KANNUR UNIVERSITY

(Abstract)

I and II Semester Scheme and Syllabus of B.Sc. Mathematics Honours/Honours with Research Programme in tune with KU-FYUGP Regulations 2024 with effect from 2024 Admission onwards- Approved- Implemented- Orders Issued

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FYUGP Spl.cell

ACAD/FYSC-III/21032/2024 Dated: 18.10.2024

Read:-1. U.O. No. FYUGPSC/FYSC-I/5074/2024, dated: 18/04/2024

2. E-mail of the Chairperson, Board of Studies in Mathematics(UG), on 08.06.2024

3.The Minutes of the Meeting of the Scrutiny Committee held on 14.06.2024

4. E-mail of the Chairperson, Board of Studies in Mathematics(UG), on 24.06.2024

5.Orders of the Vice Chancellor dtd 24.06.2024

6. The Minutes of the Meeting of the Academic Council, held on 25.06.2024

ORDER

1.The Regulations of the Kannur University Four Year UG Programmes (KU-FYUGP Regulations 2024) for affiliated Colleges was implemented with effect from 2024 admission onwards, vide paper read as(1) above.

2.Subsequently, the Chairperson, Board of Studies in Mathematics(UG) vide paper read as (2) above, submitted the I & II Semester Syllabus of the B.Sc. Mathematics Honours/Honours with Research programme in tune with KUFYUGP Regulations 2024 with effect from 2024 Admission onwards.

3.Thereafter, the Scrutiny Committee, which included the Dean, Faculty of Science vide paper read as (3) above, scrutinized the I & II Semester Syllabus and recommended suggestions.

4.Subsequently, vide paper read as (4) above, the Chairperson, Board of Studies in Mathematics(UG) forwarded the modified Syllabus of the I & II Semester B.Sc. Mathematics Honours/Honours with Research programme for approval.

5.Thereafter, the Vice Chancellor ordered to place the Syllabus before the Academic Council for consideration, as per the paper read (5) above.

6. Accordingly, the I & II Semester Syllabus of the B.Sc. Mathematics Honours/Honours with Research programme in tune with KU-FYUGP Regulations 2024 was approved by the meeting of the Academic Council held on 25-06-2024 and granted permission to publish the same, as and when it is ready, after making the necessary modifications, as per paper read as (6) above.

7.Considering the matter in detail, the Vice Chancellor approved the Minutes of the aforesaid meeting of the Academic Council and I & II Semester Syllabus of the B.Sc. Mathematics Honours/Honours with Research programme, prepared in tune with KU-FYUGP Regulations, 2024.

8.The approved Syllabus of I & II Semester B.Sc. Mathematics Honours/Honours with Research programme is appended herewith and uploaded in the University website.

Orders are issued accordingly.

Sd/-

ANIL CHANDRAN R
DEPUTY REGISTRAR (ACADEMIC)
For REGISTRAR

To: The Principals of Arts and Science Colleges affiliated to Kannur University

Copy To: 1. The Examination Branch (through PA to CE)
2. The Chairperson, Board of Studies in Mathematics(UG)
3. PS to VC/PA to R
4. DR/AR (Academic)
5. The IT Cell (For uploading in the website)
6. SF/DF/FC

Forwarded / By Order ,

SECTION OFFICER

KANNUR UNIVERSITY

FOUR YEAR UNDERGRADUATE PROGRAMME

SYLLABUS

MATHEMATICS
HONOURS/HONOURS WITH RESEARCH

(Effective from 2024 admissions)

KANNUR UNIVERSITY
VISION AND MISSION STATEMENTS

Vision

To establish a teaching, residential and affiliating University and to provide equitable and just access to quality higher education involving the generation, dissemination and a critical application of knowledge with special focus on the development of higher education in Kasargode and Kannur Revenue Districts and the Manandavady Taluk of Wayanad Revenue District.

Mission

- To produce and disseminate new knowledge and to find novel avenues for application of such knowledge.
- To adopt critical pedagogic practices which uphold scientific temper, the uncompromised spirit of enquiry and the right to dissent.
- To uphold democratic, multicultural, secular, environmental and gender sensitive values as the foundational principles of higher education and to cater to the modern notions of equity, social justice and merit in all educational endeavours.
- To affiliate colleges and other institutions of higher learning and to monitor academic, ethical, administrative and infrastructural standards in such institutions.
- To build stronger community networks based on the values and principles of higher education and to ensure the region's intellectual integration with national vision and international standards.
- To associate with the local self-governing bodies and other statutory as well as non-governmental organizations for continuing education and also for building public awareness on important social, cultural and other policy issues.

INTRODUCTION

Kannur University – Four Year Undergraduate Programme: Backdrop and Context

The implementation of the Four-Year Undergraduate Programme (FYUGP) has been driven by the pressing need to address contemporary challenges ensuring responsive changes to the evolving needs of students, industry, and society at large. Recognizing the curriculum as the cornerstone of any education system, it requires regular refinement to align with evolving socio-economic factors. Higher education must provide students with practical and technical skills relevant to their fields of interest, necessitating the development of a job-oriented curriculum. Despite significant increases in access and expansion of higher education over the years, concerns persist regarding the quality and relevance of educational outcomes, particularly in terms of employability skills. As the world becomes increasingly interconnected, our education system must evolve to instill 21st-century skills, enabling students not only to survive but to thrive in this dynamic environment. Moreover, there is a
growing need for higher education institutions to embrace social responsibility and contribute to the development of a knowledge society capable of driving sustainable development through innovation. With the central objective of fostering a robust knowledge society to support a knowledge economy, the Government of Kerala has initiated steps to reform higher education. Accordingly, three commissions were established to suggest reforms in higher education policy, legal and regulatory mechanisms, and evaluation and examination systems. It is within this context that a comprehensive reform of the undergraduate curriculum has been proposed, leading to the restructuring of the Four-Year Undergraduate Programme.

KANNUR UNIVERSITY

PROGRAMME OUTCOMES

PO1: **Critical Thinking and Problem-Solving**-Apply critical thinking skills to analyze information and develop effective problem-solving strategies for tackling complex challenges.

PO2: **Effective Communication and Social Interaction**-Proficiently express ideas and engage in collaborative practices, fostering effective interpersonal connections.

PO3: **Holistic Understanding**-Demonstrate a multidisciplinary approach by integrating knowledge across various domains for a comprehensive understanding of complex issues.

PO4: **Citizenship and Leadership**-Exhibit a sense of responsibility, actively contribute to the community, and showcase leadership qualities to shape a just and inclusive society.

PO5: **Global Perspective**-Develop a broad awareness of global issues and an understanding of diverse perspectives, preparing for active participation in a globalized world.

PO6: **Ethics, Integrity and Environmental Sustainability**-Uphold high ethical standards in academic and professional endeavors, demonstrating integrity and ethical decision-making. Also acquire an understanding of environmental issues and sustainable practices, promoting responsibility towards ecological well-being.

PO7: **Lifelong Learning and Adaptability**-Cultivate a commitment to continuous selfdirected learning, adapting to evolving challenges, and acquiring knowledge throughout life.

PREFACE

This syllabus serves as a roadmap for academic journey, outlining the courses and objectives designed to cultivate mathematical proficiency and intellectual curiosity.

Mathematics is not merely a collection of techniques and formulae; it is a language for expressing and understanding patterns, structures, and relationships in the world around us. It is the universal language which forms the bedrock of scientific inquiry and technological advancement. As a student embark on this educational voyage, he/she will explore the beauty and power of mathematical ideas while developing problem-solving skills that are invaluable in both academic and real-world contexts.

This program is structured to provide a comprehensive foundation in core mathematical disciplines, including Algebra, Number theory, Calculus, Geometry, Abstract Algebra, Linear Algebra, Analysis, Topology and Discrete Mathematics. Through a combination of theoretical study and practical applications, students can deepen their understanding of fundamental concepts and sharpen their ability to apply them creatively to solve complex problems.

In addition to core courses, students have the opportunity to tailor their studies through a variety of elective options, allowing to pursue specialized interests in areas such as Numerical Analysis, Optimization, Cryptography, Fuzzy Mathematics, Artificial Intelligence and more, which are necessary to instill 21st century skills.

Also, there is provision to align with interests and career aspirations. Whether passion lies in pure mathematics, applied mathematics, or interdisciplinary fields, one can find courses from Multidisciplinary/Value added/Skill Enhancement courses to suit his/her academic trajectory. Further, assignments, seminars and project work promote self study and develop research mind in students.

The UG Board of Studies in Mathematics puts forward this syllabus for Four Year Under-Graduate Programme in Mathematics for implementation from 2024 onwards. We thank all those who helped us by giving critical suggestions for improvement.

Dr. C.P. Santhosh
Chairman
UG Board of Studies in Mathematics
Kannur University

PROGRAMME SPECIFIC OUTCOMES

PSO 1: Understand basic concepts and tools of Mathematical logic, Set theory, Number theory, Geometry, Calculus, Vector calculus, Algebra, Abstract structures, Linear Algebra, Laplace transforms, Differential equations, Numerical Analysis, Fourier series, Real Analysis, Complex Analysis, Topology and Measure theory.

PSO 2: Develop abstract reasoning and critical thinking skills necessary for advanced mathematical study and applications in various fields.

PSO 3: Develop proficiency in defining, formulating and solving problems by applying appropriate mathematical methods and principles.

PSO 4: Formulate real world problems into mathematical models and find solutions.

PSO 5: Develop proficiency in using mathematical softwares and programming languages.

PSO 6: Understand the interdisciplinary nature of mathematics and apply mathematical concepts and techniques to solve problems in other sciences.

PSO 7: Get equipped with basic research skills.

KANNUR UNIVERSITY

FOUR YEAR UNDERGRADUATE PROGRAMME

MATHEMATICS HONOURS/HONOURS WITH RESEARCH

PROGRAMME STRUCTURE

B.Sc. Mathematics Pathway Courses (2024 admission onwards)						
Sl. No.	***Level***	***Course Code***	***Semester***	***Name of course***	***Credits***	***Major Pathway Courses***
1	100-199	KU1DSCMAT101	I	Calculus I	4	1
2	100-199	KU1DSCMAT111	I	Basic Mathematics I	4	
3	100-199	KU1DSCMAT112	I	Calculus and Matrix Algebra	4	
4	100-199	KU1DSCMAT113	I	Functions, Calculus and Matrices	4	
5	100-199	KU1DSCMAT114	I	Mathematical Economics I	4	
6	100-199	KU1DSCMAT115	I	Algebra, Differential Calculus and Probability	4	
7	100-199	KU1DSCMAT116	I	Calculus and Coordinate Systems	4	
8	100-199	KU1DSCMAT117	I	Calculus and Matrix Algebra I	4	
9	100-199	KU1DSCMAT118	I	Probability Theory I	4	
10	100-199	KU1DSCMAT119	I	Foundations of Mathematics I	4	
11	100-199	KU2DSCMAT101	II	Calculus II	4	2
12	100-199	KU2DSCMAT111	II	Basic Mathematics II	4	
13	100-199	KU2DSCMAT112	II	Differential Calculus, Curve Fitting and Coordinate Systems	4	
14	100-199	KU2DSCMAT113	II	Set theory, Number theory, Integral Calculus and Fourier Series	4	
15	100-199	KU2DSCMAT114	II	Mathematical Economics II	4	
16	100-199	KU2DSCMAT115	II	Linear Algebra, Differential Calculus and Vectors	4	
17	100-199	KU2DSCMAT116	II	Multivariable Calculus	4	

18	100-199	KU2DSCMAT117	II	Calculus and Matrix Algebra II	4	
19	100-199	KU2DSCMAT118	II	Probability Theory II	4	
20	100-199	KU2DSCMAT119	II	Foundations of Mathematics II	4	
21	200-299	KU3DSCMAT201	III		4	3
22	200-299	KU3DSCMAT202	III		3+1	4
23	200-299	KU3DSCMAT211	III		3+1	
24	200-299	KU3DSCMAT212	III		3+1	
25	200-299	KU3DSCMAT213	III		3+1	
26	200-299	KU3DSCMAT214	III		3+1	
27	200-299	KU3DSCMAT215	III		3+1	
28	200-299	KU3DSCMAT216	III		3+1	
29	200-299	KU3DSCMAT217	III		3+1	
30	200-299	KU4DSCMAT201	IV		3+1	5
31	200-299	KU4DSCMAT202	IV		3+1	6
32	200-299	KU4DSCMAT203	IV		3+1	7
33	300-399	KU5DSCMAT301	V		4	8
34	300-399	KU5DSCMAT302	V		3+1	9
35	300-399	KU5DSCMAT303	V		3+1	10
36	300-399	KU5DSEMAT301	V		4	11/12 Elective (a)
37	300-399	KU5DSEMAT302	V		4	11/12 Elective (b)
38	300-399	KU5DSEMAT303	V		4	11/12 Elective (c)
39	300-399	KU5DSEMAT304	V		4	11/12 Elective (d)
40	300-399	KU6DSCMAT301	VI		4	13
41	300-399	KU6DSCMAT302	VI		3+1	14
42	300-399	KU6DSCMAT303	VI		3+1	15
43	300-399	KU6DSEMAT303	VI		4	16/17 Elective (a)
44	300-399	KU6DSEMAT303	VI		4	16/17 Elective (b)
45	300-399	KU6DSEMAT303	VI		4	16/17 Elective (c)

46	300-399	KU6DSEMAT303	VI		4	16/17 Elective (d)
47		KU6INTMAT301	VI	Internship/Apprenticeship/Field Trip	2	18
48	400-499	KU7DSCMAT401	VII		4	19
49	400-499	KU7DSCMAT402	VII		4	20
50	400-499	KU7DSCMAT403	VII		4	21
51	400-499	KU7DSCMAT404	VII		4	22
52	400-499	KU7DSCMAT401	VII		4	23
53	400-499	KU8DSCMAT401	VIII		4	24
54	400-499	KU8DSCMAT402	VIII		4	25
55	400-499	KU8DSCMAT403	VIII		4	26
56	400-499	KU8DSEMAT401	VIII	Research Methodology in Mathematics	4	27/28/29 Elective (a)
57	400-499	KU8DSEMAT402	VIII		4	27/28/29 Elective (b)
58	400-499	KU8DSEMAT403	VIII		4	27/28/29 Elective (c)
59	400-499	KU8DSEMAT404	VIII	MOOC/Online course I	4	27/28/29 Elective (d)
60	400-499	KU8DSEMAT405	VIII	MOOC/Online course II	4	27/28/29 Elective (e)
61	400-499	KU8CIPMAT406	VIII	MOOC/Online course III	4	27/28/29 Elective (f)
62	400-499	KU8CIPMAT 400	VIII	Capstone Internship Project in Honours Programme in Mathematics	8	30(a)
63	400-499	KU8PHRMAT400	VIII	Project in Honours with Research Programme in Mathematics	12	30(b)

*Courses with codes of the form KU*DSCMAT*12 are preferable for Chemistry Major students.*

*Courses with codes of the form KU*DSCMAT*13 are preferable for Computer Science Major students.*

*Courses with codes of the form KU*DSCMAT*15 are preferable for Electronics Major students.*

*Courses with codes of the form KU*DSCMAT*16 are preferable for Physics Major students.*

*Courses with codes of the form KU*DSCMAT*17 are preferable for Statistics Major students.*

General Foundation Courses offered by Department of Mathematics

Sl. No.	*Level*	*Course Category*	*Course Code*	*Semester*	*Name of Course*	*Credits*
1	100-199	MDC	KUIMDCMAT101	I	Mathematics in Real Life	3
2	100-199	MDC	KUIMDCMAT102	I	Business Mathematics	3
3	100-199	MDC	KUIMDCMAT103	I	Matrix Theory	3
4	100-199	MDC	KU2MDCMAT101	II	Mathematical Reasoning	3
5	100-199	MDC	KU2MDCMAT102	II	Mathematics for Social Science	3
6	100-199	MDC	KU2MDCMAT103	II	Vector Algebra	3
5	200-299	MDC		III	Kerala Studies	3
6	200-299	VAC	KU3VACMAT201	III	Quantitative Arithmetic and Reasoning	3
7	200-299	VAC	KU3VACMAT202	III	Mathematical Modeling	3
8	200-299	VAC	KU4VACMAT201	IV	LaTeX	1+2
9	200-299	VAC	KU4VACMAT202	IV	Mathematical Verbal Reasoning	3
10	200-299	VAC	KU4VACMAT203	IV	Mathematical Logic	3
11	200-299	VAC	KU4VACMAT204	IV		3
12	200-299	SEC	KU4SECMAT201	IV	Geogebra	1+2
13	200-299	SEC	KU4SECMAT202	IV	Digital Image Processing	1+2
14	300-399	SEC	KU5SECMAT301	V	Type Setting of Communications in Mathematics using LaTeX	1+2
15	300-399	SEC	KU5SECMAT302	V	R Programming	1+2
16	300-399	SEC	KU5SECMAT303	V	Prompt Engineering	1+2
17	300-399	SEC	KU6SECMAT301	VI	Scilab	1+2
18	300-399	SEC	KU6SECMAT302	VI	Python Programming	1+2
19	300-399	SEC	KU6SECMAT303	VI	Artificial Intelligence	1+2

SEMESTERWISE DISTRIBUTION OF COURSES FOR FOUR YEAR U G PROGRAMME (FYUGP) MATHEMATICS

(2024 ADMISSION ONWARDS)

SEMESTER 1

No	Title	Hours/ week	Credit	CE	ESE	Total marks
1	AEC 1 (English)	3	3	25	50	75
2	AEC 2 (Additional Language)	3	3	25	50	75
3	MDC 1	3	3	25	50	75
4	DSC (Major)	4	4	30	70	100
5	DSC (Minor 1)	4	4	30	70	100
6	DSC (Minor 2)	4	4	30	70	100
	Total credits		21			

SEMESTER II

No	Title	Hours/week	Credit	CE	ESE	Total marks
1	AEC 3 (English)	3	3	25	50	75
2	AEC 4 (Additional Language)	3	3	25	50	75
3	MDC 2	3	3	25	50	75
4	DSC (Major)	4	4	30	70	100
5	DSC (Minor 1)	4	4	30	70	100
6	DSC (Minor 2)	4	4	30	70	100
	Total credits		21			

SEMESTER III

No	Title	Hours/w eek	Credit	CE	ESE	Total marks
1	MDC 3	3	3	25	50	75
2	VAC 1	3	3	25	50	75
3	DSC (Major)	4	4	30	70	100
4	DSC (Major)	4	4	30	70	100
5	DSC (Minor 1)	4	4	30	70	100
6	DSC (Minor 2)	4	4	30	70	100
	Total credits		22			

SEMESTER IV

No	Title	Hours/week	Credit	CE	ESE	Total marks
1	SEC 1	3	3	25	50	75
2	VAC 2	3	3	25	50	75
3	VAC 3	3	3	25	50	75
4	DSC (Major)	4	4	30	70	100
5	DSC (Major)	4	4	30	70	100
6	DSC (Major)	4	4	30	70	100
	Total credits		21			

SEMESTER V

No	Title	Hours/ week	Credit	CE	ESE	Total marks
1	SEC 2	3	3	25	50	75
2	DSC (Major)	4	4	30	70	100
3	DSC (Major)	4	4	30	70	100
4	DSC (Major)	4	4	30	70	100
5	DSE (Major Elective)	4	4	30	70	100
6	DSE (Major Elective)	4	4	30	70	100
	Total credits		23			

SEMESTER VI

No	Title	Hours/ week	Credit	CE	ESE	Total marks
1	SEC 3	3	3	25	50	75
2	DSC (Major)	4	4	30	70	100
3	DSC (Major)	4	4	30	70	100
4	DSC (Major)	4	4	30	70	100
5	DSE (Major Elective)	4	4	30	70	100
6	DSE (Major Elective)	4	4	30	70	100
7	Internship	2	2			
	Total credits		25			

EXIT WITH UG DEGREE/PROCEED TO FOURTH YEAR WITH 133 CREDITS

17 Major course *:17 x 4 = 68 credits*

6 minor course *:6 x 4 = 24 credits*

13 foundation courses (AEC, SEC, VAC, MDC) *:13 x 3 = 39 credits*

1 Internship *:2 x1 = 2 credits*

Total ***: 133 credits***

SEMESTER VII

No	Title	Hours/ week	Credit	CE	ESE	Total marks
1	DSC (Major)	4	4	30	70	100
2	DSC (Major)	4	4	30	70	100
3	DSC (Major)	4	4	30	70	100
4	DSC (Major)	4	4	30	70	100
5	DSC (Major)	4	4	30	70	100
	Total credits		20			

SEMESTER VIII

	Toatal Credit	Total marks for CE	Total marks for ESE	Total marks
Project and Courses as per the FYUGP Regulation	24	180	420	600

DISCIPLINE SPECIFIC COURSES

KU1DSCMAT101: CALCULUS I

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC	100-199	KU1DSCMAT101	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course is to introduce the notion of limits, continuity, derivatives and integrals and to discuss applications of differentiation and integration.

Course Prerequisite

Functions

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Comprehend trigonometric functions, exponential functions, inverse functions, logarithmic function and hyperbolic functions	Understand
2	Apply Exponential growth and decay in Finance and in Radio active decay	Apply
3	Understand the notion of limit and limit laws	Understand
4	Understand continuity of a function	Understand
5	Comprehend the notion of derivative of a function and differentiation rules	Understand
6	Comprehend the indefinite and definite integrals	Understand

7	Apply the notion of definite integrals to find area between curves and arc length	Apply

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2						✓	
CO 3	✓						
CO 4	✓						
CO 5	✓						
CO 6	✓						
CO 7	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Functions and Limits**	**12**
	1	**Functions**	
		a) Trigonometric functions	
		b) Exponential functions	
		c) Inverse functions and logarithms	
		d) Hyperbolic functions (Definition and identities only)	
	2	**Limits**	
		Limit of a function and limit laws	
II		**Continuity and Differentiation of functions**	

	1	**Continuity**	**12**
	2	**Differentiation**	
		a) The derivative as a function	
		b) Differentiation rules	
		c) Derivatives of trigonometric functions	
		d) The Chain rule	
		e) Implicit differentiation	
		f) Derivatives of inverse functions and logarithms	
		g) Derivatives of inverse trigonometric functions	
		h) Derivatives of hyperbolic functions	
III	**Integration**		**12**
	1	**Indefinite integrals**	
		a) Integral of a function	
		b) The study of Integral Calculus	
		c) Indefinite integral	
		d) Indefinite integrals and the substitution method	
		e) Integration by parts	
		f) Trigonometric substitutions	
		g) Integration of rational functions by partial fractions	
	2	**Definite integrals**	
IV	**Applications of integration**		12
	1	a) Geometric interpretation of definite integral (without proof)	
		b) Substitution and Area between curves	
		c) Arc length	

V	**Teacher Specific Module**	**12**
	Directions	
	Graphs of functions mentioned in Unit 1 in Module I	
	Precise definition of limit, One-sided limit (Sections 2.3, 2.4)	
	Riemann sums, its geometric meaning and definite integral	
	Any topic related to Module I, II, III & IV	

Essential Readings

1. G.B. Thomas Jr., M.D. Weir and J.R. Hass, Thomas' Calculus: Early Transcendentals (12^{th} edition), Pearson Education
2. S. Narayan and P.K. Mittal , Integral Calculus (Revised Edition), S. Chand & Company Ltd.

Reference Distribution

Module	Unit	Reference No.	Sections	Remarks
I	1	1	Sections 1.3, 1.5, 1.6, 7.3, 2.2	*Only quick review of Section1.3 is needed. Questions should not be asked in the End Semester Examination from section 1.3*
	2	1	Section 2.2	
II	1	1	Section 2.5	
	2	1	Sections 3.2, 3.3, 3.5, 3.6, 3.7, 3.8, 3.9, 7.3	
III	1	2	For 1(a), (b) & (c), Sections 1.1, 1.2, 1.3, 1.4 & 1.5	
		1	For 1(d), (e), (f) & (g), Sections 5.5, 8.1, 8.3 & 8.4	
	2	2	Sections 1.6, 1.7	
IV	1	2	For 1(a), Section 1.8	
		1	For 1(b) &(c), Sections 5.6, 6.3	

Suggested Readings

1. H. Anton, I. Bivens and S. Davis, Calculus, 10^{th} edition , Willey

2. Higher Engineering Mathematics, B.S. Grewal (43rd edition), Khanna Publishers
3. S Narayan and P.K Mittal , Differential calculus, Revised Edition, S. Chand & Company Ltd
4. E. Kreyszig, Advanced Engineering Mathematics (10th edition), Willey

Assessment Rubrics

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU1DSCMAT111
BASIC MATHEMATICS I

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC	100-199	KU1DSCMAT111	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This foundational math course for computer applications covers essential concepts like functions, limits and continuity, differentiation, integration, and matrix basics. It's crucial as it forms the mathematical groundwork for algorithm design, data analysis, and various computational techniques used extensively in computer applications..

Course Prerequisite

Functions, matrices, basic operations of matrices, determinant of a matrix.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Comprehend trigonometric functions, exponential functions, inverse functions, logarithmic function and hyperbolic functions	Understand
2	Understand the notion of limit, limit laws and continuity of a function	Understand
3	Apply differentiation rules, integration techniques, and matrix operations.	Apply
4	Comprehend the notion of derivative of a function differentiation rules and partial derivatives	Understand

5	Comprehend the indefinite and definite integrals	Understand
6	Evaluate rank of matrices, and solutions using Gauss-Jordan method.	Evaluate

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2						✓	
CO 3	✓						
CO 4	✓						
CO 5	✓						
CO 6	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Functions and Limits**	**12**
	1	**Functions**	
		a) Trigonometric functions	
		b) Exponential functions	
		c) Inverse functions and logarithms	
		d) Hyperbolic functions	
		e) Functions of Several Variables	
	2	**Limits**	
		a) Limit of a function and limit laws	

		b) Limits and Continuity in Higher Dimensions	
II	**Continuity and Differentiation of functions**		**12**
	1	**Continuity**	
	2	**Differentiation**	
		a) The derivative as a function	
		b) Differentiation rules	
		c) Derivatives of trigonometric functions	
		d) The Chain rule	
		e) Implicit differentiation	
		f) Derivatives of inverse functions	
		g) Derivatives of inverse trigonometric functions	
		h) Partial Derivatives and Chain Rule	
III	**Integration**		**12**
	1	**Indefinite integrals**	
		a) Integral of a function	
		b) The study of Integral Calculus	
		c) Indefinite integral	
		d) Indefinite integrals and the substitution method	
		e) Integration by parts	
		f) Trigonometric substitutions	
		g) Integration of rational functions by partial fractions	
	2	**Definite integrals**	
		a) Definite integral	
		b) Geometric interpretation of definite integral (without proof)	
IV	**Matrix basics**		12
	1	a) Transpose of a matrix, Adjoint of a square matrix, Inverse of a matrix.	

		b) Rank of a matrix, Elementary transformation of a matrix, Equivalent matrix, Elementary matrices, Gauss-Jordan method of finding the inverse	
V	**Teacher Specific Module**		**12**
	Directions		
	Graphs of functions mentioned in Unit 1 in Module I		
	Precise definition of limit, One-sided limit (Sections 2.3, 2.4)		
	Riemann sums, its geometric meaning and definite integral		
	Normal form of a matrix.		
	Any topic related to Module I, II, III & IV		

Essential Readings

1. G.B. Thomas Jr., M.D. Weir and J.R. Hass, Thomas' Calculus: Early Transcendentals (12^{th} edition), Pearson Education
2. S. Narayan and P.K. Mittal , Integral calculus, Revised Edition, S. Chand & Company Ltd.
3. Advanced Higher Engineering Mathematics (42^{nd} edition), B.S. Grewal, Khanna Pub.

Reference Distribution

Module	Unit	Reference No.	Sections	Remarks
I	1	1	Sections 1.3, 1.5, 1.6, 7.3, 2.2,14.1	*Quick review of Section1.3 is needed. Questions should not be asked in the End Semester Examination from section 1.3.* *Graphs, Level Curves, and Contours of Functions of Two Variables and computer Graphing from section 14.1 excluded*
	2	1	Section 2.2 ,14.2	*Proof of all theorems from section 14.2 excluded*

II	1	1	Section 2.5	
	2	1	Sections 3.2, 3.3, 3.5, 3.6, 3.7, 3.8, 3.9 ,14.3,14.4	*Proof of all theorems from sections 14.3 and 14.4 are excluded*
III	1	2	For 1(a), (b) & (c), Sections 1.1, 1.2, 1.3, 1.4 & 1.5	
		1	For 1(d), (e), (f) & (g), Sections 5.5, 8.1, 8.3 & 8.4	
	2	2	Sections 1.6, 1.7, 1.8	
IV	1	3	2.6	
	2	3	2.7	*Exclude 2.7 (7)*

Suggested Readings

1. H. Anton, I. Bivens and S. Davis, Calculus, 10th edition , Willey
2. Higher Engineering Mathematics, B.S. Grewal (43rd edition), Khanna Publishers
3. S Narayan and P.K Mittal , Differential calculus, Revised Edition, S. Chand & Company Ltd
4. E. Kreyszig, Advanced Engineering Mathematics (10th edition), Willey
5. Richard Bronson, Schaum's outline of Theory and Problems of Matrix Operations, Schum's outline series, The MaGraw-Hill Campanies

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU1DSCMAT112
CALCULUS AND MATRIX ALGEBRA

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC	100-199	KU1DSCMAT112	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course is to discuss limits, continuity, derivative and inverse, rank, eigenvalues and eigenvectors of a matrix.

Course Prerequisite

Functions, operations of matrices, determinant of a square matrix.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Comprehend trigonometric functions, exponential functions, inverse functions, logarithmic function and hyperbolic functions	Understand
2	Apply Exponential growth and decay in Finance and in Radio active decay	Apply
3	Understand the notion of limit and limit laws	Understand
4	Understand continuity of a function	Understand
5	Comprehend the notion of derivative of a function and differentiation rules	Understand
6	Comprehend the indefinite and definite integrals	Understand

7	Determine inverse, rank, eigenvalues and eigenvectors of a matrix	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2						✓	
CO 3	✓						
CO 4	✓						
CO 5	✓						
CO 6	✓						
CO 7	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Functions and Limits**	**12**
	1	**Functions**	
		a) Trigonometric functions	
		b) Exponential functions	
		c) Inverse functions and logarithms	
		d) Hyperbolic functions (Definition and identities only)	
	2	**Limits**	
		Limit of a function and limit laws	
II		**Continuity and Differentiation of functions**	

	1	**Continuity**	
	2	**Differentiation**	
		a) The derivative as a function	
		b) Differentiation rules	**12**
		c) Derivatives of trigonometric functions	
		d) The Chain rule	
		e) Implicit differentiation	
		f) Derivatives of inverse functions and logarithms	
		g) Derivatives of inverse trigonometric functions	
		h) Derivatives of hyperbolic functions	
III	**Integration**		
	1	**Indefinite integrals**	
		a) Integral of a function	
		b) The study of Integral Calculus	
		c) Indefinite integral	
		d) Indefinite integrals and the substitution method	**12**
		e) Integration by parts	
		f) Trigonometric substitutions	
		g) Integration of rational functions by partial fractions	
	2	**Definite integrals**	
		a) Definite integral	
		b) Geometric interpretation of definite integral (without proof)	
IV	**Matrices**		
	1	**Inverse of matrix**	
		a) Inverse by Gauss-Jordan elimination	12
		b) Inverse by determinants (or adjoint)	
	2	**Rank of a matrix**	

		(a) Rank of a matrix	
		(b) Elementary transformations of a matrix	
		(c) Invariance of rank	
		(d) normal form of matrix	
	3	**Eigenvalues and eigenvectors**	
V	**Teacher Specific Module**		**12**
	Directions		
	Graphs of functions mentioned in Unit 1 in Module I		
	Precise definition of limit, One-sided limit (Sections 2.3, 2.4)		
	Riemann sums, its geometric meaning and definite integral		
	Any topic related to Module I, II, III & IV		

Essential Readings

1. G.B. Thomas Jr., M.D. Weir and J.R. Hass, Thomas' Calculus: Early Transcendentals (12^{th} edition), Pearson Education
2. S. Narayan and P.K. Mittal , Integral calculus (Revised Edition), S. Chand & Company Ltd.
3. E. Kreyszig, Advanced Engineering Mathematics (10^{th} edition), Willey
4. S. Narayan and P.K. Mittal, A Text Book of Matrices (10^{th} edition), S. Chand & Company Ltd.

Reference Distribution

Module	Unit	Reference No.	Sections	Remarks
I	1	1	Sections 1.3, 1.5, 1.6, 7.3, 2.2	*Only quick review of Section1.3 is needed. Questions should not be asked in the End Semester Examination from section 1.3*
	2	1	Section 2.2	
II	1	1	Section 2.5	

	2	1	Sections 3.2, 3.3, 3.5, 3.6, 3.7, 3.8, 3.9, 7.3	
III	1	2	For 1(a), (b) & (c), Sections 1.1, 1.2, 1.3, 1.4 & 1.5	
		1	For 1(d), (e), (f) & (g), Sections 5.5, 8.1, 8.3 & 8.4	
	2	2	Sections 1.6, 1.7, 1.8	
IV	1	3	Section 7.8	*Theorem 3 and proof of Theorem 4 are omitted*
	2	4	Sections 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8	*All proofs are omitted*
	3	3	Section 8.1	

Suggested Readings

1. H. Anton, I. Bivens and S. Davis, Calculus, 10th edition , Willey
2. B.S. Grewal, Higher Engineering Mathematics (43rd edition), Khanna Publishers
3. S Narayan and P.K Mittal , Differential calculus (Revised Edition), S. Chand & Company Ltd.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KUIDSCMAT113
FUNCTIONS, CALCULUS AND MATRICES

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
1	DSC	100	KUIDSCMAT113	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This foundational mathematics course for computer science covers essential concepts like functions, limits and continuity, differentiation, integration, and matrix basics. It's crucial as it forms the mathematical groundwork for algorithm design, data analysis, and various computational techniques used extensively in computer science.

Course Prerequisite

Functions, matrix, basic matrix operations, determinant of matrix.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Recall trigonometric functions, exponential functions, and logarithms.	Remember
2	Comprehend limit laws, continuity and differentiation concepts	Understand
3	Comprehend differentiation rules, integration techniques, and matrix operations.	Understand

4	Understand limit properties, continuity conditions, and matrix transformations.	Understand
5	Evaluate definite integrals	Understand
6	Determine ranks of matrices	Understand
7	Find inverse of a matrix using Gauss-Jordan method.	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2	✓						
CO 3			✓				
CO 4	✓						
CO 5			✓				
CO 6	✓						
CO 7	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I	**Functions and Limits**		
	1	**Functions**	12
		a) Trigonometric functions	
		b) Exponential functions	
		c) Inverse functions and logarithms	

		d) Hyperbolic functions	
	2	**Limits**	
		Limit of a function and limit laws	
II	**Continuity and Differentiation of functions**		12
	1	**Continuity**	
	2	**Differentiation**	
		a) The derivative as a function	
		b) Differentiation rules	
		c) Derivatives of trigonometric functions	
		d) The Chain rule	
		e) Implicit differentiation	
		f) Derivatives of inverse functions	
		g) Derivatives of inverse trigonometric functions	
III	**Integration**		12
	1	Table of elementary integral	
	2	Definite integral	
	3	Two important properties of definite integrals	
	4	Integration by substitution	
	5	Three important forms of integrals	
IV	**Matrix basics**		12
	1	Related matrices: Transpose of a matrix, Adjoint of a square matrix, Inverse of a matrix.	
	2	Rank of a matrix, Elementary transformation of a matrix, Equivalent matrix, Elementary matrices, Gauss-Jordan method of finding the inverse	
V	**Teacher specific module**		**12**
	Directions		
	Graphs of functions mentioned in Unit 1 in Module I		

	Precise definition of limit, One-sided limit (Sections 2.3, 2.4)	
	Any topic related to Module I, II, III & IV	

Essential Readings

1. Thomas' Calculus:Early Transcendentals (12th edition), G.B. Thomas Jr., M.D. Weir and J.R. Hass, Pearson Education
2. Integral Calculus, Santhi Narayanan and P.K. Mittal, S. Chand and Co.
3. Advanced Higher Engineering Mathematics (42nd edition), B.S. Grewal, Khanna Pub

Reference Distribution

Module	Unit	Reference No.	Page Nos.	Remarks
I	1	1	Sections 1.3, 1.5, 1.6, 7.3, 2.2	*Quick review of Section1.3 is needed. Questions should not be asked in the End Semester Examination from section 1.3*
	2	1	Section 2.2	
II	1	1	Section 2.5	
	2	1	Sections 3.2, 3.3, 3.5, 3.6, 3.7, 3.8, 3.9	
III	1	2	1.4	
	2	2	1.6	
	3	2	1.7	
	4	2	2.2	
	5	2	2.3	
V	1	3	2.6	
	2	3	2.7	*Exclude 2.7 (7)*

Suggested Readings

1. Calculus, 10th edition, H Anton, Bivens and Davis, Willey

2. Higher Engineering Mathematics, B.S. Grewal (43rd edition), Khanna Publishers
3. Differential calculus, Revised Edition, S Narayan and P.K Mittal, S. Chand & Company Ltd
4. Advanced Engineering Mathematics (10th edition), E. Kreyszig, Willey
5. Textbook of Matrices, Shanti Narayan and P.K. Mittal, S. Chand & Co.
6. Theory of and Problems of Matrices, Frank Ayres JR, Schaum's Outline Series, McGraw- Hill Book Company.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU1DSCMAT114: MATHEMATICAL ECONOMICS I

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC	100-199	KU1DSCMAT114	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course introduces fundamental concepts in mathematical economics, covering functions, economic applications of graphs and equations, limits, continuity, differentiation, applications of derivatives in economics.

Course Prerequisite

Proficiency in basic algebraic operations and a basic understanding of economic principles.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand the properties and applications of exponent	Understand
2	Comprehend the concept of functions and their graphical representations.	Understand
3	Interpret and analyse isocost lines to understand production cost constraints	Understand
4	Apply supply and demand analysis to analyse market equilibrium and pricing.	Apply
5	Comprehend the notion of derivative of a function and differentiation rules	Understand

6	Apply derivatives to optimize economic functions for maximum efficiency or profit.	Apply
7	Apply optimization techniques to maximize or minimize economic functions.	Apply
8	Understand and interpret the relationship among total, marginal, and average concepts in economic analysis.	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2	✓						
CO 3				✓			
CO 4			✓	✓			
CO 5	✓						
CO 6			✓	✓			
CO 7			✓	✓			
CO8	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I	**Functions**		
	1	**Functions**	**12**
		a) Exponents	
		b) Polynomials	
		c) Equations: Linear and Quadratic	**12**
		d) Simultaneous Equations	

		e) Functions	
		f) Graphs, Slopes and Intercepts	
II	1	**Economic Application of Graphs and Equations**	12
		a) Isocost Lines	
		b) Supply and Demand Analysis	
		c) Income Determination Models	
		d) *IS-LM* Analysis	
III	1	**The Derivatives and the Rules of Differentiation**	**12**
		a) Limits	
		b) Continuity	
		c) The derivative	
		d) Differentiability and continuity	
		e) Derivative Notation	
		f) Rules of Differentiation	
		g) Higher order derivative	
		h) Implicit differentiation	
IV	**Application of Derivatives in Economics**		**12**
	1	a) Increasing and Decreasing function	
		b) Concavity and Convexity	
		c) Relative Extrema	
		d) Inflection Points	
		e) Optimization of functions	
		f) Successive-Derivatives Test for Optimization	
		g) Marginal Concepts	
		h) Optimizing Economic Functions	
		i) Relationship among Total, Marginal and Average Concepts	
V	**Teacher Specific Module**		**12**
	Directions		
	1.Multivariable Functions		

	1	a) Functions of Severable Variables, Partial Derivatives, Rules of Partial differentiation, Second Order partial Derivatives	
		b) Optimization of Multivariable Functions	
		c) Implicit and Inverse function Rules	
	2	**Application Of Multivariable Functions in Economics**	
		a)Marginal Productivity	
		b)Income Differentiation Multipliers and Comparative Statics	
		c)Income and Cross Price Elasticities of Demand	
		Any topic related to Module I, II, III & IV	

Essential Reading

1. Edward T. Dowling, "Introduction to Mathematical Economics", Third Edition, Schaum's Outline Series, McGraw-Hill International Edition.

Reference Distribution

Module	Unit	Reference No.	Chapter	Remarks
I	1	1	Chapter 1	
II	1	1	Chapter 2	
III	1	1	Chapter 3	*Section 3.5 and Derivation of the rules of differentiation are excluded*
IV	1	1	Chapter 4	

Suggested Readings

1. Srinath Barauh (2010). "Basic Mathematics and Its Application in Economics." Amanad, New Delhi.
2. Peter J. Hammond & Knut Sydsaeter (2010). "Mathematics for Economic Analysis." Pearson.
3. Allen R.G.D (1956). "Mathematical Analysis for Economists." Macmillan.
4. Yamane, Taro (2004). "Mathematics for Economists: An Elementary Survey." PHI, New Delhi.
5. Chiang, A.C (1988). "Fundamental Methods of Mathematical Economics." McGraw Hill.

6. Anton, H., Bivens, I., & Davis, S. (2012). "Calculus" (10th ed.). Wiley.
7. Grewal, B. S. (2015). "Higher Engineering Mathematics" (43rd ed.). Khanna Publishers.
8. Narayan, S., & Mittal, P. K. (2014). "Differential Calculus" (Revised ed.). S. Chand & Company Ltd.
9. Kreyszig, E. (2011). "Advanced Engineering Mathematics" (10th ed.). Wiley.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU1DSCMAT115
ALGEBRA, DIFFERENTIAL CALCULUS AND PROBABILITY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC	100-199	KU1DSCMAT115	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course is to introduce the notion matrices, inverse of a matrix, of limits, continuity, derivatives and probability.

Course Prerequisite

Functions

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Comprehend matrices and inverses of matrices	Understand
2	Comprehend trigonometric functions, exponential functions, inverse functions, logarithmic function and hyperbolic functions	Understand
3	Apply Exponential growth and decay in Finance and in Radio active decay	Apply
4	Understand the notion of limit and limit laws	Understand
5	Understand continuity of a function	Understand
6	Comprehend the notions of permutation, combination and probability and addition law of probability	Understand

7	Comprehend the indefinite and definite integrals	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2						✓	
CO 3	✓						
CO 4	✓						
CO 5	✓						
CO 6	✓						
CO 7	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Matrices**	12
	1	**Matrix**	
		(a) General concepts and notations, Vectors, Equality of matrices, Addition and scalar multiplication of matrices	
		(b) Matrix multiplication, Transposition, Symmetric and skew-symmetric matrices, Unit matrix	
	2	**Rank of a matrix**	
		(a) Linear independence	
		(b) Rank of matrix	
		(c) Row equivalent matrices	

	3	**Inverse of a matrix**	
		(a) Existence of inverse	
		(b) Inverse by Gauss-Jordan method	
II	**Functions and Limits**		**12**
	1	**Functions**	
		a) Trigonometric functions	
		b) Exponential functions	
		c) Inverse functions and logarithms	
	2	**Limits**	
		Limit of a function and limit laws	
III	**Continuity and Differentiation of functions**		**12**
	1	**Continuity**	
	2	**Differentiation**	
		a) Derivative – definition and meaning	
		b) Differentiation rules	
		c) Derivatives of trigonometric functions	
		d) The Chain rule	
		e) Implicit differentiation	
		f) Derivatives of inverse functions and logarithms	
		g) Derivatives of inverse trigonometric functions	
	3	**Successive differentiation**	
IV	**Probability**		**12**
	1	(a) Permutations, Combinations	
		(b) Basic terminology	
		(c) Probability and set notations	
		(d) Addition law of probability	
V	**Teacher Specific Module**		**12**

	Directions	
	Graphs of functions mentioned in Unit 1 in Module I	
	Precise definition of limit, One-sided limit (Sections 2.3, 2.4)	
	Any topic related to Module I, II, III & IV	

Essential Readings

1. E. Kreyszig, Advanced Enginering Mathematics (10^{th} edition), John Wiley & Sons

2. G.B. Thomas Jr., M.D. Weir and J.R. Hass, Thomas' Calculus: Early Transcendentals (12^{th} edition), Pearson Education

3. B.S. Grewal, Higher Engineering Mathematics (43^{rd} edition), Khanna Publishers.

Reference Distribution

Module	Unit	Reference No.	Sections	Remarks
I	1	1	Section 7.1, 7.2	*Relevant topics only. Multiplication by linear transformations and application of matrix multiplication are omitted*
	2	1	Section 7.4	*Relevant topics only. Proof of theorem 3, theorem 4 and vector space are omitted*
	3	1	Section 7.8	*Relevant topics only. Proof of theorem 1 is omitted*
II	1	2	Sections 1.3, 1.5, 1.6	*Quick review of Section1.3 is needed. Questions should not be asked in the End Semester Examination from section 1.3*
	2	2	Section 2.2	*Proofs of all theorems are omitted*
III	1	2	Section 2.5	

	2	2	Sections 3.1, .3.2, 3.3, 3.5, 3.6, 3.7, 3.8, 3.9	
	3	3	Section 4.2	
IV	1	3	Sections 26.1, 26.2, 26.3, 26.4	

Suggested Readings

1. H. Anton, I. Bivens and S. Davis, Calculus, 10th edition , Willey
2. S. Narayan and P.K Mittal , Differential calculus, Revised Edition, S. Chand & Company Ltd
3. E. Kreyszig, Advanced Engineering Mathematics (10th edition), Willey

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU1DSCMAT116

CALCULUS AND COORDINATE SYSTEMS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC	100-199	KU1DSCMAT116	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course covers the foundational concepts of functions, limits, differentiation, integration, and coordinate systems, providing students with the skills to analyze and solve mathematical problems involving trigonometric, exponential, logarithmic, and hyperbolic functions, limits and continuity, derivatives and integration techniques, and multiple coordinate systems.

Course Prerequisite

Functions and cartesian geometry

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand and apply trigonometric, exponential, inverse, and logarithmic functions in various mathematical contexts.	Understand
2	Gain proficiency in working with hyperbolic functions and their properties.	Understand
3	Master the concepts of limits, limit laws, and continuity, and apply them to solve problems involving the behaviour of functions.	Apply

4	Understand the concept of the derivative as a function, learn various differentiation rules, and apply them to compute derivatives of functions.	Understand
5	Comprehend the concept of the definite integral, view integration as the inverse process of differentiation, and apply various integration techniques	Understand
6	Demonstrate the applications of integration, and grasp the fundamental theorem of calculus.	Apply
7	Understand and convert between different coordinate systems, including Cartesian, polar, cylindrical, and spherical coordinates, and comprehend the relationships between these systems.	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2	✓						
CO 3	✓						
CO 4	✓						
CO 5			✓				
CO 6		✓					
CO 7	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I	**Functions and Limits**		
	1	**Functions**	

		a) Trigonometric functions	**12**
		b) Exponential functions	
		c) Inverse functions and Logarithmic functions	
		d) Hyperbolic functions	
	2	**Limits and Continuity**	
		a) Limit of a function and limit laws	
		b) Continuity	
II	**Differentiation**		**12**
	1	**Derivatives**	
		a) The derivative as a function	
		b) Differentiation rules	
		c) Derivatives of trigonometric functions	
		d) The Chain rule	
		e) Derivatives of inverse functions and logarithms	
		f) Derivatives of inverse trigonometric functions	
III	**Integration**		**12**
	1	a) The Definite Integral	
		b) Fundamental theorem of calculus (without proof)	
		c) Integration as the inverse of differentiation	
		d) Integration by inspection	
		e) Integration of sinusoidal functions	
		f) Logarithmic integration	
		g) Applications of integration	
IV	**Coordinate system**		**12**
	1	a) Polar coordinates	
		b) Graphing in Polar Coordinates	
		c) Cylindrical coordinates	
		d) Spherical coordinates	
		e) Relation between coordinate system	

V	**Teacher specific module**		**12**
	Directions		
	1	Graphs of functions mentioned in Unit 1 in Module I	
		Precise definition of limit, one-sided limit	
		The logarithm is defined as an integral	
		Problems in exercises 7.3 **(**Hyperbolic functions)	
		Integration of rational functions by partial fractions	
		Applications of integral and differential calculus in Physics	
		Any topic related to Module I, II, III & IV	

Essential Readings

1. G.B. Thomas Jr., M.D. Weir and J.R. Hass, Thomas' Calculus: Early Transcendentals (12^{th} edition), Pearson Education
2. K F Riley, M B Hobson, S J Bence, Mathematical Methods for Physics and Engineering

Reference Distribution

Module	Unit	Reference No.	Sections	Remarks
I	1	1	Sections 1.3,1.5,1.6	*Quick review of Section1.3 is needed. Questions should not be asked in the End Semester Examination from section 1.3*
		2	Section 3.7	
	2	1	Section 2.2 ,2.5	
II	1	1	Sections 3.2, 3.3, 3.5, 3.6, 3.8, 3.9	
III	1	1	Section 5.3, 5.4	
		2	Sections 2.2.2, 2.2.3, 2.2.4, 2.2.5, 2.2.13	
IV	1	1	Section 11.3,11.4 and 15.7	*Excluding integration part*

Suggested Readings

1. H. Anton, I. Bivens and S. Davis, Calculus, 10th edition , Willey
2. Higher Engineering Mathematics, B.S. Grewal (43rd edition), Khanna Publishers
3. S Narayan and P.K Mittal , Differential calculus, Revised Edition, S. Chand & Company Ltd
4. E. Kreyszig, Advanced Engineering Mathematics (10th edition), Willey

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU1DSCMAT117: CALCULUS AND MATRIX ALGEBRA I

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC	100-199	KU1DSCMAT117	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course introduces fundamental concepts in calculus covering functions, limits, continuity, differentiation and integration, alongside essential matrix algebra topics such as row echelon form, elementary row transformations, rank, and simultaneous equations.

Course Prerequisite

Familiarity with functions and foundational understanding of matrices.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Comprehend trigonometric functions, exponential functions, inverse functions, logarithmic function and hyperbolic functions	Understand
2	Apply Exponential growth and decay in Finance and in Radioactive decay	Apply
3	Understand the notion of limit and limit laws	Understand
4	Understand continuity of a function	Understand
5	Comprehend the notion of derivative of a function and differentiation rules	Understand
6	Comprehend the indefinite and definite integrals	Understand
7	Understand basic matrix operations	Understand

8	Understand Rank of a matrix, elementary raw and column operations	Understand
9	Solve systems of linear equations using row-echelon form	Understand
10	Solve linear systems using Gaussian elimination algorithm	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2						✓	
CO 3	✓						
CO 4	✓						
CO 5	✓						
CO 6	✓						
CO 7	✓						
CO8	✓						
CO9	✓						
CO10	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Functions and Limits**	**12**
	1	**Functions**	
		a) Trigonometric functions	
		b) Exponential functions	
		c) Inverse functions and Logarithms	
		d) Hyperbolic functions (Definitions and identities)	
	2	**Limits**	
		Limit of a function and Limit Laws	

II	**Continuity and Differentiation of functions**		**12**
	1	**Continuity**	
	2	**Differentiation**	
		a) The Derivative as a Function	
		b) Differentiation rules	
		c) Derivatives of trigonometric functions	
		d) The Chain Rule	
		e) Implicit differentiation	
		f) Derivatives of inverse functions and logarithms	
		g) Derivatives of inverse trigonometric functions	
		h) Derivatives of hyperbolic functions	
III	**Integration**		**12**
	1	**Indefinite integrals**	
		a) Integral of a function	
		b) The study of Integral Calculus	
		c) Indefinite Integral	
		d) Indefinite integrals and the substitution method	
		e) Integration by parts	
		f) Trigonometric substitutions	**12**
		g) Integration of rational functions by partial fractions	
	2	Definite integrals	
		a) Definite integral	
		b) Geometric interpretation of definite integral (without proof)	
IV	**Matrices**		**12**
	1	**Basic Operations**	
		a) Matrix Addition, Subtractions, Scalar Multiplication, Matrix Multiplication and Transpose of a Matrix.	
		b) Row-Echelon form	
		c) Elementary Row and Column Operations	
		d) Rank of a Matrix	
	2	**Simultaneous Linear Equations**	

		a) Consistency, Matrix notation	
		b) Theory of solutions, Simplifying operations, Gaussian elimination algorithm, Pivoting strategies	
		c) Gauss-Jordan elimination.	
V	**Teacher Specific Module**		**12**
	Directions		
	Graphs of functions mentioned in Unit 1 in Module I		
	Precise definition of limit, One-sided limit		
	Elementary matrices , LU Decomposition, Solve simultaneous linear equations by LU Decomposition method		
	Any topic related to Module I, II, III & IV		

Essential Readings

1. Thomas, G. B., Weir, M. D., & Hass, J. R. (2010), *Thomas' Calculus: Early Transcendentals* (12th ed.), Pearson Education.
2. Narayan S. and Mittal P.K., Integral Calculus (Revised edition), S. Chand & Company Ltd.
3. Bronson, R. (2011), *Theory and Problems of Matrix Operations* (2nd ed.), Schaum's Outline Series, McGraw-Hill.

Reference Distribution

Module	Unit	Reference No.	Sections	Remarks
I	1	1	Sections 1.3, 1.5, 1.6, 7.3	*Quick review of Section1.3 is needed. Questions should not be asked in the End Semester Examination from section 1.3*
	2	1	Section 2.2	*Proofs of all the theorems are excluded.*
II	1	1	Section 2.5	
	2	1	Sections 3.2, 3.3, 3.5, 3.6, 3.7, 3.8, 3.9 ,7.3	
III	1	2	For 1(a), (b) & (c), Sections 1.1, 1.2, 1.3, 1.4 & 1.5	
		1	For 1(d), (e), (f) & (g), Sections 5.5,, 8.1, 8.3 & 8.4	

	2	2	Sections 1.6, 1.7, 1.8	
IV	1	3	Chapter 1	*Quick review of matrix addition, subtraction, scalar multiplication,matrix multiplication, and transpose of a matrix. Questions from these topics should not be asked in the End Semester Examination.*
	2	3	Chapter 2	*Proofs of all theorems are excluded.Pivoting strategies and Gauss-Jordan elimination are also excluded.*

Suggested Readings

1. Anton, H., Bivens, I., & Davis, S. (2012). *Calculus* (10th ed.). Wiley.
2. Grewal, B. S. (2015). *Higher Engineering Mathematics* (43rd ed.). Khanna Publishers
3. Narayan, S., & Mittal, P. K. (2014). *Differential Calculus* (Revised ed.). S. Chand & Company Ltd.
4. Kreyszig, E. (2011). *Advanced Engineering Mathematics* (10th ed.). Wiley.
5. Lay, D. C., Lay, S. R., & McDonald, J. J. (2020*). Linear Algebra and Its Applications* (6*th* ed.). Pearson Education.
6. Narayan, S. & Mittal, P. K. (2004*). Textbook of Matrices*. S. Chand & Company Ltd.
7. Ayres, F. Jr. (1966). *Theory and Problems of Matrices* (Schaum's Outline Series). McGraw-Hill.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

****Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU1DSCMAT118: PROBABILITY THEORY - I

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC	100	KU1DSCMAT118	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course is to introduce Random variables, Distribution Functions, Mathematical Expectations, Joint Probability Law and Covariance

Course Pre-requisite

Set Theory, Integration

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Comprehend Random Variables	Understand
2	Understand Distribution Function	Understand
3	Understand Mathematical Expectations	Apply
4	Comprehend Joint Probability Law	Understand
5	Understand Covariance	Apply
6	Understand Jenson's Inequality	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓		✓	✓			
CO 2	✓		✓				
CO 3	✓		✓	✓			
CO 4	✓		✓				
CO 5	✓		✓	✓		✓	
CO 6	✓		✓				

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I	**Random Variables and Distribution Functions**		12
	1	a) Random Variables	
		b) Distribution Functions	
	2	a) Discrete Random Variables and Examples	
II	**Continuous Random Variables and Joint Probability Law**		12
	1	a) Continuous Random Variables and Examples	
	2	a) Joint Probability Law	
III	**Transformation of Random variables, Mathematical Expectations**		12
	1	a) Transformation of one dimensional Random variables	
		b) Mathematical Expectation	
	2	a) Expectation of a function of Random Variables	
		b) Addition Theorem of Expectation	
		c) Multiplication Theorem of Expectation	
IV	**Expectation, Covariance and Jenson's Inequality**		12
	1	a) Expectations of a linear combination of Random Variables	
		b) Covariance	
	2	a) Jenson's inequality	
V	**Teacher Specific Module**		12
	Directions		
	R programming		

Essential Readings

1. S C Gupta & V K Kapoor, Fundamentals of Mathematical Statistics (10^{th} revised edition), S Chand & Sons, 2002

2. Peter Dalgard, Introductory Statistics with R, Springer, 2008.

Reference distribution

Module	Unit	Essential Reading No.	Sections	Remarks
I	1	1	Sections 5.1, 5.2	Proof of all the Theorems in this unit are omitted
	2	1	Section 5.3	Proof of all the Theorems in this unit are omitted
II	1	1	Section 5.4	Proof of all the Theorems in this unit are omitted. Quartiles are omitted.
	2	1	Section 5.5	
III	1	1	Sections 5.6, 6.1	
	2	1	Sections 6.2, 6.3, 6.4	
IV	1	1	Sections 6.5, 6.6	Proof of all the Theorems in this unit are omitted
	2	1	Sections 6.7	Proof of all the Theorems in this unit are omitted
V	1	2	Relevant topics	

Suggested Readings

1. Dennis Wackerly, William Mendenhall Ill and Richard S, Mathematical Statistics with Application (Seventh Edition), Duxbury Press, 2007
2. Robert. V. Hogg and Allen T. Craig, Introduction to Mathematical Statistics (Fifth Edition), Higher education press, 1978
3. G Shankar Rao, Probability and Statistics for Science and Engineering, University press, 2011
4. Maria Dolores Ugarte, Ana F.Militino, Alan T. Amholt; Probability and Statistics with R; CRC Press, A Chapman & Hall Book
5. Frank S Emmert-Streib, Salissou Moutari, Matthias Dehmer; Mathematical Foundations of Data Science Using R; De Gruyter, 2022.
6. Meatloaf, Norman S; Probability and Statistics for data Science-Math+R+Data; CRC Press(2020)

Assessment Rubrics

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU1DSCMAT119: FOUNDATIONS OF MATHEMATICS - 1

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC	100-199	KU2DSCMAT119	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course is to introduce the notion of Functions Different types of functions Relations, Partial Order relations, Well-ordering theorem, Countability and uncountability of sets.

Course Pre-requisite

Sets, Relations and Functions.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand the concepts of Relations	Understand
2	How to apply induction hypothesis in proof making	Apply
3	Understand the concept of well ordering principle	Understand
4	Understand the concept of cardinality of sets	Understand
5	Comparing the cardinality of two sets	Apply
6	Understand the concept of partially ordered sets	Understand
7	Application of axiom of choice	Apply

Mapping of Course Outcomes to PSOs							
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓	✓	✓				
CO 2	✓	✓	✓			✓	
CO 3	✓	✓	✓				
CO 4	✓	✓	✓				
CO 5	✓	✓	✓			✓	
CO 6	✓	✓	✓				
CO 7	✓	✓	✓				

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Relations**	**12**
	1	Relations on sets	
	2	Types of relations	
	3	Equivalence relations	
	4	Equivalence classes and partitions of a set	
II		**Induction Principles**	**12**
	1	The Induction Principle	
	2	The Strong Induction Principle	
	3	The Well-ordering Principle	
	4	Equivalence of the three principles	
III		**Countability of Sets**	**12**
	1	Sets with same cardinality	
	2	Finite sets	

	3	Countable sets	
	4	Comparing cardinality	
IV	**Order Relations**		12
	1	Partial and Total Orders	
	2	Chains, bounds and maximal elements	
	3	Axiom of Choice and its Equivalents	
V	**Teacher Specific Module**		**12**
	Directions		
	Functions, One-one, onto functions and bijections, Composition of functions, Inverse of a function, Image of subsets under functions, Inverse image of subsets under functions		

Essential Readings

1. Ajit Kumar, S. Kumaresan, Bhaba Kumar Sarma, A Foundation Course in Mathematics, 9th Edition, Alpha Science International Ltd., Oxford, U.K., 2018.

Reference distribution

Module	Unit	Essential Reading No.	Sections	Remarks
I	1 to 4	1	*Sections 4.1 to 4.4*	
II	1 to 4	1	*Sections 5.1 to 5.4*	
III	1 to 4	1	*Sections 6.1 to 6.4*	
IV	1 to 3	1	*Sections 7.1 to 7.3*	
V		1	*Sections 3.1 to 3.4*	

Suggested Readings

1. Kenneth Kunen; The Foundation of Mathematics; College Publications 2009
2. John Peterson; Building a Foundation in Mathematics; Delmar Cengage Learning, 2011.
3. K A Stroud; Foundation Mathematics; Bloomsbery; 2009
4. S Lipschutz; Set Theory & Related Topic; 2nd Edition; Schoum's Outline Series.

Assessment Rubrics

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

KU2DSCMAT102: CALCULUS II

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC	100-199	KU2DSCMAT102	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course discusses applications of derivatives, reduction formulae for integration, functions of several variables and partial derivatives.

Course Prerequisite

Limit, continuity, derivative and integral of function of a single variable.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Comprehend successive differentiation	Understand
2	Employ the notion of derivatives to determine extreme values of functions	Apply
3	Understand mean value theorems	Understand
4	Find expansions of functions employing Maclaurin's series and Taylor's series	Understand
5	Identify indeterminate forms and employ L'Hôpital's rule to compute limits of indeterminate forms	Understand
6	Solve optimization problems in Mathematics and Economics using derivatives	Apply
7	Employ integration by successive reduction	Understand
8	Comprehend functions of several variables and their domain and range	Understand

9	Understand the notions of limits and continiuty of functions of two variables and limit laws	Understand
10	Find partial derivatives and employ chain rule for functions of two and three independent variables	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2	✓		✓	✓			
CO 3	✓						
CO 4	✓						
CO 5	✓						
CO 6				✓			
CO 7	✓						
CO 8	✓						
CO 9	✓						
CO 10	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Applications of differentiation I**	12
	1	**Successive differentiation**	
	2	**Applications of derivatives**	
		(a) Extreme values of functions	
		(b) The mean value theorem – Rolle's theorem, Lagrange's mean value theorem	
		(c) Maclaurin's series, Taylor's series and expansions of functions	
II		**Applications of differentiation II**	
	1	**Monotonic functions and the first derivatives test**	

	2	**Indeterminate forms and L'Hôpital's rule**	**12**
	3	**Applied optimization** Application of derivatives to solve optimization problems in Mathematics and Economics	
III	**Integration – Reduction formulae**		**12**
	1	**Reduction formulae**	
	2	**Integration of trigonometric functions**	
		(a) Integration of $sin^n x$, evaluation of the definite integral $\int_0^{\frac{\pi}{2}} sin^n x\, dx$	
		(b) Integration of $cos^n x$, evaluation of the definite integral $\int_0^{\frac{\pi}{2}} cos^n x\, dx$	
		(c) Integration of $sin^p x cos^q x$, evaluation of the definite integral $\int_0^{\frac{\pi}{2}} sin^p x\, cos^q x dx$	
		(d) Integration of $tan^n x$	
IV	**Partial derivatives**		**12**
	1	**Functions of several variables**	
	2	**Limits and continuity**	
		(a) Limit of a function of two variables	
		(b) Continuity of a function of two variables	
	3	**Partial derivatives**	
		(a) Partial derivatives of functions of two and three variables	
		(b) Second order partial derivatives	
		(c) Mixed derivatives theorem	
		(d) Partial derivatives of higher order	
	4	**Chain rule for functions of two and three independent variables**	
V	**Teacher Specific Module**		**12**
	Directions		
	Concavity		
	Integration of $cot^n x$, $sec^n x$, $cosec^n x$		
	Differentiability of function of two variables		
	Any topic related to Module I, II, III & IV		

Essential Readings

1. Higher Engineering Mathematics, B.S. Grewal (44th edition), Khanna Publishers
2. G.B. Thomas Jr., M.D. Weir and J.R. Hass, Thomas' Calculus:Early Transcendentals (12th edition), Pearson Education
3. S. Narayan and P.K. Mittal , Integral calculus, Revised Edition, S. Chand & Company Ltd.

Reference Distribution

Module	Unit	Reference No.	Sections/Page Nos.	Remarks
I	1	1	Section 4.1	
	2	2	For 2(a) & (b), Sections 4.1 & 4.2	
		1	For 2(c), Section 4.4	
II	1	2	Section 4.3	
	2	2	Section 4.5	
	3	2	Sections 4.6	*Example 4 is omitted*
III	1	3	Section 2.8	
	2	3	Sections 4.1, 4.1.1, 4.2, 4.2.1, 4.3, 4.3.1, 4.4.1	
IV	1	2	Section 14.1	
	2	2	Section 14.2 (Pages 773-778)	*Examples 3 & 4 and other related problems in exercise which require ε-δ definition of limit are omitted*
	3	2	Section 14.3	*Differentiability (page 789) is omitted*
	4	2	Section 14.4	

Suggested Readings

1. H. Anton, I. Bivens and S. Davis, Calculus, 10th edition , Willey
2. S. Narayan and P.K Mittal , Differential calculus, Revised Edition, S. Chand & Company Ltd
3. E. Kreyszig, Advanced Engineering Mathematics (10th edition), Willey

Assessment Rubrics

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU2DSCMAT111
BASIC MATHEMATICS II

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
2	DSC	100-199	KU2DSCMAT111	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course covers fundamental concepts in mathematics for computer applications, including basics on vectors, basics on probability, reduction formulae for sine, cosine and tangent functions, Fourier series basics and half-range expansions.

Course Prerequisite

Basic awareness of vectors, derivatives and integrals

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand three-dimensional coordinate systems, properties of vectors and lines and planes in space	Understand
2	Understand the meaning of probability, probability and set notations, random experiment, sample space, event, axioms, notations, addition law of probability, theorem of total probability, Independent events and multiplication law of probability.	Understand
3	Use integration techniques to trigonometric functions	Understand

4	Comprehend Fourier series, even and odd functions, and half-range expansions.	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2	✓						
CO 3	✓						
CO 4	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I	**Vectors and the Geometry of Space**		12
	1	Three-Dimensional Coordinate Systems	
	2	Vectors	
	3	The Dot Product	
	4	The Cross Product	
	5	Lines and Planes in Space (a) Vector and parametric equations for Lines and line segments in space (b) Vector and parametric equations for a plane in space	
II	**Probability**		12
	1	Introduction	
	2	Basic Terminology	
	3	Probability and Set Notations	
	4	Addition Law of Probability or Theorem of Total Probability	

	5	Independent Events	
III	**Integration of Trigonometric functions**		12
	1	Integration of $sin^n x$	
	2	Integration of $cos^n x$	
	3	Integration of $sin^p x\ cos^q x$	
IV	**Fourier Series**		12
	1	Fourier Series, A Basic Example	
	2	Arbitrary Period. Even and Odd Functions. Half-Range Expansions	
V	**Teacher Specific Module**		**12**
	Directions		
	Applications of vectors (Module 1)		
	Any topic related to Module I, II, III & IV		

Essential Readings

1. Thomas'Calculus (12th edition), Maurice D. Weir and Joel Hass, Pearson India Education Services.
2. Higher Engineering Mathematics (41st edition), B.S. Grewal, Khanna Publications
3. Integral Calculus, Santhi Narayanan and P.K. Mittal, S. Chand and Co.
4. Advanced Engineering Mathematics (10th edition), E. Kreyszig, Wiley

Reference Distribution

Module	Unit	Reference No.	Section	Remarks
I	1	1	12.1	
	2	1	12.2	
	3	1	12.3	
	4	1	12.4	
	5	1	12.5	*Topics related to distance, lines of intersection and angle between planes are excluded*

II	1	2	26.1	
	2	2	26.2	
	3	2	26.3	
	4	2	26.4	*Proofs are excluded*
	5	2	26.5	*Proofs are excluded*
III	1	3	4.1	
	2	3	4.2	
	3	3	4.3	
IV	1	4	11.1	*Exclude derivation of the Euler formulae and convergence and sum of a Fourier series*
	2	4	11.2	

Suggested Readings

1. Naive Set Theory, Paul R. Halmos, Dover Publications Inc. Mineola
2. Elementary number theory, David Burton, Mc Graw Hill
3. Differential and Integral Calculus, S. Narayanan and T.K.M. Pillay, S. Viswanathan Printers and Publishers, Chennai
4. A Textbook of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Pub.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU2DSCMAT112
DIFFERENTIAL CALCULUS, CURVE FITTING AND COORDINATE SYSTEMS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC	100-199	KU2DSCMAT112	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course discusses functions of several variables, partial derivatives, successive differentiation, application of derivatives to determine maxima/minima of functions, gradient of a scalar field, divergence and curl of vector fields, principle of least squares for fitting of curves and coordinate systems – Cartesian, polar, cylindrical and spherical coordinates.

Course Prerequisite

Limit, continuity, derivative of a function of a single variable, 2-dimensional geometry, vectors.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Comprehend functions of several variables and their domain and range	Understand
2	Understand the notion of limit of a function of two variables and limit laws	Understand
3	Understand continuity of a function of two variables	Understand
4	Find partial derivatives	Understand

5	Employ chain rule for functions of two and three independent variables	Understand
6	Comprehend successive differentiation	Understand
7	Employ the notion of derivatives to determine extreme values of functions	Apply
8	Understand gradient, directional derivative, divergence and curl	Understand
9	Apply the principle of least squares for fitting of curves	Apply
10	Understand Cartesian, polar, cylindrical and spherical coordinate systems and relationships between them	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2	✓						
CO 3	✓						
CO 4	✓						
CO 5	✓						
CO 6	✓						
CO 7	✓		✓	✓			
CO 8	✓						
CO 9	✓			✓		✓	
CO 10	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Partial derivatives**	12
	1	**Functions of several variables**	
	2	**Limits and continuity**	
		(a) Limit of a function of two variables	
		(b) Continuity of a function of two variables	
	3	**Partial derivatives**	
		(a) Partial derivatives of functions of two and three variables	
		(b) Second order partial derivatives	
		(c) Mixed derivatives theorem	
		(d) Partial derivatives of higher order	
	4	**Chain rule for functions of two and three independent variables**	
II		**Applications of differentiation**	12
	1	**Successive differentiation**	
	2	**Maxima and minima of functions**	
	3	**Vector calculus**	
		(a) Scalar and vector point functions, vector operator *del*	
		(b) Gradient, directional derivative	
		(c) Divergence, Curl	
III		**Curve fitting**	
	1	(a) Introduction, scatter diagram, curve fitting	
		(b) Graphical method	

		(c) Laws reducible to the linear law	**12**
		(d) Principle of least squares	
		(e) Method of least squares - to fit the straight line $y = a + bx$, to fit the parabola $y = a + bx + cx^2$	
IV	**Coordinate systems**		**12**
	1	**Three-Dimensional Coordinate sustems**	
	2	**Polar coordinates**	
	3	**Cylindrical and Spherical coordinates**	
V	**Teacher Specific Module**		**12**
	Directions		
	Any topic related to Module I, II, III & IV		

Essential Readings

1. G.B. Thomas Jr., M.D. Weir and J.R. Hass, Thomas' Calculus:Early Transcendentals (12^{th} edition), Pearson Education
2. Higher Engineering Mathematics, B.S. Grewal (42^{nd} edition), Khanna Publishers

Reference Distribution

Module	Unit	Reference No.	Sections/Page Nos.	Remarks
I	1	1	Section 14.1	
	2	1	Section 14.2 (Pages 773-778)	*Examples 3 & 4 and other related problems in exercise which require ε-δ definition of limit are omitted*
	3	1	Section 14.3	*Differentiability (page 789) is omitted*
	4	1	Section 14.4	

II	1	2	Section 4.1	
	2	2	Section 4.15	
	3	2	Sections 8.4, 8.5, 8.6	
III	1	2	Sections 24.1, 24.2, 24.3, 24.4, 24.5	
IV	1	1	Section 12.1	
	2	1	Section 11.3	
	3	1	Section 15.7	*Only relevant portions from Section 15.7*

Suggested Readings

1. H. Anton, I. Bivens and S. Davis, Calculus, 10th edition , Willey
2. S. Narayan and P.K Mittal , Differential calculus, Revised Edition, S. Chand & Company Ltd
3. E. Kreyszig, Advanced Engineering Mathematics (10th edition), Willey

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU2DSCMAT113
SET THEORY, NUMBER THEORY, INTEGRAL CALCULUS AND FOURIER SERIES

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
2	DSC	100	KU2DSCMAT113	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course covers fundamental concepts in mathematics for computer science, including set theory with operations, properties of integers including gcd and lcm, integration of trigonometric functions, Fourier series basics, and half-range expansions, preparing students for advanced computational analysis.

Course Prerequisite

Basics ideas in integration.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand sets and subsets, operations on sets, and properties of integers.	Understand
2	Comprehend properties of integers, including the notions of greatest common divisor and least common multiple.	Understand
3	Apply integration techniques to trigonometric functions and Fourier series.	Understand

4	Comprehend Fourier series, even and odd functions, and half-range expansions.	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2	✓						
CO 3			✓				
CO 4	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
1		**Set theory**	12
	1	Sets and Subsets	
	2	Operations on Sets	
2		**Properties of Integers**	12
		a) Properties of Integers	
		b) Greatest Common Divisor	
		c) Least Common Multiple	
		d) Representations of Integers	
3		**Integration of Trigonometric functions**	12
	1	Integration of $sin^n x$	
	2	Integration of $cos^n x$	

	3	Integration of $sin^p x\ cos^q x$	
IV	**Fourier Series**		12
	1	Fourier Series, A Basic Example	
	2	Arbitrary Period, Even and Odd Functions, Half-Range Expansions	
V	**Teacher Specific Module**		12
	Directions		
	Sequences, Characteristic Functions, Computer Representation of Sets and Subsets (Module 1, Section 1.3)		
	Pseudo code Versions for finding GCD (Module 2, Section 1.4)		
	Any topic related to Module I, II, III & IV		

Essential Readings

1. Discrete Mathematical Structures (Sixth edition), Bernard Kolman, Robert C. Busby and Sharon Cutler Ross, Pearson
2. Calculus, Santhi Narayanan and P.K. Mittal, S. Chand and Co.
3. Advanced Engineering Mathematics (10th edition), E. Kreyszig, Wiley

Reference Distribution

Module	Unit	Reference No.	Page Nos.	Remarks
1	1	1	1.1	
	2	1	1.2	
2	1	1	1.4	*Exclude Pseudo code Versions*
3	1	2	4.1	
	2	2	4.2	
	3	2	4.3	
4	1	3	11.1	*Exclude derivation of the Euler formulae and convergence and sum of a Fourier series*

	2	3	11.2	

Suggested Readings

1. Naive Set Theory, Paul R. Halmos, Dover Publications Inc. Mineola
2. Elementary number theory, David Burton, Mc Graw Hill
3. Differential and Integral Calculus, S. Narayanan and T.K.M. Pillay, S. Viswanathan Printers and Publishers, Chennai
4. A Textbook of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Pub.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU2DSCMAT114: MATHEMATICAL ECONOMICS II

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC	100	KU2DSCMAT114	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course introduces fundamental concepts in mathematical economics, including integration, economic applications of integration, definite integrals and their properties, and the fundamentals of matrix algebra.

Course Prerequisite

Proficiency in basic algebraic operations and basic understanding of functions.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand the concept of integration and properties	Understand
2	Understand the geometric interpretation of the definite integral	Understand
3	Apply the Fundamental Theorem of Calculus to evaluate definite integrals	Understand
4	Compute consumers' and producers' surplus using the concept of definite integrals..	Apply
5	Apply integration techniques to solve problems in economics, such as calculating total cost, total revenue, and consumer and producer surplus.	Apply
6	Understand the fundamentals of Matrix algebra	Understand

7	Understand the concepts of cofactor and adjoint matrices and their uses in matrix algebra..	Understand
8	Students will solve systems of linear equations using matrix inverses.	Understand
9	Use Cramer's Rule to solve systems of linear equations.	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2	✓						
CO 3	✓						
CO 4						✓	
CO 5						✓	
CO 6	✓						
CO 7	✓						
CO8	✓						
CO9	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Integral calculus**	12
	1	Indefinite Integral	
		a) Integration	
		b) Rules of Integration	
		c) Initial conditions and Boundary conditions	
		d) Integration by substitution	
		e) Integration by parts	

		f) Economic Application	
II	**The Definite Integral**		**12**
	1	a) Area under a curve, The definite integral	
		b) The fundamental theorem of calculus	
		c) Properties of definite integral	
		d) Area between Curve	
		e) Consumers and Producers Surplus	
III	**Fundamentals of Matrix Algebra - I**		**12**
	1	a) Definitions and Terms	
		b) Addition and Subtraction of Matrices	
		c) Scalar Multiplication	
		d) Vector Multiplication	
		e) Multiplication of Matrices	
		f) Commutative, Associative and Distributive Laws in Matrix Algebra	
		g) Identity and Null Matrices	
		h) Matrix expression of a System of Linear Equations	
IV	**Fundamentals of Matrix Algebra - II**		
	1	a) Determinants and Non-singularity	
		b) Third order Determinates	
		c) Minors and Cofactors	
		d) Properties of a Determinant	
		e) Cofactor and Adjoint matrices	
		f) Inverse Matrices	
		g) Solving Linear Equations with Inverse	
		h) Cramer's Rule for Matrix Solutions	
V	**Teacher Specific Module**		**12**
	Directions		

	Linear independence and rank of matrix - characteristic root or Eigen value – quadratic functions- The discriminants and Sign definiteness of quadratic functions- Optimization conditions of quadratic forms subject to linear constraints	
	The Jacobian, the Hessian, Higher order Hessian, The bordered Hessian for constrained optimization, Input-output Analysis	
	Any topic related to Module I, II, III & IV	

Essential Readings

1. Edward T. Dowling, Introduction to Mathematical Economics, Third Edition, Schaum's Outline Series, McGraw-Hill International Edition.

Reference Distribution

Module	Unit	Reference No.	Chapter/Section	Remarks
I	1	1	Chapter 14	
II	1	1	15.1,15.2,15.3,15.4,15.5,15.8	
III	1	1	Chapter 10	
IV	1	1	Chapter 11	*Section 11.4 and Problems related to sections 11.4 and 11.5 are excluded.*

Suggested Readings

1. Barauh, Srinath. (2010). *Basic Mathematics and Its Application in Economics*. Amanad, New Delhi.
2. Hammond, Peter J., & Sydsaeter, Knut. (2010). *Mathematics for Economic Analysis*. Pearson.
3. Allen, R.G.D. (1956). *Mathematical Analysis for Economists*. Macmillan.
4. Yamane, Taro. (2004). *Mathematics for Economists: An Elementary Survey*. PHI, New Delhi.

5. Chiang, A.C. (1988). *Fundamental Methods of Mathematical Economics*. McGraw Hill.
6. Chiang, A.C., & Wainwright, K. (2013). *Fundamental Methods of Mathematical Economics* (Fourth edition). Tata McGraw-Hill Education.
7. Allen, R.G.D. (1976). *Mathematical Economics* (2nd ed.). Macmillan.
8. Baumol, W.J. (1987). *Economic Theory and Operations Analysis* (4th ed.). Prentice Hall of India.
9. Mas-Colell, A., Whinston, M.D., & Green, J.R. (1995). *Microeconomic Theory*. Harvard University Press.
10. Hands, D.W. (1991). *Introductory Mathematical Economics*. D.C. Heath.
11. Handy, S.T. (1997). *Operations Research*. Prentice-Hall of India, New Delhi.
12. Mukherji, B., & Pandit, V. (1982). *Mathematical Method of Economic Analysis*. Allied Publishers, New Delhi.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU2DSCMAT115
LINEAR ALGEBRA, CALCULUS AND VECTORS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC	100-199	KU2DSCMAT115	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course discusses applications of matrices and determinants to solve system of linear equations, eigenvalues and eigenvectors, functions of several variables, partial derivatives, indefinite and definite integrals and basic ideas in vectors.

Course Prerequisite

Basic operations of matrices, Limit, continuity, derivative and integral of function of a single variable.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Apply matrices and determinants to solve system of linear equations	Understand
2	Compute eigenvalues and eigenvectors	Understand
3	Comprehend functions of several variables and their domain and range	Understand
4	Understand the notion of limit of a function of two variables and limit laws	Understand
5	Find partial derivatives	Understand

6	Comprehend indefinite integrals and definite integrals	Understand
7	Use Trapezoidal rule and Simpson's 1/3 rd rule to evaluate definite integrals	Understand
8	Understand vectors and scalar product, cross product and box product of vectors	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2	✓						
CO 3	✓						
CO 4	✓						
CO 5	✓						
CO 6	✓						
CO 7	✓						
CO 8	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Linear Algebra**	**12**
	1	**Solution of system of linear equations**	
		(a) Consistency	
		(b) Matrix notation	
		(c) Cramer's rule	**12**

	2	**Eigenvalues and eigenvectors**	
		(a) Eigenvalues (or characteristic roots) and eigenvectors (or characteristic vectors)	
		(b) Determination of eigenvalues and eigenvectors	
II	**Partial derivatives**		**12**
	1	Functions of several variables	
	2	**Limits**	
		limit of a function of two variables	
	3	**Partial derivatives**	
		(a) Partial derivatives of functions of two and three variables	
		(b) Second order partial derivatives	
		(c) Mixed derivatives theorem	
		(d) Partial derivatives of higher order	
III	**Integration**		**12**
	1	**Indefinite integrals**	
		a) Integral of a function	
		b) The study of Integral Calculus	
		c) Indefinite integral	
		d) Indefinite integrals and the substitution method	
		e) Integration by parts	
		f) Trigonometric substitutions	
		g) Integration of rational functions by partial fractions	
	2	**Definite integrals**	
	3	**Numerical Integration**	
		(a) Trapezoidal rule	
		(b) Simpson's 1/3 rd rule	
IV	**Vectors**		**12**
		(a) Three dimensional coordinate system	
		(b) Vectors	
		(c) The dot product	

		(d) The cross product, Triple scalar or Box product	
V	**Teacher specific module**		**12**
	Directions		
	Any topic related to Module I, II, III & IV		

Essential Readings

1. Bronson, R. (2011). Theory and Problems of Matrix Operations (2nd edition), Schaum's Outline Series, McGraw-Hill.
2. Narayan, S., & Mittal, P. K., A Text book of Matrices, S. Chand & Company Ltd.
3. Thomas Jr., G. B., Weir, M. D., & Hass, J. R. (2014). Thomas' Calculus: Early Transcendentals (12th edition), Pearson Education.
4. Narayan S. and Mittal P.K., Integral calculus (Revised Edition), S. Chand & Company Ltd.
5. Iyengar S.R.K. and R.K. Jain, mathematical Methods (2nd edition), Narosa Publishing House.

Reference Distribution

Module	Unit	Reference No.	Sections/Page Nos.	Remarks
I	1(a), (b)	1	Chapter 2	*Consistency and matrix notation only*
	1(c)	2	Section 3.8	*Problems using Cramer's rule only*
	2	2	Sections 11.1, 11.1.1	*Problems for finding eigenvalues and eigenvectors only*
II	1	3	Section 14.1	

	2	3	Section 14.2 (Pages 773-777)	*Examples 3 & 4 and other related problems in exercise which require ε-δ definition of limit are omitted.* *Continuity – definition only*
	3	3	Section 14.3	*Differentiability (page 789) is omitted*
III	1	4	For 1(a), (b) & (c), Sections 1.1, 1.2, 1.3, 1.4 & 1.5	
		3	For 1(d), (e), (f) & (g), Sections 5.5, 8.1, 8.3 & 8.4	
	2	4	Sections 1.6, 1.7	
	3	5	Sections 6.3, 6.3.1, 6.3.2	
IV	1	3	Sections 12.1, 12.2, 12.3, 12.4	*Quick review of Section 12.1 is needed. Questions shall not be asked for the end semester examination from section 12.1*

Suggested Readings

1. Anton, H., Bivens, I. & Davis, S. (2012). Calculus (10th ed.). Wiley.
2. Narayan, S., & Mittal, P. K. (Revised Edition). Differential Calculus. S. Chand & Company Ltd.
3. Kreyszig, E. (2011). Advanced Engineering Mathematics (10th ed.). Wiley.
4. Lay, D. C., Lay, S. R., & McDonald, J. J. (2020). Linear Algebra and Its Applications (6th ed.). Pearson Education.
5. Ayres, F. Jr. (1966). Theory and Problems of Matrices (Schaum's Outline Series). McGraw-Hill.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6

c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

****Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU2DSCMAT116: MULTIVARIABLE CALCULUS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC	100-199	KU2DSCMAT116	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course covers advanced calculus topics, including functions of several variables, limits and continuity in higher dimensions, partial derivatives, the chain rule, vector and scalar fields, vector calculus, gradients, divergence and curl, multiple integrals and line and surface integrals with applications.

Course Prerequisites

Differential and Integral Calculus

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand functions of several variables, including their limits and continuity in higher dimensions	Understand
2	Master the concepts of partial derivatives and the chain rule, and apply them to solve problems involving multivariable functions.	Apply
3	Understand the concepts of vector and scalar functions, and find the derivatives of these functions.	Understand
4	Gain proficiency in calculating the gradient of a scalar field, and the divergence and curl of a vector field, and understand their physical interpretations and applications.	Understand
5	Comprehend and compute double and triple integrals in various coordinate systems, and apply them to find areas and volumes of regions.	Understand
6	Learn to set up and evaluate double integrals in polar coordinates, and apply them to relevant geometric and physical problems.	Understand

7	Understand and compute line integrals and surface integrals, explore path independence and conservative fields, and apply these concepts to physical and geometric problems.	Apply

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2	✓						
CO 3	✓						
CO 4	✓					✓	
CO 5	✓						
CO 6	✓						
CO 7	✓					✓	

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Partial Derivatives**	**12**
	1	a) Functions of Several Variables	
		b) Limits and Continuity in Higher Dimensions	
		c) Partial Derivatives	
		d) The Chain Rule	
II		**Applications of Differentiation**	**12**
	1	a) Vector and Scalar Functions and Their Fields. Vector Calculus: Derivatives	
		b) Gradient of a Scalar Field. Directional Derivative	
		c) Divergence of a Vector Field	**12**
		d) Curl of a Vector Field	

III	**Multiple Integrals**		**12**
	1	a) Double and Iterated Integrals over Rectangles	
		b) Double Integrals over General Regions	
		c) Area by Double Integration	
		d) Double Integrals in Polar Form	
		e) Triple Integrals in Rectangular Coordinates	
IV	**Integration in Vector Fields**		**12**
	1	a) Line Integrals	
		b) Path Independence, Conservative Fields, and Potential Functions	
		c) Surfaces and Area	
		d) Surface Integrals	
V	**Teacher Specific Module**		**12**
	Directions		
		Moments and Centers of Mass	
		Triple Integrals in Cylindrical and Spherical Coordinates	
		Substitutions in Multiple Integrals	
		Vector Fields and Line Integrals: Work, Circulation, and Flux	
		Green's Theorem in the Plane	
		Any topic related to Module I, II, III & IV	

Essential Readings

1. G.B. Thomas Jr., M.D. Weir and J.R. Hass, Thomas' Calculus: Early Transcendentals (12^{th} edition), Pearson Education
2. Erwin Kreyszig, Advanced Engineering Mathematics (10^{th} edition)

Reference Distribution

Module	Unit	Reference No.	Sections	Remarks
I	1	1	Sections 14.1,14.2,14.3,14.4	
II	1	2	Sections 9.4, 9.7, 9.8, 9.9	

III	1	1	Section 15.1, 15.2, 15.3, 15.4, 15.5	
IV	1	1	Section 16.1, 16.3, 16.5, 16..6	

Suggested Readings

1. H. F. Davis and A. D. Snider, Introduction to Vector Analysis (6th edition), Universal Book Stall, New Delhi.
2. F. W. Bedford and T. D. Dwivedi, Vector Calculus, McGraw Hill Book Company
3. H. Anton, I. Bivens and S. Davis, Calculus (10th edition), Willey
4. Higher Engineering Mathematics, B.S. Grewal (43rd edition), Khanna Publishers.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of the best two tests is to be considered for the internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU2DSCMAT117
CALCULUS AND MATRIX ALGEBRA-II

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC	100	KU2DSCMAT117	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course discusses applications of derivatives, functions of several variables, partial derivativs, reduction formulae for integration, , matrix inversion using elementary raw operation, eigenvalues and eigenvectors and the Cayley-Hamilton theorem.

Course Prerequisite

Limit, continuity, derivative and integral of function of a single variable, basic operations of matrices.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Comprehend successive differentiation	Understand
2	Understand mean value theorems	Understand
3	Find expansions of functions employing Maclaurin's series and Taylor's series	Understand
4	Employ integration by successive reduction	Understand
5	Comprehend functions of several variables and their domain and range	Understand
6	Understand the notion of limit of a function of two variables and limit laws	Understand
7	Understand continuity of a function of two variables	Understand
8	Find partial derivatives	Understand

9	Employ chain rule for functions of two and three independent variables	Understand
10	Apply matrix inversion techniques to solve systems of linear equations efficiently	Understand
11	Comprehend Cayley-Hamilton Theorem	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2	✓						
CO 3	✓						
CO 4	✓						
CO 5	✓						
CO 6	✓						
CO 7	✓						
CO 8	✓						
CO 9	✓						
CO 10	✓						
CO 11	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Applications of differentiation**	**12**
	1	Successive differentiation	
	2	**Applications of derivatives**	
		(a) Fundamental theorems: Role's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's theorem (Generalised mean value theorem)	
		(b) expansions of functions: Maclaurin's series, expansion by use of known series, Taylor's series	

II	**Partial derivatives**		**12**
	1	Functions of several variables	
	2	**Limits and continuity**	
		(a) limit of a function of two variables	
		(b) Continuity of a function of two variables	
	3	**Partial derivatives**	
		(a) Partial derivatives of functions of two and three variables	
		(b) Second order partial derivatives	
		(c) Mixed derivatives theorem	
		(d) Partial derivatives of higher order	
	4	Chain rule for functions of two and three independent variables	
III	**Integration – reduction formulae**		**12**
	1	Reduction formulae	
	2	**Integration of trigonometric functions**	
		(a) Integration of $sin^n x$, evaluation of the definite integral $\int_0^{\frac{\pi}{2}} sin^n x\, dx$	
		(b) Integration of $cos^n x$, evaluation of the definite integral $\int_0^{\frac{\pi}{2}} cos^n x\, dx$	
		(c) Integration of $sin^p x cos^q x$, evaluation of the definite integral $\int_0^{\frac{\pi}{2}} sin^p x\, cos^q x dx$	
		(d) Integration of $tan^n x$	
IV	**Matrices**	**12**	**12**
	1	**Matrix inversion**	
		(a) The Inverse	
		(b) Simple inverses	
		(c) Calculating inverses (Using elementary raw operations)	
		(d) Simultaneous linear equations	
		(e)Properties of the inverse	
	2	**Eigenvalues and Eigenvectors**	
		(a) Characteristic equation, characteristic polynomial, eigenvalues, eigenvectors	
		(b) Properties of eigenvalue and eigenvectors	
		(c) Cayley-Hamilton theorem	

V	**Teacher specific module**	**12**
	Directions	
	Extreme values of functions	
	Applied optimization Application of derivatives to solve optimization problems in mathematics and economics	
	Vectors, linearly independent vectors, raw rank, column rank , Cramer's rule	
	Any topic related to Module I, II, III & IV	

Essential Readings

1. Grewal, B. S. (2017). Higher Engineering Mathematics (44th ed.). Khanna Publishers.
2. Narayan, S., & Mittal, P. K. (Revised Edition). Integral Calculus. S. Chand & Company Ltd.
3. Thomas Jr., G. B., Weir, M. D., & Hass, J. R. (2014). Thomas' Calculus: Early Transcendentals (12th ed.). Pearson Education.
4. Bronson, R. (2011). Theory and Problems of Matrix Operations (2nd ed.). Schaum's Outline Series, McGraw-Hill.

Reference Distribution

Module	Unit	Reference No.	Sections/Page Nos.	Remarks
I	1	1	Section 4.1	
	2		Sections 4.3, 4.4	*Proofs of all theorems are excluded*
II	1	3	Section 14.1	
	2	3	Section 14.2 (Pages 773-778)	*Examples 3 & 4 and other related problems in exercise which require ε-δ definition of limit are omitted*
	3	3	Section 14.3	*Differentiability (page 789) is omitted*
	4	3	Section 14.4	
III	1	2	Section 2.8	

	2	2	Sections 4.1, 4.1.1, 4.2, 4.2.1, 4.3, 4.3.1, 4.4.1	
IV	1	4	Chapter 4	*4.13 and 4.14 are excluded*
	2	4	Chapter 7	*All problems related to linearly independent vectors, left and right eigenvalues, the proof of the Cayley-Hamilton theorem, and the proof of properties of eigenvalues and eigenvectors are excluded.*

Suggested Readings

1. Anton, H., Bivens, I. & Davis, S. (2012). Calculus (10^{th} ed.). Wiley.
2. Narayan, S., & Mittal, P. K. (Revised Edition). Differential Calculus. S. Chand & Company Ltd.
3. Kreyszig, E. (2011). Advanced Engineering Mathematics (10^{th} ed.). Wiley.
4. Lay, D. C., Lay, S. R., & McDonald, J. J. (2020). Linear Algebra and Its Applications (6^{th} ed.). Pearson Education.
5. Narayan, S., & Mittal, P. K. (2004). Textbook of Matrices. S. Chand & Company Ltd.
6. Ayres, F. Jr. (1966). Theory and Problems of Matrices (Schaum's Outline Series). McGraw-Hill.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

****Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU2DSCMAT118: PROBABILITY THEORY II

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC	100-199	KU2DSCMAT118	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course is to introduce and understand Moment generating functions, Cumulants, Chebychev's Inequality, Bernoulli's distribution, Binomial distribution,Poisson distribution, Geometric distribution, Rectangular distribution, Normal distribution, Central limit Theorem.

Course Prerequisite

Contents of KU1DSCMAT118 Probability Theory I.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand Moment generating functions, Cumulants	Understand
2	Understand Bernoulli's distribution	Understand
3	Understand Binomial distribution	Understand
4	Understand Poisson distribution	Understand
5	Understand Geometric distribution	Understand
6	Understand Rectangular distribution, Normal distribution	Understand
7	Understand and apply Central limit Theorem	Apply

Mapping of Course Outcomes to PSOs							
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓		✓				
CO 2	✓	✓	✓	✓		✓	
CO 3	✓	✓	✓	✓		✓	
CO 4	✓	✓	✓	✓		✓	
CO 5	✓	✓	✓	✓		✓	
CO 6	✓	✓	✓	✓		✓	
CO 7	✓		✓				

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Moment generating functions, Cumulants, Chebychev's Inequality**	**12**
	1	a)Moment generating functions	
		b**)** Cumulants	
	2	a) Chebychev's Inequality	
II		**Bernoulli's distribution and Binomial distribution**	**12**
	1	Bernoulli's distribution	
	2	Binomial distribution	
III		**Poisson distribution, Geometric distribution**	**12**
	1	Poisson distribution	
	2	Geometric distribution	
IV		**Rectangular distribution, Normal distribution and Central limit Theorem**	**12**
	1	a) Rectangular distribution	

		b) Normal distribution	
	2	Central limit Theorem	
V	**Teacher Specific Module**		**12**
	Directions		
	R programming		

Essential Readings

1. S C Gupta & V K Kapoor; Fundamentals of Mathematical Statistics (10^{th} revised edition), S Chand & Sons, 2002
2. Peter Dalgard -Introductory Statistics with R, Springer, 2008.

Reference distribution

Module	Unit	Reference No.	Sections	Remarks
I	1	1	Sections 6.10, 6.11	Sections 6.10.1 ,6.11.2 are omitted
	2	1	Section 6.13	
II	1	1	Section 7.1	
	2	1	Sections 7.2, 7.2.1, 7.2.2 ,7.2.6, 7.2.7 ,7.2.9	
III	1	1	Section 7.3	Sections 7.3.1, 7.3.3, 7.3.6, 7.3.9, 7.3.10 are omitted
	2	1	Sections 7.5	7.5.1 ,7.5.2 are omitted
IV	1	1	section 8.1, 8.2	Section 8.1, 8.2, 8.2.1(derivation omitted) 8.2.14(fitting omitted) Sections 8.2.9, 8.2.10, 8.2.12, 8.2.15 are omitted
	2	1	Sections 8.10	Proof of C.L.T omitted. 8.10.1, 8.10.2, 8.10.3, 8.10.4 are omitted
V	1	2	Relevant topics	

Suggested Readings

1. Dennis Wackerly, William Mendenhall Ill and Richard S, Mathematical Statistics with Application (Seventh Edition), Duxbury Press, 2007
2. Robert. V. Hogg and Allen T. Craig, Introduction to Mathematical Statistics (Fifth Edition), Higher education press, 1978
3. G Shankar Rao, Probability and Statistics for Science and Engineering, University press, 2011
4. Maria Dolores Ugarte, Ana F.Militino, Alan T. Amholt; Probability and Statistics with R, CRC Press, A Chapman & Hall Book
5. Frank S Emmert-Streib, Salissou Moutari, Matthias Dehmer; Mathematical Foundations of Data Science Using R, De Gruyter, 2022
6. Meatloaf, Norman S; Probability and Statistics for data Science-Math+R+Data, CRC Press, 2020.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU2DSCMAT119: FOUNDATION OF MATHEMATICS-II

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC	100-199	KU2DSCMAT119	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course is to introduce basic concepts of sets and relations and how they are used in computer language.

Course Prerequisite

Basic Set Theory

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand the concept of Sets and Relation	Understand
2	Comparing growth rates and functions	Apply
3	Understand the concept of Functions.	Understand
4	Understand the concept of Pigeon hole Principle.	Understand
5	Apply Recurrence relation for solving various problems.	Understand

Mapping of Course Outcomes to PSOs							
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓	✓		✓		✓	
CO 2						✓	
CO 3	✓						

CO 4	✓						
CO 5	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I	**Set Theory**		**12**
	1	a) Basic Definitions b) Operations on Sets. c) Principle of Inclusion -Exclusion.	
II	**Functions**		**12**
	1	a) Basic Definitions. b) Operations on Functions c) Pigeon hole Principle.	
III	**Comparing Growth Rates of Functions**		**12**
	1	a) A Measure for Comparing Growth Rates b) Properties of Asymptotic Domination. c) Polynomial Functions d) Exponential and Logarithmic Functions	
IV	**Recurrence Relations**		**12**
	1	a) The Tower of Hanoi Problem. b) Solving First - Order Recurrence Relations. c) Fibonacci Recurrence Relation.	
V	**Teacher Specific Module**		**12**
	a) Introduction to Propositional Logic. b) Truth and Logical Truth.		

Essential Readings

1. Gary Haggard, John Schlipf, Sue Whitesides, Discrete Mathematics for Computer Science, Thomson Brooks/Cole.

Reference Distribution

Module	Unit	Reference No.	Sections	Remarks
I	1	1	Sections 1.1, 1.3, 1.5	
II	1	1	Section 4.1, 4.3, 4.6	
III	1	1	Sections 5.1.1, 5.1.2, 5.1.3, 5.1.4	
IV	1	1	Sections 9.1, 9.2, 9.4	
V	1	1	Relevant Topics	

Suggested Readings

1. Seymour Lipschutz, Marc Lars Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, Third edition, McGRAW-HILL
2. Seymour Lipschutz, Schaum's Outlines Set Theory and Related Topics, Second Edition,McGRAW-Hill.
3. Ralph P Grimaldi, Discrete and Combinatorial Mathematics An Applied Introduction, Fifth Edition, Addison-Wesley.
4. V K Balakrishnan, Introductory Discrete Mathematics, Dover Publications, INC.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

****Use of Scientific Calculators below 100 functions (that is, upto*fx 99*) shall be permitted.**

MULTIDISCIPLINARY COURSES

KU1MDCMAT101:
MATHEMATICS IN REAL LIFE

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	MDC	100-199	KU1MDCMAT101	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3		1	25	50	75	1.5

Course Description

This course is designed to equip students with essential knowledge and skills required to excel quantitative reasoning and arithmetic operations which in turn develop speed and accuracy also In addition, the course consists of practical applications of quantitative arithmetic in finance business and science.

Course Prerequisite

Basic operations in mathematics

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Comprehend numbers, HCF and LCM of numbers and fractions and Decimals	Understand
2	Understand Average, Problems on ages and Percentage	Understand
3	Understand Profit and loss, Ratio and proportion and Chain rule	Understand
4	Comprehend Time and work, Time and distance and Problems on trains and solves problems	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2			✓				

CO 3			✓				
CO 4			✓				

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I	1	Numbers	12
	2	HCF and LCM of numbers	
	3	Decimal fractions	
II	1	Average	11
	2	Problems on ages	
	3	Percentage	
III	1	Profit and loss	11
	2	Ratio and proportion	
	3	Chain rule	
IV	1	Time and work	11
	2	Time and distance	
	3	Problems on trains	

Essential Readings

R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand.

Reference Distribution

Module	Unit	Reference No.	Chapters	Remarks
I	1	1	Chapter 1	

	2	1	Chapter 2	
	3	1	Chapter 3	
II	1	1	Chapter 6	
	2	1	Chapter 8	
	3	1	Chapter 10	
III	1	1	Chapter 11	
	2	1	Chapter 12	
	3	1	Chapter 14	
IV	1	1	Chapter 15	
	2	1	Chapter 17	
	3	1	Chapter 18	
V	**Teacher specific module**			

Suggested Readings

1. Quantitative Aptitude for Competitive Examinations, A. Guha (7th edition), Mc Graw Hill
2. Fast Track Objective Mathematics, R. Verma (Revised edition), Arihant.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper *	10
b)	Assignment	5
c)	Seminar, Viva-Voce	10
Total		**75**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Calculators shall *not* be permitted.**

KU1MDCMAT102:
BUSINESS MATHEMATICS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	MDC	100-199	KU1MDCMAT102	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3		1	25	50	75	1.5

Course Description

This course provides students with a solid foundation in mathematical techniques and applications needed to handle complex business situations.

Course Prerequisite

Basic understanding of algebra and arithmetic.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Comprehend straight lines	Understand
2	Formulate mathematical models using linear functions and solve real world problems	Apply
3	Comprehend different types of systems of linear equations	Understand
4	Solve systems of linear equations	Understand
5	Apply matrix theory to study the relationship between industry production and consumer demand – Leontief input-output model	Apply
6	Solve linear programming problems graphically	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2				✓			
CO 3	✓						
CO 4	✓						
CO 5				✓			
CO 6	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Geometry**	11
	1	The Cartesian coordinate system	
	2	Straight lines	
	3	Linear functions and mathematical models	
II		**Linear equations**	11
	1	Systems of linear equations: An introduction	
	2	Systems of linear equations: Unique solutions	
	3	Systems of linear equations: Undetermined and overdetermined systems	
III		**Matrices**	12
	1	Matrices	

	2	Multiplication of matrices	
	3	The inverse of a square matrix	
	4	Leontief input-output model	
IV	**Linear Programming**		11
	1	Linear programming – A geometric approach	

Essential Readings

1. Soo T. Tan, Finite Mathematics for the Managerial, Life and Social Sciences (11^{th} edition), Cengage Learning.

Reference Distribution

Module	Unit	Reference No.	Chapters/Sections	Remarks
I	1	1	Section 1.1	
	2	1	Section 1.2	
	3	1	Section 1.3	
II	1	1	Section 2.1	
	2	1	Section 2.2	
	3	1	Section 2.3	
III	1	1	Section 2.4	
	2	1	Section 2.5	
	3	1	Section 2.6	
	4	1	Section 2.7	
IV	1	1	Chapter 3	

Suggested Readings

1. B. M. Aggarwal, Business Mathematics and Statistics, Ane Books Pvt. Ltd., 2013
2. A. C. Chiang and K. Wainwright, Fundamental Methods of Mathematical Economics
3. A. Francis, Business Mathematics and Statistics (6^{th} edition), ThomsonLearning, 2004

4. B.N. Gupta, Business Mathematics and Statistics, SBPD Publications, 2021
5. Knut Sydestar and Peter Hummond with Arne Storm, Essential Mathematics for Economic Analysis, Fourth Edition, Pearson.

Assessment Rubrics

Evaluation Type		Marks
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper *	10
b)	Assignment	5
c)	Seminar, Viva-Voce	10
Total		**75**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

****Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU1MDCMAT103: MATRIX THEORY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	MDC	100-199	KU1MDCMAT103	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3		1	25	50	75	1.5

Course Description

This course provides an introduction to matrices. Emphasis is placed on the development of concepts and applications for systems of equations, matrices, determinants, and orthogonality.

Course Prerequisite

Matrix algebra.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Recognise consistent and inconsistent systems of equations by the row echelon form of the augmented matrix	Understand
2	Able to solve a system of m linear equations in n unknowns using Gaussian elimination	Understand
3	Understand how elementary matrix are used for row operations and find the inverse of a matrix using row operations	Understand
4	Understand the concept ‘Rank of a matrix’.	Understand
5	Consistency of a system of linear equations using rank	Understand

Mapping of Course Outcomes to PSOs							
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2	✓		✓			✓	
CO 3	✓	✓					
CO 4	✓						
CO 5	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Systems of linear equations, Row operations**	**10**
	1	Systems of linear equations	
	2	Row operations	
II		**Gaussian elimination, homogeneous systems and null spaces**	**12**
	1	**Gaussian elimination**	
		a) The algorithm: reduced row echelon form Consistent and inconsistent systems	
		b) Linear systems with free variables	
		c) Solution sets	
	2	**Homogeneous systems and null spaces**	
		a) Homogeneous systems	
		b) Null space	
		Matrix inversion	

	1	a) Matrix inverse using row operations	
		b) Row equivalence	
		c) The main theorem	
		d) Using row operations to find the inverse matrix	
IV	**The rank of a matrix, Rank and systems of linear equations, Range**		13
	1	The rank of a matrix	
	2	Rank and systems of linear equations	
		a) General solution and rank	
		b) General solution in vector notation	
	3	Range	

Essential Reading

1. Martin Anthony and Michele Harvey Linear Algebra: Concepts and Methods, Cambridge University Press 2012.

Reference Distribution

Module	Unit	Reference No.	Sections	Remarks
I	1	1	Section 2.1	
	2	1	Section 2.2	
II	1	1	Section 2.3	Proof of Theorem 2.17 omitted.
	2	1	Section 2.4	Proof of Theorem 2.21 and Theorem 2.29 omitted.
III	1	1	Section 3.1	Proof of all the theorems in this section omitted
IV	1	1	Section 4.1	Proof of Theorem 4.5 omitted.
	2	1	Section 4.2	
	3	1	Section 4.3	

Suggested Readings

1. Jeffrey Holt; Linear Algebra with Applications; W.H Freeman & Company, New York

2. T.S Blyth and E F Robertson: Basic Linear Algebra; Springer 2002
3. Charu C Agarwal; Linear Algebra and Optimization for Machine Learning; Springer; 2020
4. Nathen Carter; Data Science for Mathematicians; CRC Press/ Chapman and Hall Handbooks in Mathematics series 2021.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper *	10
b)	Assignment	5
c)	Seminar, Viva-Voce	10
Total		**75**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

****Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU2MDCMAT101:
MATHEMATICAL REASONING

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	MDC	100-199	KU2MDCMAT101	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3		1	25	50	75	1.5

Course Description

Mathematical reasoning is an essential course designed to cultivate ability of students to think critically and analytically through mathematical techniques. The course emphasises the development of logical reasoning skills, problem solving techniques and communication of mathematical ideas.

Course Prerequisite

Basic arithmetic operations

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Recognize the underlying mathematical relationships and sequences governing the progression of numbers in the series	Understand
2	Recognize numerical patterns and relationships between sets of numbers	Understand
3	Recognize distinctive numerical characteristics that distinguish the odd numeral from the rest	Understand
4	Recognize the rules or algorithms governing the coding process and apply them to decode encrypted information	Apply
5	Recognize accurate Venn diagrams that effectively illustrate the relationships between different sets and their elements.	Understand
6	Find out how many times a number occurs in a given long series of numbers, satisfying specified conditions	Understand

7	Comprehend ranking test	Understand
8	Apply time sequence test to find a specified time/date/day	Apply
9	Read and use Bar graphs, Pie graphs and Venn diagrams.	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1		✓					
CO 2		✓					
CO 3		✓					
CO 4		✓					
CO 5	✓	✓					
CO 6		✓					
CO 7		✓					
CO 8		✓					
CO 9		✓					

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Mathematical Mental Ability I**	12
	1	Number series completion	
	2	Number Analogy	
	3	Classification (a) Choosing the odd numeral (b) Choosing the odd numeral pair/group	
II		**Mathematical Mental Ability II**	11

	1	Coding-Decoding : Number/symbol coding	
	2	Logical Venn diagram	
III	**Mathematical Mental Ability III**		11
	1	Number test	
	2	Ranking test	
	3	Time sequence test	
IV	**Data interpretation**		11
	1	Bar graphs	
	2	Pie graphs	
	3	Line graphs	

Essential Readings

1. R.S. Aggarwal, A modern approach to Verbal and Nonverbal Reasoning, S. Chand
2. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand.

Reference Distribution

Module	Unit	Reference No.	Chapters	Remarks
I	1	1	Chapter 1	
	2	1	Type 8 in Chapter 2	
	3	1	Type 3 in Chapter 3	
II	1	1	Type 4 in Chapter 3	
	2	1	Chapter 9	
III	1	1	Type 1 in Chapter 12	
	2	1	Type 2 in Chapter 12	
	3	1	Type 3 in Chapter 12	

IV	1	2	Chapter 37	
	2	2	Chapter 38	
	3	2	Chapter 39	

Suggested Readings

1. Gautam Puri, Reasoning for competitive examinations, 2023, GK Publishers
2. R.K. Thakur, A latest approach to verbal and nonverbal reasoning, Prabhat Prakashan.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper *	10
b)	Assignment	5
c)	Seminar, Viva-Voce	10
Total		**75**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

** **Use of Calculators shall not be permitted.**

KU2MDCMAT102:
MATHEMATICS FOR SOCIAL SCIENCE

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	MDC	100-199	KU2MDCMAT102	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3		1	25	50	75	1.5

Course Description

The course aims to develop students' mathematical literacy and critical thinking skills in the context of Social Science. This course provides an introduction to basic mathematical concepts used in Social Sciences. It covers fundamental concepts in Algebra and Calculus. Topics include sets, functions, differentiation, integration and matrices with applications to Business and Finance.

Course Prerequisite

Real number system.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand sets and set operations	Understand
2	Comprehend Functions, lines and linear functions	Understand
3	Understand limits, derivatives and techniques for differentiation	Understand
4	Understand definite integrals	Understand
5	Comprehend matrices, different types of matrices and matrix operations	Understand
6	Compute determinants of 2×2 and 3×3 matrices	Understand
7	Determine inverse of a non-singular matrix	Understand
8	Apply matrices and determinants to Business and Finance	Apply

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2	✓						
CO 3	✓						
CO 4	✓						
CO 5	✓						
CO 6	✓						
CO 7	✓						
CO 8						✓	

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Sets and Functions**	11
	1	Sets and set operations	
	2	Functions	
	3	Lines and linear functions	
II		**Limits and Derivatives**	11
	1	Limits	
	2	Differentiation (a) The derivative (b) Techniques of differentiation (c) Product and quotient rules, higher derivatives	
III		**Integration**	11

	1	Indefinite integrals (a) Indefinite integrals and differential equations (b) Integration by substitution	
	2	Definite integrals: The Definite integral and the fundamental theorem of Calculus	
IV	**Matrices and its applications to Business and Economics**		12
	1	Matrices (a) Matrices, row matrix, column matrix, submatrix, equal matrices (b) Addition, subtraction and multiplication of matrices (c) Identity matrix, null matrix, diagonal matrix, scalar matrix, transpose of a matrix	
	2	Determinants (a) Determinants of 2 × 2 and 3 × 3 matrices (b) Minors, cofactors and cofactor expansion	
	3	Inverse of a matrix (a) Inverse of a matrix (b) Singular and non-singular matrices (c) Cofactor matrix (d) Adjoint matrix (e) Inverse of a matrix by adjoint method (f) Method of solving system of linear equations using inverse of a matrix	
	4	Applications of matrices and determinants to Business and Finance	

Essential Readings

1. Soo T. Tan, Finite Mathematics for the Managerial, Life and Social Sciences (11^{th} edition), Cengage Learning
2. L. Hoffman, G. Bradley, D. Sobechi and M.Price, Calculus fo Business, Economics, and Social and Life Sciences: Brief edition (11^{th} edition), Mc Graw Hill
3. B.M. Aggarwal, Business & Statistics, Ane Books Pvt. Ltd.

Reference Distribution

Module	Unit	Reference No.	Chapters/Sections	Remarks
I	1	1	Section 6.1	
	2	2	Section 1.1	
	3	2	Section 1.3	

II	1	2	Section 1.5	
	2	2	Sections 2.1, 2.2, 2.3	
III	1	2	Sections 5.1, 5.2	
	2	2	Section 5.3	
IV	1	3	Sections 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.9, 1.10, 1.11, 1.12, 1.13	
	2	3	Section 1.16	
	3	3	Sections 1.15, 1.25, 1.27, 1.28, 1.29	*Solving system of homogeneous linear equations is omitted*
	4	3	Chapter 2	

Suggested Readings

1. M. Wilson, Business Mathematics, Himalaya Publishing House
2. G. Rangaraj, R. Mallieswari and V. Rema, Business Mathematics, Cengage
3. P. Hazarika, A text book of Business Mathematics (4th edition), S. Chand
4. S. Sarma and B. Baruah, Business Mathematics, Mahaveer Publications
5. J.K. Sharma, Business Mathematics (3rd edition), Techsar Pvt. Ltd.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper *	10
b)	Assignment	5
c)	Seminar, Viva-Voce	10
Total		**75**

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****Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU2MDCMAT203: VECTOR ALGEBRA

Semester	Course Type	Course Level	Course Code		Credits	Total Hours
II	MDC	100-199	KU2MDCMAT203		3	60
Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3		1	25	50	75	1.5

Course Description

This course aims to introduce the concepts of vectors, vector operations, dot product and cross product of two vectors, scalar and vector triple product and applications.

Course Prerequisite

Basic knowledge in Rectangular Cartesian System.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand the basics of vectors and vector operations	Understand
2	Comprehend the right and left handed systems	Understand
3	Understand dot product, cross product and box product of vectors	Understand
4	Apply the known concepts to illustrate some situations	Apply
5	Understand miscellaneous applications	Apply

Mapping of Course Outcomes to PSOs							
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓						
CO 2						✓	
CO 3	✓						
CO 4	✓						
CO 5	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I	**Vecror: Basic concepts**		**15**
	1	a) Fundamental concepts and definitions	
		b) Vector operations	
		c) Right handed and Left handed system	
		d) Linear dependence of vectors	
II	**Product of vectors**		**15**
	1	a) Dot product of two vectors	
		b) Projection of a vector on an axis	
		c) Cross product of two vectors	
		d) Scalar triple product	
III	**Miscellaneous applications**		**15**
	1	a) Vector triple product	
		b) Vector and Cartesian equation of lines and planes in space	
		c) Example	
		d) Miscellaneous applications	

Essential Readings

1. Demetrios P Kanoussis, Vector Algebra - for Engineers and Scientists.

Reference Distribution

Module	Unit	Essential Reading No.	Sections	Remarks
I	1	1	Chapters 1, 2, 3, 4.	
II	1	1	Chapters 5, 6, 7, 8.	
III	1	1	Chapter 9, 10, 11.	

Suggested Readings

1. James Stewart; Calculus: Early Transcendentals; 9th edition; Cengage learning, 2021
2. G. B. Thomas Jr, M. D. Weir and Joel R. Hass; Thomas' Calculus; 12th edition; Pearson 2009
3. H. Anton, I. Bivens, S. Davis; Calculus; 10th edition; Wiley.

Assessment Rubrics

Evaluation Type		Marks
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper *	10
b)	Assignment	5
c)	Seminar, Viva-Voce	10
Total		**75**

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** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**