Programme	BSc (Hons) Mathematics
Course Name	A Gateway to Mathematics
Type of Course	DSC A
Course Code	MG2DSC MAT100
Course Level	100-199
Course Summary	This course is designed to provide students with a deeper understanding of calculus and linear algebra concepts. The course begins with "Partial Differentiation", covering partial derivatives, the chain rule, and the analysis of extreme values and saddle points. It then progresses into "Integral Calculus," focusing on definite integrals, double integrals, integration methods, and the fundamental theorem of calculus. The course further explores "Matrices", where students delve into linear systems, coefficient matrices, augmented matrices, and matrix operations such as Gauss elimination and back substitution. Elementary row operations, row-equivalent systems, and the various cases of systems in Gauss elimination are covered, leading to the understanding of row echelon form and its implications. The final segment of the course introduces "Graph Theory," covering foundational definitions and examples. Topics include connectedness, adjacency, subgraphs, matrix representations, null graphs, complete graphs, cyclic graphs, path graphs, wheels, regular graphs, bipartite graphs, and the complement of a simple graph

Semester	2	Credits				4

Course Details	Learning Approach	Lecture	Tutorial	Practicum	Others	Total Hours
		3	0	1	0	**75**

Pre- requisites, If any	Differentiation, Integration and Matrices

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 concept of partial derivatives and experience its applications	U	1, 2, 3
2	Compute definite integrals of single-variable functions, double integrals and understanding their geometric interpretation.	A	1, 2, 3
3	Apply matrices to solve systems of linear equations using methods of Gaussian elimination and matrix inversion.	A	1, 2, 3, 9, 10
4	Create an insight into the basics of graph theory	C	1, 2, 3, 9, 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		**Partial Differentiation**		
	1.1	Partial derivatives	1	
	1.2	The Chain rule	1	
	1.3	Extreme values and saddle points	1	20
		Problems (Practicum)	1	
	Text 3: Chapter 14 - Sections: 14.3, 14.4, 14.7			
2		**Integral Calculus: Definite integrals and double integrals**		20
	2.1	Integrals and Integration methods (Review)	2	

	2.2	The Definite Integral	2	
	2.3	The Fundamental Theorem of Calculus (Proof of theorems excluded)	2	
	2.4	Double Integrals over rectangular regions	2	
		Problems (Practicum)	2	

Text 1: Chapter 7 - Section: 7.1; Chapter 4 - Sections: 4.5 (discontinuities and integrability excluded), 4.6(dummy variables, The mean value theorem for integrals and integrating rates of changes excluded); Chapter - 14 - Section:14.1

3		**Matrices**		
	3.1	Linear System, Coefficient Matrix, Augmented Matrix	3	
	3.2	Gauss Elimination and Back Substitution	3	
	3.3	Elementary Row Operations, Row-Equivalent Systems	3	**20**
	3.4	Gauss Elimination: The three Cases of systems	3	
	3.5	Row Echelon Form and Information from It	3	
		Problems (Practicum)	3	

Text 2: Chapter 7 -Section:7.3

4		**Graph Theory**		
	4.1	Definitions and examples	4	
	4.2	Connectedness, Adjacency	4	
	4.3	Subgraphs	4	**15**
	4.4	Matrix Representations	4	
	4.5	Null graphs, Complete graphs, cyclic graphs, path graphs and wheels	4	

	4.6	Regular graphs, Bipartite graphs, Complement of a simple graph	4	
		Problems (Practicum)	4	
	Text 4: Chapter 2, Sections: 2(Isomorphism excluded), 3 (cubes , platonic graphs and three puzzles are excluded)			
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.
 	
    It's purpose is to encourage creativity and develop Problem solving skills.
 	
    The 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)**		
	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				
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**

TEXT BOOKS:

1. Anton, Howard, Irl Bivens, Stephen Davis. *Calculus*. 10th ed. John Wiley & Sons, Inc., 2012.

2. Kreyszig, Erwin. *Advanced Engineering Mathematics*. 9th ed. Wiley International, 2011.

3. Thomas, George B., Jr., and Maurice D. Weir. *Thomas' Calculus*. 12th ed. Pearson, 2009.

4. Wilson, Robin J. *Introduction to Graph Theory*. 4th ed. Addison Wesley Longman Limited, Edinburgh Gate, Harlow, Essex CM20 2JE, England, 1996.

SUGGESTED READINGS:

1. Chartrand, Gary, and Ping Zhang. *A First Course in Graph Theory*. 2nd ed. Pearson, 2013.

2. Spivak, Michael. *Calculus and Applications*. 11th ed. Pearson, 2023.

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. Axler, Sheldon. *Linear Algebra Done Right*. 3rd ed. Springer, 2015.
2. Evans, Lawrence C. *Partial Differential Equations: An Introduction*. 2nd ed. American Mathematical Society, 2010.
3. Diestel, Reinhard. *Graph Theory*. 5th ed. Springer, 2017.
4. Fichtenholz, Grisha M. *Integration of Functions of Several variables*. 2nd ed. American Mathematical Society, 2010.
5. Strang, Gilbert. *Introduction to Linear Algebra*. 5th ed. Wellesley-Cambridge Press, 2016.
6. West, Douglas B. *Introduction to Graph Theory*. 6th ed. Pearson, 2017.

SOME SUGGESTIONS FOR TEACHER SPECIFIC CONTENTS:

➢ Demonstrate how to visualize tangent planes to surfaces at a specific point using partial derivatives.

➢ Check how to obtain absolute maximum using partial derivatives.

➢ Use Microsoft excel or spreadsheet to performs basic matrix operations.

➢ Find the integrals using integration by parts (Problem Solving).

➢ Integrate rational functions by partial fractions (Problem Solving).

➢ Finding areas using definite integrals.

➢ Find the adjacency matrix of some familiar graphs.

➢ Find the incidence matrix of some familiar graphs.