M.SC. MATHEMATICS

SEMESTER: I

COURSE CODE: 23PMA1C01

TITLE OF THE COURSE: CORE : ALGEBRA

COURSE OBJECTIVES:

- To lay the foundation for further study of higher Mathematics
- To impart in the students the basic skill to use mathematical language in a formal reasoning framework.

COURSE OUTCOMES

At the end of the course the students will be able to

CO1	Recall the idea of Group theory and list out the number of subgroups based on counting principle	K2
CO2	Retrive the notion of Euclidean ring and extend to polynomials	K2
CO3	IIlustrate extension field based on Fields and compute roots of the polynomial.	K3
CO4	Apply the concept of automorphism to construct Galois field	K4
CO5	Analyse the various forms of Linear Transformation using Matrices	K4

SYLLABUS

Credits: 4 **Instructional Hours: 90**

UNIT I Group Theory (K2) **18 Hours**

Group Theory: Conjugacy – Normalizer – Cauchy's Theorem - Another counting principle - Sylow's Theorem [https://youtu.be/Wk36dZ4NRtM] - first Part of Sylow's theorem - Second part of Sylow's Theorem - Third Part of Sylow's theorem - Direct Product

[Beyond the Curriculum –Finite Abelian Groups]

UNIT II Ring Theory (K2) **18 Hours**

Ring Theory: Euclidean rings-particular Euclidean ring – Fermat Theorem-Polynomial rings – The Division algorithm-Polynomials over rational field-Gauss Lemma- Einstein's Criterion.

(Self study-Ring Theory:Euclidean Rings)

UNIT III Fields (K3) **18 Hours**

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Fields: Extension fields-Roots of polynomials- Remainder Theorem-More about Roots

UNIT IV Fields and Galois Theory (K4) 18 Hours

Fields: Elements of Galois Theory - Elementary Symmetric Functions-Theorems on Symmetric Polynomials -Finite Fields

UNIT V Linear Transformation (K4) 18 Hours

Linear Transformation: Canonical forms: Triangular form-Trace and Transpose-Jacobson's lemma-Hermitian, unitary and normal Transformations.

(Self study-Linear Transformations)

TEXT BOOK:

I. N. Herstein (1999) Topics in Algebra (2nd Edition), Johnwiley and Sons, Pvt Ltd-Singapore

UNIT I	Chapter 2 - Sections 2.11 to 2.12
UNIT II	Chapter 3 - Section 3.7 to 3.9
UNIT III	Chapter 5 - Sections 5.1 and 5.3
UNIT IV	Chapter 5 - Sections 5.6, Chapter 7 - Section 7.1
UNIT V	Chapter 6 - Sections 6.4, 6.8 and 6.10.

REFERENCE BOOKS:

1. J.B. Fraliegh (1988), A first course in Abstract Algebra, Narosa Publishing House, New Delhi.
2. Stephen H.Friedberg, Arnold J.Insel, Lawrence E.Spence (2009), Linear Algebra, PHI learning Pvt ltd. New Delhi.
3. Waerden,Van Der. B. L (1991) Algebra.Vol. II , Springer International.
4. Sahai,Vivek & Bist Vikas (2008), Algebra, Ed 3, Narosa Publishing House, New Delhi.
5. Thomas. W Hungerford (1974), Algebra Texts in Mathematics, Springer international.

BLENDED LEARNING

UNIT	TOPICS	LINKS
I	Sylow's first theorem-Sylow p-subgroup	https://youtu.be/vTWC6LKBBA0
	Second proof of Sylow's theorem	https://youtu.be/u0GuMqnMGQI
	Second part of Sylow's theorem	https://youtu.be/cCRgIP1HPkg
	Third part of Sylow's theorem	https://youtu.be/RJk3uXvCXjk
IV	Elements of galois theory	https://youtu.be/BhRPUqD5miM

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	Theorems on Symmetric Polynomials	https://youtu.be/oIbl6aQAQso

MAPPING OF CO's WITH PO's and PSO's

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	2	3	2	2	3	1	2	1	1	3	3	3	3	3
CO2	3	2	3	2	3	3	2	2	1	1	3	3	3	3	3
CO3	3	2	3	2	3	3	2	2	1	1	3	3	3	3	3
CO4	3	2	3	3	3	3	2	2	1	1	3	3	3	3	3
CO5	3	1	3	3	3	3	3	3	2	3	3	3	3	3	3

Correlation: 3-High 2-Medium 1-Low

ASSESSMENT TOOLS:

S.No	**Assessment methods**	**Frequency of Assessment**
1.	End Semester Examination	Once in a semester
2.	CIA I	Once in a semester
3.	CIA II	Once in a semester
4.	Model Examination	Once in a semester
5.	Assignment (Unit I & II)	Twice in a semester
6.	Seminar (Unit III & IV)	Twice in a semester
7.	Term paper presentation (Unit V)	Once in a semester

Course designed by Dr.Francina Shalini	**Verified by HOD** Dr. K.Julia Rose Mary
Checked by CDC Dr.S.Jaculin Arockia Selvi	**Approved by** Principal

SEMESTER: I

COURSE CODE: 23PMA1C02

TITLE OF THE COURSE: CORE - REAL ANALYSIS

Dr. D. Jayanthi	**Dr. N. Murugesan.**	**Dr. C. Janaki**	**Mr. T. Vibu .**	**Ms. J. Magdalene**

COURSE OBJECTIVES:

- To present the concepts and techniques of analysis in a way that will provide knowledge in mastering the fundamentals of the theory.
- To provide a solid foundation in the theory of Riemaan - Steiltjes integral.
- To create an idea about Measure Theory and its Integration.

COURSE OUTCOMES

At the end of the course the students will be able to

CO1	Define R-S Integral and state its properties of Integration & differentiation	K2
CO2	Demonstrate sequences and series of functions with Uniform convergence of integration and differentiation.	K3
CO3	Apply functions of several variables into Inverse and Implicit function theorems	K3
CO4	Express Lebesgue Measure into their functions	K3
CO5	Extend Lebesgue Integral with convergence based on Lebesgue Measure.	K4

SYLLABUS

Credits: 4 **Instructional Hours: 90**

UNIT I: R-S Integral (K2) **18 Hours**

R-S Integral: Definition and Existence of the Integral - Properties of the Integral Integration and Differentiation - Integration of Vector - Valued Functions

(Self Study -Rectifiable Curves)

UNIT II Sequences and Series of Functions (K3) **18 Hours**

Sequences and Series of Functions: Discussion of main Problem – Uniform Convergence - Uniform Convergence and Continuity - Uniform Convergence and Integration - Uniform Convergence and Differentiation - Equicontinuous Families of Functions - The Stone - Weierstrass Theorem.

UNIT III Functions of several variables (K3) **18 Hours**

Functions of several variables: Linear Transformation – The Contraction Principle – The Inverse Function Theorem – The Implicit Function Theorem - Derivatives of Higher Order – Differentiation of Integrals.

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[Beyond the Curriculum –Rank Theorem, Determinants]

UNIT IV Lebesgue Measure (K3) 18 Hours

Lebesgue Measure: Outer measure - Measurable sets and Lebesgue measure - Measurable functions - Littlewood's Theorem.

UNIT V Lebesgue Integral (K4) 18 Hours

Lebesgue Integral: The Lebesgue integral of bounded functions over a set of finite measure - integral of non-negative functions - General Lebesgue Integral

(Self study -Convergence in measure)

TEXT BOOKS:

1. Rudin W, (1976), Principles of mathematical Analysis (2nd Edition), McGraw Hill, New York. (UNIT I to III: Chapters 6,7 and 9 (omit 9.30-9.37))

2. Roydon H. L, (1988), Real Analysis, (3rd Edition), Macmillan, New York.
(UNIT IV to V: Chapters 3 and 4).

REFERENCE BOOKS:

1. Bartle R.G, (1976), Elements of Real Analysis, (2nd Edition), John Willy and sons, New York.

2. Rudin , (2006), Real and Complex Analysis, (3rd Edition), Mc Graw Hill, India.

3. Rangachari M. S, (1996), Real Analysis, New Century Book House :Academic Staff College, University of Madras.

4. Goldberg, Richard R, (1964), Methods of real analysis, Oxford & IBH Publishing Co Pvt Ltd.

BLENDED LEARNING

UNIT	TOPICS	LINKS
II	Sequences and Series of Functions	https://youtu.be/bWTmUWWZnhQ
	Equicontinuous Families of Functions	https://youtu.be/sslQQHAchMY
IV	Introduction to Measure Theory	https://youtu.be/nsMUPVceFUk
	Lebesgue Measure	https://youtu.be/M7pi0UulwhA
	Littlewood's Function	https://youtu.be/MeSXfoqvZ1c

MAPPING OF CO's WITH PO's and PSO's

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3

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CO1	3	3	3	3	3	3	2	2	3	2	3	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	2	3	2	3	3	3
CO3	3	3	3	2	3	3	2	2	3	3	3	2	3	3	3
CO4	3	3	3	2	3	3	2	2	3	3	3	2	3	3	3
CO5	3	3	3	2	3	3	2	2	3	3	3	2	3	3	3

Correlation: 3-High 2-Medium 1-Low

ASSESSMENT TOOLS:

S.No	**Assessment methods**	**Frequency of Assessment**
1.	End Semester Examination	Once in a semester
2.	CIA I	Once in a semester
3.	CIA II	Once in a semester
4.	Model Examination	Once in a semester
5.	Assignment (Unit I & II)	Twice in a semester
6.	Seminar (Unit III & IV)	Twice in a semester
7.	Term Paper Presentation (Unit V)	Once in a semester

Course designed by Dr. A. Arokia Lancy	**Verified by HOD** Dr..K.Julia Rose.Mary
Checked by CDC Dr.S.Jaculin Arockia Selvi	**Approved by** Principal

SEMESTER: I

COURSE CODE: 23PMA1C03

TITLE OF THE COURSE: CORE - ORDINARY DIFFERENTIAL EQUATIONS

[Skill Development]

COURSE OBJECTIVES:

- To solve the differential equations which arise in the field of Science and Engineering in a simpler way.

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- To compare the linear and non-linear oscillations

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1	Explain Legendre equation and Legendre polynomials using the second order differential equations	K2
CO2	Demonstrate the existence and uniqueness theorem for the system of Linear Differential Equations	K3
CO3	Compute linear systems and periodic coefficients based on a system of first order equations.	K3
CO4	Examine the successive approximation based on Picard's theorem	K4
CO5	Appraise elementary linear oscillations and non-linear oscillation using Sturm's comparison theorem	K4

SYLLABUS

Credits:4 **Instructional Hours: 90**

UNIT I Solution in power series (K2) **18 hours**

Second order linear equations with ordinary points - Legendre equation and Legendre polynomials - second order equations with regular singular points-Bessel Functions

(***Self study: Properties of Bessel's functions – Bessel's equation)***

UNIT II System of linear differential equations (K3) **18 Hours**

Systems of first order equations - existence and uniqueness theorem – nth order equation - fundamental matrix – theorems based on fundamental matrix.

[Beyond the curriculum: Problems in Fundamental Matrix]

UNIT III Non-homogeneous linear systems (K3) **18 Hours**

Non-homogeneous linear systems - Linear systems with constant coefficient -linear systems with periodic coefficients.

UNIT IV Existence and uniqueness solutions (K4) **18 Hours**

Successive approximation - - Non-uniqueness of solution - Continuation and dependence on initial conditions - Existence of solutions in the large - Existence and uniqueness of solutions of systems.

UNIT V Oscillations of second order equations (K4) **18 Hours**

Fundamental results - Sturm's comparison theorem - Elementary linear Oscillations. Comparison theorem of Hille-Winter-oscillations of $x'' + a(t)x = 0$

(Self study: Elementary nonlinear oscillation)

TEXT BOOK:

Deo S.G. and Raghavendra.V, (2002)**,** Ordinary differential equations and stability theory Publisher Academic Press, New York

UNIT I Chapter – 3 Sections 3.2 - 3.5

UNIT II	Chapter - 4	Sections 4.2 - 4.4
UNIT III	Chapter - 4	Sections 4.5 - 4.7
UNIT IV	Chapter – 5	Sections 5.3 - 5.8
UNIT V	Chapter – 6	Sections 6.1 - 6.6

REFERENCE BOOKS:

1. Coddington.E.A and Levinsion.N, (1995), Theory of Ordinary Differential Equations , McGraw Hill Publishing Company, New York

2. SomaSundaram.D, (2013), Ordinary Differential Equations a First Course, Narosa Publishing Ltd, Delhi.

3. A. Chakarbarti, (2006), Elements of Ordinary Differential Equations and Special functions, New Age International Ltd, Delhi.

4. Lothar Collatz, (1986), Differential Equations, an Introduction with Applications, Wiley publisher.

BLENDED LEARNING

UNIT	TOPICS	LINKS
I	Legendre equation	*https://youtu.be/3e5BUrtUKZc*
IV	Picard's theorem	https://www.youtube.com/watch?v=oTN7hGoSPMw
V	Sturm's comparison theorem	https://www.youtube.com/watch?v=4gXY8uLgGOs

MAPPING OF CO's WITH PO's and PSO's

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	3	2	2	1	2	3	3	3	3	3	3	3	3	3
CO2	3	2	2	2	2	2	3	3	3	3	2	3	3	3	3
CO3	3	3	2	1	2	1	3	3	3	2	3	3	3	3	2
CO4	3	1	2	2	2	2	3	3	3	2	2	2	3	2	2
CO5	2	3	2	2	2	2	3	2	3	3	3	3	3	3	3

Correlation: 3-High 2-Medium 1-Low

ASSESSMENT TOOLS:

S.No	Assessment methods	Frequency of Assessment
1.	End Semester Examination	Once in a semester
2.	CIA I	Once in a semester
3.	CIA II	Once in a semester
4.	Model Examination	Once in a semester

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5.	Assignment (Unit I & II)	Twice in a semester
6.	Seminar (Unit III & IV)	Twice in a semester
7.	Real time Problem solving (Unit V)	Once in a semester

Course designed by Dr. K. Mohana	**Verified by HOD** Dr. K.Julia Rose.Mary
Checked by CDC Dr.S.Jaculin Arockia Selvi	**Approved by** Principal

SEMESTER: I

COURSE CODE: 23PMA1C04

TITLE OF THE COURSE: CORE - NUMERICAL ANALYSIS WITH MATLAB

[Skill Development]

COURSE OBJECTIVES:

- To solve the differential equations which arise in the fields of Science and Engineering by simple Numerical methods.
- To develop appropriate numerical methods to solve a differential equation.
- To introduce the Mathematical software MATLAB for high-performance numerical computations and visualization.
- To use MATLAB to solve numerical problems

COURSE OUTCOMES

At the end of the course the students will be able to

CO1	Identify the numerical methods to solve nonlinear equations and apply appropriate techniques for numerical differentiation and integration.	K2
CO2	Understand and solve a solution of the system of equations by differe methods.	K3
CO3	Solve an ordinary differential equation by appropriate numerical method	K3
CO4	Analyze the implications of approximations and to solve the numerical soluti of partial differential equations.	K4

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CO5	Investigate the boundary value problem and Eigenvalue problems.	K4

SYLLABUS

Credits: 4 **Instructional Hours: 90**

UNIT I Solving Nonlinear Equations: (K2) 18 hours

Newton's Method –- Bairstow's Method for Quadratic factors - Numerical Differentiation and Integration – Derivatives from Difference tables – Higher order derivatives – Divided difference - Central difference formula – Trapezoidal rule – Simpson's rule .

(Self Study: Trapezoidal Rule)

MATLAB: Newton-Raphson Method, Numerical Integration, Trapezoidal and Simpson's Rule,Solution of Differential Equations.

UNIT II Solution of system of equations: (K3) 18 hours

Gauss elimination method – Gauss-Jordan method – LU decomposition method - Matrix inversion method - Methods of iteration – Gauss Jacobi method and Gauss Seidal iteration. **MATLAB: Gauss Elimination and Gauss Jordan, Gauss Jacobi and Gauss Seidal iteration**.

(Self study:Gauss elimination method – Gauss-Jordan method)

UNIT III Solution of Ordinary Differential Equations: (K3) 18 hours

TheTaylor Series method - Taylor Series method of First order Equations - The Euler method and Its Modifications - Modified and Improved Euler methods - Runge-Kutta methods. Multistep methods**:** Milne's method – The Adams- Moulton Method.

MATLAB: Euler's Method - Taylor Series Method - Runge-Kutta Methods - Predictor-Corrector Methods.

UNIT IV Numerical solution of Partial differential equations (K4) 18 hours

(Solution of Elliptic, Parabolic and Hyperbolic Partial Differential Equations): Difference quotients - Elliptic equations: Laplace's equation – Liebmann's iteration process - Poisson Equations, Parabolic equations: Bender Schmidt method. Crank Nicholson Method– Hyperbolic equations.

UNIT V Boundary Value Problems and Characteristic Value Problems (K4) 18 hours

Solution through a set of equations - Derivative Boundary conditions - Characteristic Value Problems - The power Method: Eigenvalues of a matrix by Power method

(Beyond the Curriculum: The Shooting Method)

https://www.youtube.com/watch?v=_JeAp7SGGKM*MATLAB is used only for Practical not for Theory.

TEXTBOOKS

1. Curtis F Gerald and Patrick O. Wheatly, (1998), Applied Numerical Analysis, (5th edition), Pearson.

UNIT I 1.4, 1.8, 4.2 ,4.3,4.6,4.7

UNIT II 2.3, 2.4, 2.5, 2.7, 2.10

UNIT III 5.2, 5.3, 5.4, 5.5, 5.6, 5.7

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UNIT V 6.2, 6.3, 6.6, 6.7

2. MK Venkataraman, (1999)**,** Numerical Methods in Science and Engineering, Fifth edition. The National Publishing Company, Madras.

UNIT IV Chapter XII Sections 1 to 9

3. John H. Mathews and Kurds D. Fink, Numerical Methods using MATLAB,Third Edition, Prentice Hall, Upper Saddle River, NJ, 1999.

Reference Books:

1. Chapra S.C. and Canale R.P. (2006) Numerical Methods for Engineers, 5th Ed., McGraw Hill

2. Brian R Hunt, Ronald L Lipsman, Jonathan M Rosenberg, A Guide to MATLAB for Beginners and Experienced Users, Cambridge University Press, 2003.

3. C. Woodford and C. Phillips, Numerical Methods with Worked Examples, Matlab Edition, Springer, Netherlands, 2012. 38

4. Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma, MATLAB and its Applications in Engineering, Butterworth-Heinemann; 3 edition, e– book, 2013.

5. Rudra Pratap, Getting started with MATLAB 7, Oxford University Press, 2008.

6. Steven T. Karris, "Numerical Analysis Using Matlab and Excel", Third Edition, Orchard Publication, 2007.

BLENDED LEARNING

UNIT	TOPICS	LINKS
IV	Parabolic equations: Bender schmidt method.	https://www.youtube.com/watch?v=m_1ohMonnOU https://www.youtube.com/watch?v=wxW_R32ziwI
IV	Derivative Boundary Conditions	https://www .youtube.com/watch?v=_JeAp7SGGKM

MAPPING OF CO's WITH PO's and PSO's

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	3	2	2	2	2	3	2	3	3	2	3	3	3	3
CO2	3	3	2	2	2	2	3	2	3	3	2	3	3	3	3
CO3	3	3	2	2	2	2	3	2	3	3	2	3	3	3	3
CO4	3	3	2	2	2	2	3	2	3	3	2	3	3	3	3
CO5	3	3	2	2	2	2	3	3	3	3	2	3	3	3	3

Correlation: 3-High 2-Medium 1-Low

ASSESSMENT TOOLS:

S.No	Assessment methods	Frequency of Assessment

Dr. D. Jayanthi	**Dr. N. Murugesan**.	**Dr. C. Janaki**	**Mr. T. Vibu .**	**Ms. J. Magdalene**

1.	End Semester Examination	Once in a semester
2.	CIA I	Once in a semester
3.	CIA II	Once in a semester
4.	Model Examination	Once in a semester
5.	Assignment (Unit I & II)	Twice in a semester
6.	Seminar (Unit III & IV)	Twice in a semester
7.	Term Paper Presentation (Unit V)	Once in a semester

Course designed by Dr. A. Sahaya Sudha	**Verified by HOD** Dr. K.Julia Rose Mary
Checked by CDC Dr.S.Jaculin Arockia Selvi	**Approved by** Principal

SEMESTER I

COURSE CODE: 23PMA1E01

TITLE OF THE COURSE: ELECTIVE 1-PYTHON PROGRAMMING

SYLLABUS

OBJECTIVES:

- To provide a comprehensive study of the Python programming language
- To master in writing the Python scripts
- To identify problems that requires programmed solution

At the end of the course, the students will be able to

Co1	Define the Identifiers, Keywords and Variables	K2 Understanding
Co2	Discuss the operators and control flow statements	K2 Understanding
Co3	Writing Python Scripts by acquiring knowledge on functions	K3 Applying
Co4	Apply String and Lists in programmes	K4 Analyzing
Co5	Analyze and design Dictionary methods using	K4

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	tuples	Analyzing

Credits: 4 **Instructional Hours: 90**

Unit I :Introduction to Python (K2) 18 hours

Introduction- Python overview- Getting started with Python- Comments Python- Identifiers – Reserved Keywords – Variables – Standard Data types

1. **https://youtu.be/_uQrJ0TkZlc**
2. **https://www.tutorialspoint.com/python/python_overview.htm**
3. **https://youtu.be/wLJh4Gmgb9o**
4. **https://youtu.be/yHFcNNh-SsA**

Unit II : Operators and Control flow statements (K2) 18 hours

Operators – Statement and Expression – String operations – Boolean expressions - Control statements – Iteration While statement - Input from key board Operators in Python

1. **https://youtu.be/v5MR5JnKcZI**
2. **https://youtu.be/Pm9FOpOwhlA**
3. **https://fsharpforfunandprofit.com/posts/expressions-vs-statements/**

Unit III: Functions (K3) 18 hours

Introduction - Built in functions – Composition of functions - user defined functions - Parameters and arguments - Function calls -The Return statement - Python Recursive function - The Anonymous functions – Writing Python scripts.

(Self study- Built in functions)

Unit IV: Strings and Lists (K4) 18 hours

Strings – Compound data type – Len function – String slices – Strings are immutable – String Traversal – Escape characters - string formatting operators – string formatting functionsLists – Value access of elements - Lists are mutable – Traversing list – Deleting elements from list - Built in list operators – Built in list methods

(Self study-Len function)

Unit V: Tuples and Dictionaries (K4) 18 hours

Tuples - Creating tuples - Accessing values in tuples - Tuples are immutable – Tuple Assignment – Tuples Return values - Variable length argument tuple - Basic tuple operation – Built in tuple function.

Dictionaries – Creating Dictionary – Accessing values in Dictionary - Updating Dictionary – Deleting elements from Dictionary – Properties of Dictionary – Key operations in Dictionary – Built in Dictionary methods

Mapping of CO's with PO's/PSO's :

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PSO 1**	**PSO 2**	**PSO3**

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CO1	2	1	2	3	2	1	2	3	3	3	2	2	2
CO2	2	2	1	3	2	2	3	3	2	3	2	2	2
CO3	3	2	2	3	2	2	3	3	3	3	2	2	3
CO4	2	1	2	3	2	2	3	3	3	3	2	2	3
CO5	2	2	2	3	1	2	3	3	3	3	2	2	3

Correlation: H-High, M-Medium, L-Low

ASSESSMENT TOOLS:

S.NO	ASSESSMENT METHODS	FREQUENCY OF ASSESSMENT
1.	End Semester Examination	Once in a semester
2.	CIA I	Once in a semester
3.	CIA II	Once in a semester
4.	Assignment	Once in a semester
5.	Online Quiz	Once in a semester
6.	Seminar	Once in a semester
7.	Power Point Presentation	Once in a semester

TEXT BOOK:

Introduction to Computing and Problem-Solving using Python by E. Balagurusamy, McGraw Hill Education (India) Private limited, New Delhi (2016)

Unit I : Chapter 3: section 3.1 – 3.8

Unit II: Chapter 3: Section 3.9 – 3.15

Unit III : Chapter 4: 4.1 – 4.10

Unit IV : Chapter 5

Unit V: Chapter 6

REFERENCE BOOKS:

1. Wesley J. Chun, “Core Python Applications Programming”, 3rd Edition, PearsonEducation, 2016

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2. Charles Dierbach, “Introduction to Computer Science using Python”, Wiley, 2015
3. Jeeva Jose &P.SojanLal, “Introduction to Computing and Problem Solving with PYTHON”, Khanna Publishers, New Delhi, 2016
4. Mark Lutz, “Learning Python”, 5th edition, Orelly Publication, 2013, ISBN 978-1449355739

Course designed by Dr. K.Julia Rose Mary	**Verified by HOD** Dr. K.Julia Rose Mary
Checked by CDC Dr.S.Jaculin Arockia Selvi	**Approved by** Principal

SEMESTER I

COURSE CODE: 23PMA1E02

TITLE OF THE COURSE: ELECTIVE 2- ANALYSIS OF ALGORITHMS

SYLLABUS

OBJECTIVES:

- To introduce the knowledge of analysis of algorithms.
- To find the algorithms of complexity order.
- To evaluate linked lists and trees
- To understand the searching and sorting methods.

At the end of the course the students will have the able to:

Co 1	Learn the different specifications of algorithms	K2 Understanding
Co 2	Identify data structures and queues	K3 Applying
Co 3	Distinguish linked lists and trees	K3 Applying
Co 4	Evaluate search and sort in graphs	K4 Analyzing

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Co 5	Evaluate and interpolate different algebraic problems	K4 Analyzing

Credits: 4 **Instructional Hours: 90**

Unit-I Algorithms (K2) **18 hours**

Introduction-Algorithm-Algorithmspecification:PseudocodeConventions, Recursive algorithms - Performance analysis: Space Complexity, Time Complexity,AsymptoticNotation,PracticalComplexities.

Algorithmspecification:PseudocodeConventions:https://youtu.be/QCdIclk8kts

Performance analysis:https://youtu.be/sn1ugY-jzQE

Unit-II Data structures and Queues (K3) **18 hours**

Arrays – ordered lists- Representation of Arrays-Stack and Queues – Fundamentals-Evaluation of Expressions.

Self Study: Arrays

Unit-III Linked lists and trees (K3) **18 hours**

Linked Lists - Singly Linked Lists- Linked Stacks and Queues-More on LinkedLists-SimplealgorithmsofDoublyLinkedLists(insertionanddeletion only).Trees- Binary Trees-Binary Tree Representations- Binary Tree Traversal.

Self Study: Trees

Binary Tree Traversal :https://youtu.be/gm8DUJJhmY4

Linked Lists:https://youtu.be/WwfhLC16bis

Unit-IV Search and Sort (K4) **18 hours**

Divideandconquer-Generalmethod-Binarysearch-Findingthemaximum andminimuminasetofitems-Mergesort-Quicksort-Selectionsort.Basic Traversal and Search Techniques for graphs: Breadth First Search - Depth FirstSearch

Unit-V Interpolations (K4) **18 hours**

Backtracking - The 8-Queens problem - Algebraic problems - The general method-Evaluationandinterpolation-Horner'srule-Lagrangeinterpolation

Newtonian interpolation

MAPPING OF CO's WITH PO's/PSO's:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	2	1	3	3	3	1	3	2	1

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CO 2	3	3	3	3	3	2	1	3	3	3	1	3	2	1
CO 3	3	3	3	3	3	2	1	3	3	3	1	3	2	1
CO 4	3	3	3	3	3	2	1	3	3	3	1	3	2	1
CO 5	3	3	3	3	3	2	1	3	3	3	1	3	2	1

Correlation: L-Low, M-Medium, H-High

ASSESSMENT TOOLS

S.NO	ASSESSMENT TOOLS	FREQUENCY OF ASSESSMENT
1.	End semester examination	Once in a semester
2.	CIA I	Once in a semester
3.	CIA II	Once in a semester
4.	Assignment	Once in a semester
5.	Online quiz	Once in a semester

Textbooks:

1. Ellis Horowitz, Sartaj Sahniand Sanguthevar Rajasekaran, Fundamentals of Computer algorithms, Galgotia Publications Pvt. Ltd., 2004.
   Units: I Sections:1.1, 1.2, 1.3.1 to1.3.4
   Units: IV Sections:3.1 to 3.5, 6.2
   Units: V Sections:7.1, 7.2, 9.1, 9.2
2. Ellis Horowitz, SartajSahni, Fundamentals of Data Structures, Galgotia BookSource, 1981.
   Units:II Sections: 2.2, 2.4, 3.1, 3.3
   Units:III Sections:4.1, 4.2, 4.5, 4.8, 5.2, 5.3, 5.4

References

1. A.V. Aho, J.E.Hopcroft, J.D. Ullman, The Design and Analysis of Computer Algorithms,Addison-WesleyPubl.Comp.,1974.
2. Seymour E.Goodman and S.T. Hedetniemi, Introduction to the design and analysis of algorithms, McGraw Hill International Edition, 2002.

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Course designed by Dr. K.Julia Rose Mary	**Verified by HOD** Dr. K.Julia Rose Mary
Checked by CDC Dr.S.Jaculin Arockia Selvi	**Approved by** Principal

SEMESTER II

COURSE CODE: 23PMA2C05

TITLE OF THE COURSE: CORE - COMPLEX ANALYSIS

COURSE OBJECTIVES:

- To know the basic concepts of limits and continuity of analytic functions
- To evaluate complex integration and to study important related theorems

COURSE OUTCOMES

At the end of the course the students will be able to

CO1	Retrieve the idea of analytical functions and linear transformations using complex numbers	K2
CO2	Discuss Cauchy's theorem for various contours and to associate for higher derivatives	K2
CO3	Analyze on the types of singularities, calculus of residues and to have a thorough study of harmonic functions.	K3
CO4	Appraise on various forms of series and product development	K4
CO5	Outline the importance of Riemann mapping and boundary behavior.	K4

SYLLABUS

Credits: 4 **Instructional Hours: 75**

UNIT I Analytic functions (K2) **15 Hours**

Introduction to the concept of analytic function – Polynomials – Rational function – Elementary theory of power series: Power series – Abel's limit theorem – Conformality, Arcs and closed curves analytic functions in regions – Conformal Mapping – Linear transformation – The linear group – The Cross ratio – Symmetry.

(Self Study: Cross ratio)

UNIT II Complex Integration:(K2) **15 Hours**

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 - The index of a point with respect to a closed curve - The integral formula-higher derivatives**.**

UNIT III Calculus of Residues(K3) 15 Hours

Removable Singularities - Taylor's theorem - Zeros & Poles - The local mapping – The maximum principle – Chains and cycles - The Calculus of residues: The residue theorem - The argument principle - Evaluation of definite integrals - Harmonic Functions: The definitions & basic properties - Mean value property - Poisson's Formula.

[Self Study: Zeros]

UNIT IV Series & Product Developments:(K4) 15 Hours

Series & Product Developments: Weierstrass Theorem - The Taylor's series – Laurent Series - Partial fractions & Factorization - Partial Fractions - Infinite Products - Canonical Products.

UNIT V The Gamma function(K4) 15 Hours

The Gamma function - The Riemann Mapping Theorem – Statement and Proof - Boundary behavior – use of the reflection principle – Analysis arcs.

(Beyond the curriculum:Stirling's Formula)

TEXT BOOK:

1.L.V.Ahlfors, (1979), Complex Analysis, Mc Graw hill, New York,

UNIT I	Chapter – 2	Sections 1.3 – 1.4, 2.4 – 2.5
	Chapter – 3	Sections 2.1 – 2.3, 3.1 – 3.3
UNIT II	Chapter - 4	Sections 1.1 – 1.5, 2.1 - 2.3
UNIT III	Chapter – 4	Sections 3.3 – 3.4, 4.1
		Sections 5.1 5.3, 6.1 – 6.3
UNIT IV	Chapter – 5	Sections 1.1 – 1.3, 2.1 – 2.3
UNIT V	Chapter – 5	Sections 2.4
	Chapter – 6	Sections 1.1 – 1.4

REFERENCE BOOKS:

1. V.Karunakaran, (2005), Complex analysis(1st Edition),Narosa Publishing home, New Delhi.
2. S.Ponnusamy,(2005), Foundation of Complex Analysis(2rd Edition), Narosa Publishing home, New Delhi.
3. Zill,Dennis G &Shanahan,Patrick,D,(2016), Complex Analysis (Ed-3), Jones & Bartlett India Pvt. Ltd.
4. Dube,K.K,(2009), Fundamentals Of Complex Analysis Theory and Applications, I.K International Publishing House Pvt.Ltd.
5. Biswal, PurnaChandra,(2015),Complex analysis, PHI Learning Pvt Ltd.

BLENDED LEARNING

UNIT	TOPICS	LINKS
I	CONFORMAL MAPPING	HTTPS://YOUTU.BE/48AERHS9WL0

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IV	Weierstrass theorm	https://youtu.be/NXvvWBgH5wo
	Laurent Series For Complex Number	https://youtu.be/gUmIrJRXDSs
	The Taylor's series	https://youtu.be/xls_5Ly7VA4-
	Laurent Series	https://youtu.be/bB8naRlKYPI
	power series	https://youtu.be/BsDGcJN_1TU-

MAPPING OF CO's WITH PO's and PSO's

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	2	3	2	2	3	1	2	2	2	3	3	3	3	3
CO2	3	2	3	2	3	3	2	2	2	2	3	3	3	3	3
CO3	3	2	3	2	3	3	2	2	2	2	3	3	3	3	3
CO4	3	2	3	3	3	3	2	2	2	2	3	3	3	3	3
CO5	3	1	3	3	3	3	3	3	2	3	3	3	3	3	3

Correlation: 3-High 2-Medium 1-Low

ASSESSMENT TOOLS:

S.No	Assessment methods	Frequency of Assessment
1.	End Semester Examination	Once in a semester
2.	CIA I	Once in a semester
3.	CIA II	Once in a semester
4.	Model Examination	Once in a semester
5.	Assignment (Unit I & II)	Twice in a semester
6.	Seminar (Unit III & IV)	Twice in a semester
7.	Group Discussion (Unit V)	Once in a semester

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Checked by CDC Dr.S.Jaculin Arockia Selvi	**Approved by** Principal

Dr. D. Jayanthi	**Dr. N. Murugesan**.	**Dr. C. Janaki**	**Mr. T. Vibu** .	**Ms. J. Magdalene**

SEMESTER: II

COURSE CODE: 23PMA2C06

TITLE OF THE COURSE: CORE - PARTIAL DIFFERENTIAL EQUATIONS

[Skill Development]

COURSE OBJECTIVES:

- To provide the reader with an easier and systematic way of solving partial differential equations.
- To demonstrate the ability to understand and use basic models to describe and analyze initial and boundary value problems.

COURSE OUTCOMES

At the end of the course the students will be able to

CO1	Explain solving First Order Partial Differential Equations using different methods	K2
CO2	Discuss Second Order Partial Differential Equations with interpretations.	K2
CO3	Solving Linear hyperbolic equations using method of integral transforms.	K3
CO4	Apply Laplace Equations for Boundary Value Problems	K3
CO5	Appraise wave equations and Diffusion equations using separation of variables	K4

SYLLABUS

Credits: 4 **Instructional Hours: 75**

UNIT I First Order partial differential equation(K2) **15 hours**

Non linear partial differential equations of the first order - Cauchy's method of Characteristics - Compatible systems of first order equations - Charpit's method -Special types of first order equations - Jacobi's method.

UNIT II Second Order partial differential equation(K2) 15 hours

Partial differential equations of the second order - The origin of second order Equations - Linear Partial differential equations with constant coefficients - Equations with variable coefficients -Characteristic curves of second order Equations - Characteristics of equations in three variables.

UNIT III Hyperbolic Differential Equation(K3) 15 hours

The solution of Linear Hyperbolic Equations - Separation of variables - The method of integral transforms.

[Beyond the Curriculum :Non Linear equations of the Second Order]

UNIT IV Laplace Equations(K3) 15 hours

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Laplace's equations -The occurrence of Laplace's equations in Physics - Elementary Solutions of Laplace's equations - Families of equipotential surfaces - Boundary value problems

(Self Study: Separation of Variables)

UNIT V Wave Equations (K4) 15 hours

The wave equation -The occurrence of wave equation in Physics – Elementary solutions of one-dimensional wave equation - The Diffusion Equation: Elementary solutions of Diffusion Equation.

[Self Study -Separation of variables.]

TEXTBOOK:

Ian.N.Sneddon, (1989), Treatment as in Elements of Partial Differential Equations, McGraw-Hill Book Company.

UNIT I Chapter 2 Sections 7,8,9,10,11 and 13.

UNIT II Chapter 3 Sections 1, 4, 5, 6 and 7.

UNIT III Chapter 3 Sections 8 to 10.

UNIT IV Chapter 4 Sections 1 to 5.

UNIT V Chapter 5 Sections 1, 2 and Chapter 6: Sections 3, 4

REFERENCE BOOKS:

1. Amaranath.T, (2003), Partial Differential Equation, Ed.2,,Narosa Publishing House, Delhi.
2. Veerarajan T, (2004), Partial Differential Equation and integral transforms, Tata McGraw-Hill Publishing Co Ltd.
3. T.Amaranath, (2003), An Elementary Course in Partial Differential Equations, Second Edition, Narosa Publishing House Pvt Ltd, Delhi.
4. Gupta P.P, (2003), Partial Differential Equations, Pragati Prakashan House -Meerut.

BLENDED LEARNING

UNIT	TOPICS	LINKS
I	Non linear partial differential equations of the first order-	https://youtu.be/DLQi4mL_ifE
	Compatible systems of first order equations	https://youtu.be/YbBvZe035Aa
	Cauchy's method of Characteristics	https://youtu.be/FVI7N6lAEY0-
V	Diffusion equation and its introduction-	https://youtu.be/npWWesmdlxk -
	One dimensional wave equation	https://youtu.be/WgCUXYWTqPs -

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MAPPING OF CO's WITH PO's and PSO's

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	3	3	3	3	3	2	2	3	2	3	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	2	3	2	3	3	3
CO3	3	3	3	2	3	3	2	2	3	3	3	2	3	3	3
CO4	3	3	3	2	3	3	2	2	3	3	3	2	3	3	3
CO5	3	3	3	2	3	3	2	2	3	3	3	2	3	3	3

Correlation: 3-High 2-Medium 1-Low

ASSESSMENT TOOLS:

S.No	**Assessment methods**	**Frequency of Assessment**
1.	End Semester Examination	Once in a semester
2.	CIA I	Once in a semester
3.	CIA II	Once in a semester
4.	Model Examination	Once in a semester
5.	Assignment (Unit I & II)	Twice in a semester
6.	Seminar (Unit III & IV)	Twice in a semester
7.	Real time Problem solving (Unit V)	Once in a semester

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Checked by CDC Dr.S.Jaculin Arockia Selvi	**Approved by** Principal

SEMESTER: II

COURSE CODE: 23PMA2C07

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TITLE OF THE COURSE: CORE – CONTROL THEORY

[Employability]

COURSE OBJECTIVES: To solve the complexity of modern systems of control on computers, microprocessors or any electronic devices.

- To exhibit a wide variety of modern techniques that go beyond associated with traditional applied mathematics to a larger spectrum.

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1	Understand the fundamental limits of control in differential equation and observability.	K2
CO2	Discuss various properties of controllability including Linear and Nonlinear systems.	K2
CO3	Carry out the synthesis of Linear and Nonlinear stability of the system and analyze the control system stability.	K3
CO4	Design stabilization via feedback control systems based on Bass Method	K4
CO5	Formulate An optimal control problem and analyze Linear and Non linear optimal control system.	K4

SYLLABUS

Credits: 4 **Instructional Hours: 75**

UNIT I:Differential Equations and observability (K2) **15 Hours**

Differential Equations and observability: Basic results of differential equations – Fixed point method - Banach Fixed point theorem- Brouwer Fixed Point Theorem - Linear system – observability Grammian – constant coefficient systems – reconstruction Kernel- Non linear systems.

UNIT II: Controllability (K2) **15 Hours**

Controllability: Linear Systems) – Controllability Grammian – adjoint systems – constant coefficient systems – Steering function – Non linear systems-completely controllable-Growth condition.

(Beyond Curriculum: Controllability with Prescribed control)

UNIT III: Stability (K3) **15 Hours**

Stability: Linear Systems – uniform stability – asymptotic stability – of linear systems – linear time varying systems – Perturbed Linear Systems – Gronwall's Inequality – Non Linear Systems.

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UNIT IV: Stabilizability(K4) **15 Hours**

Stabilization via Linear Feedback Control– Bass method – The Controllable Subspace – Stabilization with Restricted Feedback.

(***Self study: Stabilization with Restricted Feedback***)

UNIT V: Optimal control (K4) **15 Hours**

Optimal control: Linear Time Varying Systems with quadratic performance criteria – Matrix Ricatti equation– Linear Time Invariant Systems – Non Linear Systems.

(Self study:Linear Time Invariant Systems)

TEXT BOOK:

Balachandranand.Dauer,J.P, (1999), Elements of Control Theory, Narosa Publishing House, New Delhi,

UNIT I	Chapter 1	Sections 1.2, 1.3
	Chapter 2	Sections 2.1, 2.2
UNIT II	Chapter 3	Sections 3.1, 3.2
UNIT III	Chapter 4	Section 4.1, 4.2, 4.3
UNIT IV	Chapter 5	Sections 5.1, 5.2, 5.3
UNIT V	Chapter 6	Sections 6.1, 6.2, 6.3

REFERENCE BOOKS:

1.R.Conti,(1976), Linear Differential Equations and Control Theory, Academic Press, London.

2.H.Hormes and J.O.Lasalle, (1969), Functional analysis and Time Optional Control, Academic Press

3.L.R.Leigh,(1980), Functional analysis and Linear Control, Academic Press

4. E.B.Lee and L.Markus, (1967), Foundations of Optimal Control Theory, John Wiley, New York

BLENDED LEARNING

UNIT	TOPICS	LINKS
I	Existence using Fixed point theorem	https://www.youtube.com/watch?v=ngbBa15-pX8
II	Controllability and Observability	(https://www.youtube.com/watch?v=S4_rIjCC70w&t=1388s)
IV	Stabilizability	(https://www.youtube.com/watch?v=rq1rXIdpIJw)
V	The Riccati Equation	(https://www.youtube.com/watch?v=3heIoKDhN3E)

MAPPING OF CO's WITH PO's and PSO's

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	2	3	2	2	2	2	3	3	3	2	3	2	2	3	3
CO2	2	3	2	2	2	2	3	3	3	2	3	2	2	3	3
CO3	2	3	2	2	2	2	3	3	3	2	3	2	2	3	3
CO4	2	3	2	2	2	2	3	3	3	2	3	2	2	3	3
CO5	2	3	2	2	2	2	3	3	3	2	3	2	2	3	3

Correlation: 3-High 2-Medium 1-Low

ASSESSMENT TOOLS:

S.No	Assessment methods	Frequency of Assessment
1.	End Semester Examination	Once in a semester
2.	CIA I	Once in a semester
3.	CIA II	Once in a semester
4.	Model Examination	Once in a semester
5.	Assignment (Unit I & II)	Twice in a semester
6.	Seminar (Unit III & IV)	Twice in a semester
7.	Group Discussion (Unit V)	Once in a semester

Course designed by Dr. A. Sahaya Sudha	**Verified by HOD** Dr. K.Julia Rose Mary
Checked by CDC Dr.S.Jaculin Arockia Selvi	**Approved by** Principal

SEMESTER: II

COURSE CODE: 23PMA2C08

TITLE OF THE COURSE: CORE - GRAPH THEORY

[Employability]

COURSE OBJECTIVES:

- To learn the concept of graph theory and understand its applications to other branches of Mathematics.

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- To gain knowledge about different types of graphs, their properties, relationships etc… and to implement them into real world problems.
- To understand new proofs of theorems of Brooks, Chvatal, Tutte and Vizing.

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1	To remember the definitions and properties of graphs, sub graphs and trees. To remember Cayley's formula.	K2
CO2	To understand the concept of connectivity, Euler tour and Hamilton cycles with their characteristics.	K2
CO3	To understand the concept of Matching and Covering and to apply the results to real world problems.	K3
CO4	To analyze independent set, chromatic number, chromatic polynomials and girth graphs.	K3
CO5	To understand planar graphs, dual graphs, four colour conjecture and directed graphs.	K4

SYLLABUS

Credits: 4 **Instructional Hours: 75**

UNIT I Graphs, Subgraphs and Trees (K2) **15 hours**

Graphs and simple graphs –Graph Isomorphism – Incidence and Adjacency matrices – Subgraphs – Vertex degree – Paths and Cycles.Trees – Cut edges and bonds – Cut vertices – Cayley's formula.

(Self study: Graphs and simple graphs)

UNIT II Connectivity, Euler Tours and Hamilton Cycles(K2) **15 hours**

Connectivity – Edge connectivity - Blocks – Internally disjoint paths – Whitney's theorem – Subdivision of edges - Menger's theorem - Euler Tours – Dirac theorem - Hamilton Cycles – Necessary condition for a graph to be Hamiltonian – Closure of a graph – degree majorised graph – Chvatal theorem.

UNIT III Matching and Edge Colorings(K3) **15 hours**

Matchings – Berge theorem - Matchings and Coverings in Bipartite graphs – Hall's theorem – Marriage theorem - Perfect Matchings – Tutte's theorem – multiplicity of a graph - Edge colorings – Edge Chromatic number – Vizing's theorem.

(Self study: Edge Chromatic number)

UNIT IV Independent Sets, Cliques and Vertex Colorings(K3) **15 hours**

Independent sets – Independence and covering number – edge covering – Erdos theorem - Ramsey's theorem – Vertex colourings – Critical graphs - Chromatic number – Dirac theorem - Brook's theorem – Hajos conjecture – Chromatic polynomials – Girth and Chromatic number.

UNIT V Planar Graphs and Directed graphs(K4) 15 hours

Plane and Planar graphs – Dual graphs – Euler's formula – Bridges – Kuratowski'stheorem, (Proof omitted) – The five colour theorem and the four colour Conjecture– Non hamilton planar graphs.Directed graphs – Directed paths – Directed cycles.

(Beyond the Curriculum: Networks)

TEXT BOOK:

J.A.Bondy and U.S.R.Murty, (1982), Graph Theory with Applications, North Holland, New York, Amsterdam, Oxford.

UNIT I Section: 1.1 to 1.7 & 2.1 to 2.4

UNIT II Section: 3.1 to 3.2 & 4.1 to 4.2

UNIT III Section: 5.1 to 5.3 & 6.1 to 6.2

UNIT IV Section: 7.1 to 7.3 & 8.1 to 8.5

UNIT V Section: 9.1 to 9.7 & 10.1 to 10.3

REFERENCE BOOKS:

1. Narsingh Deo, (2000), Graph Theory with Applications to Engineering and Computer Science, 19th Printing, Prentice Hall of India Private Ltd, New Delhi.

2. Frank Harary ,(1988), Graph Theory, Narosa Publishing House, New Delhi.

3. Parthasarathy K.R, (1994), Basic Graph Theory, Tata McGraw – Hill Publishing Co. Ltd,New Delhi.

4. Choudum S.A, (1987), A first course in Graph Theory, Macmillan Publishers

5. R.Balakrishnan, RJ Wilson, G.Sethuraman, (2004), Graph Theory and its Applications, Narosa Publishing House, New Delhi,

BLENDED LEARNING

UNIT	TOPICS	LINKS
IV	Ramsey Theory:	https://www.youtube.com/watch?v=-CxDfy7AsV8 https://www.youtube.com/watch?v=7p76yYMth5A https://www.youtube.com/watch?v=nZDaJenIH88
V	Planar Graphs	https://youtu.be/yklF3JDMxGk
	Coloring of planar graphs:	https://www.youtube.com/watch?v=kubJIJMOS8I

MAPPING OF CO's WITH PO's and PSO's

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	2	2	2	3	3	3	2	3	3	2	2	3	2	3	3
CO2	2	2	2	3	3	3	2	3	3	2	2	3	2	3	3

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CO3	2	2	2	3	3	3	2	3	3	2	2	3	2	3	3
CO4	2	2	2	3	3	3	2	3	3	2	2	3	2	3	3
CO5	2	2	2	3	3	3	2	3	3	2	2	3	2	3	3

Correlation: 3-High 2-Medium 1-Low

ASSESSMENT TOOLS:

S.No	**Assessment methods**	**Frequency of Assessment**
1.	End Semester Examination	Once in a semester
2.	CIA I	Once in a semester
3.	CIA II	Once in a semester
4.	Model Examination	Once in a semester
5.	Assignment (Unit I & II)	Twice in a semester
6.	Seminar (Unit III & IV)	Twice in a semester
7.	Real time Problem solving (Unit V)	Once in a semester

Course designed by Dr. Sr. Stanis Arul Mary	**Verified by HOD** Dr. K.Julia Rose Mary
Checked by CDC Dr.S.Jaculin Arockia Selvi	**Approved by** Principal

SEMESTER II

COURSE CODE: 23PMA2C09

TITLE OF THE COURSE: CORE - FORMAL LANGUAGES AND AUTOMATA

COURSE OBJECTIVES:

- To introduce the concept nuances of Automata and Grammar and enable the students to understand the applications of these techniques in computer science.
- To provide an insight to theoretical computer science.
- To get across to the students the notion of effective computability, using mathematical models

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1	Define the notion of Finite Automata and Non-deterministic finite automata	K2

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CO2	Discuss the properties of Regular sets	K2
CO3	Finding the normal forms by acquiring knowledge on grammars	K3
CO4	Apply the concept of grammars and normal forms to design pushdown automata	K4
CO5	Analyse and design the construction and techniques of the Turing machine model	K4

SYLLABUS

Credits: 4 **Instructional Hours: 75**

Unit I: (K2) **15 Hours**

Finite Automata

An Informal picture of Finite Automata -Deterministic Finite Automata – Non-Deterministic Finite automata - Finite automata with Epsilon -Transitions.

Unit II: (K2) **15 Hours**

Regular Expressions and Languages, Properties of Regular languages

Regular Expressions- Finite Automata and regular expressions- Proving languages not to be regular

(***Self Study: Closure properties of Regular languages)***

Unit III: (K3) **15 Hours**

Context-Free Grammars and Languages, Pushdown Automata

Context-Free Grammars -Parse trees -Definition of the Pushdown Automaton -The language of a PDA

(Self Study: Examples in context free grammer)

Unit IV: (K4) **15 Hours**

Pushdown Automata, Properties of Context free Languages

Equivalence of PDA's and CFG's – Deterministic Pushdown Automata- Normal forms for Context-free grammars -The Pumping lemma for Context -free languages.

[Beyond the Curriculum – Closure Properties of Context-free languages]

Unit V: (K4) **15 Hours**

Introduction to Turing Machines

Problems that Computers cannot solve-The Turing Machine-Programming techniques for Turing Machines

TEXT BOOK:

1. John E.Hopcroft, Rajeev Motwani and Jeffrey D.Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Publishing House, 3rd Edition.
   Unit I : Chapters: 2.1 – 2.3, 2.5.
   Unit II : Chapters: 3.1-3.2, 4.1.
   Unit III : Chapters: 5.1 – 5.2, 6.1 – 6.2.
   Unit IV : Chapters:6.3 - 6.4, 7.1 – 7.2.
   Unit V : Chapters: 8.1 – 8.3.

REFERENCE BOOKS:

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Second Edition, Prentice Hall, 1997.

2. A.V. Aho, Monica S. Lam, R. Sethi, J.D. Ullman, Compilers: Principles, Techniques and Tools, Second Edition, Addison-Wesley, 2007

3. A.V. Aho and Jeffrey D. Ullman, Principles of Compiler Design, Narosa Publishing House, Chennai, 2002.

BLENDED LEARNING

UNIT	TOPICS	LINKS
I	Deterministic Finite Automata-	-https://youtu.be/t_zRuXaGneQ -
	Finite Automata	https://youtu.be/iVZDqRQiPMo
	Non -Deterministic Finite Automata	https://youtu.be/ehy0jGIYRtE
III	Regular Grammer-	https://youtu.be/WgEsPTAL55Q
	Derivation from grammer-	https://youtu.be/ejXgLRSIxsA
	Context free grammer -	https://youtu.be/5_tfVe7ED3g
IV	Pushdown Automata	https://youtu.be/JtRyd7Svlew https://youtu.be/4ejIAmp_Atw

MAPPING OF CO's WITH PO's and PSO's

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	2	2	2	3	2	2	3	3	3	3	3	2	2	3	3
CO2	2	2	2	3	2	2	3	3	3	3	3	2	2	3	3
CO3	2	2	2	3	2	2	3	3	3	3	3	2	2	3	3

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CO4	2	2	2	3	2	2	3	3	3	3	3	2	2	3	3
CO5	2	2	2	3	2	2	3	3	3	3	3	2	2	3	3

Correlation: 3-High 2-Medium 1-Low

ASSESSMENT TOOLS:

S.No	Assessment methods	Frequency of Assessment
1.	End Semester Examination	Once in a semester
2.	CIA I	Once in a semester
3.	CIA II	Once in a semester
4.	Model Examination	Once in a semester
5.	Assignment (Unit I & II)	Twice in a semester
6.	Seminar (Unit III & IV)	Twice in a semester
7.	Group Discussion (Unit V)	Once in a semester

Course designed by Dr. F. Nirmala Irudayam	**Verified by HOD** Dr. K.Julia Rose Mary
Checked by CDC Dr.S.Jaculin Arockia Selvi	**Approved by** Principal

SEMESTER: II

COURSE CODE: 23PMA2E01

TITLE OF THE COURSE: ELECTIVE – OPTIMIZATION TECHNIQUES

SYLLABUS

OBJECTIVES:

- To develop logical reasoning in sequencing in a network to find the shortest route
- To give practical training in converting a managerial decision making problem to a linear programming problem.
- To understand the advance queuing models which predicts the performance of service in various systems.

At the end of the course the students will be able to

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Co 1	Determine the shortest route and minimum cost flow in a network by different algorithms	K2
Co 2	Find the optimum feasible solution by revised simplex method, bounded variable algorithm and parametric programming	K3
Co 3	Provide inventory management tools and techniques for deterministic and probabilistic inventory models of different situations	K3
Co 4	Analyze the procedure of queuing of daily life	K4
Co 5	Define mathematical queuing models for better service	K4

Credits: 4 **Instructional Hours: 75**

UNIT I:Network Models (K2) **15 hours**

Network Models: Network definitions – Minimal Spanning Tree Algorithm – Shortest Route Problem – Maximal Flow Model.

(*Self Study : Finding the shortest route problem*)

UNIT II: Advanced Linear Programming Problems (K3) **15 hours**

Advanced Linear programming: Simplex Method Fundamentals – Revised Simplex Method – Bounded Variables Algorithm.

UNIT III: Inventory Models(K3) **15 hours**

Deterministic Inventory Models: General Inventory Model – Static Economic Order Quantity Models – Dynamic Economic Order Quantity Models - Probabilistic Inventory Models: Continuous Review Models – Single Period Models – Multi Period Models.

(*Self Study : Multi Period Models*)

Deterministic Inventory Models - **https://youtu.be/uA-cR8nBP6E**

Economic Order Quantity Models - **https://youtu.be/fFR1nYhF_iw**

UNIT IV Markovian queuing (K4) **15 hours**

Advanced Markovian queuing models: Bulk input ($M/M^X/1$) - Bulk service $M/M^Y/1$ – Erlangian models ($M/E_k/1$, $E_k/M/1$, $E_j/E_k/1$).

UNIT VServer Queues(K4) **15 hours**

Models with General Arrival or Service patterns: Single server queues with Poisson input and General service (M/G/1).

QueueingModels - **https://youtu.be/xGkpXk-AnWU**

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Single server queues -**https://youtu.be/2aPlzhsEsIw**.

Mapping of CO's with PO's/ PSO's:

	Po 1	Po 2	Po 3	Po 4	Po 5	Po 6	Po 7	Po8	Po 9	Po1 0	Po1 1	Po1 2	Pso 1	Pso 2	Pso3
CO1	2	2	3	2	2	2	2	3	2	3	2	3	3	2	3
CO2	3	3	2	2	2	2	2	2	2	3	2	2	3	3	2
CO3	3	2	2	2	2	3	2	2	2	2	3	2	2	2	2
CO4	3	3	3	2	2	2	2	2	2	3	2	2	3	2	3
CO5	3	3	2	3	2	2	3	3	2	2	2	2	3	2	2

Correlation : 3-High, 2-Medium, 1-Low

ASSESSMENT TOOLS:

S.No	Assessment methods	Frequency of Assessment
1.	End Semester Examination	Once in a semester
2.	CIA I	Once in a semester
3.	CIA II	Once in a semester
4.	Assignment	Once in a semester
5.	Online Quiz	Once in a semester
6.	Seminar	Once in a semester
7.	Power Point Presentation	Once in a semester

TEXT BOOKS:

1. Hamdy A. Taha, (2002), Operations Research an introduction, Eighth Edition

UNIT I Chapter 6 Sections 6.1 – 6.4

UNIT II Chapter 7 Sections 7.1 – 7.3

UNIT III Chapter 11 Sections 11.1 – 11.3 and

Chapter 14 Sections 14.1 – 14.3

2. Donald Gross and Carl M.Harris, (2014), Fundamental of Queuing Theory,

Fourth Edition, Wiley Series Pvt Ltd, Singapore

UNIT IV Chapter 3 Sections 3.1 – 3.3

UNIT V Chapter 5 Sections 5.1(5.1.1 to 5.1.7)

REFERENCE BOOKS:

1. F.S.Hiller&Lieberman.J, Introduction to Operations Research (Seventh Edition), Tata – Mcgraw Hill Publishing Company, New Delhi.

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2. C.Beightler D Philips and B.Wilde, (1979),Foundations of Optimization, Second Edition, Prentice Hall Pvt.Ltd., NewYork.
3. Gupta C.B, (2008), Optimization Techniques in Operations Research, I.K International publishing.

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Checked by CDC Dr.S.Jaculin Arockia Selvi	**Approved by** Principal

SEMESTER: II

COURSE CODE : 23PMA2E02

TITLE OF THE COURSE : ELECTIVE –STOCHASTIC PROCESSES

SYLLABUS

OBJECTIVES:

- To study the stochastic models, transition probabilities and its classifications
- To enable the students to identify a standard stochastic process
- To understand the real life queueing problems
- To motivate the students to take up research in the area of many fields including biology, music and health care etc

At the end of the course the students will be able to

Co1	define the stochastic models and to solve the random walk associated with real life probabilistic situation	K2
Co2	Be familiar with the transition probabilities and its classifications.	K2
Co3	learn the well known models like birth-death and queueing to reorient their knowledge of stochastic analysis.	K3
Co4	Acquire knowledge on Renewal discrete time, Renewal continuous time , Renewal equations and theorems on it	K4
Co5	understand the real life queueing problems by comparing the conventional queueing models.	K4

Credits: 4 **Instructional Hours: 75**

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UNIT I :Elements of Stochastic processes and Markov chains(K2) 15 **Hours**

Stochastic processes - Specification of Stochastic processes –Stationary processes - Markov chain - Transition probabilities - Random walk Stationary processes - Markov chain : Transition probabilities:

https://youtu.be/IUb6n1Nqcik

https://youtu.be/33k8R87XB2Y

UNIT II:

Higher transition probabilities and classification of states (K2) 15 Hours

Higher transition probabilities - Classification of states - Transient and recurrent states.

UNIT III: Markov process with discrete state space (K3) 15 Hours

Poisson process - Generalizations of Poisson process - Pure birth process -Yule-Furry process - Birth-Immigration process.

Pure birth Process - https://youtu.be/OtTTVZRX9tE

Self Study: Examples in Poisson Process

UNIT IV: Renewal processes (K4) 15 Hours

Renewal process in discrete time - Renewal process in continuous time -Renewal equation - Renewal theorems.

UNIT V: Stochastic processes in queueing(K4) 15 Hours

Queueing processes - Steady state behaviour of M/M/1 queueing model -Non-Markovian queueing models - Queues with Poisson input (M/G/1)

Self Study:Examples of Queues

Mapping of CO's with Po's /PSO's:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	2	2	3	3	3	3	3	2	3	-	3
CO2	3	3	3	3	2	2	3	3	3	3	3	2	3	-	3
CO3	3	3	3	3	2	2	3	3	3	3	3	2	3	-	3
CO4	3	3	3	3	2	2	3	3	3	3	3	2	3	-	3
CO5	3	3	3	3	2	2	3	3	3	3	3	2	3	-	3

Correlation:3 - High , 2-Medium 1-Low

ASSESSMENT TOOLS:

S.No	**Assessment methods**	**Frequency of Assessment**
PP1.	End Semester Examination	Once in a semester

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2.	CIA I	Once in a semester
3.	CIA II	Once in a semester
4.	Assignment	Once in a semester
5.	Online Quiz	Once in a semester
6.	Seminar	Once in a semester
7.	Power Point Presentation	Once in a semester

TEXT BOOK:

1. J. Medhi, Stochastic Processes, New Age International Publishers,Second Edition, New Delhi, 1994.

UNIT I	Chapter 2	Sections 2.1, 2.2, 2.3
	Chapter 3	Section 3.1
UNIT II	Chapter 3	Sections 3.1 and 3.4
UNIT III	Chapter 4	Sections 4.1, 4.3 (omit 4.3.5 - 4.3.7)
UNIT IV	Chapter 6	Sections 6.1.1 - 6.1.3, 6.2 (omit example 2(b)), 6.3, 6.5(omit 6.5.2))
UNIT V	Chapter 10	Sections 10.1 (omit 10.1.4), 10.2 (omit 10.2.3.1), 10.7 (omit examples 7(a), 7(b) and Sections 10.7.3, 10.7.4)

REFERENCE BOOKS:

1. U. Narayan Bhat, Elements of Applied Stochastic Processes, Second Edition, John Wiley & Sons, New York, 1972.
2. N.V. Prabhu, Stochastic Processes, Macmillan, New York

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