College of Excellence, nirf 2023– 4th Rank
(An Autonomous Institution Affiliated to Bharathiar University)
(Accredited with 'A++' Grade by NAAC , An ISO 9001:2015 Certified Institution)
Peelamedu, Coimbatore – 641004

DEPARTMENT OF MATHEMATICS

CHOICE BASED CREDIT SYSTEM & LEARNING OUTCOME BASED CURRICULAR FRAMEWORK

MASTER OF MATHEMATICS

2024-2026 BATCH

(I SEMESTER)

PROGRAMME EDUCATIONAL OBJECTIVES

The M. Sc Mathematics curriculum is dedicated to prepare students for productive careers after 3-5 years of graduation.

1. Apply their knowledge in modern industry or teaching, or secure acceptance in high-quality graduate programs in mathematics.
2. Development in their chosen profession and/or progress toward an advanced degree
3. The trust and respect of others as effective and ethical team members.
4. Graduates will become effective collaborators and innovators, leading or participating in efforts to address social, technical and business challenges.
5. Promote the culture of interdisciplinary research among all disciplines and applied mathematics.

PROGRAMME LEARNING OUTCOMES

On the successful completion of the programme, the following are the expected outcomes

PLO1: Students acquire sound analytical and practical knowledge to formulate and solve challenging problems.
PLO2: Students will be able to read and identify mathematical and computational methods in order to solve comprehensive problems.
PLO3: Students are well prepared to take jobs in schools and colleges as Mathematics Teachers and Professors, Software Industries, Research and Development Organizations.
PLO4: Students to purse higher studies in Mathematical and Computing Sciences and to clear Competitive exams like SET/ NET/ TET etc.
PLO5: Students to learn and apply Mathematics in real life situations aiming at service to the society.

PROGRAMME SPECIFIC OUTCOMES

PSO1: Provide Strong foundation and inculcate ample knowledge on topics in pure and applied mathematics, empowering the students to pursue higher degrees at reputed academic institutions
PSO2: Advanced mathematical topics provide opportunities to research students for communication and discussion.
PSO3: Demonstrate the highest standard of ethics in research.
PSO4: Provide scope for interaction with international researchers and developing collaborations.
PSO5: Provide knowledge of a wide range of mathematical techniques and application of mathematical methods/tools in other scientific and engineering domains.
PSO6: Nurture problem solving skills, thinking, creativity through assignments, project work.
PSO7: Generate publications in reputed mathematical journals.

PSGR Krishnammal College for Women

DEPARTMENT OF MATHEMATICS

CHOICE BASED CREDIT SYSTEM & LEARNING OUTCOME BASED CURRICULAR FRAMEWORK

SYLLABUS & SCHEME OF EXAMINATION

MASTER OF MATHEMATICS

2024 -2026 BATCH & ONWARDS

Sem	Course Code	Title of the Course	Instruction hours/ Week	Contact hours	Tutorial	Duration of Examination	Examination Marks			Credits
							CA	ESE	Total	
I	MTH2301	Algebra	6	88	2	3	25	75	100	4
	MTH2302	Real Analysis	6	88	2	3	25	75	100	4
	MTH2303	Ordinary Differential Equations	6	88	2	3	25	75	100	4
	MTH2304	Mechanics	6	88	2	3	25	75	100	4
	MTH23E1 MTH23E2	**Elective I:** Financial Mathematics/ Mathematical Statistics	6	88	2	3	25	75	100	4
I - III	17MONL1	Online Course #	-	-	-	-	-	-	-	1*

* : Students completing online course through NPTEL and IIT Mumbai will get a credit of 1, for others completed status will be given.

\# : Self study

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
MTH2301	ALGEBRA	THEORY	88	2	-	4

Preamble

- To develop the capability among students for handling abstract concepts and to provide the students with experience in axiomatic mathematics while keeping in close touch with the computational aspects of the subject.
- To prepare students to understand principles, concepts necessary to formulate, solve and analyze Algebra
- To prepare the students for further courses in higher mathematics and related disciplines

Course Learning Outcomes

Upon the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand competence with the basic ideas of algebra including the concepts of direct products, finitely generated abelian groups	K2
CLO2	Apply knowledge of the structures of fields ,extension fields and finite fields	K3
CLO 3	Analyze the significance Sylow's theorem and Galois theory	K4
CLO 4	Evaluate clear and accurate proofs using the concepts of Algebra	K5
CLO 5	Create competence with the basic ideas of linear Algebra including the concepts of modules and linear transformations	K6

Mapping with Programme Learning Outcomes

CLO s/PLO s	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
CLO 1	S	S	S	S	S
CLO 2	S	S	S	M	S
CLO 3	S	S	S	S	S
CLO 4	S	S	M	S	S
CLO 5	S	S	S	S	M

S- Strong; M-Medium; L-Low

Syllabus

CORE I - SEMESTER I – ALGEBRA (MTH2301)

Unit I **(18 hrs)**

Group Theory: Another Counting principle - Sylow's theorem - Application of Sylow's theorem - **Direct products – Finite Abelian Group**.

Unit II **(18 hrs)**

Vector spaces and modules: elementary basic concepts – **linear independence and bases** – dual spaces – **inner product spaces** – modules

Unit III **(17 hrs)**

Fields: Extension Fields - **Roots of Polynomials** - More about root-Elements of Galois Theory - Solvability by radicals -**Finite fields**

Unit IV **(18 hrs)**

Linear Transformation: The algebra of linear transformations - **Characteristic roots** – Matrices - Canonical Forms -**Triangular Form** - Nilpotent Transformation

Unit V **(17 hrs)**

Canonical Forms: A Decomposition of V: Jordan form - Rational Canonical Form- **Trace and Transpose** - Determinants – Hermitian - **Unitary and Normal transformations** –Real quadratic forms.

Text book

S. No	Author	Title of the book	Publishers	Edition & Year
1.	I.N. Herstein	Topics in Algebra	John Wiley & Sons	II, 2016
	Unit I : Chapter 2 – 2.11,2.12,2.13,2.14 Unit II : Chapter 4- 4.1,4.2,4.3,4.4,4.5 Unit III: Chapter 5 – 5.1,5.3,5.5 ,5.6,5.7 Chapter 7-7.1 Unit IV: Chapter 6-6.1,6.2,6.3,6.4,6.5 Unit V : Chapter 6 – 6.6,6.7,6.8,6.9,6.10,6.11			

References

S. No	Author	Title of the book	Publishers	Edition & Year
1.	Lang Serge	Algebra	Addison-Wesley	III, 2002
2.	P. B. Bhattacharya, S. K. Jain and S. R. Noyapal	Basic Abstract Algebra	Cambridge University	II, 2009
3.	Rao & Bhimsankaran	Linear Algebra	Hindustan book	II, 2000
4.	Serge Lang	Linear Algebra	Addison-Wesley	I, 2004
5.	S. Kumaresan	Linear Algebra	Prentice Hall	I, 2000
6.	T. W. Hungerford	Algebra	Springer	I, 2000

Course Designers

Dr. Sreeja. S

Course Content and Lecture Schedule
MTH2301 - ALGEBRA

Module No.	Topic	CLO level	No. of periods	Content delivery method	Student engagement	Participatory Learning / Experiential Learning / Problem based Learning
Unit – I						
1.	Another Counting principle	CLO1, CLO2, CLO4	3	Lecture, PPT	Quiz	Participatory Learning
2.	Sylow's theorem	CLO2, CLO3, CLO4, CLO5	4	Lecture, PPT	Word cloud/ Mind map / Think Write and Share	Problem-based Learning
3.	Application of Sylow's theorem	CLO3, CLO4	3	Lecture, Assignment	Group discussion	Experiential Learning
4.	Direct products	CLO2, CLO4	4	Quiz, Video Lecture https://youtu.be/rXLz8TdckWo	Diagrams, Sketchboard	Participatory Learning
5.	Finite abelian Group	CLO3, CLO4, CLO5	4	Lecture, PPT, Video Lecture https://youtu.be/VzTFXcbB9_s	Presentation	Experiential Learning
Unit – II						
6.	Elementary basic concepts	CLO1, CLO2, CLO3	4	Lecture, PPT	Quiz	Participatory Learning

7.	Linear independence and bases	CLO2, CLO3, CLO5	4	Video Lecture https://youtu.be/CrV1xCWdY-g	Presentation	Problem-based Learning
8.	Dual spaces	CLO2, CLO4	3	Lecture, Assignment	Presentation	Problem-based Learning
9.	Inner product spaces	CLO2, CLO3, CLO5	4	Video Lecture https://youtu.be/1ySJCG6hVPg	Peer teaching, Quiz	Problem-based Learning
10.	Modules	CLO2, CLO4	3	Lecture, PPT	Peer teaching	Participatory Learning
Unit – III						
11.	Extension Fields	CLO1, CLO3, CLO4	3	Lecture, PPT	Think write and share	Participatory Learning
12.	Roots of Polynomials	CLO2, CLO3, CLO5	3	Video Lecture https://youtu.be/88YUeigknNg	Presentation	Problem-based Learning
13.	More about root	CLO2, CLO4	2	Lecture, PPT	Flipped classroom, Presentation	Participatory Learning
14.	Elements of Galois Theory	CLO3, CLO4, CLO5	3	Lecture, Assignment	Group discussion	Experiential Learning
15.	Solvability by radicals	CLO1, CLO4, CLO5	3	Lecture, Quiz	Peer teaching	Participatory Learning
16.	Finite fields	CLO3, CLO4	3	Video Lecture, PPT https://youtu.be/c6FlpordfDk	Group discussion	Experiential Learning

Unit – IV						
17.	The algebra of linear transformations	CLO1, CLO3, CLO4	3	Lecture, PPT	Group discussion	Experiential Learning
18.	Characteristic roots	CLO1, CLO2, CLO4	3	Video Lecture, PPT https://youtu.be/h7UHHYuXwhQ	Group discussion	Experiential Learning
19.	Matrices	CLO2, CLO5	3	Lecture, Assignment	Student seminar	Experiential Learning
20.	Canonical Forms	CLO1, CLO3, CLO5	3	Lecture, Quiz	Design thinking, Presentation	Problem-based Learning
21.	Triangular Form	CLO3, CLO4	3	Video Lecture, PPT https://youtu.be/vAXDnQ3EcNg	Design thinking	Problem-based Learning
22.	Nilpotent Transformation	CLO2, CLO5	3	Lecture, PPT	Quiz	Participatory Learning
Unit – V						
23.	A Decomposition of V	CLO2, CLO3	2	Lecture, PPT	Word cloud/ Mind map / Think Write and Share	Participatory Learning
24.	Jordan form	CLO3, CLO5	2	Lecture, Assignment	Word cloud/ Mind map / Think Write and Share	Problem-based Learning
25.	Rational Canonical Form	CLO1, CLO4	2	Lecture, Quiz	Student seminar	Experiential Learning
26.	Trace and Transpose	CLO2, CLO3	3	Video Lecture, PPT https://youtu.be/tnltDsa9aM4	Group Discussion	Experiential Learning

27.	Determinants	CLO2, CLO3	2	Lecture, Seminar	Student seminar, One Minute presentation	Problem-based Learning
28.	Hermitian	CLO1, CLO3, CLO4	2	Lecture, Quiz	Group reading and discussion	Problem-based Learning
29.	Unitary and Normal transformations	CLO2, CLO3 CLO5	2	Video Lecture, Seminar https://youtu.be/AJUw6ooN2Ig	Flipped Class room, Discussion	Problem-based Learning
30.	Real quadratic forms	CLO4, CLO5	2	Lecture, PPT	Peer teaching	Problem-based Learning

Participatory Learning	31 %
Experiential Learning	31 %
Problem-based Learning	38 %

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
MTH2302	REAL ANALYSIS	THEORY	88	2	-	4

Preamble

- To present students the elements and importance of the real analysis.
- To define and recognize the basic properties of the field of real numbers.
- To enable the students to the differentiability of real functions and its related theorems.

Course Learning Outcomes

Upon the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand fundamental properties of the real numbers that lead to the formal development of real analysis	K2
CLO2	Apply rigorous arguments developing the theory underpinning real analysis	K3
CLO3	Analysis an understanding of limits and how they are used in sequences, series, differentiation and integration	K4
CLO4	Evaluate the various mathematical proofs of basic results in real analysis	K5
CLO5	Create how abstract ideas and various methods in mathematical analysis can be applied to important practical problems. Exhibits rigorous mathematical proofs in real analysis like inverse function theorem and the implicit function theorem	K6

Mapping with Programme Learning Outcomes

CLO s/PLO s	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
CLO 1	S	S	S	M	S
CLO 2	S	S	S	S	S
CLO 3	S	S	M	S	M
CLO 4	S	M	S	S	M
CLO 5	S	S	M	S	S

S- Strong; M-Medium; L-Low

Syllabus

CORE II – SEMESTER I - REAL ANALYSIS (MTH2302)

Unit I **(18 Hrs)**

Riemann Stieltjes Integral: **Definition and Existence of the integral** - Properties of the integral - Integration and differentiation - **Integration of vector valued function** - Rectifiable curves.

Unit II **(18 Hrs)**

Uniform convergence and Continuity - Uniform convergence and Integration - Uniform convergence and Differentiation - Equi continuous Families of Functions- **The Stone-Weierstrass theorem**

Unit III **(18 Hrs)**

Power Series - The Exponential and Logarithmic Functions - The Trigonometric Functions – The Algebraic completeness of the complex field- Fourier series- **The Gamma Functions.**

Unit IV **(17 Hrs)**

Functions of Several Variables - Linear Transformation - Differentiation - The Contraction Principle. **The inverse function Theorem**

Unit V **(17 Hrs)**

The implicit Function Theorem -**The Rank theorem**-Determinants - Derivatives of higher order - Differentiation of Integrals

Text Book

S. No	Author	Title of the book	Publishers	Edition & Year
1.	W. Rudin	Principles of Mathematical Analysis	McGraw Hill	III, 1976
	UNIT: I – Chapter 6 – Sections: 6.1 – 6.27 UNIT: II – Chapter 7 – Sections: 7.7 – 7.26 UNIT: III – Chapter 8 – Sections: 8.1 – 8.22 UNIT: IV – Chapter 9 – Sections: 9.1 – 9.25 UNIT: V – Chapter 9 – Sections: 9.26 – 9.42			

Reference Books

S. No	Author	Title of the book	Publishers	Edition & Year
1.	R.G. Bartle	Elements of real Analysis	John Wily and Sons	II, 2006
2.	R. Goldberg Richard	Methods of real analysis	Oxford and IBH Publishing company	I, 2014
3.	Siri Krishan Wasan	Real analysis	Tata McGraw Hill	I, 2000
4.	H.L. Royden	Real Analysis	PHI Learning Private limited	IV, 2009

Course Designers

Dr. M. Deepa

Course Content and Lecture Schedule

MTH2302 - REAL ANALYSIS						
Module No.	**Topic**	**No. of hours**	**CLO's**	**Contents Delivery Method**	**Student Engagement**	**Participatory Learning / Experiential Learning / Problem based Learning**
UNIT I						
1.	Riemann Stieltjes Integral: Definition and Existence of the integral	3	CLO1 CLO2 CLO3	Lecture, Video Lecture , PPT https://youtu.be/DO0Dzz07DNI https://youtu.be/lku3QtqnRc0	Discussion	Problem-based Learning
2.	Properties of the integral	4	CLO1 CLO2 CLO3	Lecture PPT	Think,write and share	Participatory Learning
3.	Integration and differentiation	4	CLO1 CLO2 CLO3 CLO4	Video Lecture, Quiz https://youtu.be/s_7dMfUAqZk	Quiz (Quizalize/ Socrative)	Experiential Learning
4.	Integration of vector valued function	4	CLO2 CLO3 CLO4	Video Lecture, https://youtu.be/Tb-eNo5_3h8	Discussion	Problem-based Learning
5.	Rectifiable curves	3	CLO1 CLO2 CLO3	Lecture PPT/Chalk and talk	Group discussion	Problem-based Learning
UNIT II						
6.	Uniform convergence and Continuity	4	CLO1 CLO2 CLO3	Video Lecture, PPT, https://youtu.be/ckZpIsjzm0I	Discussion	Problem-based Learning
7.	Uniform convergence and Integration	4	CLO1 CLO2 CLO3 CLO4	Lecture, PPT, Assignment	Assignment	Experiential Learning

8.	Uniform convergence and Differentiation	4	CLO1 CLO2 CLO3 CLO4 CLO5	Lecture, PPT, Chalk and talk	Seminar/Discussion	Participatory Learning
9.	Equi continuous Families of Functions	3	CLO2 CLO3 CLO4	Lecture, Chalk and talk Group Discussion	Quiz	Participatory Learning
10.	The Stone-Weierstrass theorem	3	CLO4 CLO5	Video Lecture, PPT https://youtu.be/q7HJuPX8bw4	Discussion	Problem-based Learning
UNIT III						
11.	Power series:The Exponential and Logarithmic Functions	4	CLO1 CLO2 CLO3 CLO4	Video Lecture, Assignment https://youtu.be/zmZdPr5uCfI	Discussion	Experiential Learning
12.	The Trigonometric Functions	3	CLO1 CLO2 CLO3 CLO4	Lecture, PPT, Quiz	Quiz (Quizalize/ Socrative)	Experiential Learning
13.	The Algebraic completeness of the complex field	3	CLO2 CLO3 CLO4	Lecture, PPT	Discussion	Problem-based Learning
14.	Fourier series	4	CLO1 CLO2 CLO3 CLO4	Lecture, PPT	Discussion	Problem-based Learning
15.	The Gamma Functions	4	CLO1 CLO3 CLO4 CLO5	Video Lecture, PPT https://youtu.be/Njf6PExHhAM	Assignment	Participatory Learning
UNIT IV						
16.	Functions of Several Variables	3	CLO1 CLO2 CLO3 CLO4 CLO5	Video Lecture, Assignment https://youtu.be/md5UCR7mcIY	Discussion	Problem-based Learning
17.	Linear Transformation	3	CLO1 CLO3 CLO4 CLO5	Lecture, PPT	Seminar/Discussion	Participatory Learning
18.	Differentiation	4	CLO1, CLO3, CLO4, CLO5	Lecture, PPT, Quiz	Quiz	Experiential Learning

19.	The Contraction Principle	4	CLO3 CLO4 CLO5	Lecture, PPT	Discussion	Problem-based Learning
20.	The inverse function Theorem	3	CLO4 CLO5	Video Lecture, PPT https://youtu.be/R7js2_fOBCU	Group Discussion	Problem-based Learning
UNIT V						
21.	The implicit Function Theorem	3	CLO1 CLO2 CLO3 CLO4 CLO5	Video Lecture, PPT https://youtu.be/msIZz8ydzcM	Discussion	Problem-based Learning
22.	The Rank theorem	4	CLO3 CLO4	Video Lecture, PPT, Quiz https://youtu.be/_APa2ddIAVU	Seminar	Participatory Learning
23.	Determinants	4	CLO2 CLO3 CLO4	Lecture, PPT, Assignment	Assignment	Participatory Learning
24.	Derivatives of higher order	3	CLO4 CLO5	Lecture, PPT	Presentation	Experiential Learning
25.	Differentiation of Integrals	3	CLO3 CLO4 CLO5	Lecture, PPT	Discussion	Experiential Learning

Participatory Learning	30%
Experiential Learning	28%
Problem-based Learning	42%

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
MTH2303	ORDINARY DIFFERENTIAL EQUATIONS	THEORY	88	2	-	4

Preamble

- Differential equations arise for many problems in oscillations of mechanical and electrical systems
- It plays a very important role in all modern scientific and engineering studies.

Course Learning Outcomes

Upon the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand a variety of first order differential equations selecting from a variety of techniques	K2
CLO 2	Apply a variety of second order differential equations, selecting from several techniques	K2
CLO 3	Analysis the second order linear differential equations, both at ordinary points and at regular singular points	K3
CLO 4	Evaluate and be able to use various theoretical ideas and results that underlie the mathematics in this course covered in the syllabus (including various existence/uniqueness results, ideas of linear independence and the Wronskian, and convergence properties of Fourier series).	K5
CLO 5	Create the symbolic and graphical representations of functions	K6

Mapping with Programme Learning Outcomes

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO 2	S	M	S	S	S
CLO 3	S	S	M	S	S
CLO 4	S	S	S	S	S
CLO 5	S	S	M	S	M

S- Strong; M-Medium; L-Low

Syllabus

CORE III – SEMESTER I - ORDINARY DIFFERENTIAL EQUATIONS (MTH2303)

Unit I **(17 hrs)**

Second order linear equations with ordinary points - Legendre equation and Legendre polynomials - Second order equations with regular singular points - **Bessel equation**.

Unit II **(17 hrs)**

Systems of first order equation - **Existence and uniqueness theorem** - Fundamental matrix.

Unit III **(17 hrs)**

Non-homogeneous linear systems - Linear systems with constant co-efficient - Linear systems with periodic co-efficients.

Unit IV **(18 hrs)**

Successive approximation - **Picard's theorem** - non-uniqueness of solutions - continuation and dependence on initial conditions - Existence of solutions in the large - **existence and uniqueness of solutions of systems**.

Unit V **(18 hrs)**

Fundamental results - Sturm's comparison theorem - **Elementary linear oscillations** - Comparison theorem of Hille-Winter oscillations of X" + A(t) X = 0. Elementary non-linear oscillations.

Text book

S. No	Author	Title of the book	Publishers	Edition & Year
1.	S.G. Deo and V. Raghavendra	Ordinary differential equations and Stability theory	Tata Mc Graw hill publishing company (P) Ltd, New Delhi,	II, 2002
	Unit I : Chapter 3 - Section 3.2 - 3.5 Unit II : Chapter 4 - Section 4.1 - 4.4 Unit III: Chapter 4 - Section 4.5 - 4.7 Unit IV: Chapter 5 - Section 5.3 - 5.8 Unit V : Chapter 6 - Section 6.1 - 6.6			

References

S.No	Author	Title of Book	Publishers	Edition & Year
1	Harry Pollard	Ordinary Differential Equations	Dover publication Newyork.	2012
2	Edward L. Ince	Ordinary Differential Equations	Dover publication Newyork.	I, 2012
3	Wolfgang Walter	Ordinary Differential Equations	Springer Verlag , Newyork INc	2013
4	Earl A Coddington	An Introduction to Ordinary Differential Equations	Earl A. Coddington Prentice-Hall	I, 2012
5	Refaat El Attar	Ordinary Differential Equations	LULU press incorporated Morrisville USA	Null, 2006

Course Designers

Dr. R. Sasirekha,
Dr. M. Nila

Course Content and Lecture Schedule

MTH2303 - ORDINARY DIFFERENTIAL EQUATIONS						
Module No.	**Topic**	**No. of periods**	**CLO level**	**Content delivery method**	**Student engagement**	**Participatory Learning / Experiential Learning / Problem based Learning**
UNIT I						
1	Second order linear equations with ordinary points	4	CLO1, CLO2, CLO3, CLO4, CLO5	Video Lecture – Chalk and Talk/ Group readings https://youtu.be/MGLgDlE_uaU	Optimization, and Presentation, Brainstorming	Problem-based Learning
2	Legendre equation and Legendre polynomials	4	CLO1, CLO2, CLO3,	Lecture – Chalk and Talk/ Group readings	Optimization, and Presentation, Brainstorming	Problem-based Learning

			CLO4, CLO5			
3	Second order equations with regular singular points	5	CLO1, CLO2, CLO3, CLO4, CLO5	Lecture – Chalk and Talk	Word cloud/ Mind map / Think Write and Share	Participatory Learning
4	Bessel equation.	4	CLO1, CLO2, CLO3, CLO4, CLO5	Video Lecture, Observation https://youtu.be/5vaMFq57zqM	Group discussion	Experiential Learning
UNIT II						
5	Systems of first order equation	3	CLO1, CLO2, CLO3, CLO4, CLO5	Lecture – Chalk and Talk/Discussion	Quiz	Participatory Learning
6	Existence and uniqueness theorem.	3	CLO1, CLO2, CLO3, CLO4	Video Lecture – Chalk and Talk https://youtu.be/Y8cTAb68ywE	Presentation	Problem-based Learning
7	Cont., Existence and uniqueness theorem.	3	CLO1, CLO2, CLO3, CLO4	Video Lecture – Chalk and Talk https://youtu.be/Y8cTAb68ywE	Presentation	Problem-based Learning
8	Fundamental matrix	4	CLO4, CLO5	Lecture PPT	Peer teaching, Quiz	Participatory Learning
9	Cont., Fundamental matrix	4	CLO4, CLO5	Lecture PPT	Peer teaching	Participatory Learning
UNIT III						
10	Non-homogeneous linear systems	3	CLO1, CLO2, CLO3, CLO4	Video Lecture / Observation https://youtu.be/_SLr63ZTDs0	Group discussion	Experiential Learning

11	Cont.,Non-homogeneous linear systems	4	CLO1, CLO2, CLO3, CLO4	Observation	Group discussion	Experiential Learning
12	Linear systems with constant co-efficient	4	CLO1, CLO2, CLO3, CLO4	Video Lecture / Observation https://youtu.be/mnIjKW53RoA	Student seminar	Experiential Learning
13	Linear systems with periodic co-efficient	3	CLO1, CLO2, CLO3, CLO4	Lecture	Design thinking, Presentation	Problem-based Learning
14	Cont., Linear systems with periodic co-efficient	3	CLO1, CLO2, CLO3, CLO4	Lecture	Design thinking	Problem-based Learning
UNIT IV						
15	Successive approximation	3	CLO1, CLO2, CLO3, CLO4, CLO5	Lecture PPT	Quiz	Participatory Learning
16	Picard's theorem - non-uniqueness of solutions	4	CLO1, CLO2, CLO3, CLO4	Video Lecture – Chalk and Talk https://youtu.be/t-14ZwhtpAs	Optimization, and Presentation	Problem-based Learning
17	Continuation and dependence on initial conditions	4	CLO1, CLO2, CLO3, CLO4	Lecture PPT	Peer teaching	Participatory Learning
18	Existence of solutions in the large	4	CLO1, CLO2, CLO3, CLO4	Lecture / OER	Simulation	Experiential Learning
19	Existence and uniqueness of solutions of systems.	3	CLO1, CLO2,	Video Lecture – Chalk and Talk/ Group readings	Optimization, and Presentation, Brainstorming	Problem-based Learning

			CLO3, CLO4	https://youtu.be/oL97oGZUINA		
UNIT V						
20	Fundamental results - Sturm's comparison theorem	3	CLO1, CLO2, CLO3, CLO4	Lecture – Chalk and Talk/ https://youtu.be/krC9U6EKTto	Word cloud/ Mind map / Think Write and Share	Participatory Learning
21	Cont.,Sturm's comparison theorem	4	CLO3, CLO4	Lecture – Chalk and Talk, Quiz	Word cloud/ Mind map / Think Write and Share	Participatory Learning
22	Elementary linear oscillations	3	CLO1, CLO2, CLO3, CLO4	Video / Observation https://youtu.be/d60VwnUytYE	Student seminar	Experiential Learning
23	Comparison theorem of Hille-Winter oscillations of X" + A(t) X = 0.	3	CLO1, CLO2, CLO3	Spotters / Lecture	Post it parade	Experiential Learning
24	Comparison theorem of Hille-Winter oscillations of X" + A(t) X = 0.	3	CLO3, CLO4, CLO5	PPT, Optimization	Review collection, case thinking	Problem-based Learning
25	Elementary non-linear oscillations	3	CLO1, CLO2, CLO3, CLO4	Lecture – Chalk and Talk/ Group readings	Optimization, and Presentation, Brainstorming	Problem-based Learning

Participatory Learning	30 %
Experiential Learning	30 %
Problem-based Learning	40 %

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
MTH2304	MECHANICS	THEORY	88	2	-	4

Preamble

- To develop familiarity with the physical concepts and facility with the mathematical methods of classical mechanics.
- To represent the equations of motion for complicated mechanical systems using the Lagrangian and Hamiltonian formulation of classical mechanics.
- To develop skills in formulating and solving physics problems

Course Learning Outcomes

Upon the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the knowledge of the principles in mechanics	K2
CLO 2	Apply complex and difficult problems of classical dynamics in a systematic way	K3
CLO 3	Analysis the variation principle for real physical situations	K4
CLO 4	Evaluate the existing symmetries and the corresponding integrals of motion and analyze the qualitative nature of dynamics	K5
CLO 5	Create problem solving skills (approach, estimation, computation, and analysis) of classical mechanics in various contexts such as mechanical engineering, astrophysics, and biophysics.	K6

Mapping with Programme Learning Outcomes

CLO s/PLO s	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
CLO 1	M	S	S	S	M
CLO 2	S	S	S	M	S
CLO 3	S	S	M	S	S
CLO 4	S	M	S	S	S
CLO 5	S	S	S	S	M

S- Strong; M-Medium; L-Low

Syllabus

CORE PAPER - IV – SEMESTER I - MECHANICS (MTH2304)

UNIT I **(19 hrs)**

Introductory concepts: **Mechanical system** - generalized coordinates – constraints - virtual work - energy and momentum.

UNIT II **(17 hrs)**

Lagrange's equations: Derivations of Lagrange's equations – **examples** - integrals of motion.

UNIT III **(17 hrs)**

Hamilton's equations: **Hamilton's principles** - Hamilton's equations - other variational principles.

UNIT IV **(18 hrs)**

Hamilton – Jacobi theory: Hamilton's principle function - **Hamilton - Jacobi equation** - Separability.

UNIT V **(17 hrs)**

Canonical transformations: Differential forms and generating functions - **Lagrange and Poisson brackets.**

Text Book

S. No	Author	Title of the book	Publishers	Edition & Year
1.	Donald T. Greenwood	Classical Dynamics	Dover Publications	I, 1997
	UNIT I : Chapter 1 UNIT II : Chapter 2: Sections 2.1-2.3. UNIT III : Chapter 4: Sections: 4.1-4.3. UNIT IV : Chapter 5 UNIT V : Chapter 6: Sections: 6.1-6.3.			

Reference Books

S. No	Author	Title of the book	Publishers	Edition & Year
1.	H. Goldstein	Classical Mechanics	2nd Edition, Narosa Publishing House, New Delhi	II, 2001
2.	David Morin	Introduction to classical mechanics	Cambridge Press	I, 2008
3.	Takwal R G and Puranik P S	Introduction to classical mechanics	Mcgraw Hill Education Private Limited	I, 2010
4.	Sankara Rao K	Classical mechanics	Phi Learning Pvt Ltd	I, 2011
5.	Rajneesh Goel	Classical mechanics	Anmol Publication Pvt Limited, 1st edition	I, 2014

Course Designers

Dr. K. Krishnaveni

Course Content and Lecture Schedule

MECHANICS (MTH2304)

Module No.	Topic	No. of periods	CLO level	Content delivery method	Student engagement	Participatory Learning / Experiential Learning / Problem based Learning
			UNIT I			
1	Introductory concepts: Mechanical system	4	CLO1, CLO2	Lecture, Video Lecture https://youtu.be/wWnfJ0-xXRE	Quiz (Quizalize/ Socrative)	Participatory Learning
2	Generalized coordinates	3	CLO1, CLO2, CLO3	Lecture	Word cloud/ Mind map / Think Write and Share	Participatory Learning
3	Constraints	4	CLO2, CLO3,CLO4	Lecture, PPT	Post it parade	Experiential Learning
4	Virtual work	4	CLO2,CLO3, CLO4,CLO5	Lecture, Group Discussion	Diagrams, Sketchboard	Participatory Learning
5	Energy and momentum.	4	CLO3, CLO4,CLO5	Lecture, Quiz	Diagrams, Sketchboard	Experiential Learning
			UNIT II			
6	Derivations of Lagrange's equations	6	CLO2, CLO3	Lecture, PPT	Think write and share	Experiential Learning
7	Lagrange's equations-examples	6	CLO3,CLO4	Lecture, Video Lecture https://youtu.be/zhk9xLjrmi4	Presentation	Problem-based Learning

8	Integrals of motion	5	CLO3, CLO4, CLO5	Lecture, Assignment	Flipped classroom, Presentation	Participatory Learning
UNIT III						
9	Hamilton's principles	6	CLO1, CLO2,CLO3	Lecture, Video Lecture **https://youtu.be/RRB83Z1zyCU**	Group discussion	Experiential Learning
10	Hamilton's Equations	5	CLO2, CLO3,CLO4	Lecture, Group Discussion	Peer teaching	Participatory Learning
11	Other variational principles	6	CLO3, CLO4,CLO5	Lecture, Quiz	Group discussion	Experiential Learning
UNIT IV						
12	Hamilton Jacobi theory-Problems	5	CLO1,CLO2, CLO3, CLO4	Lecture	Student seminar, One Minute presentation	Participatory Learning
13	Hamilton's principle function - Problems	4	CLO2, CLO4, CLO5	Lecture, Assignment	Group reading and discussion	Problem-based Learning
14	Hamilton - Jacobi equation - Examples	5	CLO1,CLO2, CLO3, CLO4	Lecture, Video Lecture **https://youtu.be/nFpC1s1joRU**	Flipped Class room, Discussion	Participatory Learning
15	Separability and Problems	4	CLO3, CLO4, CLO5	Lecture, Group Discussion	Peer teaching	Participatory Learning
UNIT V						
16	Canonical transformations	4	CLO1, CLO2, CLO3, CLO4	Lecture, PPT	Group reading and discussion	Experiential Learning

17	Differential forms and generating functions Examples	5	CLO2, CLO3, CLO4	Lecture , Seminar	Group discussion	Experiential Learning
18	Lagrange and Poisson brackets.	4	CLO3, CLO4, CLO5	Lecture, Video Lecture **https://youtu.be/-LImlEExidU** Assignment	Group discussion	Experiential Learning
19	Lagrange and Poisson brackets Problems	4	CLO3, CLO4, CLO5	Lecture, Group Discussion	Hand's on	Experiential Learning

Participatory Learning	40 %
Experiential Learning	40 %
Problem-based Learning	20 %

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
MTH23E1	FINANCIAL MATHEMATICS	THEORY	88	2	-	4

Preamble

- To derive price-yield relationship and understand convexity
- To understand about the decomposition of matrices in statistics (and probability) point of view, e.g. principle component analysis.
- To understand the applications of financial mathematics.

Course Learning Outcomes

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the advanced knowledge in probability, statistics, stochastic calculus and numerical methods for financial applications.	K2
CLO2	Demonstrate a broad knowledge of the financial securities as well as practical aspects of risk management.	K3
CLO3	Construct quantitative models for derivative pricing, quantitative and trading strategies, risk management and scenario simulations.	K4
CLO4	Communicate effectively with potential clients and peers	K5
CLO5	Use statistical techniques and methods in data analysis; understand the advantages and limitations of different methods.	K5

Mapping with Programme Learning Outcomes

CLO s/PLO s	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
CLO 1	S	S	S	M	S
CLO 2	S	S	S	S	S
CLO 3	S	S	M	S	M
CLO 4	S	M	S	S	M
CLO 5	S	S	M	S	S

S- Strong; M-Medium; L-Low

Syllabus

ELECTIVE I – SEMESTER I - FINANCIAL MATHEMATICS (MTH23E1)

Unit I **(17Hrs)**

Single period models : Some definitions from finance - Pricing a forward -The one-step binary model - A ternary model - A characterization of no arbitrage - The risk-neutral probability measure.

Unit II **(17 Hrs)**

Binomial trees and discrete parameter martingales : The multi period binary model - American options - Discrete parameter martingales and Markov processes - Some important martingale theorems The Binomial Representation Theorem - Overture to CLO continuous models.

Unit III **(18 Hrs)**

Brownian motion : Definition of the process - Levy's construction of Brownian motion - The reflection principle and scaling - Martingales in continuous time.

Unit IV **(17 Hrs)**

Stochastic calculus: Stock prices are not differentiable - Stochastic integration - Ito's formula - Integration by parts and a stochastic Fubini Theorem - The Girsanov Theorem -The Brownian Martingale Representation Theorem - Why geometric Brownian motion- The Feynman–Kac representation.

Unit V **(19 Hrs)**

The Black – Scholes model - The basic Black – Scholes model -Black–Scholes price and hedge for European options - Foreign exchange -Dividends -Bonds - Market price of risk.

Text Book

S. No	Author	Title of the book	Publishers	Edition & Year
1	Alison Etheridge	A Course in Financial Calculus	University of Oxford	2002
	Unit I	Chapter I: 1.1 to 1.6		
	Unit II	Chapter II : 2.1 to 2.6		
	Unit III	Chapter III: 3.1 to 3.4		
	Unit IV	Chapter IV: 4.1 to 4.8		
	Unit V	Chapter V : 5.1 to 5.6		

Reference Books

S. No	Author	Title of the book	Publishers	Edition & Year
1	Robert J. Elliott, P. Ekkehard Kopp	Mathematics of Financial Markets	Springer-Verlag New York	II, 1999
2	Steven Roman	Introduction to the Mathematics of Finance	Springer-Verlag New York	I, 2012

Course Designers

Dr. K. Krishnaveni

Course Content and Lecture Schedule

Module No.	Topic	CLO level	No. of	Content delivery method	Student engagement	Participatory Learning / Experiential Learning / Problem based Learning
			Unit – I			
1	Some definitions from finance	CLO1,CLO2, CLO3	3	Lecture, PPT	Word cloud/ Mind map / Think Write and Share	Participatory Learning
2	Pricing a forward	CLO2,CLO3, CLO4, CLO5	3	Lecture, PPT	Quiz (Quizalize/ Socrative)	Participatory Learning
3	The one-step binary model	CLO2,CLO3	3	Video Lecture, PPT https://www.youtube.com/watch?v=kml52n2zmQs	Quescussion, Pro-con grid	Problem-based Learning
4	A ternary model	CLO2,CLO3, CLO4, CLO5	3	Lecture, PPT, Quiz	Diagrams, Sketchboard	Participatory Learning
5	A characterisation of no arbitrage	CLO2,CLO3, CLO4	2	Lecture	Diagrams, Sketchboard	Experiential Learning
6	The risk-neutral probability measure.	CLO1,CLO2, CLO3,CLO4, CLO5	3	Lecture, PPT https://www.youtube.com/watch?v=hLiHSj12dOg	Presentation, Group reading and discussion.	Problem-based Learning

Unit – II						
9	The multi period binary model	CLO1,CLO2, CLO3,CLO4	4	Lecture, PPT https://www.youtube.com/watch?v=h9gT0q91XBA	Think write and share	Experiential Learning
10	American options	CLO1,CLO2, CLO3,CLO4	3	Lecture, PPT, Group Discussion	Presentation	Problem-based Learning
11	Discrete parameter martingales and Markov processes	CLO2,CLO3, CLO4, CLO5	3	Lecture, PPT, Assignment	Flipped classroom, Presentation	Participatory Learning
12	Some important martingale theorems The Binomial Representation Theorem	CLO1,CLO2, CLO3,CLO4	4	Video Lecture, PPT, Quiz https://www.youtube.com/watch?v=V1AKAkGJlN8	Diagrams, Sketchboard	Participatory Learning
13	Overture to continuous models.	CLO1,CLO2, CLO3,CLO4, CLO5	3	Lecture, PPT	Presentation, Group reading and discussion.	Problem-based Learning
Unit – III						
14	Definition of the process	CLO1,CLO2, CLO3,CLO4	4	Lecture, PPT	Group discussion	Problem-based Learning
15	Levy's construction of Brownian motion	CLO1,CLO2, CLO3,CLO4, CLO5	4	Video Lecture, PPT https://www.youtube.com/watch?v=6VqBCt5PiPY	Peer teaching	Participatory Learning
16	The reflection principle and scaling	CLO1,CLO2, CLO3,CLO4, CLO5	5	Video Lecture, Assignment https://www.youtube.com/watch?v=fFNIaKe_WLg	Group discussion	Experiential Learning

17	Martingales in continuous time	CLO2,CLO3, CLO4, CLO5	5	Lecture, PPT, Quiz	Student seminar	Experiential Learning
Unit – IV						
21	Stock prices are not differentiable	CLO1,CLO2, CLO3,CLO4, CLO5	3	Lecture, PPT	Design thinking	Problem-based Learning
22	Stochastic integration	CLO4, CLO5	2	Lecture, PPT	Group reading and discussion	Problem-based Learning
23	Ito's formula .	CLO3,CLO4	2	Lecture, Quiz	Flipped Class room, Discussion	Participatory Learning
24	Integration by parts and a stochastic Fubini Theorem	CLO1,CLO2, CLO3,CLO4	2	Video Lecture, Assignment https://www.youtube.com/watch?v=gZAPmwQ1Tfs	Discussion	Participatory learning
25	The Girsanov Theorem	CLO3,CLO4	2	Lecture, PPT	Presentation	Problem Based Learning
26	The Brownian Martingale Representation Theorem	CLO1,CLO2, CLO3,CLO4	2	Lecture, PPT, Group Discussion	Student seminar	Experiential Learning
27	Why geometric Brownian motion	CLO1,CLO2, CLO3,CLO4	2	Lecture, PPT	Group reading and discussion	Experiential Learning
28	The Feynman–Kac representation	CLO1,CLO2, CLO3,CLO4	2	Video Lecture, PPT https://www.youtube.com/watch?v=mMQfcYxiMcM	Flipped Class room	Problem-based Learning
Unit –V						
31	The basic Black	CLO1,CLO2, CLO3,CLO4	2	Lecture, PPT	Group reading and discussion	Experiential Learning
32	Scholes model	CLO1,CLO2, CLO3,CLO4	2	Lecture, PPT	Group discussion	Experiential Learning
33	Black–Scholes price and hedge for European options -	CLO2,CLO3, CLO4	2	Video Lecture, PPT https://www.youtube.com/watch?v=pr-u4LCFYEY&vl=en	Hand's on	Experiential Learning

34	Foreign exchange	CLO2,CLO3, CLO4	3	Lecture, PPT, Quiz	Hand's on	Participatory learning
35	Dividends	CLO1,CLO2, CLO3,CLO4	4	Lecture, Group Discussion	Presentation	Problem-based Learning
36	Bonds	CLO1,CLO2, CLO3,CLO4	3	Lecture, PPT	Design thinking	Problem-based Learning
37	Market price of risk	CLO3,CLO4	3	Video Lecture https://www.youtube.com/watch?v=VCJoSAkYm6c	Presentation, Flipped Class room	Problem-based Learning

Participatory Learning	30 %
Experiential Learning	30 %
Problem-based Learning	40 %

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
MTH23E2	MATHEMATICAL STATISTICS	THEORY	88	2	-	4

Preamble

- To enable the students to learn the different aspects of statistics.
- To provide them a systematic knowledge to analyze, organize, present and interpret any information effectively.

Course Learning Outcomes

Upon the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the basic concepts of statistics, probability and random variables	K2
CLO2	Apply the concepts in finding the moments of the distributions	K3
CLO3	Analysis the type of the distribution	K4
CLO4	Evaluate the basics of sampling distribution theory	K5
CLO5	Creating a good estimate using unbiased, sufficient, efficient estimates	K6

Mapping with Programme Learning Outcomes

CLO s/PLO s	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
CLO 1	S	M	S	S	S
CLO 2	S	S	S	M	S
CLO 3	S	S	M	S	S
CLO 4	M	S	S	S	S
CLO 5	S	S	M	S	S

S- Strong; M-Medium; L-Low

Syllabus

ELECTIVE II – SEMESTER I - MATHEMATICAL STATISTICS (MTH23E2)

Unit I **(17 Hrs)**

Limit Theorems: Preliminary remarks - **Stochastic convergence** - **Bernoulli's law of large numbers** - The convergence of a sequence of distribution functions - Levy Cramer theorem - De-Moivre Laplace theorem - Lindberg Levy theorem - Lapunov theorem.

Unit II **(17 Hrs)**

Markov chains: Preliminary remarks - Homogeneous Markov chains - The transition matrix -**The Ergodic theorem** - Random variables forming a homogenous Markov chain.

Unit III **(19 Hrs)**

Stochastic process: The notion of a stochastic process - Markov process and processes with independent increments - **The Poisson process** -The Furry -Yule process - **Birth and death process** - The Polya process - Kolmogorov equations.

Unit IV **(18 Hrs)**

Sample moments and their functions - The notion of the sample - The notion of a statistic - The distribution of the arithmetic mean of independent normally distributed random variables - **The chi square distribution** - **The distribution of the statistic (X, S)** - Student's t distribution - Significance tests - The concept of a statistical test - Parametric tests for small samples - Parametric tests for large samples - The chi square test - Independence test by contingency tables.

Unit V **(17 Hrs)**

Theory of estimation - Preliminary notions – Consistent – unbiased - sufficient and efficient estimates - asymptotically most efficient estimates - methods of finding estimates - Confidence intervals - **Theory of hypothesis testing** .

Text Book

S. No	Author	Title of the book	Publishers	Edition & Year
1	Marek Fisz	Probability Theory and Mathematical Statistics	Robert E. Krieger Publisher	III, 1980
	Unit I : Chapter 6 : 6.1-6.4, 6.6-6.9, Unit II : Chapter 7 : 7.1-7.5. Unit III: Chapter 8 : 8.1-8.7 Unit IV: Chapter 9 : 9.1-9.6 , Chapter 12:12.1-12.4,12.7 Unit V : Chapter 13: 13.1-13.8			

References

S. No	Author	Title of the book	Publishers	Edition & Year
1.	Ajai Gaur	Statistical methods for practice and research	Sage Publications	II, 2010
2.	John, A. Rice	Mathematical and statistics and data analysis	Cengage Learning	III, 2013
3.	Robert V. Hoff and Allen T.Craig	Introduction to Mathematical Statistics	Pearson	VII, 2012
4.	S..C.Gupta	Fundamentals of mathematical statistics	Sultan Chand And Sons	I, 2014

Course Designers

Dr. P. Vidhyapriya

Course Content and Lecture Schedule

Module No.	Topic	CLO level	No. of periods	Content delivery method	Student engagement	Participatory Learning / Experiential Learning / Problem based Learning
			Unit – I			
1	Limit Theorems: Preliminary Remarks	CLO1, CLO2	2	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
2	Stochastic Convergence	CLO2	2	Lecture , PPT Video Lecture https://youtu.be/Ajar_6MAOLw	Quiz (Quizalize/ Socrative)	Participatory Learning
3	Bernoulli's law of large numbers	CLO3	2	Lecture – Chalk and talk Video Lecture, PPT https://youtu.be/Q54mEuQUOEc	Post it parade	Experiential Learning
4	The convergence of a sequence of distribution functions	CLO4	2	Lecture , Chalk and talk/ Picture	Diagrams, Sketchboard	Participatory Learning
5	Levy Cramer theorem	CLO3	2	Lecture, Spotters/ Chalk and talk	Diagrams, Sketchboard	Experiential Learning
6	De-Moivre Laplace theorem	CLO3, CLO4	3	Lecture, Chalk and talk	Presentation, Group reading and discussion.	Problem-based Learning
7	Lindberg Levy theorem	CLO4, CLO5	2	Lecture, OER	Quescussion, Pro-con grid	Problem-based Learning
8	Lapunov theorem	CLO3, CLO5	2	Demonstration	Presentation	Problem-based Learning

Unit – II						
9	Markov Chain. Preliminary remarks	CLO1, CLO2	3	Video Lecture, PPT https://youtu.be/sb4jo4P4ZLI	Think write and share	Experiential Learning
10	Homogeneous Markov chains	CLO2	3	Demonstration	Presentation	Problem-based Learning
11	The transition matrix	CLO3	4	Lecture / OER Seminar	Flipped classroom, Presentation	Participatory Learning
12	The Ergodic theorem	CLO3, CLO4	3	Video Lecture, Group Discussion https://youtu.be/ZjrJpkD3o1w	Diagrams, Sketchboard	Participatory Learning
13	Random variables forming homogenous Markov chain.	CLO4, CLO5	4	Lecture, Chalk and talk	Presentation, Group reading and discussion.	Problem-based Learning
Unit – III						
14	Stochastic process: The notion of a stochastic process	CLO1, CLO2	3	Lecture, PPT	Group discussion	Experiential Learning
15	Markov process and processes with independent increments	CLO2	3	Lecture PPT	Peer teaching	Participatory Learning
16	The Poisson process	CLO2, CLO3	2	Video Lecture, PPT https://youtu.be/5uLxFmhYnl0	Group discussion	Experiential Learning
17	The Furry-Yule process	CLO3, CLO4	3	Lecture, Demonstration	Student seminar	Experiential Learning
18	Birth and death process	CLO4, CLO5	3	PPT Video Lecture, Quiz https://youtu.be/XKYpKYspe1w	Student seminar, One Minute presentation	Participatory Learning

19	The Polya process	CLO3, CLO4	2	Lecture, Chalk and talk	Presentation	Problem Based Learning
20	Kolmogorov equations.	CLO4, CLO5	3	Lecture, Chalk and talk	Presentation, Group reading and discussion.	Problem-based Learning
Unit – IV						
21	Sample moments and their functions - The notion of the sample - The notion of a statistic	CLO1, CLO2	3	Lecture	Design thinking	Problem-based Learning
22	The distribution of the arithmetic mean of independent normally distributed random variables	CLO2	1	Lecture, Research article reading	Group reading and discussion	Problem-based Learning
23	The chi square distribution	CLO3, CLO4	2	Video Lecture https://youtu.be/dXB3cUGnaxQ Brainstorming	Flipped Class room, Discussion	Participatory Learning
24	The distribution of the statistic (X, S) - Student's t distribution	CLO4, CLO5	2	Chalk and Talk Video Lecture, https://youtu.be/32CuxWdOlow	Discussion	Participatory learning
25	Significance tests	CLO4, CLO5	1	Demonstration	Presentation	Problem Based Learning
26	The concept of a statistical test	CLO3, CLO4	2	Lecture, Demonstration	Student seminar	Experiential Learning
27	Parametric tests for small samples	CLO2, CLO3	2	Research article reading	Group reading and discussion	Experiential Learning
28	Parametric tests for large samples	CLO2, CLO3	2	Spotters	Hand's on	Experiential Learning
29	The chi square test	CLO4, CLO5	3	Lecture, PPT	Flipped Class room	Problem-based Learning
30	Independence test by contingency tables.	CLO4, CLO5	2	Research article reading	Group reading and discussion	Experiential Learning

			Unit –V			
31	Theory of estimation : Preliminary notions	CLO1, CLO2	2	Lecture, Video Lecture, PPT https://youtu.be/Y4gSdAsCO2g	Group reading and discussion	Experiential Learning
32	Consistent	CLO2	1	Lecture, Discussion	Group discussion	Experiential Learning
33	unbiased	CLO3	1	Lecture, Spotters	Hand's on	Experiential Learning
34	sufficient and efficient estimates	CLO3	1	Lecture, Spotters	Hand's on	Experiential Learning
35	asymptotically most efficient estimates	CLO3	3	Lecture	Presentation	Problem-based Learning
36	methods of finding estimates	CLO4, CLO5	3	PPT, Socrative	Design thinking	Problem-based Learning
37	Confidence intervals	CLO4, CLO5	2	Lecture	Presentation, Flipped Class room	Problem-based Learning
38	Theory of hypothesis testing	CLO4, CLO5	4	Lecture, Video Lecture, Assignment https://youtu.be/zJ8e_wAWUzE	Brainstorming, Optimization and Presentation	Problem-based Learning

Participatory Learning	30 %
Experiential Learning	30 %
Problem-based Learning	40 %

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
TH24A06	QUANTITATIVE TECHNIQUES - MATHEMATICS	THEORY	88	2	-	5

Preamble

- To provide the use of mathematical process skills to identify, pose and solve problems creatively and critically.
- To make students to understand mathematical principles with theoretical concepts and problems.
- To provide the wide knowledge of real time applications and to clear the competitive exams.
- On the successful completion of the course students will be

Course Learning Outcomes

CLO Number	CLO Statement	Knowledge Level
CLO 1	Acquires the knowledge of equation, interest and simple concept of logic	K1
CLO 2	Understand the basic principles of interest, sequence of problems.	K1
CLO 3	Interpret and apply knowledge of mathematics through differential calculus and integration.	K2
CLO 4	Identify, formulate and solve the problems.	K3
CLO 5	Understand the concepts of limit and continuity.	K3

Mapping with Programme Learning Outcomes

CLO s/PLO s	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
CLO 1	M	S	M	S	M
CLO 2	M	S	M	S	S
CLO 3	S	S	M	M	S
CLO 4	M	S	M	M	S
CLO 5	M	S	M	M	S

S- Strong; M-Medium; L-Low

Syllabus

B.COM (PA) – ALLIED - QUANTITATIVE APTITUDE – MATHEMATICS (TH24A06)

Unit I **(18 Hrs)**

Ratio and Proportion – **surds** - indices - variation – **logarithms**: Meaning - definition - related problems.

Unit II **(18 Hrs)**

Equations: Introduction - simple equation - simultaneous linear equations up to three variables – **Quadratic equation** - nature of roots - cubic equation - **graphical solution of linear equations.**

Unit III **(18 Hrs)**

Simple and Compound Interest -Definition - related terms - Effective rate of Interest – Annuity - Future value - present value - sinking fund - problems - applications - **Permutations and combinations**: Introduction - factorial - permutations - results - Problems - circular permutations - combinations - results - problems.

Unit IV **(17 Hrs)**

Sequences and Series: Sequence - Series - **Arithmetic progression - Geometric progression** - Geometric mean. Sets - Functions and relations: Sets - De Morgan's law, **Domain and range of function** - various types of functions.

Unit V **(17 Hrs)**

Limits and Continuity: Introduction - types of functions - concepts - important limits - continuity Basic concepts of differential and integral calculus: Introduction - differential coefficient - implicit functions - parametric form - Integration: Basic Formulae - methods of substitution - **integration by parts - method of partial fraction** - important properties.

Text Book

S. No	Author	Title of the book	Publishers	Edition & Year
1.	Dr. P.C. Tulsian	Quantitative Aptitude for CA CPT –Mathematics and Statistics	S.CHAND	II, 2015

References

S. No	Author	Title of the book	Publishers	Edition & Year
1.	Pradeep Jha, Parag Shah	Quantitative Aptitude for CA CPT - Mathematics and Statistics	Tata McGraw Hill	I, 2009
2.	Anup Dubey	Quantitative Aptitude for CA CPT- Mathematics and Statistics	S.CHAND	II, 2014
3.	Trivedi	Quantitative Aptitude for CA CPT- Mathematics and Statistics	Tata McGraw Hill	I, 2009
4.	CA-CPT Study Material	Quantitative Aptitude for CA CPT- Mathematics and Statistics	ICAI	2015

Course Designers

Dr. Sreeja. S
Dr. R. Anitha Cruz
Dr. P. Vidhyapriya

Course Content and Lecture Schedule

Module No.	Topic	CLO level	No. of periods	Content delivery method	Student engagement	Participatory Learning / Experiential Learning / Problem based Learning
			Unit – I			
1	Ratio and Proportion	CLO1 CLO2	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
2	Cont., Ratio and Proportion	CLO1 CLO2	1	OER	Flipped classroom, Presentation	Participatory Learning
3	Cont., Ratio and Proportion	CLO1CLO2 CLO3	1	Lecture – Chalk and Talk/Discussion	Quiz	Participatory Learning
4	Cont., Ratio and Proportion	CLO2 CLO3	1	Lecture / Seminar	Diagrams, Sketch board	Participatory Learning
5	surds	CLO2 CLO3	1	Lecture PPT	Pro/con grid	Participatory Learning
6	Cont., surds	CLO2 CLO3	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
7	Cont., surds	CLO2, CLO3	1	Spotters	Hand's on(Socrative)	Experiential Learning
8	Indices	CLO2, CLO3, CLO4	1	Lecture PPT	Pro/con grid	Participatory Learning
9	Cont., Indices	CLO2, CLO3, CLO4	1	Lecture – Chalk and	Quiz	Participatory Learning

				Talk/Discussion		
10	Cont., Indices	CLO2, CLO3, CLO4	1	PPT / OER	One minute paper	Participatory Learning
11	variation	CLO2, CLO3, CLO4	1	Lecture – Chalk and Talk	Brainstorming	Problem-based Learning
12	Cont., variation	CLO1 CLO2	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
13	logarithms: Meaning - definition	CLO1 CLO2	1	OER	Flipped classroom, Presentation	Participatory Learning
14	Cont., logarithms: Meaning - definition	CLO1CLO2 CLO3	1	Lecture – Chalk and Talk/Discussion	Quiz	Participatory Learning
15	Cont., logarithms: Meaning - definition	CLO2 CLO3	1	Lecture / Seminar	Diagrams, Sketch board	Participatory Learning
16	Related problems.	CLO2 CLO3	1	Lecture PPT	Pro/con grid	Participatory Learning
17	Cont., Related problems.	CLO2 CLO3	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
18	Cont., Related problems.	CLO2, CLO3	1	Spotters	Hand's on(Socrative)	Experiential Learning

Unit – II						
19	Equations: Introduction - simple equation	CLO2, CLO3	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
20	simultaneous linear equations up to three variables	CLO2, CLO3	1	PPT / OER	One minute paper	Participatory Learning
21	Cont., simultaneous linear equations up to three variables	CLO2, CLO3	1	Lecture – Chalk and Talk/Discussion	Quiz	Participatory Learning
22	Cont., simultaneous linear equations up to three variables	CLO2, CLO3	1	Lecture – Chalk and Talk	Optimization, and Presentation	Problem-based Learning
23	Cont., simultaneous linear equations up to three variables	CLO3, CLO4	1	OER	Flipped classroom, Presentation	Participatory Learning
24	Quadratic equation	CLO2, CLO3	1	Lecture – Chalk and Talk/Discussion	Quiz	Participatory Learning
25	Cont., Quadratic equation	CLO2, CLO3	1	PPT / OER	One minute paper	Participatory Learning
26	Cont., Quadratic equation	CLO2, CLO3	1	Lecture – Chalk and Talk	Optimization, and Presentation	Problem-based Learning
27	Cont., Quadratic equation	CLO2, CLO3	1	OER	Flipped classroom, Presentation	Participatory Learning

28	Nature of roots	CLO2, CLO3	1	Lecture – Chalk and Talk	Brainstorming	Problem-based Learning
29	Cont., Nature of roots	CLO2, CLO3	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
30	Cont., Nature of roots	CLO2, CLO3	1	PPT / OER	One minute paper	Participatory Learning
31	cubic equation	CLO2, CLO3	1	Lecture – Chalk and Talk/Discussion	Quiz	Participatory Learning
32	Cont., cubic equation	CLO2, CLO3	1	Lecture – Chalk and Talk	Optimization, and Presentation	Problem-based Learning
33	Cont., cubic equation	CLO3, CLO4	1	OER	Flipped classroom, Presentation	Participatory Learning
34	graphical solution of linear equations.	CLO2, CLO3	1	Spotters	Hand's on(Socrative)	Experiential Learning
35	Cont.,graphical solution of linear equations.	CLO2, CLO3	1	Lecture – Chalk and Talk/Discussion	Quiz	Participatory Learning
36	Cont.,graphical solution of linear equations.	CLO2, CLO3	1	PPT / OER	One minute paper	Participatory Learning
Unit – III						
37	Simple and Compound Interest -Definition - related terms	CLO2, CLO3	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning

38	Effective rate of Interest	CLO2, CLO3	1	PPT / OER	One minute paper	Participatory Learning
39	Cont., Effective rate of Interest	CLO2, CLO3	1	Lecture – Chalk and Talk/Discussion	Quiz	Participatory Learning
40	Annuity	CLO2, CLO3	1	Lecture – Chalk and Talk	Optimization, and Presentation	Problem-based Learning
41	Cont., Annuity	CLO2, CLO3	1	OER	Flipped classroom, Presentation	Participatory Learning
42	Future value ,present value	CLO2, CLO3	1	Lecture – Chalk and Talk	Brainstorming	Problem-based Learning
43	sinking fund - problems	CLO2, CLO3	1	Lecture – Chalk and Talk/Discussion	Quiz	Participatory Learning
44	applications	CLO2, CLO3	1	PPT / OER	One minute paper	Participatory Learning
45	Permutations and combinations: Introduction - factorial	CLO4, CLO5	1	Demonstration	Discussion	Experiential Learning
46	permutations - results - Problems	CLO2, CLO3, CLO4	1	Lecture PPT	Pro/con grid	Participatory Learning
47	Cont., permutations - results - Problems	CLO2, CLO3, CLO4	1	Video	Discussion	Participatory Learning
48	circular permutations	CLO3, CLO4	1	Seminar / PPT	Flipped classroom	Participatory Learning
49	Cont.,circular permutations	CLO2, CLO3	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning

50	Cont., circular permutations	CLO2, CLO3	1	PPT / OER	One minute paper	Participatory Learning
51	combinations	CLO2, CLO3	1	Lecture – Chalk and Talk/Discussion	Quiz	Participatory Learning
52	Cont., combinations	CLO2, CLO3	1	Lecture – Chalk and Talk	Optimization, and Presentation	Problem-based Learning
53	results and problems.	CLO3, CLO4	1	OER	Flipped classroom, Presentation	Participatory Learning
54	Cont., results and problems.	CLO2, CLO3	1	Spotters	Hand's on(Socrative)	Experiential Learning
Unit – IV						
54	Sequences and Series	CLO2, CLO3	2	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
55	Arithmetic progressio	CLO2, CLO3	2	PPT / OER	One minute paper	Participatory Learning
56	Geometric progression	CLO4, CLO5	2	Lecture – Chalk and Talk/Discussion	Quiz	Participatory Learning
57	Geometric mean.	CLO2, CLO3, CLO4	2	Lecture – Chalk and Talk	Optimization, and Presentation	Problem-based Learning
58	Sets .	CLO2, CLO3, CLO4	2	OER	Flipped classroom, Presentation	Participatory Learning
59	Function	CLO3, CLO4	1	Lecture – Chalk and	Quiz	Participatory Learning

				Talk/Discussion		
60	Relations	CLO2, CLO3	1	PPT / OER	One minute paper	Participatory Learning
61	De Morgan's law,	CLO2, CLO3	1	Lecture – Chalk and Talk	Presentation	Problem-based Learning
62	Domain and range of function	CLO4, CLO5	2	OER	Flipped classroom, Presentation	Participatory Learning
63	Various types of function	CLO2, CLO3, CLO4	2	Lecture – Chalk and Talk	Brainstorming	Problem-based Learning
Unit –V						
64	**Limits and Continuity:** Introduction	CLO1 CLO2 CLO3	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
65	types of functions	CLO4, CLO5	1	PPT / OER	One minute paper	Participatory Learning
66	concepts - important limits	CLO2, CLO3, CLO4	1	Lecture – Chalk and Talk/Discussion	Quiz	Participatory Learning
67	continuity Basic concepts of differential and integral calculus	CLO2, CLO3	1	Lecture – Chalk and Talk	Optimization, and Presentation	Problem-based Learning
68	differential coefficient	CLO4, CLO5	2	OER	Flipped classroom, Presentation	Participatory Learning
69	implicit functions	CLO2, CLO3, CLO4	1	Spotters	Hand's on(Socrative)	Problem-based Learning
70	parametric form	CLO2, CLO3	2	Lecture – Chalk and	Quiz	Participatory Learning

				Talk/Discussion		
71	Integration: Basic Formulae	CLO2, CLO3	1	PPT / OER	One minute paper	Problem-based Learning
72	methods of substitution	CLO2, CLO3	2	PPT / OER	One minute paper	Participatory Learning
73	integration by parts	CLO3, CLO4, CLO5	2	Lecture – Chalk and Talk	Optimization, and Presentation	Problem-based Learning
74	method of partial fraction	CLO1, CLO2, CLO3	2	OER	Flipped classroom, Presentation	Participatory Learning
75	important properties.		1	Lecture – Chalk and Talk	Brainstorming	Problem-based Learning

Participatory Learning	30 %
Experiential Learning	30 %
Problem-based Learning	40 %

QUESTION PAPER PATTERN (PG)

CA Pattern

Section A – 3 x 2 = 6
Section B – 3 x 5 = 15 (either or – same CLO Level)
Section C – 3 x 8 = 24 (either or – same CLO Level)
Total 45

ESE Pattern

Section A – 5 x 2 = 10
Section B – 5 x 5 = 25 (either or – same CLO Level)
Section C – 5 x 8 = 40(either or – same CLO Level)
Total 75

I Year PG

CIA Test	-	5	Conducted for 45 marks after 50 days
Model Exam	-	7	Conducted for 75 marks
			(Q.P. Pattern (2,5,8) Each Unit 15 Marks)
Sem/Ass/Quiz	-	5	
Class Participation	-	5	
Attendance	-	3	
		25	+ ESE 75 Marks

Question Paper Pattern (BCOM PA)

CA Pattern

Section A : 6 x 1 = 6
Section B : 3 x 3 = 9(either or – same CLO level)
Section C : 3 x10 =30(either or – same CLO level)
Total = 45

ESE Pattern

Section A : 20 x 1= 20
Section B : 5 x 3 = 15 (either or – same CLO level)
Section C : 5 x 8 = 40 (either or – same CLO level)
Total = 75

CIA

CIA Test	:	5 marks (conducted for 45 marks after 50 days)
Model Exam	:	7 marks (Conducted for 75 marks after 85 days (Each Unit 15 Marks))
Seminar/Assignment/Quiz	:	5 marks
Class Participation	:	5 marks
Attendance	:	3 marks
Total	**:**	**25 Marks**