Dr. N.G.P.ARTS AND SCIENCE COLLEGE (Autonomous)

REGULATIONS 2025-26 for Post Graduate Programme
(Outcome Based Education model with Choice Based Credit System)

M.Sc. Degree

(For the students admitted during the academic year 2025-26)

Programme: M.Sc. Mathematics

Eligibility:

A candidate who has passed the Degree Examination in B.Sc. (Mathematics) or B.Sc. (Mathematics with Computer Applications) of Bharathiar University and as per the norms set by the Government of Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the **Master of Science in Mathematics** Degree Examination of this College after a course of study of two academic years

Programme Educational Objectives:

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

1. To meet the demand for well trained Post Graduates in Mathematics with academic Excellence.
2. To demonstrate an understanding of the theoretical concepts and axiomatic underpinnings of Mathematics and an ability to construct proofs at the appropriate level.
3. To demonstrate competency in Mathematical modeling of complex phenomena, problem solving and decision making.
4. To demonstrate a level of proficiency in quantitative and computing skills sufficient to meet the growing demands of society upon modern education.

PROGRAMME OUTCOMES:

On the successful completion of the program, the following are the expectedoutcomes.

PO Number	PO Statement
PO1	Students will have knowledge, understanding and Mathematical thinking of the basic and advanced concepts, techniques from different topics
PO2	They have a fundamental and advanced understanding of at least one Mathematical topic of their choice and able to solve problem related to the topic
PO3	They can be able to communicate clearly in writing and orallying the detailed technical arguments of complex Mathematical concepts
PO4	The students develop problem solving skill and apply them independently to problems in pure and applied Mathematics
PO5	They can develop the knowledge of formulating, analyzing and problem solving in core areas of the Mathematics including Analysis, Algebra and Statistics

PG Credit Distribution:

Part	Subjects	No. of Papers	Credit	Semester No.
III	Core	16-18	13 x 04 = 52 02 x 03 = 06 01 x 05 = 05	I - IV
	Elective	04	04 x 04 = 16	I - IV
	EDC	01	01 x 03 = 03	II
	Industrial Training	01	01 x 02 = 02	III
	Project Work	01	01 x 08 = 08	IV
TOTAL CREDITS			**92**	**-**

PG CURRICULUM

M.Sc. MATHEMATICS – AY 2025-26

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
First Semester												
25MTP1CA	Core – I	Algebra	4	1	-	5	60	3	25	75	100	4
25MTP1CB	Core – II	Advanced Analysis	4	2	-	6	72	3	25	75	100	4
25MTP1CC	Core – III	Ordinary Differential Equations	4	1	-	5	60	3	25	75	100	4
25MTP1CD	Core - IV	Operations Research	4	1	-	5	60	3	25	75	100	4
25MTP1CE	Core - V	Advanced Statistics	3	2	-	5	60	3	25	75	100	3
25MTP1DA	DSE -I	Numerical Analysis	4	-	-	4	48	3	25	75	100	4
25MTP1DB		Commutative Algebra				4	48					
25MTP1DC		Mathematical Modeling				4	48					
Total						30	360				600	23

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Second Semester												
25MTP2CA	Core - VI	Complex Analysis	4	1	-	5	60	3	25	75	100	4
25MTP2CB	Core - VII	Topology	4	1	-	5	60	3	25	75	100	4
25MTP2CC	Core - VIII	Partial Differential Equations	4	1	-	5	60	3	25	75	100	4
25MTP2CM	Core -IX Practical	Computational Mathematics	3	-	4	7	84	3	40	60	100	5
25DAP2EB	EDC	Foundations of Data Analytics	3	1	-	4	48	3	25	75	100	3
25MTP2DA	DSE -II	Wavelet Analysis	4	-	-	4	48	3	25	75	100	4
25MTP2DB		Information and Coding Theory				4	48					
25MTP2DC		Mathematical Finance				4	48					
Total						30	360				600	24

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Third Semester												
25MTP3CA	Core - X	Functional Analysis	4	1	-	5	60	3	25	75	100	4
25MTP3CB	Core - XI	Classical Mechanics	3	2	-	5	60	3	25	75	100	3
25MTP3CC	Core - XII	Stochastic Differential Equations	4	2	-	6	72	3	25	75	100	4
25MTP3CD	Core -XIII	Advanced Graph Theory	4	1	-	5	60	3	25	75	100	4
25MTP3CE	Core - XIV	Fluid Dynamics	4	1	-	5	60	3	25	75	100	4
25MTP3CT	IT	Industrial Training	-	-	-	-	-	-	40	60	100	2
25MTP3DA	DSE -III	Finite Element Theory	4	-	-	4	48	3	25	75	100	4
25MTP3DB		Algebraic Number Theory				4	48					
25MTP3DC		Actuarial Mathematics				4	48					
Total						30	360				700	25

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Fourth Semester												
25MTP4CA	Core - XV	Mathematical Methods	4	1	-	5	60	3	25	75	100	4
25MTP4CB	Core - XVI	Distribution Theory	4	1	-	5	60	3	25	75	100	4
25MTP4CV	Core - XVII	Project and Viva voce	-	-	16	16	192	3	80	120	200	8
25MTP4DA	DSE -IV	Boundary Layer Theory	4	-	-	4	48	3	25	75	100	4
25MTP4DB		Lie Algebra				4	48					
25MTP4DC		Mathematical Ecology				4	48					
		Total				30	360				500	20
												92

DISCIPLINE SPECIFIC ELECTIVE

Students shall select the desired course of their choice in the listed elective course during Semesters I to IV

Semester I (Elective I)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	25MTP1DA	Numerical Analysis
2.	25MTP1DB	Commutative Algebra
3.	25MTP1DC	Mathematical Modeling

Semester II (Elective II)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	25MTP2DA	Wavelet Analysis
2.	25MTP2DB	Information and Coding Theory
3.	25MTP2DC	Mathematical Finance

Semester III (Elective III)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	25MTP3DA	Finite Element Theory
2.	25MTP3DB	Algebraic Number Theory
3.	25MTP3DC	Actuarial Mathematics

Semester IV (Elective IV)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	25MTP4DA	Boundary Layer Theory
2.	25MTP4DB	Lie Algebra
3.	25MTP4DC	Mathematical Ecology

EXTRA CREDIT COURSES

Self-study paper offered by the Mathematics Department

S. No.	Course Code	Course Title
1.	25MTPSSA	Research Methodology, IPR and Entrepreneurship
2.	25MTPSSB	Mathematics of Bioinformatics

Semester – I CORE: ALGEBRA							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	25MTP1CA	ALGEBRA	CORE	48	12	-	4

Preamble	This course has been designed for students to learn and understand • elementary group theory and how to solve contemporary problems • elementary principles on certain algebraic structures • Sylow's theorems that describe the structure of certain finite groups
Prerequisite	Knowledge on understanding of numbers, ratios, proportions, the order of operations, equality, algebraic symbolism, algebraic equations and functions.

Course Outcomes (Cos)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	define the orbits and p-groups	K1
CO2	apply Sylow theory in the factorization of polynomials	K2
CO3	analyze the structure of finite fields	K3
CO4	explain the applications of automorphisms and isomorphism	K5
CO5	explain the applications of Galois theory	K5

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓	✓	✓
CO2				✓	✓
CO3		✓		✓	
CO4		✓	✓		
CO5	✓	✓	✓		✓

25MTP1CA	CORE: ALGEBRA

Syllabus

Unit	Content	Hrs	Resources
I	**Direct Products** External direct products - internal direct products. group action on a set - fixed sets and isotropy subgroups – orbits - application on G-sets to counting: p-groups - Sylow theorems.	12	Text Book
II	**Applications of the Sylow Theory and Rings of Polynomials** Applications to p-groups and the class equation - further applications. Rings of polynomials: polynomials in an indeterminate - evaluation homomorphisms - division algorithm in $F[x]$ - irreducible polynomials – ideal structure in $F[x]$ - uniqueness of factorization in $F[x]$.	11	Reference Book
III	**Introduction to Extension Fields** Extension fields - algebraic and transcendental elements - irreducible polynomial for α over F - simple extensions - Algebraic extensions: finite extensions – algebraically closed and algebraic closures.	13	Text Book
IV	**Automorphisms of Fields** Basic isomorphism of algebraic field theory - automorphisms and fixed fields - Frobenius automorphism - isomorphism extension theorem: extension theorem - splitting fields.	14	Text Book
V	**Separable Extensions and Galois Theory** Multiplicity of zeros of a polynomial - separable extensions- perfect fields - normal extensions - the main theorem - Galois group over finite fields - illustrations of Galois theory: symmetric functions.	10	Text Book & You Tube Videos
	Total	**60**	

Text book	1.	Fraleigh J.B, 2003,"A First Course in Abstract Algebra", Third Edition, Narosa Publishing House, New Delhi.
Reference Books	1.	Herstein I.N, 2007, "Topics in Algebra", Second Edition, Narosa Publishing House, New Delhi.
	2.	Artin M, 1991, "Algebra", Prentice-Hall of India, New Delhi.
	3.	Hall HS and Knight SR, 2016,"Higher Algebra", Sixth Edition, Arihant Publications, New Delhi.
	4.	Anderson M and Feil T, 2014, "A First Course in Abstract Algebra Rings, Groups, and Fields", Third Edition, Chapman and Hall/CRC, London.

Journal and Magazines	https://www.sciencedirect.com/journal/journal-of-algebra
E-Resources and Website	https://www.uou.ac.in/lecturenotes/science/MSCMT-19/unit%201.pdf

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/Employability

Semester – I CORE: ADVANCED ANALYSIS							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	25MTP1CB	ADVANCED ANALYSIS	CORE	48	24	-	4

Preamble	This course has been designed for students to learn and understand • the concept of Riemann Stieltjes integral • the inverse and Implicit function theorems • about the concept of Lebesgue measure and Lebesgue integral.
Prerequisite	Knowledge on basic Mathematics

Course Outcomes (Cos)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	identify the Riemann Stieltjes Integral of various real functions	K1
CO2	describe the properties of various forms of Uniform convergence and continuity	K2
CO3	discuss the concept behind contraction principle of a function	K3
CO4	demonstrate the Lebesgue measure and its properties	K4
CO5	apply the properties of The Lebesgue integral to the bounded functions.	K5

Mapping with Program Outcomes:					
Cos / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	✓	✓	✓	✓	✓
CO2	✓	✓		✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓		✓	
CO5	✓	✓		✓	

25MTP1CB	CORE: ADVANCED ANALYSIS

Syllabus

Unit	Content	Hrs	Resources
I	**Riemann Stieltjes Integral** Definition and existence of the integral – properties of the integral – integration and differentiation – integration of vector valued function – rectifiable curves.	15	Text Book 1
II	**Sequences and Series of Functions** Uniform convergence and continuity – uniform convergence and integration - uniform convergence and differentiation – equicontinuous families of functions – the Stone Weierstrass theorem.	14	Text Book 1
III	**Functions of Several Variables** Linear transformation – contraction principle – inverse function theorem – implicit function theorem.	14	Text Book 1
IV	**Lebesgue Measure** Outer measure – measurable sets and Lebesgue measure – measurable functions – Littlewood's theorem.	14	Text Book 2
V	**Lebesgue Integral** The Lebesgue integral of bounded functions over a set of finite measure – integral of a non – negative function – general Lebesgue integral.	15	Text Book 2
	Total	72	

Text book	1.	Walter Rudin, 1976, "Principles of Mathematical Analysis", McGraw Hill, New York.
	2.	Roydon H.L., 1988, "Real Analysis", Third Edition, Macmillan, New York.
Reference Books	1.	Bartle R. G., 1976, "Elements of Real Analysis", Second Edition, John Wiley and Sons, New York.
	2.	Mainak Mukherjee, 2015, "A course in Real Analysis", Narosa publishing house, New Delhi.
	3.	Tom M Apostol, 2002, "Mathematical Analysis", Narosa Publishing House Pvt Ltd., Second Edition, New Delhi.
	4.	Somasundaram D and Choudhary B, 2015, "A first course in Mathematical Analysis", Narosa Publishing House, New Delhi.

Journal and Magazines	https://www.worldscientific.com/worldscinet/bms
E-Resources and Website	https://mathcs.org/analysis/reals/integ/measures.html https://archive.nptel.ac.in/courses/111/106/111106153/ https://onlinecourses.nptel.ac.in/noc22_ma43/preview

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/Employability

Semester – I CORE: ORDINARY DIFFERENTIAL EQUATIONS							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	25MTP1CC	ORDINARY DIFFERENTIAL EQUATIONS	CORE	48	12	-	4

Preamble	This course has been designed for students to learn and understand • the first order and second order ordinary differential equations • the usages of power series method to solve differential equations • the homogenous and non-homogenous order ordinary differential equations
Prerequisite	Knowledge on Differential Equations

Course Outcomes (Cos)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	define Legendre and Bessel equations	K2
CO2	describe the concept of fundamental matrix of system	K3
CO3	apply Lipschitz condition in mathematical problems	K3
CO4	inspect the existence and uniqueness of solutions	K4
CO5	analyze the solution using oscillatory theorems	K5

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	✓
CO2		✓	✓		
CO3	✓	✓		✓	
CO4			✓		
CO5	✓	✓		✓	✓

25MTP1CC	CORE: ORDINARY DIFFERENTIAL EQUATIONS

Syllabus

Unit	Content	Hrs	Resources
I	**Solutions in power series** Introduction - second order linear equations with ordinary points - Legendre equation and Legendre polynomials - second order equation with regular singular point - properties of Bessel functions.	12	Text Book
II	**System of Linear differential equations** System of first order equations - model for ARMS competition between two nations - existence and uniqueness theorem - fundamental matrix.	11	Text Book & NPTEL
III	**Non-homogeneous linear system** Non-homogeneous linear systems - linear system with constant coefficients - linear systems with periodic coefficients.	10	Text Book
IV	**Existence and uniqueness of solutions** Preliminaries - successive approximations - Picard's theorem- some examples - continuation and dependence on initial conditions - existence of solutions in the large - existence and uniqueness of solutions of system.	13	Reference Book
V	**Oscillations of second order equations** Fundamental results - Sturm's comparison theorem - elementary linear oscillations - comparison theorem of Hille - Winter - oscillations of x '' +a(t)x=0.	14	Text Book & You Tube Videos
	Total	**60**	

Text book	1.	Deo S.G, Lakshmikandham V and Raghavendra V, 2007, "Text book of Ordinary Differential Equations", Second Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.
Reference Books	1.	Reid W.T, 1971, "Ordinary Differential Equations", John Wiley & sons, New York.
	2.	Coddington E.A and Levinson N, 2006, "Theory of Ordinary Differential Equations", Tata McGraw-Hill Publishing Company Limited, New Delhi.
	3.	Tesch I.G., 2012, "Ordinary Differential Equations and Dynamics Systems", American Mathematical Society, Providence.
	4.	Coddington E A, 2006, "An introduction to Ordinary Differential Equations", PHI Private Limited, New Delhi.

Journal and Magazines	https://www.worldscientific.com/worldscinet/bms
E-Resources and Website	https://www.sciencedirect.com/topics/mathematics/system-of-ordinary-differential-equations

Learning Method	Chalk and Talk/ Assignment/Seminar
Focus of the Course	Skill Development/ Employability

Semester – I CORE: OPERATIONS RESEARCH							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	25MTP1CD	OPERATIONS RESEARCH	CORE	48	12	-	4

Preamble	This course has been designed for students to learn and understand • the dynamic, integer programming and decision analysis • concept of queueing and inventory • how to solve the queueing models.
Prerequisite	Knowledge on basic Mathematics

Course Outcomes (Cos)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	illustrate the characteristics of dynamic programming problem.	K2
CO2	derive importance of integer programming.	K5
CO3	explain the concept of Markov chain and Markov process in decision making	K3
CO4	analyze the behavior of various queueing models.	K4
CO5	analyze the applications of inventory.	K4

Mapping with Program Outcomes:					
Cos / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	✓		✓		
CO2		✓			✓
CO3	✓			✓	
CO4		✓	✓		✓
CO5	✓				✓

25MTP1CD	CORE: OPERATIONS RESEARCH

Syllabus

Unit	Content	Hrs	Resources
I	**Dynamic Programming** Prototype example for dynamic programming - characteristics of dynamic programming problems - deterministic dynamic programming.	12	Text Book
II	**Integer Programming** Prototype example - some BIP applications - innovative uses of binary variables in model formulation - some formulation examples - some perspectives on solving integer programming problems.	12	Text Book
III	**Decision Analysis** Prototype example - decision making without experimentation - decision making with experimentation - decision trees, Markov chains: Stochastic processes - Markov chains.	12	Text Book
IV	**Queueing Theory** Prototype example - basic structure - examples of real queueing systems - role of the exponential distribution – birth and death process - queueing models based on birth and death process.	12	Text Book
V	**Inventory Theory** Examples - components - deterministic continuous and periodic review model - deterministic multiechelon inventory model for supply chain management.	12	Text Book/ You Tube Videos
	Total	**60**	

Text book	1.	Frederick S. Hillier and Gerald J. Lieberman, 2010,"Introduction to Operations Research ", Nineth Edition, McGraw-Hill Companies, New Delhi.
Reference Books	1.	Taha H.A, 2006, "Operations Research: An Introduction", Eighth Edition, Prentice-Hall of India Private Limited, New Delhi.
	2.	Kandiswarup, Gupta P.K and Man Mohan, 1998,"Operations Research", S. Chand & Sons Education Publications, New Delhi.
	3.	Ravindran, Phillips D.T and Solberg J.J, 2005, "Operations Research-Principles and Practice", John Wiley & Sons, New Jersey.
	4.	Er Prem Kumar Gupta and Dr. D. S. Hira , "Introduction to Operations Research", Revised Edition, S. Chand & Company Pvt Ltd., New Delhi.

Journal and Magazines	https://www.worldscientific.com/worldscinet/bms
E-Resources and Website	https://nptel.ac.in

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/ Employability

Semester – I CORE: ADVANCED STATISTICS							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
I	25MTP1CE	ADVANCED STATISTICS	CORE	36	24	-	3

Preamble	This course has been designed for students to learn and understand • the procedure of finding estimation • the methods of testing hypothesis under various conditions • the importance of linear regression models
Prerequisite	Knowledge on Basic Statistics

Course Outcomes (Cos)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	define the point estimation.	K1
CO2	identify the confidence intervals for population variance and population parameters	K2
CO3	explain the procedures for hypothesis testing	K3
CO4	analyze the linear regression models and method of solving its variance	K4
CO5	apply various types of non-parametric test to validate hypothesis	K5

Mapping with Program Outcomes:					
Cos / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1		✓		✓	
CO2	✓			✓	
CO3	✓	✓			✓
CO4			✓	✓	
CO5	✓	✓			✓

25MTP1CE	CORE: ADVANCED STATISTICS

Syllabus

Unit	Content	Hrs	Resources
I	**Point Estimation** Introduction – method of moments and maximum likelihood – some desirable properties of point estimators – other desirable properties.	12	Text Book
II	**Interval Estimation** Introduction – large sample confidence intervals: one sample case - small sample confidence intervals for μ-A confidence interval for the population variance - confidence interval concerning two population parameters.	12	Reference Book
III	**Hypothesis Testing** Introduction – Neyman – Pearson - likelihood ratio test – hypotheses for a single parameter - testing of hypotheses for two samples - Chi-Square tests for count data.	12	Text Book
IV	**Linear Regression Models** Introduction – simple linear regression model - inferences on the least square estimators - predicting a particular value.	12	Text Book
V	**Non-parametric Tests** Introduction – nonparametric confidence interval - nonparametric hypothesis tests for one sample - nonparametric hypothesis tests for two independent samples -nonparametric hypothesis tests for $k \geq 2$ sample.	12	Text Book/ You Tube Videos
	Total	**60**	

Text book	1.	Kandethody M. Ramachandran, Chris P and Tsokos, 2009, "Mathematical Statistics with Applications", Elsevier, Haryana.
Reference Books	1.	Irwin Miller and Marylees Miller, John E. Freund's, 2007,"Mathematical Statistics with Applications", Seventh Edition, Prentices-Hall India Pvt Ltd, New Delhi.
	2.	Hogg and Craig, 2003"Introduction to Mathematical Statistics", Pearson Education, New Delhi.
	3.	J.M. Kapur and H.C. Saxena, 2001, "Mathematical Statistics", S. Chand & Co, New Delhi.
	4.	Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying E. Ye, 2018, Probability and Statistics, Pearson Education, South Asia.

Journal and Magazines	www.isaacpub.org/AboutThisJournal.aspx?ids=2
E-Resources and Website	https://www.lkouniv.ac.in/site/writereaddata/siteContent/ 20200416062602362 4Rajiv_Saksena_Advance_Statistical_Inference.pdf

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/ Employability

Semester – I DSE : NUMERICAL ANALYSIS							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
I	25MTP1DA	NUMERICAL ANALYSIS	DSE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • the method of solving nonlinear equations • analyze the solution of ordinary differential equations • analyze the convergence of various methods.
Prerequisite	Knowledge on basic Mathematics

Course Outcomes (Cos)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	apply the numerical method to solve nonlinear equations	K2
CO2	categorize the system of equations and solve by appropriate method	K3
CO3	examine the solution got by applying various of numerical differentiation and integration methods	K3
CO4	apply the Taylor's method to differential equations	K4
CO5	analyze the nature of solution of one and two dimensional partial differential equations.	K5

Mapping with Program Outcomes:					
Cos / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2	✓				
CO3	✓				
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

25MTP1DA	DSE: NUMERICAL ANALYSIS

Syllabus

Unit	Content	Hrs	Resources
I	**Nonlinear Equations** Interval halving (Bisection) revisited - linear interpolation methods - Newton's method -fixed-point iteration: $x = g(x)$ method - multiple roots -nonlinear systems.	10	Text Book
II	**Solving System of Equations** Matrices and vectors - elimination methods - the inverse of a matrix and matrix pathology - iterative methods - parallel processing.	10	Text Book
III	**Numerical Differentiation and Integration** Numerical integration - Trapezoidal Rule - Simpson's rules - Fourier series and Fourier transforms - adaptive integration - gaussian quadrature - multiple integrals - applications of cubic splines.	10	Text Book
IV	**Numerical Solution of Ordinary Differential Equations and Optimization** Taylor-Series Method - Euler method and its modifications - Runge-Kutta methods - multistep methods - higher-order equations and systems. Optimization: Finding the minimum of $y = f(x)$ - minimizing a function of several variables-linear programming.	9	Text Book
V	**Numerical Solutions of Partial-Differential Equations** Elliptic equations - parabolic equations - hyperbolic equations - finite elements for ordinary and partial differential equations.	9	Text Book
	Total	48	

Text book	1.	Gerald C. F. and Wheatley P. O., 1999, "Applied Numerical Analysis", 7th Edition, Pearson Education, New York.
Reference Books	1.	Smith. G. D., 1985, "Numerical Solution of Partial Differential Equations – Finite Difference Methods", Oxford University Press, Oxford.
	2.	Jain M. K., Iyengar S. R. K. and Jain R. K., 1993, "Numerical Methods for Scientific and Engineering Computation", 3rd Edition, Wiley Eastern Ltd, Noida.
	3.	Marghitu D. B. and Dupac M., 2012, "Advanced Dynamics: Analytical and Numerical Calculations with MATLAB", Springer, New York.
	4.	Samuel Conte D. and Boor C. D., 1983, "Elementary Numerical Analysis", McGraw- Hill International Edition, New Delhi.

Journal and Magazines	https://www.sciencedirect.com/journal/applied-numerical-mathematics,
E-Resources and Website	https://www.math.wsu.edu/math/kcooper/M448/resources.php, https://nptel.ac.in

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/Employability

Semester – I DSE : COMMUTATIVE ALGEBRA							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	25MTP1DB	COMMUTATIVE ALGEBRA	DSE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • the concepts of ideals and modules through examples • the properties to decompose the Noetherian and Artin rings • the importance of dimension theory of rings and modules
Prerequisite	Knowledge on Modern Algebra

Course Outcomes (Cos)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	define new modules using operations like tensor product and other operations	K1
CO2	discuss the construction of field	K2
CO3	demonstrate the concept of integral dependence of extension ring and chain conditions of modules	K3
CO4	analyze the importance of discrete valuation of rings and dedekind domains	K4
CO5	summarize the various forms of dimension theory and its influence in local rings	K5

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓		✓	✓	✓
CO3	✓	✓		✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓		✓	✓

25MTP1DB	DSE: COMMUTATIVE ALGEBRA

Syllabus

Unit	Content	Hrs	Resources
I	**Rings and Ideals** Rings and ring homomorphisms - ideals - quotient rings - zero divisors, nilpotent elements, units - prime ideal and maximal ideals - nilradical and Jacobson radical - operations on ideals - extension and contraction. Modules: modules and module homomorphisms – submodulus and quotient modulus - operations on submodules - finitely generated modulus.	09	Text Book
II	**Rings, modules of fractions and primary decomposition** Local properties - extended and contracted ideals in rings of fractions - primary decomposition.	09	Reference Book
III	**Integral dependence and valuations** Integral dependence - the going up theorem -Integrally closed integral domains - the going down theorem - valuation rings - Chain conditions.	09	Text Book
IV	**Noetherian rings, artin rings, Discrete valuation rings and Dedekind domains** Primary decomposition in Noetherian rings - artin rings - structure theorem for artin rings - discrete valuation rings - dedekind domains - fractional ideals.	09	Text Book /NPTEL
V	**Completions and Dimension Theory** Topologies and completions - filtrations - graded rings and modules - the associated graded ring - Hilbert functions - dimension theory of Noetherian local rings - regular local rings - transcendental dimension.	12	Text Book /You Tube Videos
	Total	**48**	

Text book	1.	Atiyah-Macdonald, 1994, "Commutative Algebra", Westview Press, London.
Reference Books	1.	Zariski and Samuel, 1991, "Commutative Algebra I, II", Springer, New York.
	2.	Eisenbud, 1995, "Commutative Algebra with a View Towards Algebraic Geometry", Springer, New York.
	3.	Bourbaki, 1989, "Commutative Algebra", Springer, New York.
	4.	Herstein I N, 2000, "Topics in Algebra", Second Edition, John Wiley and Sons, New Jersey.

Journal and Magazines	https://www.worldscientific.com/worldscinet/bms
E-Resources and Website	https://nptel.ac.in

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/Employability

Semester – I DSE: MATHEMATICAL MODELING							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	25MTP1DC	MATHEMATICAL MODELING	DSE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • the deterministic states and analysis of models • the stochastic analysis of models • various evolution of models
Prerequisite	Knowledge on Basic Mathematics

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	describe the optimal power and exponential models	K2
CO2	discuss the dimensional analysis and similarity	K2
CO3	apply the concept of probability density function to define stochastic states	K3
CO4	analyze the properties of various forms of changes using modeling	K4
CO5	develop the models for situations involving evolution theory	K5

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		
CO2	✓		✓		
CO3		✓		✓	
CO4			✓	✓	
CO5		✓		✓	✓

25MTP1DC	DSE: MATHEMATICAL MODELING

Syllabus

Unit	Content	Hrs	Resources
I	**Deterministic Analysis of Observations** Data transformations: Linear model – polynomial models – population modeling – global warming modeling - model errors – optimal linear models – optimal quadratic models – optimal power and exponential models.	9	Text Book
II	**Deterministic States** Dimensional analysis and similarity - applications of low-complexity – applications of medium complexity- time measurement - applications of high-complexity.	10	Text Book & Reference Book
III	**Stochastic States** Probability density functions – models for probability density functions – data analysis – real distribution.	9	Text Book
IV	**Deterministic and stochastic Changes** Linear changes - linear changes with delays - nonlinear changes - linear stochastic changes - diffusion - Brownian motion - population dynamics.	10	Text Book
V	**Deterministic and Stochastic Evolution** Heat and Mass Transfer: Balance – Newton's laws of motion: oscillations – population ecology: growth and self-limitation – oscillations and collapse - PDF evolution equations - Solutions to the Fokker Plank equation.	10	Text Book & You Tube Videos
	Total	**48**	

Text book	1.	Stefen Heinz, 2011,"Mathematical Modeling", Springer-Verlag, New York.
Reference Books	1.	Kapur J.N., 1998, "Mathematical Modeling", New Age International (P) Limited, New Delhi.
	2.	Crossand and Moscrcadini A.O, 1976,"The Art of Mathematical Modeling", Ellis Harwood and John Wiley, New York.
	3.	Sarah. P.Otto and Troy Day, 2000, "A Biologist guide to Mathematical Modeling in Ecology and Evolution", Princeton University Press, Princeton.
	4.	Frank. R.Glordance, Maurice D. Weir and William P.Fox, 2003, "A First course in Mathematical Modeling", Thomson Learning, London.

Journal and Magazines	https://www.sciencedirect.com/journal/applied-mathematical-modelling
E-Resources and Website	https://en.wikipedia.org/wiki/Mathematical_model#:~:text=A%20mathematical%

Learning Method	Chalk and Talk/ Assignment/Seminar

Focus of the Course	Skill Development/Employability