Scheme of Teaching

&

Detailed Syllabus

For

Master of Science

M.Sc. (Mathematics)

(Two Year Program)

(w.e.f. Academic Session 2021–22)

School of Basic & Applied Sciences

Shobhit Institute of Engineering & Technology

(Deemed to-be University)

NH-58, Modipuram, Meerut (U.P.) – 250110

Website: www.shobhituniversity.ac.in

Registrar
Shobhit Institute of Engg. & Tech.
(Deemed to-Be University)
NH-58, Modipuram, Meerut-250110

Scheme of Teaching

1st Year

Subject	Subject Code	Credit	L	T	P
Semester –I					
Linear Algebra	MAMS-101	4	3	1	0
Ordinary Differential Equations & Applications	MAMS-102	4	3	1	0
Real & Complex Analysis	MAMS-103	4	3	1	0
Number Theory & Cryptography	MAMS-104	4	3	1	0
Computer Fundamentals and Programming using C	CSMS-110	4	3	1	0
'C' Language Lab.	CSMS-154	2	0	0	4
Seminar	MAMS-181	2	0	0	4
	Total	**24**	**15**	**5**	**8**
Semester –II					
Abstract Algebra	MAMS-201	4	3	1	0
Operations Research	MAMS-202	4	3	1	0
Partial Differential Equations and Applications	MAMS-203	4	3	1	0
Advanced Numerical Analysis	MAMS-204	4	3	1	0
Data Structure Using C	CSMS-210	4	3	1	0
Numerical Analysis Lab.	MAMS-251	2	0	0	4
Personality Development and Soft Skills	HSMS-201	2	2	0	0
	Total	**24**	**17**	**5**	**4**

2nd Year

Subject	Subject Code	Credit	L	T	P
Semester –III					
Topology	MAMS-301	4	3	1	0
Fluid Dynamics	MAMS-302	4	3	1	0
Elective-I	----	4	3	1	0
Elective-II	----	4	3	1	0
Elective-III	----	4	3	1	0
Matlab	MAMS-351	2	0	0	4
Ethics in Research and Plagiarism/Report Writing	HSMS-301	2	2	0	0
	Total	**24**	**17**	**5**	**4**
Semester –IV					
Seminar	MAMS-481	2	0	0	4
Dissertation	MAMS-491	12			
	Total	**14**	**0**	**0**	**4**
Total Credit of the Course		**86**			

Electives I & II		**Electives III**	
MAMS-321	Lebesgue Measure & Integration	CSMS-321	Basics of Database Management System
MAMS-322	Functional Analysis	CSMS-322	Basics of Object oriented Programming using C++
MAMS-323	Advanced Complex Analysis	CSMS-323	Mathematical Modeling & Simulation
MAMS-324	Tensors & Differential Geometry	CSMS-324	Software Engineering
MAMS-325	Special Functions	CSMS-325	Fuzzy Sets & Fuzzy Systems
MAMS-326	Mathematical Methods		
MAMS-327	Probability & Statistics		
MAMS-328	Optimization Techniques		
MAMS-329	Discrete Mathematics and Graph Theory		

Scheme of Evaluation

1. All the theory courses will be evaluated through the process of written examination as per the University evaluation process.

2. The grade of Seminar **MAMS-481** will be evaluated by the following panel of examiners:
   (i) A Panel of three examiners submitted by the Dean/Coordinator and approved by the Vice-Chancellor
   (ii) Dean/Coordinator.
   (iii) Coordinator of the M.Sc. Programme.
3. Grades in **CSMS-154, MAMS-251** and **MAMS-351** will be awarded on the basis of
   - Final practical examination = 50 marks
   - Continuous evaluation = 50 marks

   (Continuous evaluation will be based upon attendance, practical file, practical performed, performance in practical and viva-voce.)

4. The grades in **MAMS-491** will be awarded by the following panel of examiners on the basis of viva-voce:
   (i) One external examiner appointed by the Vice-Chancellor out of a Panel of three examiners submitted by the Dean/Coordinator.
   (ii) Dean/ Coordinator.
   (iii) Coordinator of the M.Sc. Programme.
   (iv) Supervisor.

Contents

SEMESTER –I

Linear Algebra
Ordinary Differential Equations & Applications

Real & Complex Analysis
Number Theory & Cryptography
Computer Fundamentals and Programming using C
'C' Language Lab.
Seminar

SEMESTER –II

Abstract Algebra
Operations Research
Partial Differential Equations
and Applications
Advanced Numerical Analysis
Data Structure Using C
Numerical Analysis Lab.
Personality Development and Soft Skills

SEMESTER –III

Topology
Fluid Dynamics
Lebesgue Measure & Integration
Functional Analysis
Advanced Complex Analysis
Tensors & Differential Geometry

Special Functions
Mathematical Methods
Probability and Statistics
Optimization Techniques
Discrete Mathematics and Graph Theory
Basics of Database Management System
Basics of Object oriented Programming using C++
Mathematical Modeling & Simulation
Software Engineering
Fuzzy Sets & Fuzzy Systems
Matlab
Ethics in Research and Plagiarism

Semester –IV

Seminar
Dissertation

SCHOOL OF BASIC AND APPLIED SCIENCES

Programme: M.Sc. (Mathematics) Semester: I, II, III & IV

Programme Outcomes:

PO1. **Engineering Knowledge:** Understand and apply mathematical foundation, computing and domain knowledge for the conceptualization of mathematical models from defined problems.

PO2. **Problem Analysis:** Ability to identify, critically analyze and formulate complex mathematical problems using fundamentals of mathematical application domains.

PO3. **Design / Development of Solutions:** Ability to transform complex research, academic problems and contemporary issues into research problems, investigate, understand and propose integrated solutions by using emerging technologies.

PO4. **Conduct Investigations of Complex mathematical problems:** Ability to conduct analysis and interpretation of data and provide well informed conclusions.

PO5. **Modern Tool Usage:** Ability to select modern software as tools and apply appropriate techniques for necessary solutions.

PO6. **Professional Ethics:** Ability to follow ethical principles and responsibilities in a global environment.

PO7. **Life-long Learning:** Recognize the need for and develop the ability to engage in independent and continuous learning as a mathematician.

PO8. **Project Management:** Ability to demonstrate knowledge of mathematical principles to apply these to own work and manage projects in multidisciplinary environments.

PO9. **Communication Efficacy:** Communicate effectively with the mathematical community as well as society and able to write reports and design comprehend documentations and presentations.

PO10. **Environmental Concern:** Ability to recognize economical, environmental, social, health, legal and ethical issues involved in mathematical problems and impact on other relevant professional engineering solutions.

PO11. **Individual & Team Work:** Ability to work as a member or leader in diverse teams in multidisciplinary environment.

PO12. **Innovation and Entrepreneurship:** Identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.

Programme Educational Outcomes:

On the completion of this program the students will be able to

PEO's1. define the fundamental axioms in mathematics and try to improve capabilities.

PEO's2. acquire basic idea about the software and computer skills and algorithms.

PEO's3. provide an idea about the wide range of mathematical techniques and its application.

PEO's4. classify the advanced topics in pure and applied mathematics.

PEO's5. pursue career as a researcher in mathematics and inter-disciplinary fields.

PEO's6. support the students in preparing for competitive exam and higher education examination e.g. (NET GATE JRF).

Course unit code	**MAMS-101**
Course unit title	**Linear Algebra**

GENERAL INFORMATION					
Study Program	Postgraduate study program: M.Sc. (Mathematics)			**Year**	**2**
Director of the course and assistant	Mr. Shamshad Husain, M.Phil., Ph.D.(P), Assistant Professor Email: shamsahd.husain@shobhituniversity.ac.in				
Course Status	X	Mandatory		Elective	

Credit allocated and type of lectures		
	Winter semester	**Summer semester**
ECTS students workload		**6**
Number of hours per semester		**60(3L+1L)**

Course objectives, teaching and learning methods and learning outcome

The *course objectives* are:

- To understand the general scientific concepts required for technology.
- To emphasize the significance of green technology physics principles.
- To apply the physics concepts in solving engineering problems. Through Physics syllabus, students will learn the main areas of Physics at the intermediate/advanced undergraduate level, as evidenced through solving problems in waves and optics, electromagnetic, relativistic mechanics, quantum mechanics and solid state physics.

Teaching methods used in this course are: lectures and seminars

Learning methods include: analyzing case studies, preparation of seminars and individual task (project)

Learning outcome

At the end of physics course, students will be able

1 To memorize the solution of the waves and optics problems based on interference, diffraction, polarization.

2 To describe divergence and curl of static magnetic field**,** time varying fields, propagation of electromagnetic waves in different media, poynting theorem using Maxwell's equations.

3 **T**o apply the significance of Michelson-Morley experiment, Newtonian Mechanics, special theory of relativity, the relationship of length contraction, time dilation and Einstein energy mass relation and the concepts of special theory of relativity in various field of physics and engineering

4 To examine significance of wave particle duality to relize the behaviour of microscopic systems, Heisenberg's uncertainty principle and its application, Schrodinger's equations and application to one dimensional motion of particle.

5 To understand the principle of laser, formation of energy bands in solids and superconductivity.

Requirements, correspondence and correlativity

Physics as one subject in 12^{th} standard or equivalent level. To develop a scientific temper and analytical capability in the engineering students through the learning of physical concepts and their applications in engineering & technology. Comprehension of some basic physical concepts will enable students to think logically the engineering problems that would come across due to rapidly developing new technology.

Semester-I

MAMS-101

Cr	L	T	P
4	3	1	0

Course Objectives:

1. Matrix theory, determinants and their application to systems of linear equations.
2. Eigenvalues, digitalization of matrices and reduction of systems of linear equations into simpler systems of easily tractable nature.
3. Vector theory: subspace, basis, linear independence, inner product spaces etc.
4. Applications of matrix algebra.

Course Outcome:

CO1	Recall matrix manipulations
CO2	Classify the vector space, linear intendance and foundation of abstract algebraic thinking
CO3	Explain the problems of linear equitation with mathematical software i.e. matlab, wolfram mathematica etc.
CO4	Analyze system of linear equation

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1	3	2		1	1	1							2		2			2
CO2	3	2		1	1	1							2		1			2
CO3	3	3		1	1	1							2		2			2
CO4	3	2		1	1	1							2		1			2
Average	**3**	**2.2**		**1**	**1**	**1**							**2**		**1.5**			**2**

Course Contents:

Unit-I

Vector space, linear transformations (LT), representation of a LT by a matrix, Inverse of a LT.

Unit-II

Range and null spaces, Rank and nullity theorem, linear functional, Dual spaces, Change of basis and similarity transformation, Triangular form.

Unit-III

Eigen values and eigen vectors, Minimal Polynomial, Invariant subspace, Primary decomposition theorem, Eigen system of normal matrices,

Unit-IV

QR decomposition, Jordan Form, elementary divisors, Inner product spaces, normed spaces, Gram-Schmidt orthogonalization process,

Unit-V

Quadratic forms, Positive definite forms, Orthogonal and unitary transformations, Hermitian forms, Norm of matrices and linear transformations, Spectral radius and its relation to norm.

Special topics: Inverse of perturbed matrices, Defective matrices, Gerschgorin circle theorem, Diagonal dominance.

Text Books:

1. Hoffman K. and Kunze R. "*Linear Algebra*". PHI, New Delhi.
2. Krishnamurthy V., Manira V.P. and Arora J. "*Introduction to Linear Algebra*". East West Book Madras Pvt. Ltd.

References Books:

1. Datta K.B. "*Matrix and Linear Algebra: Aided with Matlab*". PHI, New Delhi

Modes of instruction and acquiring knowledge (mark in bold)				
Lectures	**Seminars and workshops**	**Exercise**	**Individual tasks**	Multimedia and internet
Distance learning	Counseling	**Laboratory**	**Tutorial**	Fieldwork

Students Requirments

The students is monitored and evaluated throughout the semester as follows:

- Attandeance and class participation=10%
- Seminar paper/project/Essay=20%
- Continuous assessment =30%
- Written exam=40%

According to the Code of evaluation the final grade is obtained as follows:

A=90- 100% 5(excellent) = 89-100% of the grade
B=80- 89.9% 4(very good) = 76-89.9% of the grade
C=70- 79.9% 3(good) = 63-75.9% of the grade
D=60- 69.9% 2(sufficient) = 89-100% of the grade
E=50- 59.9%

Assessment and evaluation of students (mark in bold)			
Attendance	**Class partipation**	Seminar paper	Experiments work
Written exam	Oral Exam	Essay	Research
Project	**Continuous assessment**	Report	Practical Work

Assessment breakdawn withen the *Europian Credit transfer system*

REQUIEMENTS	HOURS (estimation)	LEARNING OUTCOME	SHARE IN ECTS	SHARE IN GRADE
Attandance and class partipation	60	1-5	0.6	10%
Project/Seminar /Essay	20	1-5	1.2	20%
Continuous assessment	40	5	1.8	30%
Written exam	60	1-5	2.4	40%

Bibliography

Mandatory bibliogrphy

1. Beiser Arthur, Concepts of Modern Physics, TMH, New Delhi
2. Avadhanulu M.N. and Kshirsagar P.G., A Text Book of Engineering Physics, 8th edition, S. Chand, New Delhi

Additional bibliogrphy

1. De Anuradha, Optical Fibre & Laser, New Age, New Delhi

2. Ghatak Ajoy, optics, Tata McGraw Hill Education Private Ltd., New Delhi
3. Brijlal & Subramanian, Optics, S. Chand Publication, New Delhi
4. Pillai, S.O., Solid State Physics, New Age International Ltd, New Delhi
5. Griffiths David J., Introduction to Electrodynamics, PHI Learning, New Delhi
6. Gaur R.K. and Gupta S.L., Engineering Physics, Dhanpat Rai Publication
7. R.L. Singhal, P.A. Alvi, Solid State Physics, Kedar Nath Ram Nath Publication

Additional information of the course

Ordinary Differential Equations & Applications

MAMS-102

Cr	L	T	P
4	3	1	0

Course objectives:

1. To provide the standard methods for solving differential equations as well as methods based on the use of matrices or Laplace transforms.
2. To demonstrate how differential equations can be useful in solving many types of problems - in particular,
3. To show how to translate problems into the language of differential equations,
4. To find or numerically approximate the solution of the resulting differential equation subject to given conditions, and to interpret the solutions obtained.

Course Outcomes:

End of the Course students will be able to

CO1	Find general solutions to first-order, second-order, and higher-order homogeneous and non homogeneous differential equations by manual and technology-based methods.
CO2	Ability to handle ordinary differential equations and solve them under appropriate assumptions.
CO3	Ability to solve a linear system of Ordinary differential equations.
CO4	Apply important properties of stability for linear and non-linear systems

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2		1	1	1							2		2			2
CO2		2		1	1	1							2		1			2
CO3		3		1	1	1							2		2			2
CO4		2		1	1	1							2		1			2
Average		**2.2**		**1**	**1**	**1**							**2**		**1.5**			**2**

Course Content:

Unit-I

Existence and uniqueness of solutions of first order differential equation (Picard's theorem), Lipschitz condition, Continuation of solutions of first order differential equation, Existence and uniqueness of system of n differential equations in n variables (without proof).

Unit-II

Linear systems, Homogeneous and non-homogeneous systems, behaviour of solutions of nth order linear homogeneous and non-homogeneous equations.

Unit-III

Qualitative properties of solution: oscillation, Wronskian, Strum seperation and comparison theorem, Sturm –Liouvile problem.

Unit-IV

Power series solution of second order homogeneous equations, ordinary points, regular singular points, solution of Gauss hypergeometric equations, Bessel's & Legendre's functions.

Unit-V

Autonomous systems, phase plane and its phenomenon, critical points and stability for linear and non linear systems, Liapunov's direct method, periodic solutions, the Poincare-Bendixson theorem.

Text Books:

1. Coddington E.A. "Ordinary Differential Equations". TMH, 2002
2. Ross, S.L. "*Differential equations*". Wiley Publication, 3rd edition, **2014**

References Books

1. Simmons G.F. "Ordinary Differential Equations with Applications". TMH, 2003
2. Joshi,M.C. "*Ordinary Differential Equations(Modern Perspective)***".** Narosa Publishing House, **2006**

Real & Complex Analysis

MAMS-103

Cr	L	T	P
4	3	1	0

Course Objective:

1. To know the basics of real analysis
2. To learn the different tests of convergence and applications of real analysis.
3. To introduce Complex Number system
4. To equip with necessary knowledge and skills to enable them handle mathematical operations, analyses and problems involving complex numbers.

Course Outcomes:

End of the Course students will be able to

CO1	Understand the basics of Real analysis
CO2	Apply the acquired knowledge in probability theory.
CO3	Explain, how complex numbers provide a satisfying extension of the real numbers
CO4	Solve real integrals by doing complex integration; Taylor series of a complex variable illuminating the relationship between real function that seem unrelated
CO 5	Learn techniques of complex analysis that make practical problems easy (e.g. graphical rotation and scaling as an example of complex multiplication);

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2	2	1	1	1							2		2			2
CO2		2	2	1	1	1							2		1			2
CO3		2	2	1	1	1							2		2			2
CO4		3	2	1	1	1							2		1			2
CO5		3	2	1	1	1							2		2			2
Average		**2.2**	**2**	**1**	**1**	**1**							**2**		**1.6**			**2**

Course Content:

Unit-I

Metric spaces, Open and closed sets, Interior, closure and limit points of a set. Subspaces, Continuous functions on metric spaces.

Unit-II

Convergence in a metric space, complete metric spaces. Compact metric spaces. Compactness and uniform continuity, connected metric spaces.

Unit-III

Analytic functions, Polynomials, rational functions, periodicity, Logarithmic functions. Sequences and series of complex numbers. The power series. Line integrals, Cauchy's theorem, The Cauchy integral formulae.

Unit-IV

Singularities. Taylor's theorem. Zeros and poles. The maximum modulus principle, Chains and cycles. Simple connectivity, Multiple connected regions, The general form of Cauchy's theorem, Taylor and Laurent series.

Unit-V

The residue theorem. Evaluation of definite integrals using residue theorem. Weierstrass theorem. Elementary conformal maps. Bilinear transformation, Schwarz- Christoffel transformation.

Text Books:

1. Lang S. "Real and Functional Analysis". Springer-Verlag, 1993
2. Rudin W. "Principles of Mathematical Analysis". McGraw-Hill, 1976
3. Smith A.H., Albrecht W.A. "Fundamental Concepts of Analysis". PHI, New Delhi, 1987
4. Ahlfors L.V. "*Complex Analysis*". McGraw Hill, **1979**

References Books:

1. Rudin W. "Real and Complex Analysis". McGraw Hill, 1987
2. Lang S. "*Complex Analysis*". Springer International Edition, **2003**

Number Theory & Cryptography

MAMS-104

Cr	L	T	P
4	3	1	0

Course Objective:

1. Definitions of divisibility, related algorithms and basic congruence results
2. Quadratic reciprocity, distribution of primes and basic additive results
3. Diophantine approximation and transcendental numbers
4. Useful tools in cryptography and related applied subject

Course Outcome:

End of the Course students will be able to

CO1	Recall the sets and number system
CO2	Classify Divisibility, the fundamental theorem of arithmetic and the Sieve of Eratosthenes
CO3	Explain the problems of Congruence's, Quadratic residues, Euler's quotient function and Mobius inversion formula
CO4	Analyze system of primality and factoring
CO 5	Discuss to useful tools in cryptography and related applied subject

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		1	1	1	2								1		1		2	2
CO2		1	1	1	2								1		1		2	2
CO3		1	1	1	2								1		1		2	2
CO4		1	1	1	2								1		1		2	2
CO5		1	1	1	2								1		1		2	2
Average		**1**	**1**		**2**								**1**		**1**		**2**	**2**

Course Content:

Number Theory

Unit-I

Divisibility and Euclidean algorithm, extended Euclidean algorithm.The fundamental theorem of arithmetic. The Sieve of Eratosthenes. The Goldbach conjecture.

Unit-II

Congruences, solutions of congruences, Chinese remainder theorem. Quadratic residues, quadratic reciprocity, the Jacobi symbol, finite fields. Euler's quotient function, greatest integer function, arithmetic functions, the Mobius inversion formula, recurrence functions.

Unit-III

Primality and factoring, pseudoprimes, the rho method, Fermat factorization and factor bases, continued fraction method, quadratic sieve method.

Cryptography

Unit-IV

Complexity theory, modular arithmetic, finite fields. Introduction to stream ciphers, design of LFSR based stream ciphers, block ciphers, substitution-permutation networks (SPN), linear attack on SPN, introduction to DES and AES.

Unit-V

Security of hash functions, the random oracle model, iterated hash functions, the Merkle Damgard construction, message authentication codes, probabilistic signatures. The RSA cryptosystem and factoring integers, attacks on RSA, digital signatures, the secure application of RSA encryption.

Text Books:

1. Niven I., Zucketman H.S. and Montgomery H. L. "An Introduction to the Theory of Numbers", 5th Ed. John Wiley and Sons, 2000
2. Koblitz N. "A Course in Number Theory and Cryptography". Springer Verlag, 1994
3. Burton, David M. "Elementary Number Theory: Fifth Edition". McGraw-Hill 2002
4. Stinson D.R. "*Cryptography Theory and Practice*". Chapman & Hall/CRC **2002**

References Books

1. Hans D., Helmut K. "Introduction to Cryptography, Principles and Applications". Springer, 2002
2. Schneier B. "Applied Cryptography". Wiley, 1996
3. Stallings W. "*Cryptography and Network Security*". Pearson Education, **2005**

Computer Fundamentals and Programming using C

CSMS-110

Cr	L	T	P
4	3	1	0

Course Objective:

1. To know the basics of Computer System and Hardware Organization.
2. To learn the different tests of Memory Units, Input and Output Devices and Input Output Ports
3. To introduce Number system, Basics of Programming Languages and Operating Systems and Graphical User Interface and Windows
4. To equip problem solving and programming methodology, Arrays and Structures.

Course Outcomes:

End of the Course students will be able to

CO1	Learn techniques of complex analysis that make practical problems easy (e.g. graphical rotation and scaling as an example of complex multiplication); Understand the basics of Computer System and Hardware Organization
CO2	Apply the different tests of Memory Units, Input and Output Devices and Input Output Ports.
CO3	Explain basics of programming languages and operating systems and graphical user interface and windows
CO4	Solve programming methodology, arrays and structures
CO 5	Learn techniques of operations and expressions

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1	2	2		1	1	1							2		2			2
CO2	2	2		1	1	1							2		1			2
CO3	2	3		1	1	1							2		2			2
CO4	2	2		1	1	1							2		1			2
CO5	2	2		1	1	1							2		2			2
Average	**2**	**2.2**		**1**	**1**	**1**							**2**		**1.5**			**2**

Course Content:

Unit I

Computer System: Basics of computer systems, history, types, capability and limitations of computer systems, Changed scenario of computing: Desktop, client-server & embedded computers.

Hardware Organization: Anatomy of a digital computer, CPU, Accumulator and instruction characteristics, Internal architecture of CPU, Instruction cycle, Introduction to microprocessors: Clock speed, buses, processor types, generations of Microprocessor, CPU related technology, Motherboards-CPU interface, FSB.

Unit II

Memory Units: Hierarchy, primary memory-RAM, ROM, cache; Auxiliary storage devices: magnetic tapes and disks, hard disks, floppy disks, CD-ROM, optical disks.

Input and Output Devices: Input devices: Keyboard, MICR, OCR, OMR, Digitizer, mouse, light pen, and offline input devices; Output devices: Printers-impact printers: line-character printers, Non impact printers -ink-jet, laser printers; Display devices- Raster scan, Vector scan and storage tube display.

Input Output Ports: Power connectors-AT, ATx connectors. Monitor socket, VGA connector, serial parallel, USB, PS-2 ports, PCI/MCI socket, and keyboard socket, External storage connectors-IDE connectors, FDD connector; Power supplies: Basic terms, Power conditioning devices, SMPS.

Unit III

Number System: Decimal , binary, octal, hexadecimal numbers and their inter-conversions; Representation of information inside the computers, Integer representation- Signed 1's and signed 2's complement representation, Floating point representation; Character codes: BCD, ASCII, ISCII and Unicode, Concept of parity bit.

Basics of Programming Languages and Operating Systems: Low level programming languages: Machine and Assembly languages, High level languages-procedure oriented languages, problem oriented languages. Translation process- Assembler, Compiler, Interpreter. Popular programming languages.

Graphical User Interface and Windows- Working with windows operating systems, Introduction to system software systems, Operating System Principles- Concept of process, multiprogramming, Functions of an operating system, Processor Management (scheduling), Memory Management, Device Management, File Management, Difference between Buffering and Spooling, Types of Operating Systems.

Unit IV

Introduction to 'C' : History, Characters used in C, Structure of a C program, Data types, C tokens, Basic input output through printf( ) and scanf( ), Comments, Escape sequence, Use of Editor, Compiling and Linking.

Operations and Expressions: Operators- arithmetic, relational and logical, Order of evaluation of expression, Special Operators: assignment, bitwise shift Operators.

Problem Solving and Programming Methodology: Algorithms, Programming methodology, Debugging, Characteristics of a good program, Program efficiency, Documentation. Flowcharts, Decision table.

Flow of Control and I/O Functions: Compound statement, Selective execution, Repetitive execution, Nested loops. Buffered I/O, Single character functions, String-based Functions, More discussion on scanf( ) & printf( ) functions.

Unit V

Arrays and Structures: One dimensional array, Strings, Multidimensional arrays, Arrays of string, Array initialization; Structure, Nested structures, User defined data types, Enumerated data types, Unions.

Pointers and Functions: Pointer variables, Pointer and arrays, Array of pointers, Pointers and structures, Dynamic allocation. Functions prototypes, Parameters passing in functions, Returning values from functions, Passing structures to functions, Scope rules of variables, Storage class specifiers, Recursion and library functions.

File Handling in C: Data and information, File concepts, File organization, Files in C, Files and streams, Stream I/O, Sequential and Direct File organization.

Text Books:

1. Sharma, A.K. "Fundamentals of Computers and Programming with C". Dhanpat Rai Publications, New Delhi, 2005.
2. Williams, Brian K. and Stacy C. Sawyer. "Using Information Technology". TMH, New Delhi, 2003.
3. Curtin, Dennis P., Kim Foley, Kunal Sen, and Cathleen Morin. "Information Technology". TMH, New Delhi, 1998.

References Books:

1. King, K.N. "C Programming – A Modern Approach". WW Norton & Co., 1996.
2. Ritchie, Dennis M. and Brian W. Kernigham. "The C Programming Language". PHI, New Delhi, 1988.

3. Kanetkar, Yashvant. "*Let us C*". BPB Publication, Fifth edition, **2008**.

‘C’ Language Lab.

CSMS-154

Cr	L	T	P
1	0	0	2

Course Objective:

1. To develop simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs & execution (in C language).
3. To implement conditional branching, iteration and recursion.
4. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
5. To use arrays, pointers and structures to develop algorithms and programs.

Course Outcomes:

End of the Course students will be able to

CO1	Understand the algorithms for arithmetic and logical problems.
CO2	Classify algorithms of the programs & execution (in C language).
CO3	Explain the conditional branching, iteration and recursion.
CO4	Solve problem into functions and synthesize a complete program using divide and conquer approach.
CO 5	Develop algorithms and programs based on arrays, pointers and structures.

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2		1	1	1							2		2		1	2
CO2		2		1	1	1							2		1		1	2
CO3		2		1	1	1							2		2		1	2
CO4		2		1	1	1							2		1		1	2
CO5		2		1	1	1							2		2		1	2
Average		**2**		**1**	**1**	**1**							**2**		**1.5**		**1**	**2**

List of Experiments:

1. Introduction of DOS Commands, Windows and ‘C’.
2. Writing Simple Batch Program.
3. Programming using ‘C’ Language involving following constructs:

   Simple Input Output Functions, Arithmetic/Logical & Relational Operators, Sequence Control, Decision Control, Iteration, Arrays Single/Multi Dimensional (Numeric/ Character), Functions (Call by value/ Call by reference), Recursive functions, Structures, Pointers, Library functions, File streams.

Reference Books:

1. Sharma, A.K. “Fundamentals of Computers and Programming with C”. Dhanpat Rai Publications, New Delhi, 2005
2. Sharma Divya. Lab Manual: “Fundamentals of Computes and Programming with C”. Shobhit University Publication, Meerut, **2010**

Semester- II

Abstract Algebra

MAMS-201

Cr	L	T	P
4	3	1	0

Course Objective:

1. Concept of group action and theorems about group actions.
2. To understand the Structure of permutation groups.
3. To recall the Polynomial rings, EDs, PIDs, & UFDs, and relations among them.
4. To develop the Universality of Polynomial rings.

Course Outcome:

End of the Course students will be able to

CO1	Memorize about group and its application
CO2	Classify the normal Subgroups and its compositions
CO3	Illustrate the Solvability of group and some important theorem
CO4	Interpret the ring theory in detail
CO 5	Construct polynomial over arbitrary ring

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2		1	1	1							2		2			2
CO2		2		1	1	1							2		1			2
CO3		3		1	1	1							2		2			2
CO4		2		1	1	1							2		1			2
CO5		2		1	1	1							2		1			2
Average	_	**2.2**	_	**1**	**1**	**1**	_	_	_	_	_	_	**2**	_	**1.5**	_	_	**2**

Unit-I

Basic definitions of groups, characterization of finite groups, subgroups. Lagrange's theorem. Fundamental theorem of Isomorphism and its applications. Finitely generated abelian groups.

Unit-II

Normal subgroups and quotient groups, decomposable groups and Characterization of Chains, normal Chains, their refinements, Composition of normal subgroups.

Unit-III

Solvability of groups. Characterization of solvability. Conjugate classes. Class equation, Cauchy's theorem for non-abelian groups. Sylow's theorems.

Unit-IV

Characteristic of rings, Ideals, Quotient rings, fundamental theorem of ring isomorphism, specials ideals, maximal ideals, principal ideals, their characterizations. Krul Zorn theorem.

Unit-V

Imbedding theorem of integral domains in fields, Euclidean domains. Polynomials over arbitrary rings. Principal ideal domain. Eisenstein's criterion of irreducibility over(Q,+,.).

Text Books:

1. Fraleigh J. B. “A First Course in Abstract Algebra”. Narosa Publishing House, 2004
2. Gallian, J.A. “Contemporary Abstract Algebra”. 4th Ed. Narosa Publishing House, New Delhi

References Books:

1. Artin M. “Algebra”, PHI, New Delhi, 2001
2. Herstein I.N. “Topics in Algebra”. 2nd Ed., Wiley India, 2006
3. Lang,S. **“***Algebra*”. Springer, **2006**

Operations Research

MAMS-202

Cr	L	T	P
4	3	1	0

Course objectives:

1. To introduce students to the techniques of operations research in mining operations
2. To provide students with basic skills and knowledge of operations research and its application in mineral industry
3. To introduce students to practical application of operations research in big mining projects

Course Outcomes:

End of the Course students will be able to

CO1	Recall the meaning of operations research and memorize the various techniques of operations research
CO2	Use operations research to: solve transportation problems during the allocation of trucks to excavators
CO3	Formulate operation research models to solve real life problem proficiently allocating scarce resources to optimize and maximize profit
CO4	Eliminate customers / clients waiting period for service delivery
CO 5	Discuss real life problems into formulation of models and solve by linear programming etc

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2	2	1	1	1							2		2			2
CO2		2	2	1	1	1							2		1			2
CO3		3	2	1	1	1							2		2			2
CO4		2	2	1	1	1							2		1			2
CO5		2	2	1	1	1							2		2			2
Average	_	**2.2**	**2**	**1**	**1**	**1**	_	_	_	_	_	_	**2**	_	**1.6**	_	_	**2**

Course Content:

Unit-I

Different types of OR models, Graphical, simplex and revised simplex methods in linear programming, Duality theorem, Dual simplex method and sensitivity analysis, Multi- objective and goal programming

Unit-II

Cutting plane and branch and bound techniques for all integer and mixed integer linear problems. Algorithms for 0-1, traveling salesman and cargo loading problems.

Unit-III

Transportation, allocation and assignment problems, Processing of jobs through machines, CPM and PERT.

Unit-IV

Theory of games, Replacement and Maintenance models.

Unit-V

Queuing Models, The M/M/1 System, The M/M/C System, The M/M/ ~System, The M/EK/1 System, Inventory Models, Introduction to the Inventory Problem, Deterministic Models, The Classical EOQ (Economic Order Quantity) Model, The EOQ with Shortages Allowed.

Text Books:

1. Taha H.A. "Operations Research: An Introduction", 8th.Ed., PHI, New Delhi, 2006
2. Ravindran A., Phillips D.T. and Solberg J.J. "*Operations Research: Principles and Practice*", 2nd. Ed., John Wiley and Sons, **2001**

References Books:

1. Mital K.V. and Mohan C. "Optimization Methods in System Analysis and Operations research". New Age India Pvt. Ltd, 1996
2. Sharma J.K. "*Operations Research Theory and Applications*", 3rd Ed., Macmillan India Ltd., New Delhi, **2007**

Partial Differential Equations and Applications

MAMS-203

Cr	L	T	P
4	3	1	0

Course objectives:

1. To introduce students to partial differential equations
2. To solve linear Partial Differential with different methods
3. To evaluate One and two dimensional wave equation
4. To explain Laplace equation in Cartesian, polar, spherical and cylindrical coordinates

Course Outcome:

End of the Course students will be able to

CO1	Describe real-world systems using PDEs.
CO2	Students can solve first order PDEs and second order PDE using different method
CO3	Determine the existence, uniqueness, of solution of PDEs
CO4	Find out the solution of One and two dimensional diffusion equation
CO 5	Formulate Laplace equation in Cartesian, polar, spherical and cylindrical coordinates

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2	1	1	1	1							2		2			2
CO2		2	1	1	1	1							2		1			2
CO3		3	1	1	1	1							2		1			2
CO4		2	1	1	1	1							2		1			2
CO5		2		1	1	1							2		1			2
Average	_	**1**	**1**	**1**	**2**	**1**	_	_	_	_	_	_	**1**	_	**1**	_	**2**	**2**

Course Content:

Unit-I

Quasi linear first order equations, method of Lagrange, Cauchy problem, Complete integrals, Charpits' method, classification of second order quasi-linear equation.

Unit-II

Linear equations with constant coefficients, classification of second order linear PDE and reduction to canonical form.

Unit-III

One and two dimensional wave equation, solution by method of characteristics and Fourier series method.

Unit-IV

One and two dimensional diffusion equation in various coordinate systems and their solutions under different initial and boundary conditions.

Unit-V

Laplace equation in Cartesian, polar, spherical and cylindrical coordinates and its solution by Fourier series method, Poisson equation in 2D.

Text Books:

1. Snedden I.N. "*Elements of Partial Differential Equations*". Courier Dover Publications, **2006**

References Books:

1. Mc Owen. "Partial Differential Equations". 2nd Ed., Pearson Education, 2003
2. Dennemeyer R. "Introduction to Partial Differential Equations and Boundary Value Problems". TMH, 1968

Advanced Numerical Analysis

MAMS-204

Cr	L	T	P
4	3	1	0

Course Objective:

1. Concept of Linear system of equations.
2. To understand the structure of permutation group
3. To find out the Eigen values of Symmetric matrices.
4. To solve the Ordinary Differential Equations, Partial Differential Equations and relations among them.
5. To discuss Finite Element Method.

Course Outcome:

End of the Course students will be able to

CO1	Memorize about Linear equations and its application
CO2	Classify the Eigen values of Symmetric matrices and its compositions
CO3	Illustrate the techniques to solve the Ordinary Differential Equations.
CO4	Interpret the finite difference method to find the solution of Partial Differential Equations.
CO 5	Discuss the Finite Element Method over 1D & 2D

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1	3	2		1	1	1							2		2			2
CO2	3	2		1	1	1							2		1			2
CO3	3	3		1	1	1							2		2			2
CO4	3	2		1	1	1							2		1			2
CO5	3	2		1	1	1							2		2			2
Average	**3**	**2.2**	**_**	**1**	**1**	**1**	**_**	**_**	**_**	**_**	**_**	**_**	**2**	**_**	**1.5**	**_**	**_**	**2**

Course Content:

Unit-I

Linear equations: Gaussian elimination method (Basic and row interchanges), LU Decomposition, Tridiagonal system, Gauss-Jordan method, Gauss Jacobi and Gauss Seidal Method.

Unit-II

Eigen values of Symmetric matrices: Jacobi's method, Given's method, Householder's method, Strum sequences and its properties, Eigen-values of Symmetric tridiagonal matrix, Determination of Eigenvectors, LR method and QR method.

Unit-III

Ordinary Differential Equations: Initial value and Boundary value problems, Picard'smethod, Taylor Series method, Eular's method, modified Euler's method, Runge-Kutta method, Predictor-Corrector methods(Milne's and Adams-Bashforth methods)

Unit-IV

Partial Differential Equations: Standard forms of PDE, Finite difference approximations for derivatives, method for solving parabolic, elliptic and hyperbolic equations.

Unit-V

Finite Element Method: Weighted Residual methods, Variational methods, Equivalence of Rayleigh-Ritz and Galerkin methods (1D & 2D), Construction of functional (Minimum Functional theorem and its application to one dimension problems)

Text Books:

1. Gupta, R.S. "Elements of Numerical Analysis". Macmillan India Ltd., New Delhi, 2009.
2. Gerald C.F. "Applied Numerical Analysis" .Addison-Wesley Publishing, 2002
3. Smith G.D. "*Numerical Solution of Partial Differential Equations*". Oxford University Press, **2001**

References Books:

1. Jain M.K. "Numerical Solution of Differential Equations". John Wiley, 1991
2. Snedden I.N., "Elements of Partial Differential Equations", Courier Dover Publications. 2006
3. Mc Owen," Partial Differential Equations", 2nd Ed., Pearson Education. **2003**

Data Structure Using 'C'

CSMS-210

Cr.	L	T	P
4	3	1	0

Course Objective:

1. To introduce the fundamental concept of data structures.
2. To emphasize the importance of data structures in developing and implementing efficient algorithms.
3. To develop effective software engineering practice, emphasizing such principles as decomposition, procedural abstraction, and software reuse.

Course Outcomes:

End of the Course students will be able to

CO1	Define basic data structure such as arrays, linked list, stacks and queues.
CO2	Classify the types of linked list.
CO3	Describe trees and its operations.
CO4	Solve problem involving graphs, trees & heaps.
CO 5	Apply algorithm for solving problem like sorting & searching.

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1	2	2		1	1	1							2		2			2
CO2	2	2		1	1	1							2		1			2
CO3	2	3		1	1	1							2		2			2
CO4	2	2		1	1	1							2		1			2
CO5	2	2		1	1	1							2		1			2
Average	**2**	**2.2**	**_**	**1**	**1**	**1**	**_**	**_**	**_**	**_**	**_**	**_**	**2**	**_**	**1.5**	**_**	**_**	**2**

Course Contents:

Unit-I

Overview of 'C': Introduction, flow of control, input-output functions, Arrays and structures, functions.

Data Structure and algorithm: Concept of data structures, choice of data structures, type of data structures, Basic Terminology, Algorithms, Design and development of algorithms, stepwise refinement, use of accumulators and counters; algorithm analysis, complexity of algorithms, Big–oh notation.

Unit-II

Arrays, Sorting and Searching: One dimensional Arrays,

Operations on arrays: traversal, selection, searching, insertion, deletion and sorting.

Searching: linear search, binary search.

Sorting: selection sort, bubble sort, insertion sort, merge sort, quick sort, shell sort. Multidimensional arrays, address calculation of a location in arrays.

Unit-III

Stacks: Array representation and implementation of stacks, operations on stacks: Push and Pop, prefix, infix and postfix expressions and their inter-conversion, Expression evaluation.
Recursion: Definition and process, recursion in 'C', examples of recursion.
Queues: Circular queues, array representation of queues, D-queues, Priority Queues and application of queues.

Unit-IV

Pointers: Pointer variables, pointer arrays, arrays of pointers, pointers and structures, Dynamic allocation.
Linked lists: Concept of linked lists, operations on linked lists, Applications of linked lists

Unit-V

Trees: Introduction to Trees, Binary Trees, Representation and Traversal of trees, operation on Binary trees, types of binary trees, Threaded Binary trees, Application of trees,
Graphs: Introduction, terminology, set linked and matrix representation, operations on graphs, applications of graphs.

Text Books

1. Seymour Lipschutz, "Data Structures", 2nd Edition, 2008, TataMcGraw Hill.
2. Schaum's outline series, "Data Structure", TMH, 2002
3. P. S. Deshpande and O.G. Kakde, "C & Data Structure", Wiley Dreamtech, 1st Edition, 2003.

Reference Books:

1. A.M. Tanenbaum, Langsam, Moshe J. Augentem, "Data Structures using C and C++",2ndEdition, 2007, PHI Publication.
2. A.K. Sharma , "*Data Structure using C",* 1st Edition, 2011,Pearson Publication.

Numerical Analysis Lab.

MAMS-251

Cr	L	T	P
2	0	0	4

Course Objective:

1. To develop simple algorithms for Linear system of equations
2. To translate the algorithms to programs of Eigen values of Symmetric matrices (in C language).
3. To implementation for solving the Ordinary Differential Equations.
4. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
5. To develop algorithms and programs for finite difference method.

Course Outcomes:

End of the Course students will be able to

CO1	Understand the algorithms for linear system of equations.
CO2	Classify algorithms of the programs & execution to find the Eigen values of Symmetric matrices.
CO3	Solve problem of Ordinary Differential Equations
CO4	Develop algorithms and programs for finite difference method.

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		1	1	1	1	1							2		2		2	2
CO2		1	1	1	1	1							2		1		2	2
CO3		1	1	1	1	1							2		2		2	2
CO4		1	1	1	1	1							2		1		2	2
Average	**_**	**1**	**1**	***1***	**2**	***1***	**_**	**_**	**_**	**_**	**_**	**_**	**1**	**_**	**1**	**_**	**2**	**2**

'C' language based experiments:

1. Gauss elimination method for solving simultaneous linear algebraic equations.
2. Gauss-Jordan method for solving simultaneous linear algebraic equations.
3. Gauss-Seidal method for solving simultaneous linear algebraic equations
4. Crout's triangulaisation method
5. Determination of eigen values and eigen vectors of a square matrix.
6. Determination of roots of a polynomial.
7. Euler's method for solving ordinary differential equations.
8. Runge-Kutta method for solving ordinary differential equations.

9. Milne’s method for solving ordinary differential equations.
10. Solution of difference equations.

Personality Development & Soft Skill

HSMS-201

Cr	L	T	P
2	2	0	0

Course Objective:

1. To acquire basic knowledge of English Communication.
2. To develop the presentation skills for professional life.
3. To manage the work stress in professional life.
4. To enhance the ability to control inter-personal conflicts.

Course Outcome:

CO1	Trained in English language including listening, speaking, reading and writing skills.
CO2	Developed the presentation skills for professional life
CO3	Able to manage the work stress in professional life.
CO4	Able to control inter-personal conflicts.

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2	2	1	2	3								1	1	1	1	
CO2		2	2	1	3	3								1	1	1	1	
CO3		3	1	2	2	3								1	1	1	1	
CO4		1	1	3	3	3								1	1	1	1	
Average	_	**1.8**	**1.5**	**1.8**	**2.8**	**3**	_	_	_	_	_	_	_	**1**	**1**	**1**	**1**	_

UNIT – I

Self-Awareness: Meaning and Scope – Self-image/self-concept –Locus of Control – Emotional Intelligence.

UNIT – II

Personality: Personality traits – Types of Personality - Personality and Job fit - Personality and Organisational Behaviour – Indian School of thought – Integrated Personality

UNIT – III

Skill Development: Presentation, Negotiation, Quiz, Debate, Public Speaking, Event Management, Body Language.

UNIT – IV

Intra-personal facet of Personality Development: Work-Related Stress and Stress Management – Mind Control – Yoga and Meditation.

UNIT – V

Inter-personal facet of Personality Development: Transactional Analysis - Assertiveness Training – Sensitivity Training – Conflict – Inter-personal conflict management.

Reference Books:

1. Robbins, S - *Organisational Behaviour*
2. Luthans,F - *Organisational Behaviour*
3. McShane, S.L., and Von Glinow, M.A - *Organisational Behaviour*
4. Hellriegel,D., et al - *Organisational Behaviour*

Semester III

Topology

MAMS-301

Cr	L	T	P
4	3	1	0

Course Objective:

1. To understand the concept of Topology and theorems about topological space.
2. To know about the structure of Continuous functions and Homeomorphisms, components and locally connected spaces.
3. To develop the relation between Countability and Seperability.
4. To evaluate the Universality of Separation axioms- T_0 , T_1, T_2 , T_3.

Course Outcome:

End of the Course students will be able to

CO1	Memorize the basics of Topology and its application
CO2	Classify the Continuous functions and Homeomorphisms, components and locally connected spaces its compositions
CO3	Illustrate the countability and seperability with some important theorem
CO4	Interpret the Separation axioms in detail
CO 5	Construct Sequential compactness

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1	3	2		1	1	1							2		2			2
CO2	3	2		1	1	1							2		1			2
CO3	3	3		1	1	1							2		2			2
CO4	3	2		1	1	1							2		1			2
CO5	3	2		1	1	1							2		1			2
Average	**3**	**2.2**		**1**	**1**	**1**							**2**		**1.5**			**2**

Course Content

Unit-I

Topological spaces, Neighborhoods, Closure, Interior and Boundary operators and accumulation points, Derive sets, Bases and sub-bases, product spaces and relative topology.

Unit-II

Continuous functions and Homeomorphisms, the pasting lemma, connected and disconnected sets, connectedness of the real line, components, locally connected spaces.

Unit-III

Countability axioms-first and second countable spaces, separable spaces, second countability and seperability.

Unit-IV

Separation axioms- T_0 , T_1, T_2 , T_3, their characterizations and basic properties. Hausdorff, regular, completely regular and normal spaces. Urysohn's lemma and Tietz extension theorem (without proof).

Unit-V

Compact spaces, Locally compact spaces, Compactness in metric spaces. Bolzano Weierstrass property, Sequential compactness.

Text Books:

1. Munkers J. R., "*Topology, A First Course*", Prentice-Hall of India. **1988.**
2. Simmons G.F., "*Introduction to Topology and Modern Analysis*", McGraw-Hill Company. **2004.**

Reference Books:

1. Wilanski,A., "*Topology for Analysists*"**,** Kluwer Academics **2001.**
2. Joshi, K.D., "*Introduction to General Topology*", Wiley Eastern Ltd. **1983.**

Fluid Dynamics

MAMS-302

Cr	L	T	P
4	3	1	0

Course Objective:

1. To know the concept of fluid and its physical properties.
2. To understand the structure of one and two dimensional inviscid incompressible flows-Equation of continuity and motion using different theorem.
3. To aanlyse theorem of Blasius, Milne's circle theorem, Stokes stream function, Buckingham's pie theorem and Helmholtz's vorticity equation.
4. To evaluate the universality of stress and rate of strain-symmetry of stress tensor.
5. To investigate the Laminar flow of viscous incompressible fluids-Steady flow between two infinite parallel plates.

Course Outcome:

End of the Course students will be able to

CO1	Memorize about fluid and its physical properties
CO2	Classify the One and two dimensional inviscid incompressible
CO3	Illustrate theorem of Blasius, Milne's circle, Stokes stream function and Buckingham's pie
CO4	Interpret the principal axis and principle values of stress tensor in detail
CO 5	Construct flow of viscous incompressible fluids-Steady flow between two infinite parallel plates (non-porous and porous)

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2		1	1	1							2		2			2
CO2		2		1	1	1							2		1			2
CO3		3		1	1	1							2		2			2
CO4		2		1	1	1							2		1			2
CO5		1		1	1	1							2		1			2
Average		**2.2**		**1**	**1**	**1**							**2**		**1.5**			**2**

Course Content

Unit-I

Concept of fluid and its physical properties, Continuum hypothesis, Kinematics of fluids-Lagrangian and Eulerian descriptions, continuity of mass flow, circulation, rotation and irrotational flows, boundary surface, streamlines, path lines, streak lines, vorticity.

Unit-II

One and two dimensional inviscid incompressible flows-Equation of continuity and motion using stream tube-Bernoulli's theorem, Irroational motion-Circulation theorem, Stokes theorem, Kelvin's theorem, Constancy of circulation, Green's theorem, Kelvin's minimum energy theorem.

Unit-III

Stream function, complex-potential, sources, sinks and doublets, method of images, theorem of Blasius, Milne's circle theorem, Stokes stream function, Dynamical similarity, Buckingham's pie theorem. Helmholtz's vorticity equation, vortex filaments, vortex pair.

Unit-IV

General theory of stress and rate of strain-symmetry of stress tensor, principal axis and principle values of stress tensor, constitutive equations for Newtonian fluid. Navier-Stokes equations, dissipation of energy, diffusion of vorticity.

Unit-V

Laminar flow of viscous incompressible fluids-Steady flow between two infinite parallel plates (non-porous and porous), Plane Couette flow, Plane Poiseuille flow, Flow through a circular pipe (Hagen-Poiseuille flow), Flow between two co-axial cylinders, Flow between two con-centric rotating cylinders and sphere.

Text Books:

1. Yuan S.W., "*Foundation of Fluid Mechanics*", 3rd Ed.**,** Prentice Hall. **1976**
2. Batechelor G.K., "*An Introduction to Fluid Dynamics*", Cambridge **1997**

References Books:

1. Raisinghania, M.D., "*Fluid Dynamics*", S. Chand & Co. Ltd.**, 2003**

Elective I & II

Lebesgue Measure & Integration

MAMS-321

Cr	L	T	P
4	3	1	0

Course Objectives:

1. To know Algebra of sets, Lebesgue outer measure and non-measurable sets.
2. To learn Measurable functions, Littlewood's three principles and Convergence in measure.
3. To introduce Integration of bounded & measurable functions and of non-negative functions, Fatou's lemma and Comparison of Lebesgue and Riemann integrals.
4. To equip with necessary knowledge of Differentiation of monotone functions, Absolute continuity and Differential of an integral.
5. To assemble L^p –Spaces, Holder's and Minkowski's inequalities and Riesz representation theorem.

Course Outcome:

End of the Course students will be able to

CO1	Recall Algebra of sets and Measure of open and closed sets
CO2	Classify the Approximation of measurable functions
CO3	Explain the Lebesgue integral of simple functions, Integration of bounded & measurable functions and of non-negative functions and Monotone convergence theorem etc.
CO4	Analyze system of L^p –Spaces and Holder's and Minkowski's inequalities.

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1	3	2		1	1	1							2		2			2
CO2	3	2		1	1	1							2		1			2
CO3	3	3		1	1	1							2		2			2
CO4	3	2		1	1	1							2		1			2
Average	**3**	**2.2**	**_**	**1**	**1**	**1**	**_**	**_**	**_**	**_**	**_**	**_**	**2**	**_**	**1.5**	**_**	**_**	**2**

Course Content

Unit-I

Algebra of sets, Lebesgue outer measure, Measure of open and closed sets, Borel sets, Measurable sets, Regularity, A non-measurable sets.

Unit-II

Measurable functions, Approximation of measurable functions, Egorof's theorem, Simple functions, Littlewood's three principles, Convergence in measure.

Unit-III

Lebesgue integral of simple functions, Integration of bounded & measurable functions and of non-negative functions, Monotone convergence theorem, Fatou's lemma, General Lebesgue integral, dominated convergence theorem, Comparison of Lebesgue and Riemann integrals.

Unit-IV

Differentiation of monotone functions, Dini's derivatives, Functions of bounded variation, Absolute continuity, Differential of an integral.

Unit-V

L^p –Spaces, Holder's and Minkowski's inequalities, Completeness of Lp–spaces, Convergence in mean, Bounded linear functions on L^p –spaces, Riesz representation theorem.

Text Books:

1. Royden H.L., "*Real Analysis*", 4th Ed. MacMillan Publishing Co. Inc. **2010**
2. Jain P.K. and Gupta V.P., " *Lebesgue Measure & Integration*", New Age International

References Books:

1. Rana I.K. "*An Introduction to Measure and Integration*", Narosa Publishing House Delhi, 1997

Functional Analysis

MAMS-322

Cr	L	T	P
4	3	1	0

Course Objective:

1. To know the basics of Normed linear spaces and Banach spaces.
2. To learn the orthogonal and orthonormal systems in Hilbert space, Bessel's and Parseval's inequality .
3. To introduce Continuity of linear maps on normed linear spaces.
4. To equip with necessary knowledge of Projection operators on Banach spaces and Hilbert spaces.

Course Outcome:

End of the Course students will be able to

CO1	Understand the basics of Normed linear spaces and Banach spaces.
CO2	Apply the Orthogonal and orthonormal systems in Hilbert space with examples, Bessel's and Parseval's inequality.
CO3	Analyse Continuity of linear maps on normed linear spaces.
CO4	Solve real Isometric isomorphism of H onto itself under Unitary operators and their importance and Projection operators on Banach spaces and Hilbert spaces.
CO 5	Explain the techniques of Contraction Mappings with examples.

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2		1	1	1							2		2			2
CO2		2		1	1	1							2		1			2
CO3		3		1	1	1							2		2			2
CO4		2		1	1	1							2		1			2
CO5		3		1	1	1							2		2			2
Average	_	**2.2**	_	**1**	**1**	**1**	_	_	_	_	_	_	**2**	_	**1.5**	_	_	**2**

Course Content

Unit-I

Recapitulatisation of Hölder inequality, Minkowski inequality and vector spaces with examples of ℓ_p and L_P spaces. Normed linear spaces, Banach spaces with examples, Convergence and absolute convergence of series in a normed linear space. Inner product spaces, Hilbert spaces, Relation between Banach and Hilbert spaces. Schwarz inequality.

Unit-II

Convex sets, Existence and uniqueness of a vector of minimum length, Projection theorem. Orthogonal and orthonormal systems in Hilbert, space with examples, Bessel's inequality, Parseval's identity, Characterization of complete orthonormal systems.

Unit-III

Continuity of linear maps on normed linear spaces, Four equivalent norms on B(N,N`), Conjugate and Dual spaces, The Riesz Representation Theorem.

Unit-IV

Adjoint operators, self adjoint operators, normal operators, Unitary operators on Hilbert spaces (H) and their properties. Isometric isomorphism of H onto itself under Unitary operators and their importance. Projection operators on Banach spaces and Hilbert spaces. Orthogonal Projections.

Unit-V

Contraction Mappings with examples, Banach–fixed point theorems and applications. Eigen-values, Eigenvectors and Eigen spaces, Invariant spaces, Spectral Theorem on finite dimensional Hilbert spaces. The Closed Graph Theorem, The Uniform Boundedness Principle and its applications, The Hahn – Banach Extension and Separation Theorems, Open mapping Theorem and applications.

Text Books:

1. Simons, G. F., "Introduction to Topology and Modern Analysis", McGraw Hill. **2004**
2. Debnath L. K. and Mikusinski P., "Introduction to Hilbert Spaces with Applications", Academic Press. **2005.**

References Books:

1. Bachman G. and Narici L., "Functional Analysis", Academic Press. **1972.**
2. Ponnusamy S., "Foundation of Functional Analysis", Narosa Publication. **2002.**
3. Jain P. K. and Ahuja O. P., "Functional Analysis", New Age International Publishers. **2010.**
4. Nair, M. T., "Functional Analysis: A First Course", PHI Pvt. Ltd. **2004.**

Advanced Complex Analysis

MAMS-323

Cr	L	T	P
4	3	1	0

Course Objective:

1. To define of Analytic Functions and Entire Functions.
2. To understand the basics of Harmonic functions in the disc, Mean Value Property and Maximum and Minimum Principle Quadratic reciprocity
3. To distribution of Spaces of Analytic functions, Compactness and Convergence.
4. To relate Function theory, Subordination, Riemann mapping theorem and Univalent functions.
5. To explain Gamma function, Riemann zeta function, Riemann hypothesis

Course Outcome:

End of the Course students will be able to

CO1	Recall the Analytic Functions and Entire Functions.
CO2	Classify Harmonic functions in the disc, Mean Value Property and Maximum and Minimum Principle Quadratic reciprocity.
CO3	Explain the Spaces of Analytic functions, Compactness and Convergence.
CO4	Analyze of Gamma function, Riemann zeta function, Riemann hypothesis
CO 5	Discuss to useful tools in Analytic Continuation, Definition and uniqueness of analytic continuation, standard method of analytic continuation using power series

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		1		1	2	1							2		1			2
CO2		1		1	2	1							2		1			2
CO3		1		1	2	1							2		1			2
CO4		1		1	2	1							2		1			2
CO5		1		1	2	1							2		1			2
Average	_	**1**	**1**	_	**2**	_	_	_	_	_	_	_	**2**	_	**1**	_	**2**	**2**

Course Content

Unit-I

Analytic Functions: Zeroes of analytic functions, Jensen's theorem, Meromorphic functions, their zeroes and poles, Poisson-Jensen's formula. Revisit to Argument principle, Rouche's theorem.

Entire Functions: Order and genus of entire functions, Hadamard's factorization theorem, coefficient formula for the order, the derived function, exceptional values, Borel's theorem, Little Picard and Great Picard theorem.

Unit-II

Harmonic Functions: Harmonic functions in the disc, Mean Value Property, Maximum and Minimum Principle, Harnack's inequality, Harnack's theorem, The Dirichlet Problem.

Unit-III

Spaces of Analytic functions Compactness and Convergence, Hurwitz Theorem, Weirstrass factorization theorem, Runge's theorem, Mittag Leffler theorem, Normal families, Equiboundedness, Arzela's theorem

Unit-IV

Function theory: Subordination, Riemann mapping theorem, Univalent functions. Gamma function, Riemann zeta function, Riemann hypothesis.

Unit-V

Analytic Continuation: Definition and uniqueness of analytic continuation, standard method of analytic continuation using power series, the principle of reflection, Hadamard multiplication theorem, Monodromy theorem, Riemann Surfaces,. Homology and homotopy versions of Cauchy's theorem, simply connected regions.

Text Books:

1. Ahlfors, L. V., "Complex Analysis", McGraw Hill .**1988.**
2. Conway, J. B., "Functions of one complex Variables I", Narosa Publishing House..**2000.**
3. Gamelin, T. W., "Complex Analysis", Springer-Verlag.**2001.**

References Books:

1. Greene, R., and Krantz, S. G., "Function Theory of One Complex Variable", GSM, Vol. 40, American Mathematical Society, (3^{rd} Ed.)**.2006.**
2. Lang, S., "Complex Analysis", Springer – Verlag.**2003.**
3. Narasimhan, R. and Nievergelt, Y., "Complex Analysis in One Variable", Birkhauser (2^{nd} Ed.).**2001.**

Tensors & Differential Geometry

MAMS- 324

Cr	L	T	P
4	3	1	0

Course objectives:

1. To provide the standard methods for solving Theory of Space Curves.
2. To understand the different types of Parametric curves on surfaces and Principal and Gaussian curvatures.
3. To associate with space curves and curves on surfaces and Minimal surfaces.
4. To find out the nature of geodesics on a surface of revolution and Clairaut's theorem and Normal property of geodesics.

Course Outcomes:

End of the Course students will be able to

CO1	Find general solutions Theory of Space Curves.
CO2	Understand the theory of Surfaces, Principal and Gaussian curvatures.
CO3	Develop the relations between the space curves and curves on surfaces
CO4	Apply Gauss-Bonnet theorem, Surfaces of constant curvature, Conformal mapping, Geodesic mapping and Tissot's theorem.
CO 5	Discuss the useful tools in Tensors: Summation convention and indicial notation, Coordinate transformation and Jacobian, Contra-variant and Covariant vectors, Tensors of different type, Algebra of tensors and contraction.

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1	2	2		1	1	1							2		2			2
CO2	2	2		1	1	1							2		1			2
CO3	2	3		1	1	1							2		2			2
CO4	2	2		1	1	1							2		1			2
CO5	2	3		1	1	1							2		3			2
Average	**2**	**2.2**	**_**	**1**	**1**	**1**	**_**	**_**	**_**	**_**	**_**	**_**	**2**	**_**	**1.5**	**_**	**_**	**2**

Course Content

Unit-I

Theory of Space Curves: Space curves, Planer curves, Curvature, Torsion and Serret-Frenet formulae. Osculating circles, Osculating circles and spheres. Existence of space curves. Evolutes and involutes of curves.

Unit-II

Theory of Surfaces: Parametric curves on surfaces. Direction coefficients. First and second Fundamental forms. Principal and Gaussian curvatures. Lines of curvature, Euler's theorem. Rodrigue'sformula, Conjugate and Asymptotic lines.

Unit-III

Developables: Developable associated with space curves and curves on surfaces, Minimal surfaces.

Unit-IV

Geodesics: Canonical geodesic equations. Nature of geodesics on asurface of revolution. Clairaut's theorem.Normal property of geodesics. Torsion of a geodesic. Geodesic curvature. Gauss-Bonnet theorem. Surfaces of constant curvature. Conformal mapping. Geodesic mapping. Tissot's theorem.

Unit-V

Tensors: Summation convention and indicial notation, Coordinate transformation and Jacobian, Contra-variant and Covariant vectors, Tensors of different type, Algebra of tensors and contraction, Metrictensor and 3-index Christoffel symbols, Parallel propagation of vectors, Covariant and intrinsic derivatives, Curvature tensor and its properties, Curl, Divergence and Laplacian operators in tensor form, Physical components.

Text Books:

1. Willmore, T. J., "An Introduction to Differential Geometry", Dover publications.2012.
2. O'Neill B., Elementary Differential Geometry, Academic press, 2ndEd.2006.
3. Weatherburn, C.E. Differential Geometry of Three Dimensions, Cambridge University Press (digital pub)2003.

References Books:

1. Struik, D., J., "Lectures on Classical Differential Geometry", DoverPublications.1988.
2. Lang, S., Fundamentals of Differential Geometry, Springer.1999.
3. Spain, B., "Tensor Calculus: A concise Course", Dover Publications2003.

Special Functions

MAMS-325

Cr	L	T	P
4	3	1	0

Course Objective:

1. To define of hyper geometric functions and basics of analytic continuation.
2. To understand the elementary properties, term by term differentiation, integration, theorem of uniqueness and Watson's lemma.
3. To find out the generating functions of some standard forms including Boas and Buck type.
4. To explain the nature of expansion in terms of orthogonal polynomials, three term recurrence relation
5. To discuss the useful tools in Christofel-Darboux formula, Bessel's inequality. Hermite, Laguerre and Jacobi and Ultra spherical polynomials

Course Outcome:

End of the Course students will be able to

CO1	Recall the Hyper geometric functions.
CO2	Classify Barnes' contour integral representation, Confluent hyper geometric function and its elementary properties
CO3	Explain the problems of elementary properties, term by term differentiation, integration, theorem of uniqueness and Watson's lemma
CO4	Analyze system of some standard forms including Boas and Buck type.
CO 5	Create the useful tools Christofel-Darboux formula, Bessel's inequality. Hermite, Laguerre and Jacobi and Ultra spherical polynomials

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1	3	2		1	1	1							2		2			2
CO2	3	2		1	1	1							2		1			2
CO3	3	3		1	1	1							2		2			2
CO4	3	2		1	1	1							2		1			2
CO5	3	2		1	1	1							2		2			2
Average	**3**	**2.2**	_	**1**	**1**	**1**	_	_	_	_	_	_	**2**	_	**1.5**	_	_	**2**

Course Content

Unit-I

Hyper geometric functions: Solution of homogeneous linear differential equations of second order near an ordinary and regular singular point, their convergence and solutions for large values. Differential equations with three regular singularities, hyper geometric differential equations. Gauss hyper geometric function, elementary properties, contiguous relations, integral representation, linear and quadratic transformation and summation formulae.

Unit-II

Analytic Continuation: Barnes' contour integral representation. Confluent hyper geometric function and its elementary properties. Generalized hyper geometric function $p\ q\ F$ and its elementary properties– linear and quadratic transformations, summation formula.

Unit-III

Asymptotic series: Definition, elementary properties, term by term differentiation, integration, theorem of uniqueness, Watson's lemma. Asymptotic expansion of 1F1 and 2F1 hyper geometric series.

Unit-IV

Generating functions of some standard forms including Boas and Buck type. Sister Celine's techniques for finding pure recurrence relation. Characterization: Appell, Sheffes and s-type characterization of polynomial sets.

Unit-V

Orthogonal polynomials: Definition, their zeros, expansion in terms of orthogonal polynomials, three term recurrence relation, Christofel-Darboux formula, Bessel's inequality. Hermite, Laguerre, Jacobi and Ultra spherical polynomials: Definition and elementary properties.

Text Books:

1. T.S, Chihara - An introduction to orthogonal polynomials, Dover Publications 2011.
2. M.E.H. Ismail, Classical and Quantum Orthogonal Polynomials in One variable, Cambridge University Press.2005.

References Books:

1. F. Marcellan and W.Van Assche, Orthogonal polynomials and Special functions: Computation and Applications, Lecture Notes in Mathematics, Springer 2006.
2. E.D. Rainville – Special Functions, MacMillan 1960.
3. G. Szego – Orthogonal Polynomials, Memoirs of AMS, 1939.

Mathematical Methods

MAMS-326

Cr	L	T	P
4	3	1	0

Course objectives:

1. To recall the standard methods for solving Inner products of functions, Orthogonal set of functions and Fourier series and their properties.
2. To understand the differentiation and Integration of Fourier series and solution of boundary value problems by Fourier series method.
3. To introduce the Fredholm and Voterra's integral equations and its relation.
4. To explain the eigen values and eigen functions, iterated kernels, iterative scheme for solving and Fredholm integral equation of second kind.
5. To analyze the Hilbert Schmidt theory, symmetric kernels and orthonormal systems of functions of integral equations.

Course Outcomes:

End of the Course students will be able to

CO1	Memorize standard methods for solving inner products of functions, Orthogonal set of functions and Fourier series and its properties
CO2	Discuss the differentiation and integration of Fourier series and solution of ordinary boundary value problems in Fourier series
CO3	Demonstrate the relation between of Fredholm and Voterra's integral equations
CO4	Solve eigen values and eigen functions, iterated kernels and iterative scheme for solving Fredholm and Voterra's integral equation of second kind
CO 5	Apply Hilbert Schmidt theory, symmetric kernels and orthonormal systems of functions of integral equations

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1	2	2		1	1	1							2		2			2
CO2	2	2		1	1	1							2		1			2
CO3	2	3		1	1	1							2		2			2
CO4	2	2		1	1	1							2		1			2
CO5	2	2		1	1	1							2		2			2
Average	**2**	**2.2**	**_**	**1**	**1**	**1**	**_**	**_**	**_**	**_**	**_**	**_**	**2**	**_**	**1.5**	**_**	**_**	**2**

Course Content

Unit-I

Inner products of functions. Orthogonal set of functions. Fourier series and their properties. Bessels inequality and property of Fourier constants. Parseval's equation, Convergence of Fourier series, Fourier theorem. Uniform convergence of Fourier series

Unit-II

Differentiation of Fourier series, Integration of Fourier series, Solution of ordinary boundary value problems in Fourier series, a slab with faces at prescribed temperature, a Dirichlet problem (in Cartesian coordinates only), A string with prescribed initial velocity, An elastic bar. Application of Fourier series in Strum Liouville problems.

Unit-III

Definitions of integral equations and their classification, relation between integral and differential equation, Fredholm integral equation of second kind with separable kernels, reduction to a system of algebraic equation**.**

Unit-IV

Eigen values and eigen functions, iterated kernels, iterative scheme for solving Fredholm integral equation of second kind (Neumann series), Resolvent kernel, application of iterative scheme to Voterra's integral equation of second kind.

Unit-V

Hilbert Schmidt theory, symmetric kernels, orthonormal systems of functions. Fundamental properties of eigenvalues and eigen functions for symmetric kernels. Solution of integral equations by using Hilbert Schmidt theory**.**

Text Books:

1. J.W. Brown, R.V. Churchill, Fourier Series and Boundary Problems, McGraw Hill Education, New Delhi .
2. R.P. Kanwal , Linear Integral Equation, Theory of Technique , Academic press New York 1971.

References Books::

1. V. Lovitt, Linear integral Equations, Wiley Inter Science New York.

Probability and Statistics

MAMS-327

Cr	L	T	P
4	3	1	0

Course Objective:

1. To know the basics of probability and its distributions.
2. To introduce correlation, regression, multiple and partial correlation coefficient and Multiple regression analysis
3. To discuss the concept of point and interval estimation, Statistical hypothesis, Null and alternative hypothesis, Two types of errors and Power of test.
4. To explain the components of a time series and Measurement of trend by methods.

Course Outcomes:

CO1	Understand the basics of probability and its distributions.
CO2	Classify correlation, regression, multiple and partial correlation coefficient and Multiple regression analysis
CO3	Describe the point and interval estimation, Statistical hypothesis, Null and alternative hypothesis, Two types of errors and Power of test.
CO4	Discuss techniques of components of a time Series and measurement of trend by methods.
CO 5	Understand the basics of probability and its distributions.

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		1	1		3								1		1			2
CO2		1	1		1								1		1			2
CO3		1	1		2								1		1			2
CO4		1	1		2								1		1			2
CO5		1	1		2										1			2
Average	_	**1**	**1**	_	**2**	_	_	_	_	_	_	_	**1**	_	**1**	_	**2**	**2**

Course content

Unit-I

Definition of probability, Additive and multiplicative rules of probability, Conditional probability, Baye's theorem. Random variable, Discrete and continuous probability distribution, Expected value and variance.

Unit-II

Discrete Distributions - Uniform, Bernoulli, Binomial, Poisson, Geometric.

Continuous Distributions – Uniform, Exponential, Normal, Gamma, beta and Weibull

Sampling Distributions – Z, t, χ^2, F

Unit-III

Bivariate random variables, joint and marginal distributions, covariance, Concept of correlation, scattered diagram, Karl Pearson's correlation coefficient, Regression line of y on x and of x on y. Multiple and partial correlation coefficient. Multiple regression analysis.

Unit-IV

Concept of point and interval estimation, Statistical hypothesis, Null and alternative hypothesis, Two types of errors. Power of test.

Large and small sample tests, Level of significance, p-value, Tests for population proportion, difference of two proportions, population mean, difference of two population means, t test, test for population variance, χ^2 goodness of fit test.

Unit-V

Introduction: Components of a time Series, Additive and multiplicative models, Measurement of trend by methods of moving averages and semi averages. Fitting trend by a straight line, parabola and exponential curve, seasonal variations, cyclical variations, random variations.

Characteristics and uses of index numbers, Methods of constructing index numbers, Criteria of a good index number, Index numbers of Laspeyre's, Pasche's, Fisher's, Marshal Edgeworth's. Walsh's and Bowley's.

Text Books:

1. Mathematical Statistics by J.E. Fveund & Roanld E. Walpole Prentice Hall of India Pvt. Ltd., New Delhi.
2. Mathematical Statistics by J.N. Kapur & H.C. Saxena, S. Chand & Co. Pvt. Ltd., New Delhi.
3. Introduction to the theory of statistics by A.M. Mood, F.A. Grabill & D.C. Boes. McGraw Hill Kugakusha Ltd. Japan

References Books:

1. Statistical Methods by S.P. Gupta, Sultan Chand & Sons.
2. Probability and Statistical Inference by R.V. Hugg, E.A. Tanis & J.M. Rao

Optimization Techniques

MAMS-328

Cr	L	T	P
4	3	1	0

Course Objective

1. To recall the definition of convex sets and their properties from the point of view of mathematical programming and Kuhn-Tucker conditions
2. To revise simplex algorithm, duality theory of linear programming and Sensitivity analysis.
3. To classify unconstrained optimization techniques
4. To explain Quadratic programming, Wolfe's algorithm, Beales algorithm, Theil and Vande Panne algorithm.
5. To analyze the separable programming and geometric programming.

Course Outcome

End of the Course students will be able to

CO1	Recall the Convex sets and their properties from the point of view of mathematical programming, Kuhn-Tucker conditions and concept of concavity and convexity
CO2	Classify Theory of revised simplex algorithm, duality theory of linear programming and Sensitivity analysis
CO3	To know Unconstrained optimization techniques
CO4	Explain the Quadratic programming, Wolfe's algorithm, Beales algorithm, Theil and Vande and Panne algorithm.
CO 5	Analyze duality theory of quadratic and convex programming and sequential inconstrained minimization.

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2		1	1	1							2		2			2
CO2		2		1	1	1							2		1			2
CO3		3		1	1	1							2		2			2
CO4		2		1	1	1							2		1			2
CO5		2		1	1	1							2		2			2
Average	_	**2.2**	_	**1**	**1**	**1**	_	_	_	_	_	_	**2**	_	**1.5**	_	_	**2**

Course Content

Unit-I

Convex sets, convex functions, Pseudo-convex function, quasi-convex, explicit quasi-convex, quasi-monotonic functions and their properties from the point of view of mathematical programming, Kuhn-Tucker conditions, concept of concavity and convexity.

Unit-II

Theory of revised simplex algorithm. Duality theory of linear programming. Sensitivity analysis. Parametric linear programming. Integer programming and linear goal programming.

Unit-III

Unconstrained optimization techniques e.g. classical methods (Newton's method), Search methods for functions of one variable (Fibonacci search), Gradient methods (method of Steepest Descent), direct search methods for functions of n variables (Method of Hooke and Jeeves),

Unit-IV

Quadratic programming, Wolfe's algorithm, Beales algorithm, Theil and Vande Panne algorithm.

Unit-V

Duality theory of quadratic and convex programming, separable programming and geometric programming, sequential inconstrained minimization.

Text Books:

1. Introduction to Optimization Operation Research, J.C. Pant, 7th Ed. Jain Brothers, New Delhi 2012.
2. Operation research-An Introduction, H.A. Taha, Prentice- Hall of India Pvt. Ltd., New Delhi
3. Nonlinear and Dynamics Programming, G.Hardy, Addison-Wesly, Reading Mass.

References Books:

1. Operation research- 'Kanti Swroop, P.K. Gupta and Man Mohan sultan' Chand and Sons, New Delhi.
2. Operation research-Friderick S. Hiller and Gerald J. Lieberman.

Discrete Mathematics and Graph Theory

MAMS-329

Cr	L	T	P
4	3	1	0

Course Objective

1. To define the logic and connectives
2. To understand the theory of revised Boolean algebra, Lattices and Sublattices
3. To classify Hamiltonian paths and circuits of graphs, existence theorem for Eulerian and Hamiltonian graphs and traveling salesman problem.
4. To discuss the fundamental circuits and cut-sets and their properties, connectivity and separability, network flows and isomorphism.
5. To explain Euler's formula, Kuratowski's graphs, tools in fundamental cut set matrix, path matrix and adjacency matrix of a graph and digraph.

Course Outcome

End of the Course students will be able to

CO1	Recall the logic and connectives
CO2	Interpret Boolean algebra, Lattices and Sublattices
CO3	Discuss Hamiltonian paths and circuits of graphs and its existence theory and traveling salesman problem.
CO4	Apply cut-sets on circuits, connectivity and separability, network flows and 1-isomorphism and 2-isomorphism.
CO 5	Create Euler's formula, Kuratowski's graphs, tools in fundamental cut set matrix, path matrix and adjacency matrix of a graph and digraph.

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2	2	1	1	1							2		2			2
CO2		2	2	1	1	1							2		1			2
CO3		3	2	1	1	1							2		2			2
CO4		2	2	1	1	1							2		1			2
CO5		2	2	1	1	1							2		2			2
Average	_	**2.2**	**2**	**1**	**1**	**1**	_	_	_	_	_	_	**2**	_	**1.6**	_	_	**2**

Course Content

Unit-I

Logic and Connectives, Truth tables, Arguments and proofs. Propositional functions and Quantifiers, Relations- Digraph, Adjacency Matrix, Equivalence relations, order relations, Paths, Closures, Functions. Recurrence relations & solution, Inductive process, Generating Functions, Discrete functions.

Unit-II

Boolean algebra: Lattices, Sublattices, Isomorphism. Boolean algebra, Application of circuit theory, Circuit minimization.

Automata: Monoids, Isomorphism, Grammars and their types, Languages, Finite state machines, Monoid and Machine.

Unit-III

Definition of a graph, simple graph, degree of a vertex, regular graph, bipartite graphs, sub graphs, complete graph, complement of a graph, operations of graphs, isomorphism, digraphs and relations. Walks, paths and circuits, connectedness of a graph, disconnected graphs and their components, Euler graphs, Hamiltonian paths and circuits, existence theorem for Eulerian and Hamiltonian graphs, traveling salesman problem.

Unit-IV

Trees and their properties, distance and centre in a tree and in a graph, rooted and binary trees, spanning trees, fundamental circuits, breadth first and depth first search. Cut-sets and their properties, fundamental circuits and cut-sets, connectivity and separability, network flows,1-isomorphism, 2-isomorphism.

Unit-V

Planar graphs, Euler's formula, Kuratowski's graphs, detection of planarity, geometric dual, combinatorial dual. Incidence matrix and its sub matrices, reduced incidence matrix, circuit matrix, fundamental circuit matrix, cut set matrix, fundamental cut set matrix, path matrix, adjacency matrix of a graph and of digraph.

Text Books:

1. Liu C.L., "*Elements of Discrete Mathematics*", Tata McGraw Hill. **2000**
2. Lovasz L., Pelikan J. and Gombi V. K., "*Discrete Mathematics*", Springer International Ed. **2003**
3. Kolman B., Busby R.C. and Ross S.C., "*Discrete Mathematical Structures*", 5th Ed, Pearson Education. **2005**
4. Deo N., "*Graph Theory with Applications to Engineering and Computer Science*", Prentice Hall of India. **2004**

References Books:

1. Clark J. and Holton D.A., "*A First Look at Graph Theory*", Allied Publishers Ltd. **1995**
2. West D.B., "*Introduction to Graph Theory*", Pearson Education. **2002**
3. Mott J.L., Kandel A, and Baker T.P., "*Discrete Mathematics for Computer Scientists and Mathematicians*", Prentice Hall of India. **2001**
4. Reinhard D., "*Graph Theory*", Springer International Edition.. **2004**
5. Agnarsson G. and Greenlaw R., "*Graph Theory : Modeling, Applications, and Algorithms*", Pearson Education. **2008**

Elective III

Basics of Database Management System

CSMS-321	**Cr.**	**L**	**T**	**P**
	4	**3**	**1**	**0**

Course Objective:

1. Overview of Database management system (DBMS) and Comparison of DBMS with file processing system.
2. To understand the theory of Entity Relationship Model.
3. To investigate the Relational Model.
4. To explain Query Languages: Structured Query Language (SQL).
5. To introduce Transaction Processing.

Course Outcome:

End of the Course students will be able to

CO1	Recall the Database management system (DBMS) and Comparison of DBMS with file processing system.
CO2	Classify Entity Relationship Model.
CO3	Interpret the Relational Model.
CO4	Explain the Query Languages: Structured Query Language (SQL).
CO 5	Analyze system of Transaction Processing

Mapping of course outcomes with program outcomes

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PEO 1**	**PEO 2**	**PEO 3**	**PEO 4**	**PEO 5**	**PEO 6**
CO1	2	2		1	1	1							2		2			2
CO2	2	2		1	1	1							2		1			2
CO3	2	3		1	1	1							2		2			2
CO4	2	2		1	1	1							2		1			2
CO5	2	3		1	1	1							2		2			2
Average	**2**	**2.2**	**_**	**1**	**1**	**1**	**_**	**_**	**_**	**_**	**_**	**_**	**2**	**_**	**1.5**	**_**	**_**	**2**

Course Content

Unit-I

Introduction: Introduction: Concept & Overview of Database management system (DBMS), Comparison of DBMS with file processing system, Data Models, Database Languages, schema and instances, data independence, Database Users, Database Administrator (DBA), Database language: DDL, DML, overall structure of DBMS.

Unit-II

Entity Relationship Model: Basic terminologies: entity, attribute, relationship, mapping cardinality, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Case study of E-R models related to banking system, library management system etc.

Unit-III

Relational Model: Basic terminologies: relation, domain, tuple, keys, Integrity constraints, Functional Dependency, Different anomalies in designing a Database, Decomposition and its properties, Normalization, different normal forms: first normal form, second normal form, third normal form and BCNF.

Unit-IV

Query Languages: **Structured Query Language (SQL):** Characteristics of SQL, SQL data types. SQL commands: DDL, DML, Set operations, aggregate function, constraints and keys.
Relational algebra: unary operators, binary operators, writing simple relational algebra queries.

Unit-V

Transaction Processing: Transaction Concept, Transaction properties, Transaction state, Shadow copy scheme, Concurrent Executions, Serializability, Recoverability, testing of serializability, Concurrency control, locking techniques for concurrency control, log based recovery, checkpoints.

Text books:

1. Henry F. Korth and Silberschatz Abraham, "*Database System Concepts*", McGraw Hill.5th edition, 2006.
2. Elmasri Ramez and Novathe Shamkant, "*Fundamentals of Database Systems*", Addison Wesley Publishing Company, 6th edition, 2010.

References Books:

1. Ramakrishnan: *Database Management System*, McGraw-Hill, 3rd edition, 2007.
2. Date C J, "*An Introduction to Database System*", Addison Wesley, 8th edition, 2004.
3. Ivan Bayross, "*SQL, PL/SQL: The programming language with oracle*" BPB

Basics of Object Oriented Programming

CSMS-322

Cr.	L	T	P
4	3	1	0

Course Objective

1. Overview of Object oriented paradigm, Basic concepts, Tokens, Keywords and Identifiers and Constants.
2. To know theory of Classes, Objects, Constructors and Destructors.
3. To interpret the basic concept, types of inheritance, Single Inheritance, Multi level Inheritance, Hierarchical Inheritance, Multiple Inheritance, Virtual Base class, Abstract classes and Constructors in derived classes and Function overriding.
4. To introduce Working with files
5. To analyze the useful tools in Exception Handling and String handling

Course Outcome

End of the Course students will be able to

CO1	Recall the Object oriented paradigm, Basic concepts, Tokens, Keywords and Identifiers and Constants.
CO2	Classify the Classes, Objects, Constructors and Destructors..
CO3	Explain the Basic concept, Types of inheritance, Single Inheritance, Multi level Inheritance, Hierarchical Inheritance, Multiple Inheritance, Virtual Base class, Abstract classes and Constructors in derived classes and Function overriding
CO4	Discuss the Working with files of system
CO 5	Analyze Exception Handling and String handling of system

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		1	1		2								1		1		2	2
CO2		1	1		2								1		1		2	2
CO3		1	1		2								1		1		2	2
CO4		1	1		2								1		1		2	2
CO5		1	1		2								1		1		2	2
Average	_	**1**	**1**	_	**2**	_	_	_	_	_	_	_	**1**	_	**1**	_	**2**	**2**

Course Content

Unit I

Introduction of C++: Object oriented paradigm, Basic concepts, Tokens, Keywords, Identifiers and Constants, Basic data types, user defined data types, derived data types, Operators in C++.

Functions: Function Prototype, Function Call, Function Definition, and Inline functions

Unit-II

Classes and Objects: Specifying a class, Defining member functions, Private member functions, and Memory allocation for objects, Arrays within the class, Static data members and static member functions, Friend functions.

Unit-III

Constructors and Destructors: Constructor, Parameterized constructor, multiple constructors, constructors with default arguments, Dynamic initialization of objects, Copy constructor, Dynamic constructors, Destructors.

Unit-III

Inheritance: Basic concept, Types of inheritance, Single Inheritance, Multi level Inheritance, Hierarchical Inheritance, Multiple Inheritance, Virtual Base class, Abstract classes, Constructors in derived classes and Function overriding.

Unit-IV

Introduction to files, Working with files: Classes for File stream operations, opening and closing a file, file modes, file pointers and their manipulators. Reading from files and writing into a file.

Unit-V

Exception Handling: Try, Throw, Catch, **String handling:** Creating string objects, Manipulating string objects, Relational operators, string characteristics, Comparing strings.

Text Books:

1. Object Oriented Programming with C++, *E. Balagurusamy, TataMcGrawHill, Third Edition.*
2. Object Oriented Programming in C++, *Robert Lafore, Galgotia Publications, Third Edition.*

References Books:

1. Roger S. Pressman, "*Software Engineering: a practitioner's approach"*, McGraw Hill Higher education, 7th Edition, 2010.
2. Pankaj Jalote,"*An Integrated Approach to Software Engineering"*, Springer, 3rd Edition, 2005.

Mathematical Modeling & Simulation

CSMS-323

Cr.	L	T	P
4	3	1	0

Course Objective

1. Overview of System definition and components, Stochastic activities, Continuous and discrete Systems
2. To understand the theory of System simulation.
3. To know about Discrete system Simulation and Fixed time step vs event to event model.
4. To interpret the basic concept System dynamics, exponential growth models, Exponential decay models and Modified exponential growth models.
5. To introduce Simulation of PERT networks.

Course Outcome

End of the Course students will be able to

CO1	Recall the of System definition and components, Stochastic activities, Continuous and discrete Systems
CO2	Classify the System simulation.
CO3	Discuss about Discrete system Simulation and Fixed time step vs event to event model..
CO4	Explain the Basic concept System dynamics, exponential growth models, Exponential decay models and Modified exponential growth models
CO 5	Analyze system of Simulation of PERT networks.

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1	2	2		1	1	1							2		2			2
CO2	2	2		1	1	1							2		1			2
CO3	2	3		1	1	1							2		2			2
CO4	2	2		1	1	1							2		1			2
CO5	2	2		1	1	1							2		2			2
Average	**2**	**2.2**	**_**	**1**	**1**	**1**	**_**	**_**	**_**	**_**	**_**	**_**	**2**	**_**	**1.5**	**_**	**_**	**2**

Course Content

Unit-I

System definition and components, Stochastic activities, Continuous and discrete Systems, System modeling types of models, Static and dynamic physical models, Static and dynamic mathematical models, Full corporate model, types of system study.

Unit-II

System simulation, Why to simulate and when to simulate. Simulation of water reservoir system, simulation of a servo system, Simulation of an autopilot.

Simulation of continuous systems, Analog vs. Digital simulation of water reservoir system, Simulation of a servo system, Simulation of an autopilot.

Unit-III

Discrete system Simulation, Fixed time step vs event to event model, generation of random numbers. Test for random, Generalization of non-uniformly simulation.

Unit-IV

System dynamics, exponential growth models, Exponential decay models, Modified exponential growth models, logistic curves, Generalization of growth models, System Dynamics diagrams, Feedback in Socio – Economic system, World model.

Unit-V

Simulation of PERT networks, critical path computation, uncertainties in Activity duration, Resources allocation and consideration.

Text Books:

1. Gordon Geoftrey, "*System Simulation*", PHI.
2. Deo, Narsingh, "*System Simulation With Digital Computer*", PHI.

References Books:

1. Averill M. Law, W and David Kelton, "*Simulation Modeling and Analysis*", TMH.

Software Engineering

CSMS-324

Cr.	L	T	P
4	3	1	0

Course Objective

1. To define software engineering and Project Management
2. To understand the theory of Software Requirement Analysis, Scheduling and Implementation
3. To explain Software Design, Software Architecture Design and Coding.
4. To find test plans and test specifications, Black-Box and White-Box Testing, Debugging, Use of Program analysis tools, Usability testing, Unit-and Integration Testing, System testing, Performance testing, Stress testing and Regression testing.
5. To introduce Software Quality Management and Maintenance and Quality certifications

Course Outcome

End of the Course students will be able to

CO1	Recall the software engineering and Project Management.
CO2	Classify the Software Requirement Analysis and Scheduling and Implementation.
CO3	Discuss Software Design, Software Architecture Design and Coding
CO4	Explain the testing in virus forms and model.
CO 5	Analyze system of Software Quality Management and Maintenance and Quality certifications.

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2		1	1	1							2		2			2
CO2		2		1	1	1							2		1			2
CO3		3		1	1	1							2		2			2
CO4		2		1	1	1							2		1			2
CO5		2		1	1	1							2		2			2
Average	_	**2.2**	_	**1**	**1**	**1**	_	_	_	_	_	_	**2**	_	**1.5**	_	_	**2**

Course Content

Unit-I

Introduction to software engineering Software Characteristics and Software Applications, Software life cycle, Classical and Modern life cycle models and their comparison. **Software Project Management** Overview of project management, Organization structure and Responsibilities of software Project Manager.

Unit-II

Software Requirement Analysis Requirement gathering and specification, Tools and techniques viz. SRS documents, Analysis Principles, Data Modeling, Functional Modeling, Data Dictionary, Other Classical Analysis Methods. Planning, Estimation and budgeting, Work Breakdown Structures, Staffing. **Scheduling and Implementation** Recruitment patterns, PERT & Gantt charts, Risk and change management, Software Configuration Management, Documentation, Acceptance testing.

Unit-III

Software Design Function oriented and Object Oriented design paradigms, Modeling tools viz. DFD, ERD, HIPO and Menu charts, Class Diagram, User interface design methodology. **Software Architecture Design, Coding** Reviews and walkthroughs, Structured Vs. Object Oriented approach, Design Patterns and Component based Development.

Unit-IV

Testing Test plans and test specifications, Black-Box and White-Box Testing, Debugging, Use of Program analysis tools, Usability testing, Unit-and Integration Testing, System testing, Performance testing, Stress testing and Regression testing, Technical Metrics for Software.

Unit-V

Software Quality Management and Maintenance Product centric, Process centric and User centric QM, Verification and validation analysis, Formal Technical Reviews, People management, Quality Management Systems. **Quality certifications** ISO 9000, SEI Capability Maturity Model, TQM, Reverse Engineering and Re-engineering.

Text Books:

1. Roger S. Pressman, "*Software Engineering: a practitioner's approach"*, McGraw Hill Higher education, 7th Edition, 2010.
2. Pankaj Jalote,"*An Integrated Approach to Software Engineering"*, Springer, 3rd Edition, 2005.
3. R. Mall,"*Fundamentals of Software Engineering"*, Prentice Hall of India, 2nd Edition, 2007.

References Books:

1. K.K.Aggarwal& Yogesh Singh,"*SoftwareEngineering*",New Age International,3rd Edition,2005.
2. Aditya P Mathur*, " Foundation of Software Testing"*, Pearson Education, 1st Edition ,2008.

Fuzzy Sets & Fuzzy Systems

CSMS-325

Cr	L	T	P
4	3	1	0

Course Objective

1. To define the basic concepts of fuzzy set, α-level sets and comparison with classical (crisp) sets.
2. To understand the theory of operations on fuzzy sets.
3. To discuss Fuzzy equivalence relations, Fuzzy compatibility relations, Fuzzy relation equations, Fuzzy graphs and similarity relation.
4. To explain Fuzzy logic and multi valued logics.
5. To introduce approximate reasoning.

Course Outcome

End of the Course students will be able to

CO1	Recall concepts of fuzzy set, α-level sets, and comparison with classical (crisp) sets.
CO2	Classify the Operations on fuzzy sets.
CO3	Use of Fuzzy equivalence relations, Fuzzy compatibility relations, Fuzzy relation equations, Fuzzy graphs and similarity relation.
CO4	Explain Fuzzy logic and multi valued logics.
CO 5	Analyze system of approximate reasoning

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2	2	1	1	1							2		2			2
CO2		2	2	1	1	1							2		1			2
CO3		3	2	1	1	1							2		2			2
CO4		2	2	1	1	1							2		1			2
CO5		2	2	1	1	1							2		2			2
Average	_	**2.2**	**2**	**1**	**1**	**1**	_	_	_	_	_	_	**2**	_	**1.6**	_	_	**2**

Course Content

Unit-I

Basic concepts, α-level sets, comparison with classical (crisp) sets, Types of fuzzy sets, membership functions, extension principle.

Unit-II

Operations on fuzzy sets, Cartesian product, algebraic sum, bounded sum, bounded difference and algebraic product of fuzzy sets, m-th power of a fuzzy set, set theoretic operations, t-norm and t-conforms. Interval arithmetic and its classifications

Unit-III

Fuzzy arithmetic and Fuzzy numbers, lattice of Fuzzy numbers, Fuzzy equations.

Fuzzy relations on Fuzzy sets, composition of Fuzzy relations, Min-max composition and its properties, Fuzzy equivalence relations, Fuzzy compatibility relations, Fuzzy relation equations, Fuzzy graphs, similarity relation.

Unit-IV

Fuzzy logic, multi valued logics, propositions and quantifiers, Linguisitic variables and hedges, Inference from conditional fuzzy propositions, the compositional rule of inference.

Unit-V

Approximate reasoning. Fuzzy implications and their selection, multi conditional approximate reasoning and role of fuzzy relation equation.

Text Books:

1. Zimmermann H.J., "*Fuzzy Set Theory and its Applications*", Allied Publishers Ltd. **1991**.
2. Klir G.J. and Yuan B., "*Fuzzy Sets and Fuzzy Logic:Theory and Applications*", Prentice Hall of India, **1995**

References Books

1. Timothy, J.R. "*Fuzzy Logic with Engineering Applications*", John Wiley & Sons, **2004**
2. Bojadziev G. and Bojadziev M., "*Fuzzy Sets, Fuzzy Logic, Applications*", World Sci., **1995**

Ethics in Research and Plagiarism

HSMS-301

Cr	L	T	P
2	2	0	0

Course Objective

1. To understand the basic of philosophy of science, research integrity and publication ethics.
2. To identify research misconduct of publications.
3. To index and citation databases and open access publications
4. To analyze the research metrics and plagiarism.

Course Outcome

End of the Course students will be able to

CO1	Learn the basic of philosophy of science, research integrity and publication ethics.
CO2	Describe research misconduct of publications.
CO3	Analyze the indexing and citation databases in open access publications
CO4	Explain the research metrics and plagiarism.

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2		1	1	1							2		2			2
CO2		2		1	1	1							2		1			2
CO3		3		1	1	1							2		2			2
CO4		2		1	1	1							2		1			2
Average		**2.2**		**1**	**1**	**1**							**2**		**1.5**			**2**

Unit-I

Philosophy and Ethics: Introduction to philosophy: definition, nature and scope, concept, branches, Ethics: definition, moral philosophy.

Unit-II

Scientific Conduct: Ethics with respect to science and research, Intellectual honest and research integrity, scientific misconducts: Falsification, Fabrication, and Manipulation, Redundant publications: duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data.

Unit-III

Publication Ethics: Definition, introduction and importance, Best practices/standards setting initiatives and guidelines, Conflicts of interest, Publication misconduct: definition, concept, problems that lead to unethical behavior and *vice versa*, types, Violation of publication ethics, authorship and contributor-ship, Identification of publication misconduct, complaints and appeals.

Unit-IV

Writing Good Quality Research Papers: Approved and peer reviewed Research journals, identify good research journals, good quality research paper, writing good paper. Indexing databases, Citation databases, Research Metrics: Impact Factor of journal, SNIP, SJR, IPP, Cite Score. Metrics: h-index, i10 index, Google Scholar, Pub-med *etc*.

Unit-V

Plagiarism and its Detection: Plagiarism, its types and avoidance, Detecting plagiarism, Plagiarism Checking Software, UGC Guidelines on Plagiarism

References Books

1. Sana Loue, *Research Ethics: Theory and Practice*,
2. Jasanoff, S., *The Ethics of Invention: Technology and the Human Future*
3. R Subramanian, *Professional Ethics*, Oxford University Press.
4. Premvir Kapoor, *Professional Ethics and Human Values*, Khanna Book Publishing
5. R.R. Gaur, R. Sangal, G.P. Bagaria. *A Foundation Course in Human Values and Professional Ethics*, Excel Books, Delhi.
6. Kothari C R, "*Research Methodology Methods & Techniques*", New Age International Publishers.

Matlab

MAMS-351

Cr	L	T	P
2	0	0	4

Course Objective:

1. To develop simple algorithms for plotting of trigonometric, exponential and logarithmic functions.
2. To understand script file and function file
3. To demonstrate the algorithms to programs of all matrix manipulations
4. To implementation to program based on if-else, for and while loops
5. To find out the roots of polynomial and partial fractions.
6. To solve the ordinary differential equations.
7. To develop algorithms and programs for interpolation & curve fitting.

Course Outcomes:

End of the Course students will be able to

CO1	Understand the algorithms for plot of a curve, script file and function file
CO2	Classify algorithms of the programs & execution to all matrix manipulations.
CO3	Implementation of if-else, for and while loops
CO4	Develop algorithms and programs for interpolation & curve fitting
CO 5	Solve the problems of ordinary differential equations

Mapping of course outcomes with program outcomes

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5	PEO 6
CO1		2	1	1	3	3								1	1	1	1	
CO2		2	2	1	2	3								1	1	1	1	
CO3		3	1	2	3	3								1	1	1	1	
CO4		2	1	2	2	3								1	1	1	1	
CO5		1	2	1	2	3								1	1	1	1	
Average	_	**1.8**	**1.6**	**1.8**	**2.8**	**3**	_	_	_	_	_	_	_	**1**	**1**	**1**	**1**	_

To use MATLAB as a calculator.

1. Plotting of trigonometric, exponential and logarithmic functions.
2. Creating array and sub-arrays.
3. Demonstration of all matrix manipulations.
4. To write programs based on script file and function file.
5. To write programs based on if-else & Switch case construct.

6. To write program based on for and while loops.
7. To find roots of polynomial and partial fractions.
8. To write programs to solve ordinary differential equations (ODE).
9. To write programs based on interpolation & curve fitting.