TEACHING SCHEME & SYLLABI

M.Sc. (Mathematics)
w. e. f. 2018-19

School of Engineering & Technology

Shobhit Institute of Engineering and Technology, Meerut

(Deemed to-be University)

Approved and adopted in year 2018 (Board of Studies, August 3, 2018)
by 19th Academic council (Agenda no-3.2 a)

M.Sc. (Applied Mathematics)

Shobhit
Institute of Engineering & Technology

AC 24
AC 25

I.O.N.

Dated : ~~26.12.19~~ 27/07/2019

To: The Registrar

Subject: Agenda points for the forthcoming meeting of Academic Council

Applied The subject codes of three courses **B.Tech. (First Year), M.Sc.(Mathematics) and M.Phil. (Mathematics),** have been revised by the Board of Studies, School of Basic and Applied Sciences in the meeting. The revised teaching scheme of codes of syllabi is enclosed herewith as Agenda Point for the forthcoming meeting of Academic Council Meeting.

26/12/19

Coordinator, SBAS

Enclosures:

1. Syllabus and teaching scheme of B.Tech. (First Year)
2. Syllabus and teaching scheme of M.Sc.(Mathematics)
3. Syllabus and teaching scheme of M.Phil.(Mathematics)

BOS
19/10/2019

~~28/11/2020~~

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w.e.f. 2018-19

A. 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-421	Basics of Database Management System
MAMS-322	Functional Analysis	CSMS-422	Basics of Object oriented Programming using C++
MAMS-323	Advanced Complex Analysis	CSMS-423	Mathematical Modeling & Simulation
MAMS-324	Tensors & Differential Geometry	CSMS-424	Software Engineering
MAMS-325	Special Functions	CSMS-425	Fuzzy Sets & Fuzzy Systems
MAMS-326	Mathematical Methods		
MAMS-327	Probability & Statistics		
MAMS-328	Optimization Techniques		
MAMS-329	Discrete Mathematics and Graph Theory		

B. 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.

Semester-I

Linear Algebra

MAMS-101

Cr	L	T	P
4	3	1	0

Unit-I
Vector space, Linear Transformations(LT), Representation of a LT by a matrix, Inverse of a LT.

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

Unit-III
Range and null spaces, Rank and nullity theorem, Linear functionals, Dual spaces, Change of basis and similarity transformation, Triangular form.

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

Unit-V
Quardatic 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.

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

Ordinary Differential Equations & Applications

MAMS-102

Cr	L	T	P
4	3	1	0

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 n^{th} 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.

Books:

1. Coddington E.A. "*Ordinary Differential Equations*"**.** TMH, **2002**
2. Ross, S.L. "*Differential equations*". Wiley Publication, 3rd edition, **2014**
3. Simmons G.F. "*Ordinary Differential Equations with Applications*"**.** TMH, **2003**
4. 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

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.

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

Number Theory & Cryptography

MAMS-104

Cr	L	T	P
4	3	1	0

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.

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**
5. Hans D., Helmut K. "*Introduction to Cryptography, Principles and Applications*". Springer, **2002**
6. Schneier B. "*Applied Cryptography*". Wiley, **1996**
7. 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

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.

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**.
4. King, K.N. "*C Programming – A Modern Approach*". WW Norton & Co., **1996**.
5. Ritchie, Dennis M. and Brian W. Kernigham. "*The C Programming Language*". PHI, New Delhi, **1988**.
6. Kanetkar, Yashvant. "*Let us C*". BPB Publication, Fifth edition, **2008**.

'C' Language Lab.

CSMS-154

Cr	L	T	P
1	0	0	2

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.

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

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,+,.).

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

Operations Research

MAMS-202

Cr	L	T	P
4	3	1	0

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.

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**
3. Mital K.V. and Mohan C. "*Optimization Methods in System Analysis and Operations research*"**.** New Age India Pvt. Ltd, **1996**
4. 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

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.

Books:

1. Snedden I.N. "*Elements of Partial Differential Equations*". Courier Dover Publications, **2006**
2. McOwen. "*Partial Differential Equations*". 2nd Ed., Pearson Education, **2003**
3. 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

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)

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**
4. Jain M.K. "*Numerical Solution of Differential Equations*"**.** John Wiley, **1991**
5. Snedden I.N., "Elements of Partial Differential Equations", Courier Dover Publications. 2006
6. McOwen," Partial Differential Equations", 2nd Ed., Pearson Education. **2003**

Data Structure Using 'C'

CSMS-210

Cr.	L	T	P
4	3	1	0

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.

Reference Books:

1. A.M. Tanenbaum, Langsam, Moshe J. Augentem, "*Data Structures using C and C++"*,2nd Edition, 2007, PHI Publication.
2. A.K. Sharma , "*Data Structure using C",* 1st Edition, 2011,Pearson Publication.
3. Seymour Lipschutz, "*Data Structures"*, 2nd Edition, 2008, TataMcGraw Hill.

Personality Development & Soft Skill

HSMS-201

Cr	L	T	P
2	1	1	0

Course Content

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.

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

Additional information of the course

Numerical Analysis Lab.

MAMS-251

Cr	L	T	P
2	0	0	4

'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.

Semester III

Topology

MAMS-301

Cr	L	T	P
4	3	1	0

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.

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

Fluid Dynamics

MAMS-302

Cr	L	T	P
4	3	1	0

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.

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**
3. 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

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.

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
3. 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

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.

Reference 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.**
3. Bachman G. and Narici L., "Functional Analysis", Academic Press. **1972.**
4. Ponnusamy S., "Foundation of Functional Analysis", Narosa Publication.**2002.**
5. Jain P. K. and Ahuja O. P., "Functional Analysis", New Age International Publishers.**2010.**
6. 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

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.

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

Tensors & Differential Geometry

MAMS- 324

Cr	L	T	P
4	3	1	0

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.

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

Special Functions

MAMS-325	Cr	L	T	P
	4	3	1	0

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 $_pF_q$ 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.

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

Mathematical Methods

MAMS 326

Cr	L	T	P
4	3	1	0

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 0a 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**.**

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

Probability and Statistics

MAMS-327

Cr	L	T	P
4	3	1	0

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.

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
4. Statistical Methods by S.P. Gupta, Sultan Chand & Sons.
5. 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

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.

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

Discrete Mathematics and Graph Theory

MAMS-329	Cr	L	T	P
	4	3	1	0

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.

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

Elective III

Basics of Database Management System

CSMS 421	**Cr.**	**L**	**T**	**P**
	4	**3**	**1**	**0**

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.

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

Basics of Object Oriented Programming

CSMS 422	Cr.	L	T	P
	4	3	1	0

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.

Reference Book:

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

Mathematical Modeling & Simulation

CSMS 423	Cr.	L	T	P
	4	3	1	0

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.

Books:

1. Gordon Geoftrey, "*System Simulation*", PHI.
2. Deo, Narsingh, "*System Simulation With Digital Computer*", PHI.
3. Averill M. Law, W and David Kelton, "*Simulation Modeling and Analysis*", TMH.

Software Engineering

CSMS 424

Cr.	L	T	P
4	3	1	0

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.

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

Fuzzy Sets & Fuzzy Systems

CSMS-425

Cr	L	T	P
4	3	1	0

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-conorms. Interval arithmetic and its classifications

Unit-III

Fuzzy arithmetic and Fuzzy numbers, lattice of Fuzzy numbers, Fuzzy equations.
Fuzzy relations on Fuzzy sets, composistion 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, multivalued 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, multiconditional approximate reasoning and role of fuzzy relation equation.

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

Matlab

MAMS-351	Cr	L	T	P
	2	0	0	4

To use MATLAB as a calculator.

2. Plotting of trigonometric, exponential and logarithmic functions.
3. Creating array and sub-arrays.
4. Demonstration of all matrix manipulations.
5. To write programs based on script file and function file.
6. To write programs based on if-else & Switch case construct.
7. To write program based on for and while loops.
8. To find roots of polynomial and partial fractions.
9. To write programs to solve ordinary differential equations (ODE).
10. To write programs based on interpolation & curve fitting.

Ethics in Research and Plagiarism

HSMS-301	Cr	L	T	P
	2	2	0	0

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.