, U, E	1,2, 3, 4, 10
3	Learn the essentials of data analysis, including concepts of simple interest, compound interest and solving calendar problems. Develop analytical skills to interpret and utilize data effectively.	K, U, A	1, 2, 3, 10
4	Gain expertise in mathematical measurements through topics like time and work, time and distance, and stocks and shares. Apply mathematical concepts to solve practical problems in these areas.	K, A, E	1, 2, 3, 10
*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 System and Numerical Techniques		18
	1.1	Type of Numbers	1	
	1.2	HCF and LCM of Numbers	1	
	1.3	Decimal Fractions, Simplification	1	
	1.4	Square Roots and Cube Roots	1	
		Problems (Practicum)	1	
Text 1: Relevant Portions				

2		Logical Reasoning & Data Analysis		
	2.1	Ratio and Proportion	2	24
	2.2	Percentage	2	
	2.3	Profit and Loss	2	
	2.4	Problems on Ages	2	
	2.5	Simple Interest & Compound Interest	3	
	2.6	Calendar	3	
		Problems (Practicum)	2, 3	
Text 1: Relevant Portions				
3		Mathematical Measurements		
	3.1	Time and Work	4	18
	3.2	Time and Distance	4	
	3.3	Stocks and Shares	4	
		Problems (Practicum)	4	
Text 1: Relevant Portions				
4	<p style="text-align: center;">Teacher Specific Contents</p> <p><i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i></p> <p style="text-align: center;">This content will be evaluated internally</p>			

Practicum
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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)													
	Lecture and Tutorial													
Assessment Types	MODE OF ASSESSMENT													
	A	Continuous Comprehensive Assessment (CCA) 25 Marks												
		<table border="1"> <thead> <tr> <th>Components</th> <th>Mark Distribution</th> </tr> </thead> <tbody> <tr> <td>Module Test- I</td> <td>5 Marks</td> </tr> <tr> <td>Module Test- II</td> <td>5 Marks</td> </tr> <tr> <td>Module Test- III</td> <td>5 Marks</td> </tr> <tr> <td>Assignment/Seminar</td> <td>5 marks</td> </tr> <tr> <td>Quiz/Viva voce</td> <td>5 Marks</td> </tr> </tbody> </table>	Components	Mark Distribution	Module Test- I	5 Marks	Module Test- II	5 Marks	Module Test- III	5 Marks	Assignment/Seminar	5 marks	Quiz/Viva voce	5 Marks
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	Module Test- III	5 Marks												
	Assignment/Seminar	5 marks												
	Quiz/Viva voce	5 Marks												
		End Semester Evaluation (ESE) 50 marks												
		<p>Question Pattern (MCQ Examination)</p> <p>[Maximum Time 75 Minutes, Maximum Marks 50]</p> <table border="1"> <thead> <tr> <th>Module</th> <th>Number of Questions</th> </tr> </thead> <tbody> <tr> <td>I</td> <td>8</td> </tr> <tr> <td>II</td> <td>14</td> </tr> <tr> <td>III</td> <td>8</td> </tr> </tbody> </table> <p>Answer any 25 questions out of 30 Multiple Choice Questions. Each question carries 2 marks.</p>	Module	Number of Questions	I	8	II	14	III	8				
Module	Number of Questions													
I	8													
II	14													
III	8													
B														

REFERENCES:

1. Aggarwal, R.S. *Quantitative Aptitude*, Sultan Chand and company Ltd, New Delhi, 2017.

SUGGESTED READINGS:

1. Abhijit Guha, *Quantitative Aptitude for Competitive Examinations*, McGraw Hill Education 2011.
2. Tyra M., *Magical Book on Quicker Maths.*, BSC Publishing Company, 2018.

SOME SUGGESTIONS FOR TEACHER SPECIFIC CONTENTS:

- Discuss different number systems, such as decimal, binary, octal, and hexadecimal, and their conversions.
- Show how number theory concepts apply in various real-life scenarios, like cryptography or data encoding.
- Provide examples where LCM and HCF are used, such as in simplifying fractions, adding and subtracting fractions, or solving equations.
- Incorporate problems where knowledge of roots is essential, such as in Geometry, Physics, or Engineering.
- Provide examples where ratios and proportions are used in real-life situations, such as in finance, cooking, or map scales.
- Provide examples of profit and loss situations in business, trading, and investment scenarios.
- Discuss problem-solving strategies for analyzing profit and loss situations and determining the best course of action.
- Provide examples of interest calculations in banking, investments, loans, and savings accounts.
- Show the difference between simple interest and compound interest and how they affect the total amount over time.
- Provide examples of time and work problems in production scenarios, team projects, or construction projects.