M.Sc. Mathematics

SEM	Course Code	Course	Course Title	Ins. Hrs / Week	Credit	Exam Hrs	Marks		Total
							CIA	ESE	
I	20PMA1CC1	Core– I	Algebra-I	6	5	3	25	75	100
	20PMA1CC2	Core – II	Real Analysis	6	5	3	25	75	100
	20PMA1CC3	Core– III	Classical Dynamics	6	4	3	25	75	100
	20PMA1CC4	Core – IV	Ordinary Differential Equations	6	4	3	25	75	100
	20PMA1DE1	DSE – I #		6	4	3	25	75	100
			TOTAL	**30**	**22**				**500**
II	20PMA2CC5	Core – V	Algebra-II	6	5	3	25	75	100
	20PMA2CC6	Core – VI	Complex Analysis	6	5	3	25	75	100
	20PMA2CC7	Core– VII	Topology	6	4	3	25	75	100
	20PMA2CC8	Core – VIII	Numerical Analysis	6	4	3	25	75	100
	20PMA2DE2	DSE – II #		6	4	3	25	75	100
			TOTAL	**30**	**22**				**500**
III	20PMA3CC9	Core– IX	Functional Analysis	6	5	3	25	75	100
	20PMA3CC10	Core– X	Partial Differential Equations	6	5	3	25	75	100
	20PMA3CC11	Core– XI	Modern Probability Theory	6	4	3	25	75	100
	20PMA3CC12	Core– XII	Advanced Graph Theory	6	4	3	25	75	100
	20PMA3DE3T	DSE – III (a)#		3	2	3	10	40	50
	20PMA3DE3P	DSE – III (b)#		3	2	3	10	40	50
	20PMA3EC1	Extra Credit Course – I	Online Course (MOOC)	-	1*	-	-	-	-
			TOTAL	**30**	**22**				**500**
IV	20PMA4CC13	Core– XIII	Measure theory and integration	6	5	3	25	75	100
	20PMA4CC14	Core– XIV	Fluid Dynamics	6	5	3	25	75	100
	20PMA4CC15	Core– XV	Integral Equations and Calculus of Variations	6	5	3	25	75	100
	20PMA3DE4	DSE - IV #		6	4	3	25	75	100
	20PMA4PW	Project	Internship and Project Report	6	4	-	-	100	100
	20PCNOC	Online Course (Compulsory)		-	1	-	-	-	-
	20PMA4EC2	Extra Credit Course – II	Mathematics for career examinations	-	5*	3	-	100	100*
			TOTAL	**30**	**24**				**500**
			GRAND TOTAL		**90**				**2000**

*Not considered for grand total and CGPA

Discipline Specific Electives

SEMESTER	Course Code	DISCIPLINE SPECIFIC ELECTIVE
I	20PMA1DE1A	Mathematics of Finance
	20PMA1DE1B	Control Theory
II	20PMA2DE2A	Fuzzy Analysis & its Applications
	20PMA2DE2B	Mathematical Methods in Biology
III	20PMA3DE3AT	Python Programming
	20PMA3DE3AP	Python Programming - Practical
	20PMA3DE3B	Computer Algorithms
IV	20PMA4DE4A	Advanced Operations Research
	20PMA4DE4B	Stochastic Processes

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PMA1CC1	Core – I	ALGEBRA-I	6	5	100	25	75

Course Outcomes:

1. Discuss Sylow's theorems, Solvability of Symmetric group with examples.
2. Construct new groups from existing groups using direct products and illustrate with some examples.
3. Recognize the concept of vector spaces as R-module.
4. Describe some of the canonical forms of linear transformations such as triangular and nilpotent transformations.
5. Solve problems based on different kinds of transformations.

Unit I **18hours**

Another Counting Principle – Sylow's Theorems (for Theorem 2.12.1, first proof only).

Unit II **18 hours**

Solvability by Radicals – #Direct Products# – Finite Abelian Groups – Modules.

Unit III **18 hours**

Canonical Forms: Triangular Form – Nilpotent Transformations.

Unit IV **18 hours**

Canonical Forms: Jordan Form – Rational Canonical Form.

Unit V **18 hours**

#Trace and Transpose# – Hermitian, Unitary and Normal Transformations – Real Quadratic Forms.

 # # Self-study portion.

Text Book:

I. N. Herstein, Topics in Algebra, Second Edition, Wiley India Pvt. Ltd., New Delhi, 2006

UNIT I Chapter 2: Sections 2.11, 2.12 (Section 2.12: Omit Lemma 2.12.5)
UNIT II Chapter 5: Section 5.7 (Lemma 5.7.1, Lemma 5.7.2, Theorem 5.7.1 only)
Chapter 2: Sections 2.13, 2.14 (Section 2.14: Theorem 2.14.1 only)
Chapter 4: Section 4.5
UNIT III Chapter 6: Sections 6.4, 6.5
UNIT IV Chapter 6: Sections 6.6, 6.7
UNIT V Chapter 6: Sections 6.8, 6.10, 6.11

Books for Reference:

1. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra, Second Edition, Cambridge University Press , (1995).
2. Michael Artin, Algebra, Second edition, Pearson-Prentice Hall, New Delhi, 2015
3. Vijay K Khanna and S K Bhambri, A course in Abstract Algebra, Third Edition, Vikas Publishing House Pvt. Ltd.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code			Title of the Paper			Hours		Credits
I	20PMA1CC1			ALGEBRA-I			6		5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√	√	√	√	√	√	√	√	√	√
CO2	√		√	√	√		√	√	√	√
CO3	√		√	√	√	√		√	√	√
CO4	√	√		√	√	√		√	√	√
CO5	√	√	√	√	√		√		√	√
Number of Matches= 42, Relationship : HIGH										

Prepared by:
Mr. N. Mohamed Thoiyab
Ms. B.ShafinaBanu
Ms. C.Vijayalakshmi

Checked by:
Dr.A. Solairaju

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PMA1CC2	Core – II	REAL ANALYSIS	6	5	100	25	75

Course Outcome:

1. Discuss the basic concepts of topology and illustrate with examples.
2. Apply domain knowledge for Riemann - Stieltjes integral.
3. Explain the sequences and series of functions with the examples.
4. Determine the partial derivatives and directional derivatives.
5. Prove the chain rule,inverse function theorem and Implicit function theorem.

UNIT I **18 hours**

Basic topology - Metric spaces - Compact sets - Perfect sets.

UNIT II **18 hours**

Riemann - Stieltjes integral - Definition and existence of the integral - #Properties of theintegral# - Integration and differentiation - Rectifiable Curves.

UNIT III **18 hours**

Sequences and series of functions - Uniform convergence- Uniform convergence andcontinuity - Uniform convergence and integration - Uniform convergence and differentiation – Stone -Weierstrass theorem.

UNIT IV **18 hours**

Multivariable differential calculus – Directional derivatives - Total derivative - Matrix of linearfunction - Jacobian matrix - Chain rule - Mean value theorem - Sufficient condition for differentiability- Equality of partial derivatives - Taylor's formula.

UNIT V **18 hours**

Functions with non-zero Jacobian determinant - Inverse function theorem - Implicit functiontheorem.

 # # Self-study portion.

Text Books:

T.B-1. Walter Rudin, Principles of Mathematical Analysis, McGraw-Hill International Editions, Third
Edition (1987).

T.B-2. Tom M. Apostol, Mathematical Analysis, Addison-Wesley Publishing Company, Second Edition
(1974).

UNIT I	Chapter 2	Sections 2.15 - 2.43	**T.B-1**
UNIT II	Chapter 6	Sections 6.1 - 6.22, 6.26, 6.27	**T.B-1**
UNIT III	Chapter 7	Sections 7.1 - 7.18, 7.26, 7.27	**T.B-1**
UNIT IV	Chapter 12		**T.B-2**
UNIT V	Chapter 13	Sections 13.1 - 13.4	**T.B-2**

Books for Reference:

1. V. GanapathyIyer, Mathematical analysis, Tata McGraw-Hill Publishing Company, Ltd, (1977).
2. Gabriel Klambauer, Real Analysis, American Elsevier Publishing Company, INC, (1973).

Web Source

https://nptel.ac.in/courses/111/106/111106053/
https://nptel.ac.in/courses/111/105/111105069/
https://nptel.ac.in/courses/111/105/111105098/

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code			Title of the Paper				Hours		Credits
I	20PMA1CC2			REAL ANALYSIS				6		5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√	√		√	√		√	√		√
CO2	√	√		√	√	√		√	√	
CO3	√		√	√		√	√	√		√
CO4	√	√	√	√	√	√		√	√	
CO5		√	√		√	√	√		√	√
Number of Matches= 36, Relationship : HIGH										

Prepared by :
Mr. S. Masoothu
Dr. D. Dhamodharan

Checked by :
Mr.N.Mohamed Thoyaib

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PMA1CC3	Core – III	CLASSICAL DYNAMICS	6	4	100	25	75

Course Outcomes

1. Discuss the basic concepts of Mechanical System.
2. Derivation of Lagrange's Equation for holonomic and non holonomic system and solve simple problems.
3. Analyze the applications of Impulsive Motion.
4. Examine the concept of Hamilton's principle and other variational principles.
5. Express the ideas of separability using Stackle's Theorem and solving problems.

Unit I **18 hours**

Mechanical system – Generalized Co-ordinates – Constraints – Virtual work – #Energyand Momentum#

Unit II **18 hours**

Derivation of Lagrange's Equation – Examples – Integrals of the motion – SimpleProblems

Unit III **18 hours**

Rayleigh's Dissipation Function – Impulsive motion - #Velocity dependent potentials#

Unit IV **18 hours**

Hamilton`s principle – Hamilton's equation - #Other variational principles#

Unit V **18 hours**

Hamilton`s principal function – The Hamilton's – Jacobi equation – Separability– SimpleProblems

 # #Self-study portion.

Text Book

Donald. T. Green wood, Classical Dynamics, Prentice Hall of India, (1985).

UNIT I Sections 1.1 - 1.5
UNIT II Sections 2.1 - 2.3
UNIT III Sections 3.1, 3.2 and 3.4
UNIT IV Sections 4.1, 4.2, 4.3
UNIT V Sections 5.1, 5.2 and 5.3

Books for Reference

C.R. Mondal, Classical Mechanics, Revised Edition, Prentice Hall of India, (2008).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code			Title of the Paper			Hours		Credits
I	20PMA1CC3			CLASSICAL DYNAMICS			6		4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√	√		√	√	√	√		√	
CO2	√	√		√	√	√	√			√
CO3	√			√	√	√	√	√		√
CO4	√		√	√	√	√	√		√	√
CO5	√		√	√	√			√	√	√
Number of Matches= 36, Relationship : HIGH										

Prepared by:
N. Abdul Ali
M.S. AfyaFarhana

Checked by:
Dr.S.Mohamed Yusuff Ansari

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PMA1CC4	Core – IV	ORDINARY DIFFERENTIAL EQUATIONS	6	4	100	25	75

Course Outcomes:

CO1: Apply domain knowledge for solving second order linear differential equations and method of variation of parameters.

CO2: Demonstrate and discuss Oscillations, Sturm separation and comparison Theorem with examples.

CO3: Show regular singular points and solve Gauss's Hypergeometric equation with examples.

CO4: Investigate Legendre polynomials and Bessel functions with examples.

CO5: Determine linear systems with illustrative examples and Prove Picard's theorem.

UNIT I **18 hours**

Second order linear Equations- #The general solution of the Homogeneous equation# The Use of a known solution to find another- The Homogeneous equation with constant coefficients-The method of variation of parameters.

UNIT II **18 hours**

Oscillations and the Sturm separation theorem – The Sturm comparison theorem Series solutions of First order equations-Second order linear equations-ordinary points.

UNIT III **18 hours**

Regular singular points-Regular singular points (continued) - Gauss's Hypergeometric equation-# The point at Infinity#.

UNIT IV **18 hours**

Legendre Polynomials – Properties of Legendre Polynomials – Bessel functions –#The Gamma function#–Properties of Bessel functions.

UNIT V **18 hours**

Linear systems- Homogeneous linear systems with constant coefficients – The method of successive approximations –Picard's theorem.

 # # Self-study portion.

Text Book:

G.F.Simmons, Differential Equations with Applications and Historical notes, second edition, Tata McGraw-Hill Publishing company Ltd, New Delhi, 2003.

UNIT I Sections 14, 15, 16, 17,19

UNIT II Sections 24, 25, 27, 28

UNIT III Sections 29, 30, 31, 32

UNIT IV Sections 44, 45, 46, 47

UNIT V Sections 55, 56, 68, 69

Books for Reference:

1. Earl .A. Coddington, An Introduction to Ordinary Differential equations, PHI, 1961.

2. M.D. Raisinghania, Advanced Differential Equations, Seventh Revised Edition, S. Chand and Company Ltd, New Delhi, 2000.

Website and e-learning source

https://nptel.ac.in/courses/111/106/111106100/

https://nptel.ac.in/courses/111/108/111108081/

https://nptel.ac.in/courses/111/107/111107111/

Unit-I

Introduction to Second order ODE's (https://www.youtube.com/watch?time_continue=2&v=dPJY0i5qNzU)

Properties of solutions of second order homogeneous ODE (https://www.youtube.com/watch?v=iQ6SN5CDKTw)

The Use of a known solution to find another (https://www.youtube.com/watch?time_continue=1&v=U5s1z9qaZng), (https://www.youtube.com/watch?v=C3C67IXZIgQ)

The Homogeneous equation with constant coefficients (https://www.youtube.com/watch?v=lUpQg32D9kE), (https://www.youtube.com/watch?v=NvXF62IllCY)

The method of variation of parameters (https://www.youtube.com/watch?v=blF7FUu9Vtk)

Unit-II

ordinary points (https://www.youtube.com/watch?time_continue=1585&v=E9Mx1Ef_cD0)

Second order linear equations (https://www.youtube.com/watch?v=utSvQMsr3g8), (https://www.youtube.com/watch?time_continue=2037&v=YQcFBh6HQ9o)

Unit-III

Legendre differential equation (https://www.youtube.com/watch?time_continue=2&v=5c4KptxCS80)

Power series solutions around a regular singular point (https://www.youtube.com/watch?time_continue=1944&v=3mKFtZl6ZZs)

Frobenius method (https://www.youtube.com/watch?v=2LdCV3qf-ZI), (https://www.youtube.com/watch?v=FOlHg93WtjY), (https://www.youtube.com/watch?time_continue=1&v=KcTgFeyJ6h0)

Unit-IV

Legendre polynomials (https://www.youtube.com/watch?v=k5n698fUwuU)

Properties of Legendre Polynomials (https://www.youtube.com/watch?v=g2BifBEjmnM)

Bessel differential equation (https://www.youtube.com/watch?v=_UmpTFoKqxE)

The Gamma function (https://www.youtube.com/watch?v=aK61gh-wUa4)

Properties of Bessel functions (https://www.youtube.com/watch?v=8KIs9zzTS8c), (https://www.youtube.com/watch?time_continue=4&v=MvZecjM4at8)

Unit-V

Pichard's Theorem (https://www.youtube.com/watch?v=oL97oGZUINA&list=PLbMVogVj5nJSGlf9sluucwobyr_zz6glD&index=19&t=0s), (https://www.youtube.com/watch?v=2DaINaf1Zfo&list=PLbMVogVj5nJSGlf9sluucwobyr_zz6glD&index=20&t=0s)

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code			Title of the Paper			Hours		Credits
I	20PMA1CC4			ORDINARY DIFFERENTIAL EQUATIONS			6		4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√	√	√	√	√		√		√	√
CO2		√	√		√	√	√	√	√	
CO3	√			√		√		√		√
CO4	√	√		√	√			√	√	
CO5	√		√	√		√	√	√	√	√
Number of Matches= 34, Relationship : Moderate										

Prepared by :

Dr. S. Ismail Mohideen
Dr. M.A. Rifayathali
Dr. K.S. KanzulFathima

Checked by :

Dr.A.Prasanna

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PMA1DE1	DSE – I	MATHEMATICS OF FINANCE	6	4	100	25	75

Course Outcomes:

1.Recall basic concepts of simple interest, simple discount, equivalent rates and discount value

2.Expain an accumulated and discount values for fractional interest period.

3.Apply the mathematical idea of annuities with examples.

4.Analyze the Amortization of a debit.

5.Bring out bounds and related properties with illustrations.

UNIT I **18 hours**

Simple interest- the time between dates-equations of value-partial payments- #simple discount# -promissory notes-Accumulated values-equivalent rates-discount value.

UNIT II **18 hours**

Accumulated and discount values for fractional interest periods-finding the rate-finding the time- Equations of value- compound discount at a discount rate-Accumulated values of a simple annuity-discounted value of an ordinary simple annuity.

UNIT III **18 hours**

Other simple annuities-finding the term of an annuity-finding the interest rate-general annuities – perpetuities-annuities whose payments vary.

UNIT IV **18 hours**

Amortization of a debt-outstanding principal – mortgages-refinancing a loan-Sinking funds-comparison of amortization and sinking fund methods.

UNIT V **18 hours**

Introduction and terminology of bonds-purchase price to yield a given investment rate-callable bonds-premium and discount-price of a bond between bond interest rates-finding the yield rate-other types of bonds.

 # #Self-study portion.

Text Book:

Mathematics of Finance, second edition(2005),peter zima and Robert L.Brown,Tata McGraw-Hill publishing company limited,New Delhi.

UNITI	Chapter 3	Sec.3.1-3.6
	Chapter 4	Sec.4.1-4.3
UNIT II	Chapter 4	Sec.4.4-4.8
	Chapter 5	Sec.5.1-5.3
UNIT III	Chapter 5	Sec.5.4-5.6
	Chapter 6	Sec.6.1-6.3

UNIT IV Chapter 7 Sec.7.1-7.6
UNIT V Chapter 8 Sec.8.1-8.7

Books for Reference:

An introduction to the Mathematics of Finance,MC Cutchoon and Scoot-Hoinenmann professional publishing.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code			Title of the Paper			Hours		Credits	
I	20PMA1DE1			MATHEMATICS OF FINANCE			6		4	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		√	√		√		√	√		√
CO2	√	√	√	√	√	√	√		√	√
CO3		√	√		√			√	√	
CO4	√		√	√		√	√	√	√	√
CO5	√	√		√	√	√	√	√	√	√
Number of Matches= 38, Relationship : HIGH										

Prepared by:
Dr.A.Prasanna
A.Nafiunisha

Checked by:
Dr.M.Mohamed Althaf

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PMA1DE1B	DSE – I	CONTROL THEORY	6	4	100	25	75

Course Outcome:

1. Discuss the basic concepts of Observability and illustrate the examples.
2. Explain controllability and nonlinear systems with the examples.
3. Apply the domain knowledge of asymptotic stability of linear systems and perturbed linear systems.
4. Analyze the stabilization via linear feedback control.
5. Solve the matrix Riccati equations

UNIT I **18 hours**

Observability: Linear Systems – Observability Grammian– Constant coefficient system - Reconstruction kernel – Nonlinear Systems

UNIT II **18 hours**

Controllability: Linear systems – Controllability Grammian – Adjoint systems – Constant coefficient systems – steering function – Nonlinear systems

UNIT III **18 hours**

Stability:Stability – Uniform Stability – Asymptotic Stability of Linear Systems - Linear timevarying systems – Perturbed linear systems – Nonlinear systems

UNIT IV **18 hours**

Stabilizability: Stabilization via linear feedback control – Bass method – Controllable subspace - Stabilization with restricted feedback

UNIT V **18 hours**

Optimal control: Linear time varying systems with quadratic performance criteria – Matrix Riccati equation – Linear time invariant systems – Nonlinear Systems

Text Book:

Elements of Control Theory by K.Balachandran and J.P.Dauer, Narosa, New Delhi, 1999.

UNIT I Chapter 2
UNIT II Chapter 3 Sections 3.1 - 3.3
UNIT III Chapter 4
UNIT IV Chapter 5
UNIT V Chapter 6

Books for Reference:

1. Linear Differential Equations and Control by R.Conti, Academic Press,London, 1976.
2. Functional Analysis and Modern Applied Mathematics by R.F.CurtainandA.J.Pritchard, Academic Press, New York, 1977.
3. Controllability of Dynamical Systems by J.Klamka, Kluwer AcademicPublisher, Dordrecht, 1991.
4. Mathematics of Finite Dimensional Control Systems by D.L.Russell, MarcelDekker, New York,1979.
5. E.B. Lee and L. Markus, Foundations of optimal Control Theory, John Wiley,New York, 1967

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code			Title of the Paper			Hours			Credits
I	20PMA1DE1B			CONTROL THEORY			6			4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√	√		√	√		√	√		√
CO2	√	√		√	√	√		√	√	
CO3	√		√	√		√	√	√		√
CO4	√	√	√	√	√	√		√	√	
CO5		√	√		√	√	√		√	√
Number of Matches= 36, Relationship : HIGH										

Prepared by :
Dr.A.Prasanna

Checked by :
Dr.M.A.Rifayath Ali

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20PMA2CC5	Core – V	ALGEBRA-II	6	5	100	25	75

Course Outcomes

1. Discuss the algebraic concepts of finite and infinite fields and its illustrations.
2. Analyze the fundamental concepts of algebra and their role in modern mathematics.
3. Recognize and Recall the algebraic expressions, using the commutative, associative and distributive properties.
4. Explain the accurate and efficient use of advanced algebraic techniques
5. Demonstrate mathematical ideas through analyzing, proving and explaining concepts from advanced algebra

Unit I **18 hours**

Extension fields – The Transcendence of e .

Unit II **18 hours**

Roots of Polynomials – More about Roots.

Unit III **18 hours**

The Elements of Galois Theory.

Unit IV **18 hours**

Finite Fields – Wedderburn's Theorem on Finite Division Rings.

Unit V **18 hours**

Solvability by Radicals – A Theorem of Frobenius – Integral Quaternions and the Four-Square Theorem.

Text Book

I. N. Herstein, Topics in Algebra, Second Edition, Wiley India Pvt. Ltd., New Delhi,2006.

UNIT I **Chapter 5 Sections 5.1, 5.2**

UNIT II **Chapter 5 Sections 5.3, 5.5**

UNIT III **Chapter 5 Section 5.6**

UNIT IV **Chapter 7 Sections 7.1, 7.2 (Theorem 7.2.1 only)**

UNIT V **Chapter 5 Section 5.7** (Omit Lemma 5.7.1 Lemma 5.7.2 and Theorem 5.7.1).
Chapter 7 Sections 7.3, 7.4

Books for Reference

1. M. Artin, Algebra, Pearson - Prentice Hall, New Delhi,2007
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra, Second (Indian) Edition, Cambridge University Press,1997

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code			Title of the Paper			Hours		Credits
II	20PMA2CC5			ALGEBRA-II			6		5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√		√	√	√	√	√	√	√	
CO2	√	√	√	√	√	√	√	√	√	√
CO3	√			√	√	√	√	√	√	
CO4	√		√	√	√				√	√
CO5	√		√	√	√		√	√	√	√
Number of Matches= 39, Relationship : HIGH										

Prepared by:
Dr. A.Solai Raju
Mr. N. Mohamed Thoiyab
Dr. D.Dhamodaran
Ms. A. FathimaBegam

Checked by:
Dr.R.Jahir Hussain

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20PMA2CC6	Core – VI	COMPLEX ANALYSIS	6	5	100	25	75

Course Outcome:

1. Recognize the basic concept of Line integrals, rectifiable arcs with examples and prove Cauchy's theorems.
2. Demonstrate the homology in complex plain and prove Taylor's theorem.
3. Discuss argument principle and evaluate the definite integrals.
4. Describe the properties of Harmonic functions and prove Poisson's formula.
5. Explain the canonical products and gamma functions with examples.

UNIT I **18 hours**

Fundamental theorems – 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 – Index of a point with respect to a closed curve - Integral formula for higher derivatives.

UNIT II **18 hours**

Local properties of analytical functions – Removable singularities - Taylor's theorem - Zeros and poles. Local mapping - Maximum principle. General form of Cauchy theorem – Chains and cycles -Simple connectivity - Homology.

UNIT III **18 hours**

General statement of Cauchy's theorem - Proof of Cauchy's theorem - Locally exact differentials. Calculus of residue - Residue theorem - Argument principle - Evaluation of definite integrals.

UNIT IV **18 hours**

Harmonic functions – Definition and basic properties – Mean-value property - Poisson's formula- Schwartz's theorem - Reflection principle. Power series expansions – Weierstrass's theorem – Taylor series - Laurent series.

UNIT V **18 hours**

Partial fractions and factorization – Partial fractions - Infinite products - Canonical products - Gamma functions.

Text Book:

Lars. V. Ahlfors, Complex Analysis, McGraw Hill International Edition, Third Edition (1979).

UNIT I Chapter 4 Sections 1.1 - 1.5, 2.1 - 2.3.
UNIT II Chapter 4 Sections 3.1 - 3.4, 4.1 - 4.3.
UNIT III Chapter 4 Sections 4.4 - 4.6, 5.1 - 5.3
UNIT IV Chapter 4 Sections 6.1 - 6.5
Chapter 5 Sections 1.1 - 1.3
UNIT V Chapter 5 Sections 2.1 - 2.4

Books for Reference:

1. Jacob Sonnenschein and Simon Green, Elements of Complex analysis, Dickenson Publishing Company, INC. (1977).

2. S. Ponnusamy, Foundations of Complex Analysis, NarosaPvt. Ltd., Second Edition (2008).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code			Title of the Paper				Hours		Credits
II	20PMA2CC6			COMPLEX ANALYSIS				6		5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√		√	√	√		√	√	√	√
CO2	√	√		√	√		√	√	√	√
CO3	√		√	√		√		√		
CO4	√	√	√	√	√		√	√	√	√
CO5	√	√	√		√	√	√	√	√	
Number of Matches= 38, Relationship : HIGH										

Prepared by : **Checked by :**

Dr.R.Jahir Hussain Dr.A.Mohamed Ismayil

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20PMA2CC7	Core – VII	TOPOLOGY	6	4	100	25	75

Course Outcome:

1. Illustrate and Describe the origin of topological spaces.
2. Apply domain knowledge for metric space and connected spaces with examples.
3. Prove the Tychonoff theoremwith examples.
4. Determine the countability axioms, separation axioms and prove the Urysohnlemma.
5. Explain theBaire category theorem in topological point of view.

UNIT I **18 hours**

Topological spaces - Basis for a topology- Order topology, product topology- SubspaceTopology - Closed sets and limit points - Continuous functions - # Product Topology #.

UNIT II **18 hours**

Metric topology - Metric topology (continued) - Connected spaces.

UNIT III **18 hours**

Compact spaces - Limit point compactness - Tychonoff theorem.

UNIT IV **18 hours**

Countability axioms - Separation axioms - Urysohn lemma - Urysohnmetrization theorem - Completely regular spaces.

UNIT V **18 hours**

Complete metric spaces - Compactness in metric spaces - Baire spaces.

 # # Self-study portion.

Text Book:

James R. Munkres, Topology A First Course, Prentice Hall of India, (1998).

UNIT I Sections 2.1 - 2.8
UNIT II Sections 2.9, 2.10, 3.1
UNIT III Sections 3.5, 3.7, 5.1
UNIT IV Sections 4.1 - 4.4, 5.2
UNIT V Sections 7.1, 7.3, 7.7

Books for Reference:

1. Sze-Tsen Hu, Elements of General Topology, Holden Day, INC. (1964).
2. K.D. Joshi, Introduction to General Topology, Wiley Eastern Ltd. (1983).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code			Title of the Paper			Hours		Credits
II	20PMA2CC7			TOPOLOGY			6		4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√	√		√	√	√	√	√	√	√
CO2	√	√		√	√		√	√	√	√
CO3	√		√	√		√	√	√		
CO4	√	√	√	√	√		√	√	√	
CO5	√	√	√		√	√	√		√	√
Number of Matches= 38, Relationship : HIGH										

Prepared by :
Dr. A. Nagoor Gani

Checked by :
Dr.M.Mohammed Jabarulla

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20PMA2CC8	Core–VIII	NUMERICAL ANALYSIS	6	4	100	25	75

Course Outcomes:

1. Recall the iteration methods to solve the problems.
2. Identify the approximate solution to the given problems.
3. Find the interpolation value with illustrations.
4. Examine the convergence of the solution for the given problems.
5. Compare various methods and choose the best method to solve the problems.

UNIT I **18 hours**

Iteration method based on Second degree equations - Chebyshev Method – Multipoint Iteration Methods – Bridge Vieta Method – Baristow Method – Graeffe's root Squaring Method.

UNIT II **18 hours**

Iteration Methods - Jacobi Method - Guass Seidel Method - Successive Over Relaxation Method – Iterative Method for A^{-1} – #Eigen Values and Eigen Vectors# – Jacobi Method for symmetric Matrices - Power Method.

UNIT III **18 hours**

Interpolation and Approximation – Hermite Interpolation – Piecewise cubic Interpolation and cubic Spline interpolation – Bivariate interpolation – Lagrange and Newton's Bivariate interpolation – #Least Square approximation# – Gram-Schmidt Orthogonalizing Process.

UNIT IV **18 hours**

Differentiation and Integration: Numerical Differentiation – Methods Based on Interpolation –Partial Differentiation – Numerical Integration – Methods Based on Interpolation – Methods Based on Undetermined Coefficients – Gauss Quadrature methods - Gauss Legendre and Gauss ChebyshevIntegration Methods – Double Integration – Trapezoidal and Simpson's Rule – Simple Problems.

UNIT V **18 hours**

Ordinary Differential Equations: Numerical Methods – Euler Method – #Backward Euler Method# – Mid-Point Method – Runge-kutta Methods – Implicit Runge-KuttaMethods – Predictor – Corrector Methods.

 # # Self-study portion.

Text Book:

M.K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Private Ltd, Sixth Edition (2012).

UNIT I	Chapter II	Sections 2.4, 2.9
UNIT II	Chapter III	Sections 3.4, 3.5,3.7, 3.11
UNIT III	Chapter IV	Sections 4.5, 4.6, 4.7, 4.9
UNIT IV	Chapter V	Sections 5.2, 5.5, 5.6, 5.7, 5.8, 5.11
UNIT V	Chapter VI	Sections 6.3, 6.4, 6.7

Books for Reference:

1. Samuel. D. Conte and Carl De Boor, Elementary Numerical Analysis,McGraw Hill Company, Third Edition (1965).

2. F.B. Hildebrand, Introduction to Numerical Analysis, Tata McGraw Hill Company,2nd Edition (1974).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	**Code**			**Title of the Paper**				**Hours**		**Credits**
II	**20PMA2CC8**			**NUMERICAL ANALYSIS**				**6**		**4**
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√	√	√	√	√	√	√		√	
CO2	√	√	√	√		√	√	√	√	√
CO3	√	√		√		√	√	√		√
CO4		√	√		√	√	√	√	√	
CO5	√	√		√	√		√	√	√	√
Number of Matches= 39, Relationship : HIGH										

Prepared By:
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Ms. HyroonBee

Checked by:
Dr.U.Abuthahir

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20PMA2DE2A	DSE – II	FUZZY ANALYSIS AND ITS APPLICATIONS	6	4	100	25	75

Course Outcome:

1: Apply domain knowledgefrom classical sets to fuzzy sets with illustrations.
2: Describe the fuzzy arithmetic, Linguistic variables and examineFuzzy equations.
3: Determine fuzzy logic and fuzzy propositions.
4: Examine fuzzy Decision making problem and Fuzzy Linear programming problem.
5: Classify fuzzy relations and properties of fuzzy relations.

UNIT I **18 hours**

From Classical Sets to Fuzzy sets – Fuzzy set: Basic types – Fuzzy sets Versus Crisp sets- Extension Principle for fuzzy sets – Operations on Fuzzy sets – #Types of operations# – Fuzzy complements.

UNIT II **18 hours**

Fuzzy Arithmetic – Fuzzy numbers - Linguistic variables – Arithmetic operations on intervals –Arithmetic operations on Fuzzy numbers –Lattice of Fuzzy numbers– Fuzzy equations.

UNIT III **18 hours**

Fuzzy Logic – Multi-valued Logics – Fuzzy Propositions – Unconditional and Unqualified Fuzzy propositions – Unconditional and qualified Propositions – Conditional and Unqualified propositions –Conditional and Qualified propositions – Linguistic Hedges – Inference from conditional Fuzzy propositions- #Inference from conditional and qualified propositions#.

UNIT IV **18 hours**

Fuzzy Decision making – #Individual decision making# – Fuzzy Ranking methods – Fuzzy Linear programming.

UNIT V **18 hours**

Fuzzy Relations – Composition of fuzzy relations – Properties of fuzzy relations.

 # # - Self study

Text Books:

T.B-1 George J. Klir and Bo Yuan, Fuzzy sets and Fuzzy Logic Theory and Applications, Prentice Hall of India, (2004).

T.B-2 A. Nagoor Gani and V.T. Chandrasekaran, A first look at Fuzzy Graph Theory, Allied Publishers Pvt. Ltd., (2010).

UNIT I	Chapter 1	Sections 1.3, 2.3	
	Chapter 3	Sections 3.1&3.2	**T.B-1**
UNIT II	Chapter 4	Sections 4.1-4.6	**T.B-1**
UNIT III	Chapter 8	Sections 8.2, 8.3, 8.5-8.7	**T.B-1**
UNIT IV	Chapter 15	Sections 15.2, 15.6, 15.7	**T.B-1**
UNIT V	Chapter 1	Sections 1.3-1.5	**T.B-2**

Books for Reference:

1. H.J. Zimmermann, Fuzzy Set Theory and its Applications, Allied Publishers Limited (1991).
2. M. Ganesh, Introduction to Fuzzy sets and Fuzzy logic, Prentice Hall of India, New Delhi (2006).

Web Source:

https://nptel.ac.in/courses/108/104/108104157/
https://nptel.ac.in/courses/111/102/111102130/
https://nptel.ac.in/courses/127/105/127105006/

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code			Title of the Paper			Hours		Credits
II	20PMA2DE2A			FUZZY ANALYSIS AND ITS APPLICATIONS			6		4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√	√		√	√	√	√	√	√	√
CO2	√		√	√	√	√	√	√	√	
CO3	√	√		√		√	√	√	√	√
CO4		√	√	√	√			√	√	√
CO5	√		√	√		√	√	√		√
Number of Matches= 39, Relationship : HIGH										

Prepared by :
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Dr. H. Sheik Mujibur Rahman

Checked by :
Dr.M.Mohamed Althaf

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20PMA2DE2B	DSE – II	MATHEMATICAL METHODS IN BIOLOGY	6	4	100	25	75

Course Outcome:

1. Discuss the sequence alignments , alignment graphs and CDNA matching with illustrations .
2. Demonstrate the Multiple sequence alignments and Multifunction tools for sequence analysis .
3. Explain the Phylogenetic analysis, Evolutionary Trees and Phylogeny with examples.
4. Apply the domain knowledge for SQL,DDL, DML and TLC commands.
5. Determine the bioinformatics tools for database search using engines.

UNIT I **18 hours**

Sequence alignments, Basic string definitions, The importance of sequence comparison in Molecular Biology, The edit distance between two strings, String alignment, Edit graphs, String similarity, Alignment graphs, Local alignment, Introduction to Gaps, CDNA matching, A concrete illustration, Choices for gap weights, Time analysis.

UNIT II **18 hours**

Overview of RDBMS, Advantages of DBNS, Normalization, Oracle data types, Introduction to SQL, DDL, DML, & TLC commands. Data definition Language, Data Manipulation Language, Transaction Control & data, Control language Grant & Revoke Privilege Command.

UNIT III **18 hours**

Multiple sequence alignments, the morphological to the molecular, Common multiple alignment methods, multiple sequence alignments, Local alignment gaps, parametric sequencealignments, suboptimal alignments, Multifunction tools for sequence analysis.

UNIT IV **18 hours**

Phylogenetic analysis, Evolutionary Trees and Phylogeny, Ultrasonic trees, Parsimony, Ultrametric problem, Perfect phylogeny, Phylogenetic alignment, Connection between multiplealignment and tree construction, Methods in Phylogeneic Analysis, Profiles and Motifs

UNIT V **18 hours**

Tools in Bioinformatics, Tools for database search using search engines, Finding scientific articles, Finding public data bases, Depositing data into public data bases, Tools for Sequence Analysis, Algorithms issues in data base search, FASTA, BLAST, Amino acid substitution matrices PAM and BLOSSUM

Text Books:

1. George Koch and Kevin Loney; ORACLE 8-THE COMPLETE REFERENCE, Tata McGraw – Hill Edition, 1988.
2. Michael Abbey andMichael J. Correy; ORACLE 8 – A BEGINNERS GUIDE, 1997.
3. Eddy, S.R., Durbin et al; Computational Molecular Biology, 2002.

4. Cynthia Gibas& Per Jampeck, Developing Bioinformatics ComputerSkills; Shroff Publishers and Distributors Private Limited, Calcutta, 2001.
5. Waterman,Michael S, Introduction to Computational Biology, Chapman and Hall, CRC Press, 2000.

Books for Reference:

1. Baxevanis, A.D., and Ouellette, Francis, B.F., Bioinformatics – A practical Guide to theAnalysis
of genes and Proteins, JohnWiley and Sons Inc. Publishing, New York, 1998.
2. Dan Gusfield, Algorithms on Strings, trees and sequences, Cambridge University Press, USA.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code			Title of the Paper			Hours		Credits	
II	20PMA2DE2B			MATHEMATICAL METHODS IN BIOLOGY			6		4	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√	√	√	√	√	√	√	√	√	√
CO2	√	√		√	√	√		√	√	
CO3	√		√	√		√	√	√		√
CO4	√	√	√	√	√		√	√	√	
CO5		√	√		√	√	√		√	√
Number of Matches= 36, Relationship : HIGH										

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