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

# REGULATIONS 2024-25 for Post Graduate Programme (Outcome Based Education model with Choice Based Credit System)

#### M.Sc. Degree

(For the students admitted during the academic year 2024-25)

**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 expected outcomes.

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
P03	They can be able to communicate clearly in writing and orallying the detailed technical arguments of complex Mathematical concepts
P04	The students develop problem solving skill and apply them independently to problems in pure and applied Mathematics
P05	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.
	Core	16-18	$ 13 \times 04 = 52 \\ 02 \times 03 = 06 \\ 01 \times 05 = 05 $	I - IV
	Elective	04	04 x 04 = 16	I - IV
III	EDC	01	$01 \times 03 = 03$	II
	Industrial Training	01	$01 \times 02 = 02$	III
	Project Work	01	$01 \times 08 = 08$	IV .
	TOTAL CREDITS	92		

#### PG CURRICULUM

## M.Sc. MATHEMATICS – AY 24-25

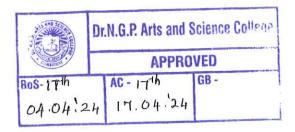
Course Code	Course Category	Course Name	L	Т	P	Instru Ho		Exa m (h)	N	Iax M	Iarks	Credits
Couc						Week	Total					
						=			CIA	ESE	Total	
First Semester		•	•									
24MTP1CA	Core - I	Algebra	4	1	-	5	60	3	25	75	100	4
24MTP1CB	Core - II	Advanced Analysis	4	2	12	6	72	3	25	75	100	4
24MTP1CC	Core - III	Ordinary Differential Equations	4	1	-	5	60	3	25	75	100	4
24MTP1CD	Core - IV	Operations Research	4	1	-	5	60	3	25	75	100	4
24MTP1CE	Core - V	Advanced Statistics	3	2	-	5	60	3	25	75	100	3
24MTP1DA		Numerical Analysis				4	48					
24MTP1DB	DSE -I	Commutative Algebra	4	-	_	4	48	3	25	75	100	. 4
24MTP1DC		Mathematical Modeling				4	48					
	*	Total				30	360				600	23

Course Code	Course Category	Course Name	L	Т	P		uction ours	Exa m (h)	N	Iax M	arks	Credit
						Week	Total					
4									CIA	ESE	Total	
Second Semest	er											
24MTP2CA	Core - VI	Complex Analysis	4	1	-	5	60	3	25	75	100	4
24MTP2CB	Core - VII	Topology	4	1	-	5	60	3	25	75	100	4
24MTP2CC	Core - VIII	Partial Differential Equations	4	1	-	5	60	3	25	75	100	4
24MTP2CM	Core -IX Practical	Computational Mathematics	3	-	4	7	84	3	40	60	100	5
24DAP2EB	EDC	Foundations of Data Analytics	3	1	-	4	48	3	25	75	100	3
24MTP2DA		Wavelet Analysis				4	48					
24MTP2DB	DSE -II	Information and Coding Theory	4	-	-	4	48	3	25	75	100	4
24MTP2DC		Mathematical Finance				4	48					
		Total				30	360				600	24

Course Code	Course Category	Course Name	L	Т	P		uction urs	Exa m (h)	, N	Max N	<b>J</b> arks	Credits
. (		-				Week	Total					
×									CIA	ESE	Total	ac
Third Semeste	r											
24MTP3CA	Core - X	Functional Analysis	4	1	-	5	60	3	25	75	100	4
24MTP3CB	Core - XI	Classical Mechanics	3	2	-	5	60	3	25	75	100	3
24MTP3CC	Core - XII	Stochastic Differential Equations	4	2	-	6	72	3	25	75	100	4
24MTP3CD	Core -XIII	Advanced Graph Theory	4	1	-	5	60	3	25	75	100	4
24MTP3CE	Core - XIV	Fluid Dynamics	4	1	-	5	60	3	25	75	100	. 4
24MTP3CT	IT	Industrial Training	-	-	-	-	ï	1	40	60	100	2
24MTP3DA		Finite Element Theory				4	48	3	25	75	100	4
24MTP3DB	DSE -III	Algebraic Number Theory	4	-	-	4	48					
24MTP3DC		Actuarial Mathematics				4	48					
ii ii		Total				30	360				700	25

Course	Course Category	Course Name	L	Т	P	Instru Ho		Exa m (h)	N	1ax M	arks	Credits
Code						Week	Total		CIA	ESE	Total	
Fourth Semes	ter								l·			
24MTP4CA	Core - XV	Mathematical Methods	4	1	-	5	60	3	25	75	100	4
24MTP4CB	Core - XVI	Distribution Theory	4	1	-	5	60	3	25	75	100	- 4
24MTP4CV	Core - XVII	Project	1.00	-	16	16	192	3	80	120	200	8
24MTP4DA	5	Boundary Layer Theory				4	48	3	25	75	100	4
24MTP4DB	DSE -IV	Lie Algebra	4	=	-	4	48					2
24MTP4DC		Mathematical Ecology				4	48					
		Total				30	360				500	20
										1 1		92

BoS Chairman/HoD
Department of Mathematics
Dr. N. G. P. Arts and Science College
Coimbatore – 641 048





## 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.	<b>Course Code</b>	Name of the Course
1.	24MTP1DA	Numerical Analysis
2.	24MTP1DB	Commutative Algebra
3.	24MTP1DC	Mathematical Modeling

## Semester II (Elective II)

#### **List of Elective Courses**

S. No.	<b>Course Code</b>	Name of the Course
1.	24MTP2DA	Wavelet Analysis
2.	24MTP2DB	Information and Coding Theory
3.	24MTP2DC	Mathematical Finance

#### Semester III (Elective III)

#### **List of Elective Courses**

S. No.	Course Code	Name of the Course
1.	24MTP3DA	Finite Element Theory
2.	24MTP3DB	Algebraic Number Theory
3.	24MTP3DC	Actuarial Mathematics

#### Semester IV (Elective IV)

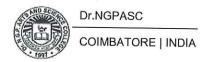
#### **List of Elective Courses**

S. No.	Course Code	Name of the Course
1.	24MTP4DA	Boundary Layer Theory
2.	24MTP4DB	Lie Algebra
3.	24MTP4DC	Mathematical Ecology

#### EXTRA CREDIT COURSES

## Self-study paper offered by the Mathematics Department

S. No.	Course Code	Course Title
1.	24MTPSSA	Research Methodology, IPR and Entrepreneurship
2.	24MTPSSB	Mathematics of Bioinformatics



#### Semester - I CORE - I : ALGEBRA

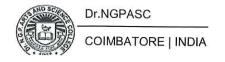
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MTP1CA	ALGEBRA	CORE	48	12	-	4

Preamble	This course has been designed for students to learn and understand
	<ul> <li>elementary group theory and how to solve contemporary problems</li> <li>elementary principles on certain algebraic structures</li> </ul>
100 C	<ul> <li>Sylow's theorems that describe the structure of certain finite groups</li> </ul>
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	К3
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	<b>✓</b>		<b>✓</b>	✓ ·	✓	
CO2				✓	✓	
CO3		<b>✓</b>	0	1		
CO4		<b>✓</b>	<b>✓</b>			
CO5	✓	<b>✓</b>	1		1	



Unit	Content	Hours	E-Contents / 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
ш	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
ш	Introduction to Extension Fields: Extension fields - algebraic and transcendental elements - irreducible polynomial for $\alpha$ 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
<b>V</b> *	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	, second Edition, runosa i donsting House,				
	2.	Artin M, 1991, "Algebra", Prentice-Hall of India, New Delhi.			
	3.	Fraleigh J.B, 2014,"A First Course in Abstract Algebra", Seventh Edition, Pearson Education Limited, London.			
	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	T	
E-Resources and Website	https://www.uou.ac.in/lecturenotes/science/MSCMT-19/unit%201.pdf	Я

Learning Method	Chalk and Talk/Assignment/Seminar	
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Focus of the Course Skill Development/Employability	
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## Semester - I CORE - II : ADVANCED ANALYSIS

Semester	Course Code	Course Name	Category	L	Т	P	Credits
I	24MTP1CB	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 Outco	mes (COs)

#### CO Course Outcomes (COs) Statement Bloom's Taxonomy Number **Knowledge Level** CO<sub>1</sub> identify the Riemann Stieltjes Integral of various real functions K1 describe the properties of various forms of Uniform CO<sub>2</sub> K2 convergence and continuity discuss the concept behind contraction principle of a function K3 CO<sub>3</sub> K4 demonstrate the Lebesgue measure and its properties CO<sub>4</sub> apply the properties of The Lebesgue integral to the bounded K5 CO<sub>5</sub> functions

Mapping with	Mapping with Program Outcomes:						
COs / POs	PO1	PO2	PO3	PO4	PO5		
CO1	✓	<b>✓</b>	<b>✓</b>	✓	✓		
CO2	<b>✓</b>	<b>✓</b>		✓	✓ .		
CO3	✓	<b>✓</b>	✓°	✓	✓		
CO4	✓	1		✓			
CO5	<b>✓</b>	1		✓			

#### 24MTP1CB - ADVANCED ANALYSIS

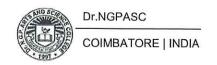
Unit	Content	Hours	E-Contents / Resources
I	Riemann Stieltjes Integral:  Definition and existence of the integral – properties of the integral – integration and differentiation – integration of vector valued function – rectifiable curves.	15	Text Book 1
п	Sequences and Series of Functions:  Uniform convergence and continuity – uniform convergence and integration - uniform convergence and differentiation – equicontinuous families of functions – the Stone Weierstrass theorem.	14	Text Book 1
Ш	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
43	Total	72	

Text Book	1.	Walter Rudin, 1976, "Principles of Mathematical Analysis", McGraw Hill, New York. [Unit I & II : Chapter 6 & 7.Unit III: Chapter 9 (Pages 204 to 227)]
	2.	Roydon H.L., 1988, "Real Analysis", Third Edition, Macmillan, New York.  [Unit IV: Chapter 3 (except Section – 4), Unit V: Chapter 4 (Sections 2, 3 & 4 only)]
Reference Books	1.	Bartle R. G., 1976, "Elements of Real Analysis", Second Edition, John Wily 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.
ď	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	https://mathcs.org/analysis/reals/integ/measures.html
Website	https://archive.nptel.ac.in/courses/111/106/111106153/
	https://onlinecourses.nptel.ac.in/noc22_ma43/preview

Learning Method	Chalk and Talk/Assignment/Seminar	
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Focus of the Course Skill Development/Emp	oloyability
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# Semester - I CORE - III : ORDINARY DIFFERENTIAL EQUATIONS

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MTP1CC	ORDINARY DIFFERENTIAL EQUATIONS	CORE	48	12	-	4

Preamble	<ul> <li>This course has been designed for students to learn and under the first order and second order ordinary differential the usages of power series method to solve differential the homogenous and non-homogenous order ordinal</li> </ul>	l equations tial equations	
Prerequisi	te Knowledge on Ordinary Differential Equations and its appl	ications	
Course Ou	tcomes (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	К3	
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	✓	<b>✓</b>		✓	✓	
CO2	\$1	<b>✓</b>	✓		#	
CO3	✓	✓		✓		
CO4			✓			
CO5	✓	✓		<b>✓</b>	✓	

## 24MTP1CC - ORDINARY DIFFERENTIAL EQUATIONS

Unit	Content	Hours	E-Contents / 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 theoremsome 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 $x$ " $+a(t)x=0$		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	
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Focus of the Course	Skill Development/Employability	a -
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#### Semester - I CORE - IV: OPERATIONS RESEARCH

Semester	Course Code	Course Name	Category	L	Т	P	Credits
I	24MTP1CD	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				
Prerequisit	e Knowledge on basic Mathematics			
Course Ou	tcomes (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			1		✓		
CO5	✓	✓			1		

Unit	Content	Hours	E-Contents / Resources
I	Dynamic Programming:  Prototype example for dynamic programming - characteristics of dynamic programming problems - deterministic dynamic programming.	12	Text Book
п	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
ш	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.	rederick S. Hillier and Gerald J. Lieberman, 2010,"Introduction to Operations Research, Nineth Edition, McGraw-Hill Companies, New Delhi			
Reference Books	Reference Taha H.A, 2006, "Operations Research: An Introduction", Eighth Edition, Pren				
	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.	Hillier F and Lieberman G, 2010, "Introduction to Operations Research", Nineth Edition, McGraw-Hill Professional, 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
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Focus of the Course	Skill Development/Employability
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#### Semester - I CORE - V: ADVANCED STATISTICS

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

Preamble	ditions					
Prerequisi	equisite Knowledge on Basic Mathematics					
Course Ou	tcomes (COs)					
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level				
CO1	define the point estimation	K1				
CO2	identity 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 it 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		1		1		
CO2	1			1		
CO3	1	1			1	
CO4			1	1		
CO5	1	1			1	

Unit	Content	Hours	E-Contents / Resources
I	Point Estimation: Introduction - method of moments and maximum likelihood - some desirable properties of point estimators - other desirable properties.	12	Text Book
и	Interval Estimation: Introduction – large sample confidence intervals: one sample case - small sample confidence intervals for $\mu$ -A confidence interval for the population variance - confidence interval concerning two population parameters.	12	Reference Book
Ш	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.
y.	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/ 202004160626023624Rajiv_Saksena_Advance_Statistical_Inference.pdf

Learning Method	Chalk and Talk/Assignment/Seminar	
	8	

#### Semester - I **DSE 1: NUMERICAL ANALYSIS**

Semester	Course Code	Course Name	Category	L	Т	P	Credits
I	24MTP1DA	NUMERICAL ANALYSIS	DSE	48	-	-	4

Preamble	<ul> <li>This course has been designed for students to learn and unde</li> <li>the method of solving nonlinear equations</li> <li>analyze the solution of ordinary differential equations</li> <li>analyze the convergence of various methods</li> </ul>	
Prerequisite	e Knowledge on basic Mathematics	
Course Out	comes (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	K5

Lapping with	Program Outco	omes:			
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1					
CO2	<b>✓</b>			2	
CO3	✓				
CO4	✓	✓	<b>✓</b>	1	<b>✓</b>
CO5	<b>✓</b>	✓	✓	<b>√</b>	<b>✓</b>

**CO5** 

dimensional partial differential equations

#### 24MTP1DA - NUMERICAL ANALYSIS

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Unit	Content	Hours	E-Contents / 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.	09	Text Book
V	Numerical Solutions of Partial-Differential Equations:  Elliptic equations - parabolic equations - hyperbolic equations - finite elements for ordinary and partial differential equations.	09	Text Book
ti.	Total	48	

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

## Semester - I DSE I: COMMUTATIVE ALGEBRA

Semester	Course Code	Course Name	Category	<b>L</b>	T	P	Credits
I	24MTP1DB	COMMUTATIVE ALGEBRA	DSE	48	8-0	-	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 Out	comes (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		

Sapping with	Program Outc	omes:			
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	<b>✓</b>	✓	1	✓	<b>✓</b>
CO2	✓		<b>✓</b>	✓	✓
CO3	✓	✓		✓	✓
CO4	1	1	<b>✓</b>	√ ·	✓
CO5	<b>✓</b>	1		<b>✓</b>	✓

#### 24MTP1DB - COMMUTATIVE ALGEBRA

Unit	Content	Hours	E-Contents / 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	09	Text Book
	submodules - finitely generated modulus.  Rings, modules of fractions and primary decomposition:		
II	Local properties - extended and contracted ideals in rings of fractions - primary decomposition.	09	Reference Book
Ш	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.
ø.	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	https://www.worldscientific.com/worldscinet/bms
Magazines	The state of the s
E-Resources and	https://nptel.ac.in
Website	
Learning Method	Chalk and Talk/Assignment/Source

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

#### Semester - I DSE I: MATHEMATICAL MODELING

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MTP1DC	MATHEMATICAL MODELING	DSE	48	-	-	4

Preamble	erstand	
Prerequisit	ke Knowledge on Basic Mathematics	
Course Ou	tcomes (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	К3
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	1	1	1		
CO2	1		~		
CO3		1		~	
CO4			~	~	(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)
CO5		1		<b>✓</b>	V

#### 24MTP1DC - MATHEMATICAL MODELING

Unit	Content	Hours	E-Contents / 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
П	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
Ш	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	

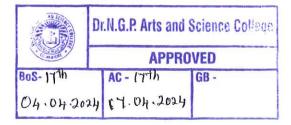
Text Book	1.	Stefen Heinz, 2011, "Mathematical Modeling", Springer-Verlag, New York.
Reference Books	1.	Kapur J.N., 1998, "Mathematical Modeling", New Age International (P) Limited, New Delhi.
9	2.	Crossand and Moscreadini A.O, 1976, "The Art of Mathematical Modeling", Ellis Harwood and John Wiley, New 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%20model%20is%20an,model%20is%20termed%20mathematical%20modeling.	*		

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/Employability	

BoS Chairman/HoD
Department of Mathematics
Dr. N. G. P. Arts and Science College
Coimbatore – 641 048





	Elv¥.	Semester - II CORE: COMPLEX ANA	ALYSIS	PACE S			
Semester	Course Code	Course Name	Category	L	T	P	Credits
II	24MTP2CA	COMPLEX ANALYSIS	CORE	48	12	-	4

D 11		
Preamble	<ul> <li>This course has been designed for students to learn and under the methods of integration with complex function.</li> <li>the existence and applications of conformal mapping the concept of elliptic functions</li> </ul>	
Prerequisi	te Real Analysis, Complex Variables	quini norol
Course Ou	atcomes (COs)	to enturis:)
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	apply the concept of analytic function and linear transformations.	K2
CO2	illustrate complex integration through Cauchy's integral formula.	К3
CO3	analyze the calculus of residues and evaluating complex integrals	m aname M — rotyndo K3
CO4	assess the boundary behavior at an angle through reflection principle	K4
CO5	examine the properties of simply periodic functions and doubly periodic functions.	roq Viqui K5

Mapping with	Program Outo	comes:	nen minioriales. Serai propenies c	i module – 3 snical Base – Ge	omag omas D
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	1		<b>✓</b>	<b>✓</b>	<b>✓</b>
CO2		✓	✓	<b>✓</b>	1
CO3	<b>✓</b>	<b>✓</b>	<b>✓</b>	✓	1
CO4	<b>✓</b>	<b>✓</b>	<b>✓</b>		
CO5	1	1	1		1

24MTP2CA

## CORE: COMPLEX ANALYSIS

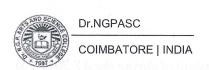
Unit	Content	Hours	E-Contents Resources
Ī	Complex integration:  Line integrals - Rectifiable arcs - Line integrals as functions of arcs - Cauchy's theorem for a rectangle - Cauchy's theorem in a disk - Cauchy's integral formula - Higher derivatives. Removable singularities - Taylor's theorem - Zeros and poles - Local mapping - Maximum principle.	14	Text Book
II Isvo.i	Calculus of residues:  Residue theorem – Argument principle – Evaluation of definite integrals. Mean-value property – Poisson's formula.	12	Text Book
Ш	Series and product developments:  Weierstrass's theorem – Taylor series – Laurent series. Partial fractions – Infinite products – Canonical products.	12	Text Book
IV	Riemann mapping theorem and applications:  Riemann mapping theorem – Statement and proof – Boundary behavior – Use of the reflection principle – Analytic arcs - behavior at an angle –Schwarz-Christoffel formula – Mapping on a rectangle	mila. yzc <mark>i f</mark> lic grals es die bi	Text Book
V	Elliptic Functions:  Simply periodic functions - The Fourier development - Functions of finite order - Doubly periodic functions - The period module - Unimodular transformations - the Cannonical Base - General properties of Elliptic functions - The Weierstrass p-function - The differential equations.	ciple othe func 11 rogram	Text Book
-8434	Total	60	

Text Book	1.	Ahlfors, Lars V, 2019, "Complex Analysis", 3rd Edition., McGraw-Hill, New Delhi.
Reference Books	1.	James Ward Brown and Churchill, Ruel V, 2013, "Complex Variables and Applications", 9th Edition., Tata McGraw Hill, New Delhi.
	2.	Joseph Bak and Newman, Donald J., 2010, "Complex Analysis", 3rd Edition, Springer, New York.
	3.	Kasana, H.S., 2005, "Complex Variables: Theory and Applications", 2nd Edition, PHI Learning, New Delhi
	4.	Conway, John B., 2000, "Functions of one Complex variable", 2nd Edition, Narosa Publication, New Delhi.

Journal and Magazines	https://onlinelibrary.wiley.com/journal/9372	Number
E-Resources and Website	https://nlist.inflibnet.ac.in/ https://www.youtube.com/watch?v=JPg4XFjDOW4	CO1 - C

Learning Method	Chalk and Board, Seminar
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Focus of the	Skill Davalanment/Employability
rocus of the	Skill Development/Employability
Course	
Course	Verging authorities of the control o



		Semester - II CORE: TOPOLO	GY				
Semester	Course Code	Course Name	Category	L	T	P	Credits
II	24MTP2CB	TOPOLOGY	CORE	48	12	-	4

Preamble	This course has been designed for students to learn and understand  the concept of topological Spaces  the countability and separation axioms  the influence of metric space in topology			
Prerequisit	e Real Analysis and Abstract Algebra			
Course Out	tcomes (COs)			
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level		
CO1	explain the concepts behind topological spaces	K1		
CO2	analyzing connectedness and compactness concepts	equal K3		
CO3	applying countability axioms to find the existence of countable set with certain properties	К3		
CO4	examine the properties of metric spaces	K4		
CO5	analyzing the concept of complete metric spaces and function spaces	K5		

Mapping with Program Outcomes:					
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	<b>√</b>	✓		✓	
CO2	✓	<b>✓</b>	✓		<b>√</b>
CO3	✓	<b>√</b>		✓	
CO4	<b>√</b>		✓	✓	
CO5	✓	✓	<b>√</b>	✓	<b>✓</b>

24MTP2CB

**CORE: TOPOLOGY** 

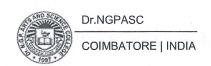
Unit	Content	Hours	E-Contents / Resources
I	Topological Spaces and Continuous Functions: Topological spaces – basis – order topology – subspace topology - closed sets and limit points – continuous functions – product topology – metric topology.	14	Textbook
II	Connectedness and compactness:  Connected Spaces – connected subspace of the real line R – components and local connectedness – compact spaces – compact subspaces of the real line - limit point compactness - local compactness.	12	Textbook
III	Countability and seperation axioms:  Countability axioms – separation axioms - normal spaces – Urysohn's Lemma – Urysohn metrization theorem - Tietz extension theorem.	/12 12	Textbook
IV	The Tychonoff Theorem, metrization Theorems and paracompactness:  Tychonoff Theorem - stone-cech compactification - local finiteness - Nagata-Smirnov metrization theorem - paracompactness - The Smirnov metrization theorem.	12	Textbook
V	Complete Metric spaces and Function Spaces:  Complete metric spaces – compactness in metric Spaces – pointwise and compact convergence - Ascoli's theorem.	10	Textbook
	Total	60	

Text Book	1.	Munkres, J. R., 2021, "Topology", 2 <sup>nd</sup> Edition., Prentice-Hall of India Private Limited, New Delhi
Reference Books	1.	Nainpally, S. and Peters, J, 2013, "Topology with Applications: Topological Spaces via Near and Far", World Scientific, Singapore.
	2.	Sze-Tsen Hu., 1966, "Introduction to General Topology", Holden-Day, INC., San Franscisco.
	3.	Adams and Franzosa, 2007, "Introduction to Topology: Pure and Applied", Pearson-Prentice Hall, New Delhi.
	4.	Simmons, G.F., 2004, "Introduction to topology and modern analysis", Tata McGraw-Hill, New Delhi.

Journal and Magazines	Topology and its Applications: Elsevier, Journal of Topology: Oxford Academic
E-Resources and Website	wikipedia.org, planetmath.org, topologyatlas.org

Learning Method	Chalk and Talk, Assignment, Seminar
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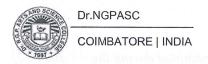
Course	Focus of the	Skill development	
	Course	Complete within spaces - compactiess in metric Spaces - 1 19	



	CORE	Semester - II PARTIAL DIFFERENTIA	AL EQUATIO	NS			
Semester	Course Code	Course Name	Category	L	Т	P	Credits
II	24MTP2CC	PARTIAL DIFFERENTIAL EQUATIONS	CORE	48	12	3_	4

Preamble	<ul> <li>This course has been designed for students to learn and under the basic forms of partial differential equations and remainder analytical techniques used to solve parabolic and hypothese the various forms of solutions that exists for partial of the various forms of solutions.</li> </ul>	methods to solve it perbolic equations
Prerequisit	e Ordinary Differential Equations	oos-ment)
Course Out	tcomes (COs)	
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	identify the method of solving first order partial differential equations	somendood K2 III
CO2	determine the characteristic curve for a second order partial differential equation	K3
CO3	analyze the characteristics of Laplace's equation	K4
CO4	analyze the solvability of wave equations	K4
CO5	evaluating diffusion equations by using integral transforms method	K5

Mapping with	Program Outco	mes:	i is deministration (d. 1844). National deministration (d. 1844).	described the second of the second se	riolo: inev
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1		<b>√</b>	<b>✓</b>		<b>✓</b>
CO2		1	1	<b>√</b>	1
CO3	<b>✓</b>	1	1	<b>✓</b>	
CO4	✓ ·	1		<b>✓</b>	
CO5	✓			✓	



24MTP2CC

## CORE: PARTIAL DIFFERENTIAL EQUATIONS

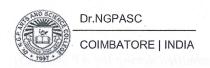
Unit	Content	Hours	E-Contents Resources
	Partial differential equations of first order:  Cauchy's problem for first order equations-nonlinear partial	5.3593.67	
I	differential equations of the first order-Cauchy's method of characteristics-compatible systems—Charpit's method-special types—solutions satisfying given conditions.	14 14 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Textbook
ena Goine	Partial differential equations of second order:		
II	Origin—second order and higher order equations in physics- linear partial differential equations with constant coefficients— equations with variable coefficients—characteristic curves - characteristics of equations in three variables.	13	Textbook
1979.1	Laplace equation:		34800
Ш	Occurrence-elementary solutions of Laplace's equation–families of equipotential surfaces-boundary value problems-separation of variables-problems with axial symmetry.	5811 (148 2000)	Textbook
	Wave equation:	Lindman	no.
IV	Occurrence-elementary solutions of the one-dimensional wave equation— Riemann-Volterra solution-vibrating membranes-applications of the Calculus of variations—three dimensional problems - general solution of the wave equation.	12	Textbook
	The Diffusion equation:	o gritadi bod	
V	Occurrence–resolution of boundary value problems- elementary solutions of the diffusion equation–separation of variables-use of integral transforms - use of Green's function.	10	Textbook
501	Total	60	109 (20)

Text Book	1.	Sneddon, I. N., 2006, "Elements of Partial Differential Equations", Dover Publications, New York.
Reference	1	TynMyint-U and Lokenath Debnath, 2007, "Linear Partial Differential Equations for
Books	1.	TynMyint-U and Lokenath Debnath, 2007, "Linear Partial Differential Equations for Scientists and Engineers", 4 <sup>th</sup> Edition, Birkhavser, Boston.
	2	AslakTveito and Ragnar Winther, 1998, "Introduction to Partial Differential Equations:
	2.	A Computational Approach", Springer-Verlag, New York.
	3.	Hillen T, Leonard E.I and Van Roessel H, 2012, "Partial Differential Equations: Theory
	٥.	and Completely Solved Problems", John Wiley& Sons, New Jersey.
	1	O'Neil V., 2008, "Beginning Partial Differential Equations", 2 <sup>nd</sup> Edition., John Wiley &
	4.	Sons, New Jersey.

Journal and Magazines	https://www.scitechnol.com/scholarly/calculus-journals-articles-ppts-list.php https://maa.org/press/periodicals/mathematics-magazine
E-Resources and	https://www.coursera.org/projects/finite-element-method-linear-nonlinear-analysis-
Website	post-processing
	https://www.edx.org/learn/finite element method

Learning Method	Chalk and Talk, Assignment, Seminar modern and advantage of the se
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Focus of the	Skill development, Employability
Course	reautorated and a realization of the control of the



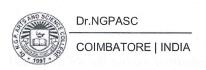
	CORE PRA	Semester - II CTICAL: COMPUTATIO	NAL MATHE	MATI	CS		
Semester	Course Code	Course Name	Category	L	Т	P	Credits
II	24MTP2CM	COMPUTATIONAL MATHEMATICS	CORE	36	-	48	5

Preamble	This course has been designed for students to learn and understand  the method of typesetting using Latex  various build - in functions from Latex and MATLAB  the logic of coding in MATLAB			
Prerequisit	e Knowledge on Basic Mathematics	enod " i		
Course Out	comes (COs)			
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level		
CO1	define various basic commands in Latex	K1		
CO2	illustrate the method of representing equations, tables and diagrams in Latex	Man K2		
CO3	describe the basic commands in MATLAB	K3		
CO4	design graphs by computation through MATLAB	indi heK4 Agains		
CO5	employ MATLAB for computation	K5		

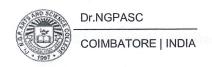
Mapping with	Program Outcor	nes:			OMESS OF THE
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	<b>✓</b>	<b>✓</b>	1	<b>✓</b>	<b>✓</b>
CO2		✓	<b>✓</b>		<b>✓</b>
CO3	<b>✓</b>		1	✓	1
CO4	<b>✓</b>	1	1		
CO5	<b>✓</b>	<b>✓</b>	1		<b>✓</b>

# 24MTP2CM CORE PRACTICAL: COMPUTATIONAL MATHEMATICS

Unit	Content CA	Hours	E-Contents / Resources	
I Book 2	LATEX: Basics and Basic Typesetting:  Introduction to LATEX: Pros and Cons – basics - document hierarchy - document management - labels and cross - references - bibliography - table of contents and lists of things - class files – packages - errors and troubleshooting.  Running text: Special characters— abbreviations - alignment.  1. Create a Latex document with Mathematical formulas  2. Create a Latex document with proper justification  3. Create a bibliography using Latex	16 munit	Text Book 1 & Reference Books 1, 2 & 3	
DSH319	LATEX: Tables, Diagrams, and Data Plots:  Presenting External Pictures: Figure environment - special packages - external picture files - graphicx package - setting default key values - setting a search path - graphics extensions.  Presenting Diagrams: tikzpicture Environment - \tikz command - grids - paths - coordinate labels - extending paths - actions on paths - nodes and node labels - spy library - trees - logic circuits - commutative diagrams - option - styles.  4. Create a Latex document with table, graph or picture 5. Create a question paper using Latex 6. Create a simple beamer presentation 7. Create a one-page curriculum vitae in Latex 8. Rewrite a research article in the form of LATEX document	bodian bodian bodia mixom bodia bodia 16	Text Book 1 & Reference Books 1, 2 & 3	
Ш	MATLAB: Introduction and Iterative Computation:  Maximum and minimum value of a function- necessary conditions for extreme values - sufficient condition - use of second order derivative- applications  9. Create a simple MATLAB program using arithmetic operators 10. Write MATLAB code with matrix operations  11. Write MATLAB code for finding the results of the students in exam	16	Text Book 2 & Reference Book 4	
IV	MATLAB: Graphics & Errors:  Graphics: Basic 2-D plots – 3-D plots – handle graphics – saving and printing graphs – animation.	16	Text Book 2 & Reference Book 4	



	Errors.		
V a version	<ul><li>12. Design a simple plot, multiple plots and contour plots in a single window</li><li>13. Design a bar chart and phi chart</li></ul>		
Soortin	14. Design a 3D plot		
	MATLAB: Applications:	ier (EriX)	ITA I
	Algebraic equations: Linear Algebra - nonlinear algebraic equations.	or nonsu	
Book 1 leregee	Data analysis and regression: Curve fitting and regression analysis – correlations - statistics.	oces - bio cliles – p	
3 L 2 K	Differential equations: Numerical integration – solution of ODEs for initial value problems - solution of ODEs for boundary value problems – advanced topics.	ng texti: S ate a Late	
	Solving an equation with one variable- finding a minimum or a maximum of a function- numerical integration.	ate a Lab ate a bibl	Text Book 2
V Book 1 ference	<ul> <li>15. Solve a first order differential equation using Euler's method and Runge-Kutta fourth order method</li> <li>16. Solve the wave and heat equations.</li> <li>17. Write a MATLAB program to find minimum and a maximum value of a given function.</li> <li>18. Solve simple integral equations with boundary values.</li> <li>19. Find the eigen values and eigen vectors of the system of equations.</li> </ul>		& Reference Book 4
	20. Solve numerical integration problems using Simpson's 1/3 rule, Trapezoidal rule and Romberg's method.	ns on par concurts Crease	
	Total noimheasig isimise signia	84	0

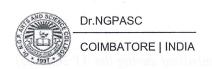


New York.  RudraPratap, 2017, "Getting started with MATLA" and Engineers", Oxford University Press, New Yo		Van Dongen M.R.C., 2012, "LATEX and Friends", Springer-Verlag Berlin Heidelberg, New York.
		RudraPratap, 2017, "Getting started with MATLAB: A Quick Introduction for Scientists and Engineers", Oxford University Press, New York.
		Stefan Kottwitz, 2011, "LATEX Beginner's Guide", Packt Publishing Limited, London.
	2.	Kopka H., and Daly P.W., 1999, "A Guide to LATEX", 3rd Edition, Addison Wesley, London.
3 N		Nambudiripad K.B.M., 2014, "LATEX for Beginners", Narosa Publishing House Private Limited, New Delhi.
	4.	Kirani Singh Y., and Chaudhuri B.B., 2007, "MATLAB Programming", 1st Edition, PHI Learning, New Delhi.

Journal and Magazines	https://oa.mg/journals/open-access-matlab-journals
E-Resources and	https://www.mathworks.com/help/matlab-online-server/ug/matlab-online.html
Website	https://nptel.ac.in/courses/111102137

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the	Skill Development/Employability
Course	



	EDC	Semester - II : FOUNDATIONS OF DAT	A ANALYTIC	CS			
Semester	Course Code	Course Name	Category	L	T	P	Credits
II	24DAP2EB	FOUNDATIONS OF DATA ANALYTICS	EDC	36	12	-	3

Preamble  This course has been designed for students to learn and understand  The core principles and foundations of data analytics  The concepts of data pre-processing and clustering  The application of frequent itemset mining, regression and classification				
Prerequisite	Basic Knowledge in Statistics	nerNI , l		
Course Out	comes (COs)			
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level		
CO1	understand the various types of data and data science components	K2		
CO2	apply appropriate data preprocessing methods to solve data driven problems	К3		
CO3	interpret various clustering methods	K2		
CO4	analyze the suitable type of itemset mining	K4		
CO5	apply the concepts of regression and classification to solve problems	K3		

Mapping with	Program Outcom	nes:			- 1997 -
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	<b>✓</b>	<b>✓</b>	7	<b>✓</b>	1
CO2	<b>✓</b>	<b>√</b>	<b>✓</b>		
CO3	1		✓	1	1
CO4	<b>✓</b>	<b>√</b>	<b>✓</b>	<b>✓</b>	<b>✓</b>
CO5	✓		<b>✓</b>	1	1

24DAP2EB

### **EDC: FOUNDATIONS OF DATA ANALYTICS**

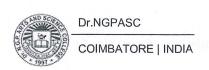
Unit	Content	Hours	E-Contents / Resources	
I	Understanding Data and Data Analytics:  Introduction – Types of Data: Numeric-Categorical Graphical-High dimensional data – sources: Time series- Transactional data- Biological data- Spatial data – Social Network data – Big Data and Data science – Big Data Architecture – Data Analytics – Examples of Data Use – Methodologies for Data Analytics – Knowledge Discovery in Databases (KDD) Process	10	Text Book	
Ш	Data Quality and Data Preprocessing:  Data Quality - Missing values - Redundant data - Inconsistent Data - Noisy Data - Outliers - Converting Nominal to Relative - Converting Ordinal to Relative - Data Transformation - Dimensionality Reduction - Attribute Aggregation - Principal Component Analysis - Independent Component Analysis - Multidimensional Scaling - Attribute Selection - Filters - Wrappers - Embedded	has somh	Text Book	
Ш	Clustering:  Distance Measures – Distance Measures for objects with Quantitative Attributes- Distance Measures for Non-Conventional Attributes - Clustering Validation – Clustering Techniques - K –means – Centroids and Distance Measures - DBSCAN – Agglomerative Hierarchical Clustering Techniques - Dendrograms	9	Text Book	
IV	Frequent Pattern Mining:  Frequent Itemsets - Setting the Threshold – Apriori a join-based Method - FP Growth- Maximal Frequent Itemsets - Closed Frequent itemsets – Association Rules – Support and Confidence - Sequential patterns - Frequent Sequence Mining - Closed and Maximal sequences	10	Text Book	
V	Regression and Classification:  Regression: Predictive Performance Estimation and Measures for Regression - Types: Linear, Ridge, Lasso Regression - Classification: Binary classification - Distance Based Learning Algorithms - K Nearest Neighbor Algorithm - Decision Trees - Probabilistic Classification Algorithms - Naive Bayes Algorithm. Case Study: Using Linear Regression to Predict Performance	10	Text Book	
	Total	48		

Text Book	1.	Moreiraj.M, Andre Carvalho, T.Horvath, 2019, "A General Introduction to Data Analytics", John wiley and Sons, USA.
Reference Books	1.	Jain, V.K, 2018, "Data Science and Analytics", Khana Book Publishing, New Delhi.
	2.	Woz, R.J., 2017, "Data Analytics for Beginners", Createspace Independent Platform, California.

Journal and Magazines	International Journal of Data Science and Analytics Analytics India Magazine
E-Resources and Website	https://skillsbuild.org/students/course-catalog/data-science https://www.coursera.org/specializations/machine-learning-introduction? https://datasciencefoundation.org/

Learning Method	Chalk and Talk/Assignment/Seminar
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Focus of the	Skill Development	-
Course	Comparison Archites Distance Measures for Non-	



		Semester - II DSE: WAVELET ANA	LYSIS				
Semester	Course Code	Course Name	Category	L	Т	P	Credits
II	24MTP2DA	WAVELET ANALYSIS	DSE	48	-	-	4

Preamble	This course has been designed for students to learn and understand  Influence of Fourier analysis in processing signals  the Concept of Haar wavelet analysis and multi resolution analysis  the necessity of wavelet algorithm, wavelet transform and its inverse				
Prerequisit	e Fourier Transforms				
Course Out	tcomes (COs)				
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level			
CO1	explain the relation between Fourier transform and discrete signals	K2			
CO2	describe the concept of Haar wavelet analysis K2				
CO3	explain multi resolution analysis	K3			
CO4	discuss the applications of Daubechies wavelets K4				
CO5	analyze the computational complexity and wavelet algorithm K5				

Mapping with	Program Outco	omes:			Days -
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	V 10450	nonjourde	✓ bas non	ng. doorapos form	<b>✓</b>
CO2	88	1	✓ max	1	1
CO3	✓	1		<b>✓</b>	<b>✓</b>
CO4	<b>√</b>	1			✓
CO5	<b>✓</b>	1			<b>✓</b>

24MTP2DA DSE: WAVELET ANALYSIS

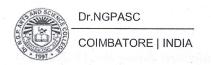
Unit	Content	Hours	E-Contents / Resources
I	The Fourier transform and discrete Fourier analysis:  Informal development of the Fourier transform - properties - discrete Fourier transform - discrete signals	10	Textbook
Louis III y	Haar wavelet analysis:  Haar wavelets - Haar scaling function - basic properties of the Haar scaling function - Haar wavelet -Haar decomposition and reconstruction algorithms - decomposition - reconstruction - filters and diagrams	10	Textbook
Ш	Multi resolution analysis:  The multire solution framework - scaling relation - associated wavelet and wavelet spaces - implementing decomposition and reconstruction - decomposition and reconstruction algorithm - processing a signal - Fourier transform criteria	10 11 11 11 11 11 11 11 11 11 11 11 11 1	Textbook
IV	Daubechies wavelets:  Daubechies' construction - classification - moments - smoothness - computational issues - the scaling function at dyadic points	9	Textbook
V	Wavelets in higher dimensions:  Computational complexity - wavelets in higher dimensions - relating decomposition and reconstruction - wavelet transform	9	Textbook
	Total	48	26

Text Book	1	Albert Bogges, Francis .J. Narcowich, 2009, "A first course in Wavelets with Fourier
	1.	analysis", John Wiley & Sons, Inc, New Jersey
Reference	1	Raghuveer Rao and AjitS.Bopardikar, 2000, "Wavelet transforms Introduction, Theory
Books	1.	and applications", Pearson Education Asia, HongKong
	2	Goswami J.C and Chan A.K., 2011, "Fundamentals of Wavelets: Theory, Algorithms,
	4.	and Applications", 2 <sup>nd</sup> Edition, Wiley, New Jersey
	2	Michel Misiti, Yves Misiti, Georges Oppenheim, Jean-Michel Poggi, 2010, "Wavelets
	٥.	and their Applications", John Wiley & Sons, New Jersey
	1	Joseph Burgess, 2018, "Wavelets: Principles, Analysis and Applications", Nova
	4.	Science, Italy

Journal and Magazines	https://www.worldscientific.com/worldscinet/ijwmip https://www.quantamagazine.org/how-wavelets-allow-researchers-to-transform-and-understand-data-20211013/
E-Resources and	https://www.angelfire.com/ma/madany/Wavelets.html
Website	https://ocw.mit.edu/courses/18-327-wavelets-filter-banks-and-applications-spring-2003/

Learning Method	Chalk and Talk, Assignment, Seminar
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Focus of the	Skill development	us tosus of linelu	ours lo editement	att i englantile	1
Course	7				



	DSE:	Semester - II INFORMATION AND CO	DING THEOR	RY			C
Semester	Course Code	Course Name	Category	L	T	P	Credits
II	24MTP2DB	INFORMATION AND CODING THEORY	DSE	48	-	-	4

Preamble	erstand nication theory mission scriptions	
Prerequisit	e Basics of Probability and Linear Algebra	
Course Out	tcomes (COs)	
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	define basic ideas of information and coding theory	K1
CO2	describe error-correcting codes using linear algebra and matrix theory concepts	K2
CO3	apply the entropy function to measure information along with theorem of Shannon	K4
CO4	analyze Hadamard matrices and codes	К3
CO5	explain the properties of various forms of linear codes	III. K5 Materia

Mapping with Program Outcomes:							
COs / POs	PO1	PO2	PO3	PO4	PO5		
CO1	1	1		1	~		
CO2	1	<b>✓</b>	1		✓		
CO3			<b>✓</b>	<b>✓</b>	1		
CO4	1			1	1		
CO5			1	1	<b>✓</b>		

24MTP2DB

## DSE: INFORMATION AND CODING THEORY

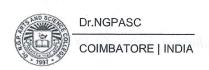
Unit	Content	Hours	E-Contents / Resources
obacoo	Source coding: definitions and examples - Uniquely decodable codes - Instantaneous Codes - Constructing instantaneous codes - Kraft's inequality - McMillan's inequality - Comments - Optimality binary Huffman codes - Average word-length - Optimality - r-ary Huffman codes - Extensions of Sources	10	Textbook
II gnibro-	Entropy and information channels:  Entropy: Information and entropy - properties - entropy and average word-length - Shannon-Fane coding - entropy of extensions and products - Shannon's first theorem and example. Information Channels: definitions - the binary symmetric channel -system entropies - extension of Shannon's first theorem	12	Textbook
Ш	Information channels and using an unreliable channel:  Information channels: Mutual information - Mutual information for the binary symmetric channel -channel capacity - Decision rules - example of improved reliability - hamming distance - statement and outline proof of Shannon's theorem - comments	ong sharif 2 10 wata shusifa	Textbook
IV	Error-correcting codes:  Introductory concepts - examples - minimum distance - Hamming's sphere-packing bound - the Gilbert-Varshamov bound - Hadamard matrices and codes.	8	Textbook
V	Linear codes:  Matrix description of linear codes - equivalence of linear codes - minimum distance of linear codes - the Hamming Codes -the Golay codes - the standard array contents - syndrome decoding.	8	Textbook
	Total	48	

Text Book	1.	Gareth A. Jones and Mary Jones, 2002, "Information and Coding Theory", Springer-Verlag, New York.
Reference Books	1.	Monica Borda, 2011, "Fundamentals in Information Theory and Coding", Springer-Verlag Berlin.
	2.	Ranjan Bose, 2008, "Information Theory, Coding and Cryptography", second edition, Tata McGraw Hill Education, New Delhi.
P.S. Satyanarayana, 2005, "Concepts of Inform		P.S. Satyanarayana, 2005, "Concepts of Information Theory and Coding", Dynaram Publication, New Delhi.
	4.	Richard B. Wells, 2004, "Applied Coding and Information Theory for Engineers", Pearson Education Pte. Ltd, New Delhi.

Journal and Magazines	https://www.mdpi.com/journal/entropy/special_issues/4NW2965K19
E-Resources and	https://www.coursera.org/learn/information-theory
Website	https://www.ee.iitb.ac.in/web/course_lists/ee-708-information-theory-and-coding/

Learning Method	Chalk and Talk, Assignment, Seminar	laformation channels at
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Focus of the	Skill development, Employability	iligango, Lestar a hare comercianas	Language - Lacisten
Course			



		Semester - II DSE: MATHEMATICAL	FINANCE				
Semester	Course Code	Course Name	Category	L	Т	P	Credits
II	24MTP2DC	MATHEMATICAL FINANCE	DSE	48	<u>-</u>	-	4

Preamble	erstand	
Prerequisit	e ODE, PDE, Graphs, Trees	manum birech i
Course Out	comes (COs)	
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	represent the financial market terminologies using Mathematical concepts	mibis-nort K1
CO2	discuss the various option pricing models	K2
CO3	explain the concept behind Black-Scholes model	К3
CO4	analyze the output from various interest rate models	K4
CO5	determine the price of a bond through various models	K5

Mapping with Program Outcomes:					
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓ 01 3d	i ola roge – alea maces – a Bandu	Sould block	earanno/ b oaid <b>a l</b> Tearl — Tantian	V
CO2	<b>✓</b>	1	<b>✓</b>	✓ Jabour Jab	~
CO3	85	1	In)eX	✓	<b>~</b>
CO4	<b>✓</b>	<b>✓</b>	1	✓	
CO5	✓	<b>√</b>	1		4

24MTP2DC

DSE: MATHEMATICAL FINANCE

Unit	Content	Hours	E-Contents / Resources
I	Financial markets, Binomial trees, Portfolios and Arbitrage:  Markets and Math – Stocks -derivatives -futures contracts – Bond markets-interest rate futures- Game theory method – replicating portfolios – probabilistic approach -risk-Arbitrage	11	Text Book
imane - 1979 II	Stock models and Option Pricing models:  Stock model- Tree model – Pricing an American and Exotic option- adjusting to real world data -Hedging the N-period – Discrete and continuous model – Black-Scholes formula and its derivation – Trees and Continuous models	9	Text Book
III	Black-Scholes model and Hedging: Black-Scholes model- derivation-Options on futures – Delta hedging – methods of hedging – Implied volatility-parameters $\Delta_{,}\Gamma$ and $\Theta$ .	8	Text Book/Reference book
IV	Interest Rate models:  Interest rates and forward rates – Zero-coupon bonds – Swaps – Pricing and hedging a swap- Interest Rate models.	10	Text Book
109	Pricing Bonds:	109	*()(%:\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
V .	Bond price dynamics – Bond price formula – spot rate -The HJM miracle – Tree models for bond prices - a Binomial Vasicek model.	10	Text Book
	Total	48	

Text Book	1	Joseph Stampfli, Victor Goodman.(2003), The Mathematics of Finance: Modeling and	
	1.	Hedging, Thomson Brooks/Cole, Singapore.	
Reference	1	Sankarshan Basu, John.C.Hull, (2022), Options, Futures and Other Derivatives (11 <sup>th</sup> Edition), Pearson Education, New Delhi.	
Books	1.		
	2	Mark S.Joshi, (2008), The Concepts and Practice of Mathematical Finance, Cambridge	
	2.	University Press, London.	
	3.	Sheldon M. Ross, (2011), An Elementary Introduction to Mathematical Finance,	
	Cambridge University Press, London		
	1	Ernst Eberlein, Jan Kallsen, (2019), Mathematical Finance, Springer Nature,	
	4.	Switzerland.	

Journal and Magazines	SIAM Journal on Financial Mathematics, Applied Mathematical Finance	
E-Resources and Website	https://www.optiontradingtips.com/pricing/free-spreadsheet.html https://study.com/academy/lesson/fundamentals-of-option-valuation.html	

Learning Method Chalk and Talk, Seminar
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Focus of the	Skill development, Employability, Entrepreneurship	
Course	Skill development, Employability, Entrepreneursing	*

BoS Chairman/HoD
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