Five Year Integrated M. Sc. Course in Mathematics and Computing(revised)

Course Structure and Syllabus

First Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMP1001	AP	Physics I (General Properties of Matter and Waves & Oscillations)	3	1	0	4
2.	IMC1001	AC	Chemistry I	3	0	0	3
3.	IMM1001	AM	Mathematics I (Analytical Geometry and Calculus)	3	1	0	4
4.	CS 1302	CS	Fundamentals of UNIX & C Programming	1	0	3	3
5.	HU1103		English (BR- 1)	2	1	0	3
6.	IMP1002	AP	Physics Lab I	0	0	3	2
7.	IMC1002	AC	Chemistry Lab I	0	0	3	2
8.	GA1006		Co-curricular Activity	0	0	2	1
							22

Second Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMP2001	AP	Physics II (Basic Electromagnetic Theory)	3	0	0	3
2.	IMC2001	AC	Chemistry II	3	1	0	4
3.	IMM2001	AM	Mathematics II (Matrix Algebra & Complex Variables)	3	0	0	3
4.	CS2301	CS	Fundamentals of Data Structures	3	1	0	4
5.	CH2303	AC	Environmental Science(BR- 2)	3	0	0	3
6.	IMP2002	AP	Physics Lab II	0	0	3	2
7.	IMC2002	AC	Chemistry Lab II	0	0	3	2
8.	CS2302	CS	Data Structures Lab	0	0	3	2
9.	GA2006		Co-curricular Activity	0	0	2	1
							24

Third Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMP3001	AP	Physics III (Modern Physics)	3	0	0	3
2.	IMC3001	AC	Chemistry III	3	0	0	3
3.	IMM3001	AM	Mathematics III (Ordinary Differential Equations with Special Functions)	3	1	0	4
4.	CS 3101	CS	Java Programming & Web Technology	3	0	0	3
5.	PS 3001	PS	Biological Sciences(BR- 3)	3	0	0	3
6.	IMP3002	AP	Physics Lab III	0	0	3	2
7.	IMC3003	AC	Chemistry Lab III	0	0	3	2
8.	CS 3102	CS	Java Programming Lab	0	0	3	2
9.	GA3006		Co-curricular Activity	0	0	2	1
							23

Forth Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMP4001	AP	Physics IV	3	0	0	3
2.	IMC4001	AC	Chemistry IV	3	0	0	3
3.	IMM4001	AM	Mathematics IV (Integral Transform & Partial Differential Equations)	3	1	0	4
4.	IMM4003	AM	Discrete mathematics	3	1	0	4
5.	CS 6101	CS	Design and Analysis of Computer Algorithm	3	0	0	3
6.	MSH1151	MA	Value education & human rights (BR-4)	3	0	0	3
7.	GA4006		Co-curricular Activity	0	0	2	1
							21

Fifth Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMM5001	AM	Numerical methods	3	0	0	3
2.	IMM5003	AM	Probablity and statistics	3	1	0	4
3.	IMM5005	AM	Modern & Linear Algebra	3	1	0	4
4.	CS 4105	CS	Data Base Management Systems	3	0	0	3
5.	SGI 1001	RS	Principle Remote Sensing (Br-5)	3	0	0	3
6.	IMM5002	AM	Numerical methods lab	0	0	3	2
7.	CS 4106	CS	RDBMS Lab	0	0	3	2
							21

Sixth Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMM6001	AM	Optimization technique	3	0	0	3
2.	IMM6003	AM	Topology & Real analysis	3	1	0	4
3.	CS 4107	CS	Operating System	3	0	0	3
4.	CS 4109	CS	Computer System Architecture	3	1	0	4
5.	MSH1143 /1145		Foreign Language(German/ French /etc.) (Br-6)	3	0	0	3
6.	IMM6002	AM	Optimization technique Lab	0	0	3	2
7.	IMM6004	AM	Computing Lab(MAT Lab)	0	0	3	2
							21

Seventh Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMM7001	AM	Number Theory and its Applications	3	0	0	3
2.	IMM7003	AM	Complex Analysis & Measure theory	3	0	0	3
3.	IMM7005	AM	Differential Geometry & Reimann Geometry	3	0	0	3
4.	CS7103	CS	Computer Graphics	3	0	0	3
5.		AM/CS	Elective-I	3	0	0	3
6.	MSH1105		E-Commerce (BR7)	3	0	0	3
7.	CS7104	CS	Computer Graphics Lab	0	0	3	2
							20

Eighth Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMM8001	AM	Operations Research	3	1	0	4
2.	IMM8003	AM	Classical Mechanics and Hydro Mechanics	3	1	0	4
3.	CS 6107	CS	Computer Networks	3	0	0	3
4.		AM/CS	Elective-II	3	0	0	3
5.			Elective-III(Free)-	3	0	0	3
6.	ARC 8037	ARC	Disaster Management(Br-8)	3	0	0	3
							20

Ninth Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMM9001	AM	Stochastic Process and Simulation	3	0	0	3
2.	IMM9003	AM	Functional Analysis	3	1	0	4
3.	CS 5101	CS	Formal Languages & Automata Theory	3	1	0	4
4.		AM/CS	Elective-IV	3	0	0	3
5.			Elective-V(Free)	3	0	0	3
6.	MSH1109		Entrepreneurship & Small Business(Br -9)	3	0	0	3
							20

Tenth Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1	IMM10001	AM	Project /Dissertation				20

Total credits in 10 semesters:--212

List of Electives:

Elective I

1. IMM 7009 Advanced PDE & Boundary Value Problem
2. IMM 7011 Mathematical Logic & Logic Programming
3. IMM 7013 Finite Element Method: Theory and Applications
4. CS 7111 Genetic Algorithm
5. CS 6109 Software Engineering

Elective II

1. IMM 8007 Mathematical Modeling & simulation
2. IMM 8009 Statistical Inference
3. IMM 8011 Queuing Models for Computer and Communication System
4. CS 7105 Parallel Computing
5. IT 8101 Data Mining & Ware Housing

Elective III (Free)

1. TSC 1103 Artificial Neural Network and Fuzzy Logic
2. EC 9005 Data Communication Techniques
3. MCD 1105 Advanced Dynamics and Vibrations
4. IPA 1019 Mathematical & Statistical Methods in Climate System
5. IPA 2004 Boundary Layer Meteorology and Air Pollution

Elective IV

1. IMM 9007 Advanced Operations research (OR) and Stocahstic methods in Industry
2. IMM 9009 Theory of Computation
3. CS 7121 Cryptography and Network Security
4. IMM 9011 Sampling Theory & Design of Experiments
5. IMM 9013 Mathematical Biology

Elective V(Free)

1. SAM 3001 Computational Fluid Dynamics
2. MSR 2127 Computational Aerodynamics
3. TSC 2115 Wavelets: Theory and Applications
4. MCD 1009 Fracture Mechanics and Theory of Failures
5. SAM 3017 Theory of Elasticity

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Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMP1001	AP	Physics I (General Properties of Matter and Waves & Oscillations)	3	1	0	4
2.	IMC1001	AC	Chemistry I	3	0	0	3
3.	IMM1001	AM	Mathematics I (Analytical Geometry and Calculus)	3	1	0	4
4.	CS 1302	CS	Fundamentals of UNIX & C Programming	1	0	3	3
5.	HU1103		English (BR- 1)	2	1	0	3
6.	IMP1002	AP	Physics Lab I	0	0	3	2
7.	IMC1002	AC	Chemistry Lab I	0	0	3	2
8.	GA1006		Co-curricular Activity	0	0	2	1
							22

Second Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMP2001	AP	Physics II (Basic Electromagnetic Theory)	3	0	0	3
2.	IMC2001	AC	Chemistry II	3	1	0	4
3.	IMM2001	AM	Mathematics II (Matrix Algebra & Complex Variables)	3	0	0	3
4.	CS2301	CS	Fundamentals of Data Structures	3	1	0	4
5.	CH2303	AC	Environmental Science(BR- 2)	3	0	0	3
6.	IMP2002	AP	Physics Lab II	0	0	3	2
7.	IMC2002	AC	Chemistry Lab II	0	0	3	2
8.	CS2302	CS	Data Structures Lab	0	0	3	2
9.	GA2006		Co-curricular Activity	0	0	2	1
							24

Third Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMP3001	AP	Physics III (Modern Physics)	3	0	0	3
2.	IMC3001	AC	Chemistry III	3	0	0	3
3.	IMM3001	AM	Mathematics III (Ordinary Differential Equations with Special Functions)	3	1	0	4
4.	CS 3101	CS	Java Programming & Web Technology	3	0	0	3
5.	PS 3001	PS	Biological Sciences(BR- 3)	3	0	0	3
6.	IMP3002	AP	Physics Lab III	0	0	3	2
7.	IMC3003	AC	Chemistry Lab III	0	0	3	2
8.	CS 3102	CS	Java Programming Lab	0	0	3	2
9.	GA3006		Co-curricular Activity	0	0	2	1
							23

Forth Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMP4001	AP	Physics IV	3	0	0	3
2.	IMC4001	AC	Chemistry IV	3	0	0	3
3.	IMM4001	AM	Mathematics IV (Integral Transform & Partial Differential Equations)	3	1	0	4
4.	IMM4003	AM	Discrete mathematics	3	1	0	4
5.	CS 6101	CS	Design and Analysis of Computer Algorithm	3	0	0	3
6.	MSH1151	MA	Value education & human rights (BR-4)	3	0	0	3
7.	GA4006		Co-curricular Activity	0	0	2	1
							21

Fifth Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMM5001	AM	Numerical methods	3	0	0	3
2.	IMM5003	AM	Probablity and statistics	3	1	0	4
3.	IMM5005	AM	Modern & Linear Algebra	3	1	0	4
4.	CS 4105	CS	Data Base Management Systems	3	0	0	3
5.	SGI 1001	RS	Principle Remote Sensing (Br-5)	3	0	0	3
6.	IMM5002	AM	Numerical methods lab	0	0	3	2
7.	CS 4106	CS	RDBMS Lab	0	0	3	2
							21

Sixth Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMM6001	AM	Optimization technique	3	0	0	3
2.	IMM6003	AM	Topology & Real analysis	3	1	0	4
3.	CS 4107	CS	Operating System	3	0	0	3
4.	CS 4109	CS	Computer System Architecture	3	1	0	4
5.	MSH1143 /1145		Foreign Language(German/ French /etc.) (Br-6)	3	0	0	3
6.	IMM6002	AM	Optimization technique Lab	0	0	3	2
7.	IMM6004	AM	Computing Lab(MAT Lab)	0	0	3	2
							21

Seventh Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMM7001	AM	Number Theory and its Applications	3	0	0	3
2.	IMM7003	AM	Complex Analysis & Measure theory	3	0	0	3
3.	IMM7005	AM	Differential Geometry & Reimann Geometry	3	0	0	3
4.	CS7103	CS	Computer Graphics	3	0	0	3
5.		AM/CS	Elective-I	3	0	0	3
6.	MSH1105		E-Commerce (BR7)	3	0	0	3
7.	CS7104	CS	Computer Graphics Lab	0	0	3	2
							20

Eighth Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMM8001	AM	Operations Research	3	1	0	4
2.	IMM8003	AM	Classical Mechanics and Hydro Mechanics	3	1	0	4
3.	CS 6107	CS	Computer Networks	3	0	0	3
4.		AM/CS	Elective-II	3	0	0	3
5.			Elective-III(Free)-	3	0	0	3
6.	ARC 8037	ARC	Disaster Management(Br-8)	3	0	0	3
							20

Ninth Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1.	IMM9001	AM	Stochastic Process and Simulation	3	0	0	3
2.	IMM9003	AM	Functional Analysis	3	1	0	4
3.	CS 5101	CS	Formal Languages & Automata Theory	3	1	0	4
4.		AM/CS	Elective-IV	3	0	0	3
5.			Elective-V(Free)	3	0	0	3
6.	MSH1109		Entrepreneurship & Small Business(Br -9)	3	0	0	3
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Tenth Semester

Sl. No.	Subject Code	Offering Department	Name of the Subject	L	T	P	Credit
1	IMM10001	AM	Project /Dissertation				20

Total credits in 10 semesters:--212

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2. IMM 9009 Theory of Computation
3. CS 7121 Cryptography and Network Security
4. IMM 9011 Sampling Theory & Design of Experiments
5. IMM 9013 Mathematical Biology

Elective V(Free)

1. SAM 3001 Computational Fluid Dynamics
2. MSR 2127 Computational Aerodynamics
3. TSC 2115 Wavelets: Theory and Applications
4. MCD 1009 Fracture Mechanics and Theory of Failures
5. SAM 3017 Theory of Elasticity

Detailed Syllabus :

IMP 1001 Physics I - General Properties of Matter and Waves & Oscillations (3-1-0-4)

Module 1 **[6]**

Systems of particles**:** Centre of mass, Linear momentum, Conservation of linear momentum, System with varying mass: A Rocket; Potential energy and conservation of energy, Conservative and non-conservative forces, Force as gradient of potential energy; Particle collisions: Elastic and inelastic collision.

Module II **[6]**

Angular momentum of a particle and system of particles, Angular momentum of rigid body rotating about a fixed axis, Conservation of angular momentum, Torque, Rotation about a fixed axis. Moment of inertia and its calculation

Module III **[5]**

The world and gravitational force, Newton's law of gravitation, Gravitation near earth's surface, Gravitation inside earth, Gravitational potential energy, Planets and satellites: Keplar's Laws.

Module IV **[5]**

Torsion of a cylinder, Bending moment, Cantilever, Beam supported at both ends, Beams clamped at both ends, Reciprocity theorem; Elastic energy in different types of deformation.

Module V **[6]**

Molecular forces, Surface tension and surface energy, Angle of contact, Excess pressure over a curved liquid surface, Capillarity, Shape of liquid drops. Ripples, Streamline and turbulent motion, Reynold's number; Poiseuille's equation. Stoke's law, Rotating cylinder and rotating disc methods for determining the coefficient of viscosity, Euler's equation for liquid flow; Bernoulli's theorem and its applications.

Module VI & VII **[8]**

Simple harmonic motion, Motion of simple and compound pendulum, Damping, Forced vibration and resonance, Wave equation in one dimension, Phase velocity, Group velocity, Dispersion. Types of wave, Transverse and longitudinal waves. Speed of a travelling waves, Wave speed on a stretched string, Energy and power of a travelling string wave, The principle of superposition for waves, Interference of waves, Stationary waves, Sound waves, speed of sound Intensity of sound. Measurement of intensity; The Doppler effect, Shock waves

Text Books:

1. Fundamental of Physics, Halliday D., Resnick R. and Walker J., Wiley India
1. Sears and Zemansky's University Physics, Young H.D., Freedman R.A., Ford A.L., Pearson
2. General properties of Matter, Newman and Searle
3. Properties of Matter: C. J. Smith

Reference Books:

1. Mechanics, D.S.Mathur.
2. Mechanics, Shukla R.K. and Srivastava A.
3. Physics Course vol. I, Berkley
4. Textbook of sound, Wood A. B.
5. Waves and Oscillations, French

IMC 1001 Chemistry-I Credit: 3 (3-0-0)

Module I: Atomic Structure & Periodic Properties [5]

Atomic Structure, Electronic Configuration, Atomic and ionic radii, ionization energy, electron affinity and electronegativity, trends in periodic table and applications in predicting and explaining the chemical behaviour.

Module II: Chemical Bonding [7]

Covalent Bond – Valence bond theory and its limitations, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, CIF_3, ICI_2 and H_2O. MO theory, homonuclear diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference. Weak Interactions – Hydrogen bonding, Van der Waals forces.

Module III & IV Gaseous & Liquid States of Matter [8]

Postulates of kinetic theory of gases, deviation from ideal behavior, van der waals equation of state.Law of corresponding states. Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule Thomson- effect) Intermolecular forces, structure of liquid. Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid . Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

Module V Introductory Organic Chemistry [7]

IUPAC nomenclature: Alkanes, cyclo-alkanes, alkenes, alkynes, halogen compounds, alcohols, ethers, aldehydes, ketones, carboxylic acids, nitro compounds. Hybridization and Geometry of Molecules: methane, ethane, ethylene, acetylene. Electronic Effects: Inductive, resonance, hyper conjugation and steric effect. Cleavage of bonds: homolytic and heterolytic C-C bond fission. Reaction Intermediates and their stability: carbocations, carbanions and free radicals.

Module VI & VII: Basic Organic Synthesis and Principles [9]

Alkanes: preparation by reduction of alkyl halides, Wurtz reaction and Kolbe's electrolytic methods with mechanism; Alkenes: preparation by dehydration of alcohols, dehydrohalogenation of alkylhalides, dehalogenation of vicdihalides and by Kolbe's electrolytic method. Alkynes: Preparation by dehydrohalogenation of vic-dihalides and gem-dihalides, dehalogenation of tetrahalides and Kolbe's electrolytic method. Reactions:addition reactions with hydrogen, halogens, hydrogen halide (markownikoffs rule, peroxide effect), hydroboration, ozonolysis, hydroxylation with KMnO4, allylic substitution by NBS. Conjugated Dienes; Electrophilic addition of dienes: 1,2, & 1,4 addition, Diels . Alder reaction

Books Recommended:

1. Organic Chemistry, Morrison and Boyd, Prentice Hall.
2. Advanced Organic Chemistry, Bahl, B S, Bahl A.
3. Physical Chemistry by **P. W. Atkins,** Elbs
4. Basic Inorganic Chemistry by **F. A. Cotton & Wilkinson**, John Wiley
5. Inorganic Chemistry by **J. E. Huhey**, Harpes & Row

IMM 1001 Mathematics I Analytical Geometry and Calculus (3-1-0- 4)

Module I

Analytical Geometry (2D & 3D): Polar equation of conics. Cones, cylinders and conicoids, Central conicoids, normals and conjugate diameters. [5L]

Differential Calculus:

Module II

Successive differentiation of one variable and Leibnitz theorem. Curvature and asymptotes, concavity, convexity and point of inflection, Curve tacing. Taylor's and Maclaurin's expansion of functions of single variable. [5L]

Module III

Functions of several variables, partial derivatives, Euler's theorem, derivatives of composite and implicit functions, total derivatives, Jacobian's. Taylor's and Maclaurin's expansion of functions of several variables, Maxima and minima of functions of several variables, Lagrange's method of undetermined multipliers. [5L]

Module IV

Integral Calculus: Improper integrals, convergence of improper integrals, test of convergence, Beta and Gamma functions and its properties, Differentiation under integral sign, differentiation of integrals with constant and variable limits, Leibinitz rule. [5L]

Module V

Evaluation of double integrals, Change of order of integrations, change of coordinates, evaluation of area using double integrals, Evaluation of triple integrals, change of coordinates, evaluation of volumes of solids and curved surfaces using double and triple integrals. Mass, center of gravity, moment of inertia and product of inertia of two and three-dimensional bodies and principal axes. [5L]

Module VI

Vector Calculus: Scalar and vector fields, Level surfaces, differentiation of vectors, Directional derivatives, gradient, divergence and curl and their physical meaning, vector operators and expansion formulae. [5L]

Module VII

Line, surface and volume integrations, Theorems of Green, Stokes and Gauss, Application of vector calculus in engineering problems, orthogonal curvilinear coordinates, expressions of gradient, divergence and curl in curvilinear coordinates. [5L]

Books:

1. T. M. Apostol : Calculus Vols I and II, 2nd Edition, John Wiley and sons, 1967 and 1969.
2. M. D. Weir, J. Hass and F. R. Giordano: Thomas' Calculus, 11th edition, Pearson Educations, 2008
3. Dennis G. Zill, Warren S. Wright: Advanced Engineering Mathematics, 4th edition, Jones and Bartlett Publishers, 2010
4. E. Kreyszig : Advanced Engineering Mathematics, 8th Edition John Wiley and sons 1999.
5. Murray R Spiegel, Theory and problems of Vector Analysis and an Introduction to Tensor Analysis, McGraw Hill, Schaum's Outline Series

CS 1302 Fundamentals of UNIX and C Programming (1-0-3-3)

Module – I

The Free Software Movement, Open source definition, Open source business strategy, Problem Solving and its tools, Flow chart, Pseudo code, Modular programming. Fundamentals of Unix Operating System, Login & Password, Different Commands, Unix directory, Structure and working with directories, Vi-editor, Basic Structure and execution of C programmes, Constants, Variables, and Data Types and various type of declarations, Different type operators and Expressions, Evaluation of Expressions, Operator Precedence and Associability, Mathematical Functions. [6]

Module –II

Managing Input and Output operations, Decision Making and Branching Decision Making and Looping. [4]

Module – III

One – dimensional Arrays and their declaration and Initialisations, Two-dimensional Arrays and their initialisations, Multidimensional Arrays, Dynamic Arrays, String Variables, Reading and Writing Strings, Arithmetic Operations on characters, Putting Strings together, Comparison of Two Strings, String – handling functions. [6]

Module –IV

Need and Elements for user –defined Functions, Definition of Functions, Return values and their types, Function calls and Declaration, Arguments and corresponding return values, Functions that return multiple values, Nesting of functions, Recursion, Passing arrays and strings to functions, The Scope, Visibility and Life time of variables. [5]

Module –V

Defining Structure, Declaring Structure Variable and Accessing Structure Members, Initialisation of Structure, Comparing Structure Variables, Operation on Individual Members, Arrays of Structures, Structures within structures, Structures and Functions, Unions, Size of Structures, Bit Fields. [5]

Module- VI

Understanding Pointers, Accessing the Address of a Variable, Declaration and Initialisation of Pointer Variables, Accessing a Variable through its Pointer, Chain of Pointers, Pointer Expressions, Pointer Increments and Scale Factor, Pointers and Arrays, Pointers and Character Strings, Arrays of Pointers, Pointers and Function Arguments, Functions Returning Pointers, Pointers to Functions, Pointers and Structures, [6]

Module – VII

File Management in C. use of fopen(), fclose(), Formatted file I/O, Searching through files using fseek(), ftell(), rewind(). [4]

Text Book :

1 Kernighan K. R., Ritchie D. M. - The C Programming Language, Ansi C Edition, Prentice Hall, India

2 E. Balagurusamy – Programming in ANSI C, 3rd Edn. , TMH, New Delhi ; 2004

3 A. N. Kanthane – Programming with ANSI and TURBO C, Pearson Education, New Delhi; 2004

4 Y. Kanetkar – Let us C, 4th Edition, BPB Publication , New Delhi; 2002

5 Chris DiBona, Sam Ockman , Open Sources : Voices from the Open Source Revolution (Web book), Oreilly Press, 2nd edition,1999

HU 1103 ENGLISH (2-1-0-3)

Module 1:

1. Short stories
   A) The castaway – Rabindra nath Tagore
   B) Mr. know all - somerset Maugham (4)

Module-II

2. Essays
   a) Life's Philosophy – Jawaharlal Nehru
   b) Ideas that have helped mankind – Bertrand Russell (4)

Module III & IV:

3. Vocabulary
   a) One word substitution
   b) Idioms & Phrases
   c) Pairs of word
   d) Synonyms & Antonyms
4. Comprehension (12)

Module V:

1. Communication
   a) Definition & Meaning
   b) Effective communication
   c) Barriers to communication
   d) Verbal & Non- Verbal communication (8)

Module VI

2. Official correspondence
   a) Memorandum
   b) Notice, Agenda, Minutes
   c) Invitation letter for Seminar etc.
   d) Refusal & Acceptance letter (8)

Module VII:

3. Drafting C.V. & writing Application
4. Paragraph writing (4)

Reference books:

1. Selected short stories , Prof. Damodar Thakur(ed)- Mcmillan India Ltd.
2. Modern Masters – An Anthology of English prose; Bord of editors- Orient longman
3. Student's Companion- W D Best - Rupa & Co.
4. Effective Business Communication- Asha Kaul- Prentice Hall of India
5. Business Communication- Satya Swaroop Debasish, Bhagban Das- Prentice hall of India

ISP 1002 Physics Lab-1 (0-0-3-2)

1. Error analysis using vernier calipers, screw gauge, and spherometer
2. Determination of Young's modulus, modulus of rigidity and Poisson's ratio of material of a wire using Searle's method.
3. Determination of Young's modulus of material of a metallic bar by bending of beam method.
4. To study the standing waves on a stretched string and verify the relation between tension, frequency and number of loops.
5. To determine the frequency of ac mains supply using sonometer.
6. Determination of viscosity of liquid using Poiseuille's method.
7. Determination of surface tension of a liquid by capillary tube method.
8. Determination of acceleration due to gravity using compound pendulum

IMC 1002 Chemistry Lab-1 (0-0-3-2)

1. Demonstration & concept of good lab practices including safety, glassware handling, chemical nature understanding, chemical handling, chemical/glassware waste management, Error Analysis, notebook maintenance.

2. Calibration and handling of balances, pipettes and burettes, basic principles & experiments related to sample & reagent preparation: practical concept of Molarity, Molality, Normality, equivalence, weight %, vol.%, Preparation of standard solutions, Dilution 0.1 M to 0.001 M solutions.

3. Calibration of Thermometer
    a. 80-82 C (Naphthalene), 113.5-114 C (Acetanilide)
    b. 132.5-133 (Urea), 100 C (Distilled Water)

2. Determination of Melting Point
    Naphthalene 80-82 C, Benzoic Acid 121.5-122 C
    Urea 132.5-133 C, Succinic Acid 184.5-185
    Cinnamic Acid 132.5-133, Salicylic Acid 157.5-158 C
    Acetanilie 113.5-114 C, m-Dinitrobenzene 90 C
    p-Dichlorobenzene 52 C, Aspirin 135 C

3. Determination of Boiling Point
    a. Ethanol 78 C, Cyclohexane 81.4 C, Toluene 110.6 C

4. Crystallization
    a. Phthalic acid from hot water (using fluted filter paper and stemless funnel)
    b. Acetanilide from boiling water
    c. Naphthalene from ethanol
    d. Benzoic acid from water

5. Distillation

    a. Simple distillation of ethanol-water mixture using water condenser
    b. Distillation of nitrobenzene and aniline using air condenser

6. Macro analysis (qualitative) of cations and anions (known samples)

    Books Suggested:
    1. Vogels Textbook of Practical Organic Chemistry
    2. Experiments in General chemistry, C. N. R. Rao and U. C. Agarwal
    3. Vogel's Textbook of Practical Organic Chemistry (5th Edition)
    4. Vogel’s Inorganic Practical Chemistry

Co-curricular Activity (0-0-2-1)

IMP 2001 Physics II - Basic Electromagnetic Theory (3-0-0-3)

Module I

Fields: [6]

Vector and scalar fields, physical and mathematical concepts of gradient, divergence and curl, Gauss's theorem and Stokes' theorem.

Module II & III

Electrostatics: [9]

Coulomb's law, Gauss's law in integral and differential form, electric potential and relation with E, electrostatic energy density, dielectrics, Relation between E, D and P vectors, dielectric susceptibility, boundary conditions on E and D.

Module IV & V

Magnetism: [9]

Motion of charged particles in electric and magnetic fields, Biot-Savart law, Ampere's law in integral and differential form, applications, Hall effect.

Types of magnetism – diamagnetism, paramagnetism and ferromagnetism, Weiss field, domains, magnetic permeability and susceptibility, Relation between B, H and M vectors, boundary conditions on B and H, hysteresis.

Module VI & VII

Electromagnetic theory: [12]

Faraday's law of electromagnetic induction in integral and differential form, Inductance, magnetic energy density, continuity equation for charge, displacement current, Maxwell's equations in free space, electromagnetic wave equation for plane waves in dielectric medium and free space, relation between ***E, B,*** and ***k***, Poynting vector, radiation pressure.

Text books:

1. Fundamental of Physics: Halliday, Resnick & Walker (6^{th} Edition)
2. Engineering Electromagnetics: William Hayt, John Buck, McGraw-Hill Companies (7^{th} Edition)

Reference books:

1. Introduction to Electrodynamics: David J Griffiths, 3rd Ed.
2. Electricity and Magnetism: Jackson

IMC2001 **Chemistry II** **(3-1-0-4)**

Module- I Colloidal State [5]

Definition of colloid, classification of colloids. Solids in liquids (sols): properties – kinetic, optical and electrical: stability of colloids, protective action Hardy-Schulze law, gold number. Liquids in solids (gels): classification, preparation and properties, inhibition, general application of colloids.

Module-II Chemical kinetics and Catalysis [6]

Introduction to chemical kinetics Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy, Simple collision theory based on hard sphere model transition state theory (equilibrium hypothesis) Expression for the rate constant based on equilibrium constant and thermodynamic aspects. Catalysis, characteristics of catalysed reactions, classification of catalysis, miscellaneous examples.

Module III: s- and p- Block Elements [5]

Comparataive study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies, an introduction to alkyls and aryls.

Chemical properties of the noble gases, chemistry of xenon, structure and bonding xenon compounds Role of Mg, Na, K, Ca ions in biology.

Module IV: Acids and Bases [4]

Arrhenius, Bronsted-Lowry, solvent system, Lewis and HSAB concept of acids and bases.

Module V: Aromatic Compounds & Aromaticity [5]

Aromatic hydro carbons and aromaticity, resonance in benzene, Huckel's (4n+2) rule and its simple applications. Acidic character of phenols - explanation on the basis of resonance stabilization. Electrophilic substitution reactions in aromatic compounds. General mechanisms of nitration, halogenation, sulphonation, Friedel-Craft's acylation and alkylation, ortho/para/meta directive influence with examples.

Module VI: Elimination & Substitutions Reactions [5]

SN1 and, SN2 reaction mechanism: effects of structure, substrate, solvent, nucleophile and leaving groups. Mechanisms of E1 and E2 reactions, Hoffmann and Sayetzeffs rules cis and trans eliminations, Elimination Vs substitution.

Module VII: Stereochemistry [6]

Introduction, Concept of Isomerism, Classification of Stereoisomers, Optical isomerism, Chirality & Elements of symmetry, Wedge formula, Fischer projection, Newmann projection. Relative and absolute configurations, sequence rules, D & L, R & S systems of nomenclature. Understanding with examples for Enantiomers, mesoform, erythro/threo forms, diastereoisomers, inversion, retention, and racemization. Conformational understanding with an example of ethane, n-butane, Cyclohexane and Decalin**.**

Books Recommended:

1. Fundamentals of Organic Chemistry Solomons, John Wilev
2. Introduction to Organic Chemistry, Streitwiesser, Hathcock and Kosover, Macmillan.
3. Physical Chemistry Vol. 1-5, by K.L Kapoor
4. Physical Chemistry: A Molecular Approach by McQuarrie & Simon Viva
5. Concise Inorganic Chemistry by **J D Lee,** Amazon
6. Comprehensive Co-ordination Chemistry by G. Wilkinson, R. D. Gillars & J. A. Mccleverty, Pergamon
7. Chemistry of the Elements by N. N. Greenwood & Earnshow, Pergamon

IMM 2001 Mathematics II - Matrix Algebra & Complex Variables (3-0-0-3)

Module I

Inequalities- A.M., G.M. Cauchy Schwartz inequality, Weirstrass's inequality, Holder's inequality. Simple Continued Fractions [3]

Module II

Infinite serie -- Convergency and divergency of Infinite series. Comparison test, D' Alembert's Ratio test, Raabe's test, logarithmic test, Cauchy's root test, Higher Logarithmic ratio Test, Gauss's Test, Alternating series, Leibinitz test, absolute and conditional convergence, power series, uniform convergence. [6]

Module III

Matrix Algebra: Orthogonal, Hermitian, skew- Hermitian and unitary matrices, Elementary row and column transformations, rank and consistency conditions and solution of simultaneous equations, linear dependence and consistency conditions and solution of simultaneous equations, linear dependence and independence of vectors, Linear and orthogonal transformations [6]

Module IV

Eigen values and Eigen vectors, properties of Eigen values, Cayley-Hamilton theorem, reduction to normal forms, quadratic forms, reduction of quadratic forms to canonical forms, index, signature, Matrix calculus & its applications in solving differential equations. [4]

Module V

Theory of equations- Descartes's rule of Signs. Relation between roots and coefficients of a polynomial equation, transformation of equation, reciprocal equation, symmetric function of roots, solution of cubic polynomial by Cardon's method, solution of bi-quadratic equations by Ferrari's and Descarte's method. **[**5]

Module VI

Complex variables: Introduction to complex variables. Functions of a complex variable. Limit, continuity, differentiability and analyticity of complex functions. Cauchy-Remann equations. [6]

Module VII

Complex Integration, Cauchy's theorem and Cauchy's Integral formula, Morera's Theorem, Power series, Taylor's, Laurent's Theorems, Cauchy's inequality, Liouville's theorem, fundamental theorem of algebra. Calculus of residues, Contour integrals, Conformal mappings, and Bilinear Transformations. [6]

Text Books:

1. M. D. Weir, J. Hass and F. R. Giordano: Thomas' Calculus, 11th edition, Pearson Educations, 2008.
2. Complex Variables and applications- R.V. Churchill and J.W. Brown, 7th edition, 2004, McGraw-Hill.
3. A.D. Wunsch, Complex Variables with Applications, 3rd edition, Pearson Education, Inc.
4. M J Ablowitz and A S Fokas, Complex Variables Introduction and Applications Cambridge Texts, 2nd Ed.
5. Higher Algebra- **S Branard & J M Child,** Maxford Books (2003)
6. Introduction to Matrices and Linear Transformations: Third Edition- Daniel T. Finkbeiner, Dover Publications, 2011
7. Higher Algebra-Hall & Knight - Arihant Prakashan.
8. T. M. Apostol : Calculus Vols I and II, 2nd Edition, John Wiley and sons, 1967 and 1969.

CS 2301 Fundamentals of Data Structures (3-1-0-4)

Module – I

Algorithms and Analysis of Algorithms: Definition, Structure and Properties of Algorithms, Development of an Algorithm, Data Structures and Algorithms, Data Structure – Definition and Classification, Efficiency of Algorithms, Apriory Analysis, Asymptotic Notations, Time Complexity of an Algorithm using *O* Notation, Polynomial Vs Exponential Algorithms, Average, Best and Worst case Complexities, Analyzing Recursive Programs, Open source software development process. **[5]**

Module – II

Arrays, Stacks and Queues: Array Operations, Number of Elements in an Array, Representation of Arrays in Memory, Applications of Array, Stack-Introduction, Stack Operations, Applications of Stack, Queues-Introduction, Operations on Queues, Circular Queues, Other Types of Queues, Applications of Queues. [5]

Module – III

Linked List, Linked Stacks and Linked Queues: Singly Linked Lists, Circularly Linked Lists, Doubly Linked Lists, Multiply Linked Lists, Applications of Linked Lists, Introduction to Linked Stack and Linked Queues, Operations on Linked Stacks and Linked Queues, Dynamic Memory Management and Linked Stack, Implementations of Linked Representations, Applications of Linked Stacks and Linked Queues. [5]

Module – IV

Trees, Binary Trees, BST, AVL Trees and B Trees: Trees: Definition and Basic Terminologies, Representation of Trees, Binary Trees: Basic Terminologies and Types, Representation of Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Applications, BST & AVL Trees: Introduction, BST: Definition and Operations, AVL Trees: Definition and Operations, B Trees: Introduction, m-way search trees: Definition and Operations, B Trees: Definition and Operations. [6]

Module – V

Graphs: Introduction, Definitions and Basic Terminologies, Representations of Graphs, Graph Traversals, Single-Source Shortest-Path Problem, Minimum Cost Spanning Trees. [5]

Module – VI : Sorting: Introduction, Shell Sort, Quick Sort, Heap Sort. [5]

Module – VII : Searching: Introduction, Binary Search, Transpose Sequential Search, Interpolation Search. [5]

Text Book:

1. G A V Pai – Data Structures and Algorithms: Concepts, Techniques and Applications, 2nd Edn, Tata McGraw-Hill, 2008
2. Horowitz E.Sahni, S., Susan A., Fundamentals of Data Structures in C, 2nd Edition, University Press, 2010

Reference Books:

1. **J. P.** Tremblay **, P. G.** Sorenson – An Introduction to Data Structures With Applications, 2nd Edn**,** McGraw-Hill, Inc. New York, NY, USA.
2. Seymour Lipschutz – Data Structures, 6th Edn, 9th Reprint 2008, Tata McGraw-Hill.
3. Adam Drozdek – Data Structures and Algorithms in C++, Thomson Learning, ND–2007.
4. J. Feller, B. Fitzgerald -Understanding Open Source Software Development, Pearson Edu. Ltd. ND.

CS 2302 Data Structures Lab (0-0-3-2)

CH 2303 Environmental Science (3-0-0-3)

Module 1 **[6]**

Introduction to Environment Pollution: Environmental Awareness, concept of an ecosystem, structure and function of an ecosystem, energy and nutrient flow biogeochemical cycle, sources, pathways and fate of environmental pollutants.

Module II **[8]**

Air Pollution: Composition, major sources of air pollution, their detrimental effects, stationary emission sources, some control methods, eg.cyclon separators, west scrubbers electrostatic precipitators etc.

Automobile emission control, smog, green house effect, ozone depletion, global warming and acid rains etc.

Module III **[6]**

Water Pollution: Water resources, sources of water pollution, various pollutants their detrimental effects.

Portability limits as per WHO & PHED specification, treatment of municipal supply water, slow sand filters, rapid sand filter, disinfections, their advantage & disadvantages, break point chlorination.

Module IV **[5]**

Industrial Water: Specification for boiler feed water, internal and external treatment, ion exchange electro dialysis and reveres osmosis.

Module V **[5]**

Sewage Treatment: Composition aerobic & anaerobic treatment, chemical & biological oxygen demand.

Module VI

A brief Introduction to Noise Pollution & Radioactive Pollution [3]

Module VII

Soil pollution and solid waste management [3]

Book Recommended:

De.A.K.Environmental Chemistry, Wiley Eastern ltd,
Miller T.G.Jr., Environmental Science, Wadsworth publishing House, Meerut
Odum.E.P.1971. Fundamental of Ecology. W.B. Saunders Co.U.S.A.

IMP 2002 **Physics Lab-II** **(0-0-3-2)**

Determination of resistance per unit length and an unknown resistance using C. F. Bridge.

1. Determination of thermal conductivity of a bad conductor using Lee's disc method.
2. To determine the electrical equivalent of heat.
3. To determine the band gap energy of a given semiconductor by four-probe method.
4. B-H curve and hysteresis loss.
5. To study series and parallel resonant L. C. R. circuit.
6. To measure voltage and frequency of a sinusoidal waveform using a CRO and to find unknown frequencies by producing Lissajous figures.
7. To determine the emf and internal resistance of a cell using a stretched wire potentiometer.
8. (a) To study deviation of light through a prism and obtain the angle of minimum deviation using Raytrace software.

   (b) To study the relationship between position of an object and its image produced by a convex lens and to find the resulting magnification.

IMC 2002Chemistry Lab-II **(0-0-3-2)**

1. Volumetric analysis

(a) Determination of acetic acid in commercial vinegar using NaOH

(b) Estimation of calcium content in chalk as calcium oxalate by permangatometry.

(c) Estimation of hardness of water by EDTA.

(d) Estimation of copper using thiosulphate

2. Synthesis and analysis

(a) Preparation of Ni-DMG complex, $[Ni(DMG)_2]$

(b) Gravimetric analysis of Ni as Ni-DMG complex

(c) Qualitative inorganic analysis of mixtures containing not more than 4 radicals from the following:
Cation Radicals: Na+, K+, Ca+2, Sr+2, Ba+2, Al+3, Cr+3, Mn+2, Fe+3, Co+3, Ni+3, Cu+2, Zn+2.
Anion Radicals: F-, Cl-, Br-, BrO3, , I-, SCN-, S2-, SO42-, S2O3, 2-, NO3-, NO2-, PO43-, BO33-, CrO4 2-/ Cr2O7 2-, Fe(CN)6 4-, Fe(CN)6 3-.
Insoluble Materials: Al2O3, Fe2O3, Cr2O3, SnO2, SrSO4, BaSO4, CaF2.
Experiment A: Preliminary Tests for acid and basic radicals in given samples.
Experiment B: Wet tests for Acid and Basic radicals in given samples.
Experiment C: Confirmatory tests.

Practical Book:

1. G. Svehla: Vogel's Qualitative Inorganic Analysis.
2. J. Mendham, R. C. Denny, J. D. Barnes, M. J. K. Thomas: Vogel's Text Book of Quantitative Chemical Analysis.
3. Vogel's Textbook of Quantitative Chemistry.
4. Synthesis & characterization of Inorganic Compounds by W. L. Jolly, Prentice Hall.

Co-curricular Activity (0-0-2-1)

IMP 3001 Physics III - Modern Physics (3-0-0-3)

Module I

Atomic structure: Bohr and Sommerfeld model of hydrogen atom, Effect of finite nuclear mass, Idea of discrete energy levels and electron spin, Significance of four quantum numbers and concept of atomic orbital. [6]

Module II & III

Vector atom Model:, One valence electron atom: Orbital magnetic dipole moment, Orbital, spin and total angular moment, Stern–Gerlach experiments, Larmor precession, Vector model of atom, Electronic configuration and atomic states, Spin-orbit interaction and fine structure, Intensity of spectral lines, General selection rules. Magnetic moment of the electron, Lande g factor, Zeeman Effect, Doublet structure of alkali spectra. [6]

Module IV

Multi electron Atom: Pauli's exclusion principle, shell structure, Hund's rule, Atomic ground state and periodic table. [6]

Module V

Molecular spectra: The molecular bond, Electron sharing, Types of molecular energy state and molecular spectra, molecular orbital method, MO treatment of hydrogen molecule and molecular ion, diatomic molecular orbital, Molecular orbital energy level diagrams, Molecular Symmetry.

[6]

Module VI

Special theory of relativity: Postulates, Galilean transformations, Lorentz transformations, length contraction, time dilation, velocity addition, mass change and Einstein's mass energy relation. [6]

Module VII

Introduction to X-ray: Electromagnetic radiations, continuous spectrum, characteristic spectrum, production of x-rays, detection of x-rays, properties of x-ray, safety precautions. X-ray diffraction, the Bragg law, filters. [6]

Textbooks:

1. Modern Physics, Arthur Beiser, Tata McGraw-Hill Edition (2008)
2. Modern Physics, R. A. Serway, C. J. Moses & C. A. Moyer, Thomson books (2007).

Reference books:

3. Richtmeyer, Kennard, Cooper

IMC3001 Chemistry III (3-0-0-3)

Module-I Thermodynamics [6]

Thermodynamic terms, State and path functions and their differentials. Thermodynamic process. Concept of heat and work. First Law of thermodynamics, energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law – Joule – Thomson coefficient and inversion temperature. Calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic condition for reversible process. Introduction to Thermo chemistry, Kirchhoff's equation. Second law of thermodynamics

Module-II Chemical Equilibrium [6]

Equilibrium Constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier's principle. Reaction isotherm and reaction isochore, Clausius – Clapeyron equation and applications.

Module III Oxidation and Reduction [5]

Nernst Equation, Electrochemical series, Use of redox potential data – analysis of redox cycle,. Principles involved in the extraction of the elements.

Module IV Chemistry of d and f block Elements [6]

Characteristic properties of d- and f- block elements. Properties of the elements, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry. lanthanide contraction, complex formation

Module V & VI Hydroxy and Carbonyl Compounds [7]

Preparation of monohydric alcohols from carbonyl compounds using Grignard reagents, Methods to distinguish between Primary, secondary and tertiary alcohols (Lucas, Victor Meyer's and oxidation method) Preparation of aldehydes and ketones by Rosenmund's reduction, Oppeanauer oxidation. Reactions of aldehydes and ketones (Reduction using $LiA1H_4$, Clemensen and Wolf-Kishner reduction, reaction with alcohols) Mechanism of Aldol condensation, Cannizzaro's reaction, Reimer – Tiemann reaction, Perkin's reaction, Benzoin condensation.

Module VII Organic Compounds of Nitrogen [6]

Preparation of nitroalkanes and nitroarenes, Separation of primary, secondary and tertiary amines using Hinsberg and Hoffmann method, Structural & basicity relation of amines, Amine salts as phase transfer catalyst, Reduction of nitro compounds, Reductive amination of aldehyde and ketones, Gabriel-phthalimide reaction, Synthetic transformation of aryl diazonium salts, azo coupling.

Books Recommended:

1. Chemistry of the Elements by N. N. Greenwood & Earnshow, Pergamon
2. Metalo-organic Chemistry by A. J. Pearson, Wiley
3. Physical Chemistry by Samuel Glasstone
4. Physical Chemistry by IRA. N. Levine TMH
5. Organic Chemistry by Morrison Boyd
6. Organic Chemistry by Finar
7. Fundamentals of Organic Chemistry Solomons, John Wilev

IMM 3001 Mathematics III - Ordinary Differential Equations with Special Functions

(3-1-0-4)

Module I & II

Differential Equations: Linear Differential equation of Ist order. Differential Equations of first order and higher degree, Linear independence and dependence of functions. Higher order differential equations with constant coefficient, Rules of finding C.F. and P.I., Method of variation of parameter. Cauchy and Legendre's linear equations, Simultaneous linear equations with constant coefficients. [8]

Module III

Linear differential equations of second order with variable coefficients; Removal of first derivative (Normal form), Change of independent varaiable, Applications of higher order differential equations. [6]

Module VI

Total Differential equations and conditions of integrability. Initial value problems, Existence and Uniqueness theorem. Series solution around an ordinary point and a regular singular point, the method of Frobenius. [6]

Module V & VI

Special Functions: Bessel, Legendre and Hypergeometric equations, Confluent Hypergeometric equation, Self adjoint eigen value problems, Green's functions, Second order boundary value problems, Sturm Liouville problems. [10]

Module VII

Fourier Series:

Periodic functions, Euler's formulae, Dirichlet's conditions, expansion of even and odd functions, half range Fourier series, Perseval's formula, complex form of Fourier series. [6]

Text Book:

1. Simmons G.F., Differential Equations with Applications and Historical Notes, TMH, 2nd ed.,1991.
2. Dennis G. Zill, Warren S. Wright, Advanced Engineering Mathematics, 4th edition, Jones and Bartlett Publishers, 2010
3. Edwards & Penney, Differential Equations and Boundary value problems, Pearson Education, 3rd ed.
4. Shepley L. Ross, Differential Equations, Wiley India Pvt. Ltd, 3rd ed.
5. Birkhoff & Rota, Ordinary Differential Equations, Wiley India Pvt. Ltd., 4th ed.
6. Zill, Differential Equations, Thomson Learning, 5th ed., 2004

CS 3101 Java Programming & Web Technology (3-0-0-3)

MODULE – I

Introduction to Java Applications, Memory Concepts, Arithmetic, Decision making, Equality and Relational Operators. Introduction to Java Applets, Drawing strings and lines.

Control Statements: if, if ... else, selection statements, while statement, compound assignment operators, increment decrement operators, for ... statement, do.... While, switch, break and continue, labelled break and continue, logical operators.

Methods in java: declarations, argument promotions, scope of declarations, method overloading, Recursion.

Arrays: declaring and creating references and reference parameters, passing arrays to methods, multi dimensional arrays.

MODULE – II

Object based programming, classes, class scope, controlling access to members, this keyword and its use, constructors, overloading constructors, composition, garbage collection, static class members, final instance variables, crating packages, package access, Data abstraction and encapsulation.

MODULE – III

Inheritance and polymorphism: super class and subclass, protected members, Relation ship between super and sub class. Inheritance hierarchy, abstract classes and methods, final methods and classes, nested classes, Type wrappers.

MODULE – IV

Exception handling, Java exception hierarchy, rethrowing an exception, finally clause, stacks unwinding, chained exception, declaring new exception types.

Multithreading: Life cycle of a thread, priorities and scheduling, creating and executing threads synchronization.

MODULE – V

Files and streams, hierarchy, files and streams, File class, Sequential access file manipulation, random access file handling, Introduction to String class and its members.

MODULE – VI

World Wide Web, Client / Server architecture, Web browser, Web server, creating a web site and mark up languages, HTML, document structuring tags in HTML, Special tags in HTML.

MODULE – VII

Introduction to DHTML, scripting languages, java script: objects, methods, events & event handling, Document object model.

Text Book:

1. Dietel,Dietel - Java How to program , 5th edition; Pearson Education , New Delhi.

2. S. Raj Kamal – Intrernet and Web Technology, Tata McGraw Hill, New Delhi, 2002.

Reference:

1. C. Horstmann,G. Cornell - Core Java 2 Vol I & Vol II ; Pearson Education , New Delhi.
2. Balagurusamy -Programming in Java, 2nd Edition; Tata McGraw Hill Publication; New Delhi.
3. Patrick Naghton & H. Schildt – The Complete Reference Java 2, Tata McGraw Hill Publication, New Delhi.

CS 3102 Java Programming Lab (0-0-3-2)

PS: 3001 BIOLOGICAL SCIENCE (3-0-0-3)

Module I 4L

1. Unit of life: Cell as a unit of life, structural organization of cell, cytoplasmic organelles, nuclear organelles, cell reproduction

Module II 7L

2. Organisms and environment: Nature and scope of biology, species and population, biotic community,
   Ecosystem, biosphere, natural resources and their utilization,
   Environmental pollution, wild life and forest conservation
   Genetics: Mendalism, chromosomal aberration, polyploidy

Module III 3L

3. Biological Classification of plants: Artificial system, natural system, phylogenetic and chemical system of classification of plants

Module IV 6L

4. Plant Metabolism: Photosynthesis, Glycolysis, Transpiration, TCA cycle, Energy changes and exchange of matters

Module V 8L

5. General survey of Animal Kingdom:
   Structure and life history of parasites as illustrated by amoeba, entamoeba, trypnosoma, plasmodium, taenia, and ascaris.
   General Structure and Life History of Insects (in relation to humans & medicinal crops)**:** Mosquito, Housefly, Mites, Tse – Tse fly.

Module VI 5L

6. Composition and functions of blood and its elements & their disorders, Blood groups and their significance, Blood pressure and its regulation,

Module VII 7L

7. Brief outline of disorders, Gastric ulcer, Asthma, Myocardial Infarction, Thalasemia. Hypertension, Diabetes, Parkinsonism, occupational diseases.

Books recommended

1. A.C.Dutta: “Text Book of Botany”

2. Maheshwari: “Text Book of Botany”

3. Gupta: “Genetics”

4. Hess: “Plant Physiology”

5. Truemans: “Elementary Biology”

6. Vidyarathi: “Text book of Biology”

7. Guyton & Hall: Textbook of Medical Physiology” WB Saunders Company.

8. Chatterjee: Human Physiology” Vol I & II, Medical Allied Agency, Calcutta.

9. Chauraisia: “Human Anatomy – Regional & Applied” Part I, II, III, CBS Publishers & Distributors.

IMP 3002 Physics Lab – III (0-0-3-2)

1. To study the force experienced by a current carrying conductor placed in a magnetic field (Lorentz force) using a mechanical balance.
2. Determination of boiling point of a liquid by platinum resistance thermometer.
3. Determination of wavelength of sodium yellow line by Newton's rings.
4. Determination of wavelength of mercury lines by diffraction grating.
5. To study polarization by reflection and determine Brewster's angle.
6. Determination of wavelength of sodium yellow line by Fresnal's Biprism
7. Michelson Interferometer with sodium vapour lamp.
8. To determine the slit width of a given aperture by laser diffraction method.

IMC3002 Chemistry Lab-III (0-0-3-2)

1. Mixed melting point determination
    a. Urea-Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1)

2. Decolorisation and Crystallization using Charcoal
    a. Decolorisation of brown sugar (sucrose) with animal charcoal using gravity filtration.
    b. Crystallization and decolorisation of impure naphthalene (100 g of naphthalene mixed with 0.3 g Congo Red using 1 g decolorizing carbone) from ethanol
3. Sublimation (Simple and Vacuum)
    Camphor, Naphtalene, Phthalic Acid and Succinic Acid

4. Qualitative Analysis
    a. Element detection and Functional group determination (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and aniline) in simple organic compounds and mixture analysis.

5. Thin Layer Chromatography: Determination of Rf values and identification of organic compounds.
    a. Separation of green leaf pigments (spinach leaves may be used).
    b. Preparation and separation of 2,4-dinotrophenylhydrazones of acetone, 2-butanone, hexan-2- and 3-one using toluene and light petroleum (40:60).
    c. Separation of mixture of dyes using cyclohexane and ethyl acetate (8.5: 1.5)

6. One step organic synthesis:
    a. Rf determination, crystallization, melting point determination.
    b. UV and IR spectroscopic analysis.

Books Suggested:

1. Vogels Textbook of Practical Organic Chemistry
2. Experiments in General chemistry, C. N. R. Rao and U. C. Agarwal
3. Experimental Organic Chemistry Vol 1 and 2, P R Singh, D S gupta, K S Bajpai, Tata McGraw Hill
4. Laboratory Manual in Organic Chemistry, R. K. Bansal, Wiley.

Co-curricular Activity (0-0-2-1)

IMP 4001 Physics IV - Modern Optics (3-0-0-3)

Physical Optics

Module I & II

Interference: Conditions for sustained interference, Theory of interference, Two-Beam Interference, Interference in parallel and wedge shaped films, Achromatic fringes, Color of thin films. Newton's rings and Michelson interferometer and their applications. Multiple beam interference in parallel film and Fabry-Perot interferometer. [12]

Module III

Diffraction: Fresnel's diffraction, Zone plate, diffraction due to straight edge. Fraunhoffer diffraction due to single and double slits, plane transmission grating and its resolving power. [6]

Module IV & V

Polarization : Polarization of light, Malus's law, polarization by reflection, Brewster's law, Analysis of linearly and circularly polarized light, Polarization by double refraction and Huygen's theory, Nicol prism, Retardation plates, Opticalactivity and Fresnel's theory, Biquartz polarimeter

[8]

Module VI & VII

Lasers and Holography:
Lasers: Einstein coefficients, Threshold condition for LASER action, Rate equation for three level laser system, Characteristics of laser radiation. He-Ne and Nd-YAG Laser.

Holography: Principle of holography, recording and reconstruction method and its theory as interference between two plane waves, Applications of Holography. [10]

Textbooks:

1. Jenkins and White ; Fundamentals of Optics
2. Ghatak; Optics

Reference books:

3. Hecht & Zajak; Optics
4. An introduction to Laser Theory and Application – M.N.Avdhanulu
5. Perspective of Modern Physics, A. Beiser (AB), Mc Graw Hill Int

IMC4001 Chemistry IV (3-0-0-3)

Module I Phase Equilibrium [6]

Statement and meaning of the terms – phase, component and degree of freedom, phase equilibria of one component system – water, phase equilibria of two component system – solid equilibria, simple eutectic – Pb-Ag system, desilverisation of lead.

Module II Electrochemistry [6]

Electrical transport, Migration of ions and kohlrausch law, Arrhenius theory of electrolytic dissociation, Application of conductivity measurements, conductometric titrations. Types of reversible electrodes Electrode reactions, Nernst equation, derivation of cell E. M. F. and single electrode potential, standard hydrogen electrode – reference electrodes, electrochemical series and its significance. Electrolytic and Galvanic cells – reversible and irreversible cells. EMF of a cell and its measurement. Potentiometric titrations.

Module III Coordination Compounds [6]

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

Module IV Nuclear chemistry [5]

Radioactivity: Characteristics of radioactive decay, Decay kinetics, types of decay, α, β, γ-emissions, artificial radioactivity. Nuclear fission and fusion; Nuclear Reactors: Classification of reactors, reactor power, and application of radioactivity, nuclear waste Management.

Module V Carboxylic Acids & its derivatives [5]

Acidity of Carboxylic Acids, Effects of Substituent's on Acid Strength. Preparation and reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation, effect of heat and dehydrating agents, Mechanisms of esterification and hydrolysis (acidic and basic).

Module VI Spectroscopic Characterization of Organic Molecules [4]

Basic principles of UV-VIS and, FTIR, spectroscopy. Brief application of spectroscopic characterization of organic molecules.

Module VII Biomolecules [4]

Classifications and nomenclature of monosaccharides, Mechanism of osazone formation, Interconversion of glucose and fructose, formation of glycosides, Cyclic structure of D(+)-glucose, Mechanism of mutarotation, Classification, structure and stereochemistry of amino acids, isoelectric point, Brief introduction to peptide and proteins, Classical peptide synthesis, introduction and constituents of nucleic acids, the double helical structure of DNA.

Books Recommended :

1. Modern Electrochemistry – Vol – I & II, by **J. O. M. Bockris & A. K. N. Reddy,** Plenum.
2. Organic Chemistry, F.A. Carey, McGraw-Hill Inc.
3. Organic Chemistry, Morrison and Boyd, Prentice Hall.
4. Concise Inorganic Chemistry by **J D Lee,** Amazon.
5. Comprehensive Co-ordination Chemistry by G. Wilkinson, R. D. Gillars & J. A. Mccleverty, Pergamon
6. Principles of Bio-inorganic Chemistry by S. J. Lippard & J. M. Berg, University Science Books.

IMM 4001 Mathematics IV - Integral Transform & Partial Differential Equations

(3-1-0-4)

Module I & II

Laplace Transform : Definition of Laplace Transform, Linearity property, condition for existence of Laplace Transform; First & Second Shifting properties, Laplace Transform of derivatives and integrals; Unit step functions, Dirac delta-function. Differentiation and Integration of transforms, Convolution Theorem, Inversion. Periodic functions. Evaluation of integrals by L.T., Solution of boundary value problems. [6]

Module III

Fourier Transform: Fourier Integral formula, Fourier Transform, Fourier sine and cosine transforms. Linearity, Scaling, frequency shifting and time shifting properties. Self reciprocity of Fourier Transform. Convolution theorem. Application to boundary value problems. [6]

Module IV & V

Integral Equations: Integral Equations: Basic concepts, Volterra integral equations, Relationship between linear differential equations and Volterra equations, Resolvent kernel, Method of successive approximations, Convolution type equations, Volterra equation of first kind, Abel's integral equation, Fredholm integral equations, Fredholm equations of the second kind, the method of Fredholm determinants, Iterated kernels, Integral equations with degenerate kernels, Introduction to Singular integral equations. [12]

Module VI & VII

Partial Differential Equations: Formation of P.D.E, Equations solvable by direct integration,Linear and non-linear equations of first order, Lagrange's equations, and Charpit's method, Homogeneous and non-homogeneous linear P.D.E. with constant coefficients, Rules for finding C.F. & P.I. Linear and quasi linear equations, Partial Differential Equations of second order with constant and variable coefficients, Classification and reduction of second order equations to canonical form, Cauchy's, Neumann and Dirichlet's problems, Solution of Laplace and Poisson's equations in two and three dimensions by variable separable method, Solution of wave equation and unsteady heat equation in homogeneous, non-homogeneous cases. [12]

Text Books:

1. The use of integral Transforms -**I.N. Sneddon**, TATA McGraw-Hill
2. Elements of Partial Differential Equations-**I.N. Sneddon** -Dover Publications
3. Simmons G.F., Differential Equations with Applications and Historical Notes, TMH, 2nd ed.,1991.
4. Zill, Differential Equations, Thomson Learning, 5th ed., 2004
5. **F H Miller,** Partial Differential Equations **--** J. Wiley & Sons, Inc.

MSH 1151 Value Education, Human Rights and Legislative Procedure (3-0-0-3)

Module I **[5]**

Concept of value and value education: Social Values and Individual Attitudes, Work Ethics, Indian Vision of Humanism, Moral and Non-moral Valuation, Standards and Principles, Value Judgments.

Module II **[5]**

Theories of value development: Rural Development in India, Co-operative Movement and Rural Development.

Module III **[5]**

Human Rights, UN declaration, Role of various agencies in protection and promotion of rights.

Module IV **[6]**

Indian Constitution: Philosophy of Constitution, Fundamental Rights and Fundamental Duties, Legislature, Executive, and Judiciary: Their Composition, Scope and Activities.

Module V **[5]**

The Legislature: Function of Parliament, Constitution of Parliament, Composition of the Council of the States, Composition of the House of People, Speaker.

Module VI **[5]**

Legislative Procedure: Ordinary Bills, Money Bills, Private Member Bills; Drafting Bills; Moving the Bills, Debate, Voting, Approval of the President/Governor.

Module VII **[5]**

Vigilance: Lokpal and Functionaries

Books:

1. Value education and human rights: R.P.Shukla, Sarup & Sons.
2. Human Rights, Education, & Global Responsibilities, Vol 3, James Lynch, Celia Modgil, Sohan Modgil 1992, The Falmer press.
3. Human Rights, Volume 4: U.N. Gupta, Atlantic Publishers And Distributers
4. **Human rights:** an interdisciplinary approach, Michael Freeman, Wiley-Blackwell,

IMM 4003 Discrete Mathematics (3-1-0-4)

Module I

Discrete Mathematics:

Logic and Mathematical Reasoning: Logic, Propositional Equivalences, Predicates and Quantifiers, Methods of Proof, Mathematical Induction, Recursive Definition and Algorithms, Program Correctness. (5L)

Module II

Permutation, Combination, Use of generating function as enumerator of permutation and combination, Ordering of permutations and combination.

Principles of Counting and Algorithms: The Principle of Inclusion – Exclusion, the Addition and Multiplication Rules, The Pigeon-Hole Principle.

Recurrence Relations and their solutions using generating function.

Relation, Equivalence relations, Partial Ordering Relations and Lattices. (5L)

Module III

Subgroups, Groups and Coding: Binary Operations, Semi groups, Products and Quotients of Semi groups, Groups, Product and Quotients of Groups, Coding of Binary Information and Error Correction, Decoding and Error Correction. Language and Grammar (5L)

Module IV

Graph theory:

Definitions of basic terminologies, isomorphism, connected & disconnected graphs, Euler & Hamilton graphs.

Tree: Properties and basic terminologies, spanning tree.

Cut sets: Properties, Fundamental circuits and cut sets, connectivity, separability, network flows.

Planar and dual graphs: Combinational representation, planar graphs, Kuratowshi's graphs, detection of planarity, dual graphs. (5L)

Module V

Matrix representation of graph: adjacency matrix, incidence matrix, circuit matrix, cut set matrix, path matrix fundamental matrices, and relationships among matrices.

Coloring, covering & partioning: Chromatic number, chromatic portioning, matching, covering, four color problem. (5L)

Module VI& VII

Directed graphs: Different types, directed path, and connectedness, Euler digraphs, trees, matrix representation, tournament.

Graph theoritic algorithms: Algorithms for connectedness, a spanning tree, fundamental circuits, cut vertices, directed circuits, shortest paths.

Applications: graph in sequential switching networks, graph in coding theory, graph in Markov process, graphs in computer programming. (11L)

Text Books:

1. **Mott , Abraham & Baker** : Discrete Mathematics for computer scientist & mathematicians PHI, 2nd edition 2002.
2. **C.L.LIU :** Elements of Discrete maths, Mcgraw Hill, 2nd edition, 2001.
3. **ROSS & WRIGHT :** Discrete Mathematics PHI 2nd edition , 1988.
4. Kolman, Rusby, Ross: Discrete Mathematics Structures, PHI, 5th ed, 2005

CS 6101 DESIGN AND ANALYSIS OF COMPUTER ALGORITHMS (3-0-0-3)

MODULE -I

Basic Tools on Designing Algorithms: What is an algorithm? Algorithm specification and performance analysis, randomized algorithms. [4]

MODULE –II

Divide-and-Conquer: The general method, application to binary search, finding the maximum and minimum, merge sort, quick sort, the problem of selection and Strassen's matrix multiplication.

[6]

MODULE -III

The Greedy Method: The general method, application to optimal storage on tapes, job sequencing with deadlines, optimal merge patterns and minimum weight spanning trees. [6]

MODULE –IV & V

Dynamic Programming: The general method, application to multistage graphs, all pairs shortest paths, optimal binary search trees,0/1-Knapsack and traveling salesman problem, Flow shop scheduling

Backtracking: The general method, application to 8- puzzle problem, 8- queen problem and sum of subsets.

[8]

MODULE -VI

Branch and Bound: The method, application to 0/1 Knapsack traveling salesman problems, and efficiency considerations. [4]

MODULE -VII

NP-Hard and NP-Complete Problems: Introduction and basic concepts, non-deterministic turing machine, the classes of P and NP, NP-hard graph problems, NP-completeness of the satisfiability problem, and polynomial- space-bounded problem. [8]

Text Book:

1. E. Horowitz. et.al., Fundamentals of computer Algorithms, Galgotia Publication Pvt. Ltd., New Delhi, 2004

Reference Books:

1. J.Kleinberg & E. Tardos – Algorithm Design, Pearson Education, New Delhi, 2006
2. G.Brassard & P. Bratley – Fundamentals of Algorithms, PHI, New Delhi, 2005
3. T.H. Cormen et.al. – Introduction to Algorithms – PHI, New Delhi, 2005
4. S.Dasgupta et.al. – Algorithms, TMH, New Delhi - 2007

Co-curicular Activity (0-0-2-1)

IMM 5001 **Numerical methods** **(3-0-0-3)**

Module I

Transcendental and Polynomial Equations: Introduction, Bisection Method, Iterative Methods, Rate of Convergence, Methods for Complex Roots, Polynomial Equations. (4L)

Module II

System of Linear Algebraic Equations and Eigenvalue Problems: Introduction, Direct Methods, Error analysis, Iteration Methods, Largest and Least eigenvalues and corresponding eigen vectors by Power method. The Rayleigh quotient. Inverse iteration. Jacobi's methods, Given and Household's methods. Leverriar – Faddeeva method. (6L)

Module III

Interpolation and Approximation: Introduction to Lagrange and Newton Interpolations, Finite difference operators, Interpolating polynomial using finite differences, Hermit interpolations, Piecewise and spine interpolation. (6L)

Module IV

Differentiation and Integration: Introduction, Numerical differentiation, Numerical integration, Methods based on interpolation. (6L)

Module V

Numerical solution of first order ordinary differential equation with initial condition by Picard's, Euler's & Taylor series method; Runge Kutta Method, Predictor-Corector methods (Milne & Adams-Bashforth). Boundary value problem: linear, non-linear, shooting and finite difference method. (6L)

Module VI & VII

Partial Differential Equations : Finite difference approximations to partial derivatives, solution of Laplace & Poisson's equations using standard five pt. formula & diagonal five pt. formula. Solution of one dimensional heat conduction equation by Schmidt method and Crank Nicolson method. Solution of wave equation. Stability of finite difference schemes for parabolic and hyperbolic equations. (8L)

Books

1. Numerical Methods for Scientific and Engineering Computation, M.K.Jain, New Age Publication.
2. Numerical Methods , Germund Dahlquist, Åke Björck, Dover Publication

IMM 5002 **Numerical methods Lab** **(0-0-3-2)**

IMM 5003 Probability and Statistics (3-1-0-4)

Module I

Concept of a frequency distribution, graphical statistics, measure of central tendency, dispersion skewness and kurtosis.

Probability : Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Baye's Theorem, and independence . (5)

Module II

Random Variables : Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, moment generating function, Chebyshev's Inequality. (5)

Module III

Special Distributions : Discrete uniform, Binomial, Negative Binomial, Geometric, hypergeometric, Poisson, Exponential, Gamma, Normal distributions, Function of a Random Variable . (5)

Module IV

Joint Distributions : Joint, marginal and conditional distributions, product moments, correlation, independence of random variables, bivariate normal distribution.

Sampling Distributions : The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions. (5)

Module V

Estimation : Efficiency, consistency and sufficiency. The method of moments and the method of maximum likelihood estimation, confidence intervals for the mean(s) and variance(s) of normal populations . (4)

Module VI & VII

Testing of Hypotheses : Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, the most powerful test and Neyman's Pearson Fundamental Lemma, tests for one sample problems for normal populations.

Anova: One way and two way classification of Anova. Design of experiment-CRD and RBD. **(12)**

Text Book :

1. Richard A. Johnson, Miller & Freund's Probability & Statistics for Engineers, 8th Edition, PHI,2009

Reference Books:

2. Feller, W., Introduction to Probability theory & applications, V.I, John Wiley, 1968
3. Freund, J.E., Mathematical Statistics, Pearson Education, 2002
4. Meyer, P.L., Introductory Probability and Statistical Appl., Oxford & IBH, 1970.
5. Arnold and Milton, Probability and Statistics, TMH, 2rd ed, 2007
6. Hines, W., Montgomery D., Goldsman, D. and Borror, C: Probability & Statistics in Engineering, 4th Ed., John Wiley, 2002

IMM 5005 Modern & Linear Algebra (3-1-0-4)

Modern Algebra

Module I

Groups, subgroups, cyclic groups, cosets, Lagrange theorem. Normal subgroup, quotient group; homomorphism, fundamental theorem of homomorphism; permutation group, Cayley's theorem; Sylow's theorem. Direct product of group. (6L)

Module II & III

Cummutative ring with identity: Axioms, examples, integral domain; field, ideals, quotient ring, prime and maximal ideal, principal ideal domain; Euclidean domain, the field of quotients of an integral domain; polynomial ring over a field. Roots of polynomials, extension of fields, splitting fields. Euclidean ring and unique factorization in it. Field of quotients and embedding theorem. (10L)

Linear Algebra

Module IV & V

Vector spaces: Finite dimensional vector spaces over a field; linear combination, linear dependence and independence, basis and dimension. Inner-product spaces; Schwartz inequality, orthonormal set, orthonormal basis and Gram-Schmidt construction for finite dimentional inner product space. (10L)

Module VI & VII

Linear transformations and projections, Sylvester law of nullity, matrix representation of linear transformation, linear functional, dual spaces, Self-adjoint, Unitary and normal operators, Orthogonal projections. Bilinear forms, Symmetric, Skew-symmetric, Positive and semi-positive forms etc. (10L)

Text Book :

1. IN Herstein, Topics in Algebra, 2nd ed., John Wiley, 1999.
2. Hoffmann and Kunj, Linear Algebra, Pearson Education, 3rd ed, 2008

Reference Books:

3. J.B. Fralieigh, A first course in Abstract algebra, 5th ed., Addison-wesley, 1994.
4. Henry Helson, Linear Algebra; Hindustan Publishing House, 1994.

CS 4105 Data Base Management System (3-0-0-3)

Module I

Introduction: Purpose of Database Systems, View of Data. Database Language, Transaction Management, Database Architecture, Database Users Administrator.

Database Design and Entity- Relational Model: Overview of Design Process, E-R model, Conatraints, E-R diagrams, Weak Entity Sets, Extended E-R Features. [6L]

Module II

Relational Model: Structure of relational databases, Fundamental Relational Algebra, Operation, Additional Operations, Tuple Relational, Calculus. [5L]

Module III

SQL and Advanced SQL: Data Definition, basic structure of SQL Operations, Set Operations, Aggregate Functions, NULL Valus, Nested Sub-Queries, Complex Queries, views and modifications of database, SQL data Type and schemas, integrity constrains, Authorization, Embedded SQL. [5L]

Module IV

Relational Database Design: Atomic domains and First Normal form, decompositions using Functional dependencies, decompositions using Multi-valued dependencies, More Normal forms. (5L)

Module V

Indexing and Hashing: Basic concepts, Ordered Indices, B+ tree index files, , B tree index files, Multiple Key Access, Hashing, comparison of ordered Indexing and Hashing. [5L]

Module VI

Query Processing: overview, measures of Query cost, Selection operation, sorting join Oprerations [3L]

Module VII

Transaction and Concurrency Control : Transaction concepts and ACID properties, Transaction States, Concurrent executions, Serializability and its Testing, Recoverability, Introduction to Concurrency Control, Locked base Protocol and Deadlock handling, Timestamp- based Protocol, Validation-based Protocol. Multiple Granularity. (7L)

Books:

1. A. Silberschatz, et.al. "Database System Concepts", 5th Edition, Tata McGrew Hill, ND, 2000.
2. Date C.J., "An Introduction to Database Systems", Pearson Ed. ND,2005
3. R. Elmasri et.al. "Fundamentals of Database Systems", 3rd Edition – Addison Wesley

CS 4106 RDBMS Lab (0-0-3-2)

SGI 1001 PRINCIPLES OF REMOTE SENSING (3-0-0-3)

Module I: Basic Principles

- Remote Sensing: History, Development, Definition, Advantages and Limitations, Concept & Principles
- Electromagnetic Radiation (EMR): Spectrum and its properties, wavelength regions and their applications Atmospheric windows, Interaction of EMR with atmosphere & Earth's Surface
- Spectral response pattern
- Spectral, Spatial, Temporal and Radiometric Resolutions

Module II: Sensors, Scanners And Detectors

- Photographic System: Cameras, filters & Films
- Remote Sensing Systems: Platform, types of platforms & its characteristics.
- Sensor classification: Active and Passive, Optical-Mechanical Scanners & Push-broom scanners
- Ground Truth Instruments: GTR

Module III: Unit 3 Remote Sensing Satellites

- Satellites & their characteristics – Geostationary & Sun Synchronous
- Earth Resource Satellite: Introduction to commonly used multi-spectral remote sensing satellite systems: IRS Series of Satellites, Landsat, SPOT, Ikonos, Quickbird, Modis, Radarsat, ERS, etc.
- Weather & Communication Satellites: Introduction, NOAA, TERRA, MOS, INSAT, GOES, etc.

Module IV: Aerial Photography And Photogrammetry

- Introduction: Fundamentals of Aerial Photography, Aerial photography planning & execution of photographic flights
- Photogrammetry: Basic concepts of scale, measurements of object height and length,
- Stereo Photogrammetry: Stereovision & Stereoscopes, Stereoscopic Parallax & Parallax Equations
- Relief dIMPlacement, Vertical exaggeration

Module V: Digital Photogrammetry

- Basic Concepts
- Generation of Digital Photogrammetric Images
- Interior Orientation, Exterior Orientation
- Generation of Digital Elevation Models & Ortho-images

Module VI: Thermal & Microwave Remote Sensing

- Thermal Infrared: Introduction, Radiation Properties, Kinetic Heat, Temperature, Radiant Energy and Flux, methods of transferring heat
- Thermal properties of terrain: Thermal Capacity, Thermal conductivity, Thermal Inertia, Thermal Infrared MultIMPectral scanners, Thermal IR Remote sensing examples
- Microwave: Passive & Active Microwave Sensors, Side looking RADAR, Scatterometer

Module VII: Remote Sensing Applications

1. Brief introduction to Remote Sensing (RS) Applications: Agriculture, Forestry, Land cover/Land use, Water resources & Earth System Science

REFERENCE BOOKS

1. Jensen, J.R., (2006) "Remote Sensing of the Environment – An Earth Resources Perspective", Pearson Education, Inc. (Singapore) Pte. Ltd., Indian edition, Delhi.
2. George Joseph, (2004) "Fundamentals of remote sensing", Universities press (India) Pte Ltd., Hyderabad.
3. Sabins, F.F. Jr., (2007) Edition. 'Remote Sensing – Principles and Interpretation", W.H. Freeman & Co.
4. Reeves, Robert G. (1991), "Manual of Remote Sensing, Vol. I, American Society of Photogrammetry and Remote Sensing, Falls Church, Virginia, USA
5. Lillesand, Thomas M. and Kiefer, Ralph, W., (2007) "Remote Sensing and Image Interpretation", 4th Edition, John Wiley and Sons, New York
6. Rampal, K.K., (1999) Handbook of Aerial Photography and Interpretation, Concept Publishing Company, New Delhi

IMM 6001 OPTIMIZATION TECHNIQUES (3-0-0-3)

Module – I & II

Introduction to Linear Programming (LP): Graphical LP Solution, Graphical sensitivity analysis; The Simplex Method: Computational details, Artificial starting solution: M-Methods, Two Phase methods, Special cases in simplex method applications (8L)

Module – III

Duality and sensitivity analysis: Definition of dual problem, primal dual relationship, Dual Simplex algorithm, Generalized simplex algorithm, Postoptimal or sensitivity analysis (4L)

Module – IV

Transportation Algorithm and Assignment Model

Network Models: Minimal Spanning Tree Algorithm, Shortest Route Problem, Maximal Flow Model, Minimum cost capacitated flow problem, CPM and PERT (6L)

Module – V

Advanced Linear Programming: Revised Simplex Method, Parametric Linear Programming, Karmakar Interior Point method (6L)

Module VI

Integer Linear Programming:

Integer programming Algorithms: Branch and Bound Algorithm, Cutting Plane Algorithm

Solution of Travelling salesman Problem: Branch and Bound Algorithm, Cutting Plane Algorithm (6L)

Module – VII

Goal Programming: The weights method, The preemptive method. (6L)

Text Books:

1. Hamdy A Taha: Operations Research, 9th ed, Pearson Education, 2009

Reference Books:

2. Hiller and Lieberman, Operation Research, 8th ed, McGraw Hill, 2009
3. Winston, Operations Research, 4th ed, Thomson Learning, 2007
4. Ronald L. Rardin, Optimization in Operations Research, Pearson Education, First Indian Reprint 2002

IMM 6002 OPTIMIZATION TECHNIQUES LAB (0-0-3-2)

IMM 6003 Real Analysis & Topology (3-1-0-4)

Real Analysis

Module I

Sequence of real numbers, bounded and monotonic sequence, notion of convergence, upper and lower limits of a sequence, Cauchy sequence and Cauchy's general principle of convergence. Subsequence and their convergence. (6L)

Module – II & III

Sequence and Series of functions, uniform convergence, uniform convergence and continuity, uniform convergence and integration, uniform convergence and differentiation. Equi-continuity, Ascoli's Theorem

Riemann integral, definition and existence of the integral, Properties of the integral, differentiation and integration, Fundamental theorem of integral calculus. Darboux theory of Riemann integration for bounded functions, upper and lower integrals. Riemann integrability of continuous and monotonic functions, discontinuous functions. Mean value theorems of integral calculus. Continuity, compactness and differentiability of functions by integrals. (10L)

Module- IV & V

Real number system and set theory, Completeness property, Archimedean property, Denseness of rationals and irrationals. Countable and uncountable sets, supremum and infimum of sets of real numbers, bounds and limit points of a set, Cardinality, Zorn's lemma. Bolzano-Weierstrass theorem, open and closed sets. Compact sets, Heine-Borel theorem.

Metric spaces, definitions and examples, open sets and closed sets, convergence and completeness, continuity and uniform continuity, completeness and compactness. Baire's category theorem, Cantor's intersection theorem. real line as an example of a metric set. (10L)

Module VI & VII

Topology

Topological spaces, Weak topology, Subspace topology, Product and quotient spaces, Contiuous maps and homeomorphism, Connectedness, Paths, Equivalence classes of paths. Path connected spaces, Separation axioms Compact and locally compact spaces. (10L)

Text-Book:

1. Rudin, Principles of Mathematical Analysis, McGraw,Hill 3rd edition, 1983.
2. James R., Munkres, Topology, 2nd Edition, Pearson Education (Singapore) Pte. Ltd., 2001

Reference Books:

3. Apostal: Mathematical Analysis , Addision Wesley,1983
4. Dieudonne, J. : Foundations of Modern Analysis, Academic Press, New York.,1983.
5. Piotr. B & Alfred W: Problems in Mathematical Analysis, Marcell-Dekker 1990
6. J Dugundji – Topology, PHI
7. M Eisenberg – Topology (Holt, Rinehart and Winston)
8. J L Kelley –General Topology (Von Nostrand)
9. G F Simmons – Introduction to Topology and Modern Analysis (McGraw Hill)
10. Steen & Seebach – Counterexamples in Topology (Holden Day)
11. S Willard –General Topology (Addison Wesley)

IMM 6004 Computing Lab-Mat Lab (0-0-3-2)

CS 4107 **Operating System** **(3-0-0-3)**

Module I

Introduction: What is an Operating System? Simple Monitor, Performance, Multiprogramming, time-sharing, Real time system, protection. [4L]

File System: File concept and support, Access and allocation methods, direct systems, file protection [2L]

Module II

CPU Scheduling: Scheduling concepts and algorithms, Algorithms evaluations and Multiple processor Scheduling. [5L]

Module III

Memory Management: Preliminaries, Bare Machine. Resident monitor, Swapping, multiple partitions, Paging, Segmentation, combined system [5L]

Module IV

Virtual Memory: Overlays, Demand paging, Performance of Demand paging , Page replacement, Virtual Memory Concepts, Page replacement Algorithms, Allocation Algorithms and Thrashing. (5L)

Module V

Disk Scheduling: Physical characterization, Disk Management, Swap-Space Management, RAID Structure, FCFS Scheduling and Short-Seek-Time –First. (5L)

Module VI

Deadlock: The Deadlock problem, Deadlock characterization, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock and combined approach to Deadlock handling. [5L]

Module VII

Process Synchronization : Semaphores, OS Synchronization, Automatic Transaction

Security: The Security Problem, User Authentication, Cryptography (5L)

Text Book:

1. Silver Schatz, A and Peter Baer Galvin "Operating System Concepts" 5th edition, John Wiley, NY, 2000

Reference Books:

2. Deitel HM , 'An Introduction to Operating Systems",Addison Wesley, Inc., London, 1995.
3. Mandinck S E., " Operating Systems", McGraw Hill., London 1993.

CS 4109 Computer System Architecture (3-1-0-4)

Module I

Design Methodology: System design, system representation, Design process, the Gate level.

The Register Level: Register Level Components, Programmable Logic Devices, Register Level Devices.

The Processor Level: Processor level components, Processor level Design. [5L]

Module II

Processors Basics:

CPU Organization: Fundamentals, Additional Floating-point Numbers.

Data Representation:Basic Format, Fixed-point numbers, Floating point numbers

Instruction Sets: Instruction Formats and types [5L]

Module III

Datapath Design:

Fixed-point Arithmetic—Addition, Subtraction, multiplication and Division.

Arithmetic Logic Units—Combinational ALUS, Sequential ALUs [5L]

Module IV

Control design:

Basic Concepts-- Introduction, Hardware Control

Microprogrammed-- Basic Concepts,Multiplier Control Unit

Control—pipeline Control, Instruction Pipeline, Arithmatic Pipeline [5L]

Module V

Memory Organization:

Memory Technology-- Memory Device Characteristic, Random Access Memories, Serial Access Memories

Memory Systems—Multilevel Memories, Address Translation, Memory Allocation.

Cache-- Main Features, Address Mapping. [6L]

Module VI

Systen Organization:

Communication Methods—Basic concepts, Bus Control

System Control---DMA and Interrupts [5L]

Module VII

Advanced Topics

Pipeline processing, Parallel Processing [5L]

Text Book:

1. J.P.Hayes- Computer Architecture and Organization, 3rd Ed, McGraw Hill, New Delhi

Reference Books:

1. Heuring V.P., et al., Computer System Design and Architecture, Addision Wesley IP2000
2. V. Hamacher- Computer Organization, 5th Edn, McGraw Hill, New Delhi-2002.
3. M.M.Mano- Computer System Architecture, 3rd Edn, PHI/Pearson Education, ND-2006.
4. Ram B., Computer Fandamentals: Architecture and Organization3rd Ed. New Age Int. Pub.

MSH 1143 German Language (3-0-0-3)

A. AIMS AND OBJECTIVES

1. Developing the following language skills:

LISTENING: To enable the learners to listen and understand the spoken German language which uses the elementary spoken structures.

SPEAKING: To enable the learners to speak and engage in simple dialogues in German.

READING SKILLS AND TEXTUAL COMPREHENSION: To enable the learners to read and understand the elementary texts in German.

WRITING**:** To enable the learners to write simple sentences and short paragraphs in German.

2. To enable the learners to manipulate the simple grammatical structures of the language and the most essential vocabulary.

3. To expose the learners to the culture of German speaking countries

D. Contents of the Syllabus

Module I: Simple texts and interactions useful in daily life
Module II: Life and culture of Germany and German speaking countries
Module III: Describing the immediate environment and things of common interest.
Module IV & V: Functional Grammar:

1. Articles
2. Nouns and pronouns
3. Present tense
4. Position of verbs in different types of sentences
5. Direct and indirect objects
6. Interrogative sentences
7. Articles as pronouns
8. Internet sites for language skills

Module VI: Geography of Germany and German speaking countries
Module VII: Introduction to German culture (intercultural perspectives)

Books recommended :

1. Tangram aktuell A 1 -1, Kursbuch, Arbeitsbuch, Glossar, Übungsheft und CD Lektion 1 - 4: Deutsch als Fremdsprache, Authors: Rosa-Maria Dallapiazza, Eduard von Jan, und Til Schönherr,Verlag: Hueber.
2. Tangram aktuell A1- 2, Kursbuch, Arbeitsbuch, Glossar, Übungsheft und CD, Lektion 5 - 8: Deutsch als Fremdsprache, Authors: Rosa-Maria Dallapiazza, Eduard von Jan, und Til Schönherr,Verlag: Hueber.

Cassel's Language

IMM 7001 Number Theory and its Applications (3-0-0-3)

Module I

Unique Factorisaton in $\mathbb{Z}$ (and Id's) Euclidean Algorithm., Application to linear Diophantine equations. Arithmetic functions Primality Testing and factorization algorithms, Pseudo-primes, Fermat's pseudo-primes, Pollard's rho method for factorization, Continued fractions, Continued fraction method Hash Functions. (6L)

Module II

Arithmetic in Quadratic Number fields: Integers, Units Primes and irreducible elements, Failure of unique factorization, (Informal) definition of Ideal class group, Pell's equation and relation to continued fractions. Diophantine equations problems: Use of congruence, Fermat equations. (6L)

Module III & IV

Introduction to algebraic integers. Algebraic and Transcendental numbers : Lioville's theorem, Transcendence of (and of without proof) Dedekind theory of ideals with emphasis on algebraic integers.

A. Integral Extensions, Algebraic extension, algebraic Number fields. Norms and traces, discriminant.

B. Dedekind domains, Integral closure of a Dedekind domain is a Dedekind domain, Integers in number fields: Quadartic and Cyclotomic integers.

C. Ideal class group, finiteness, Dirichlet's theorem on units.

D. Splitting of primes in a extension field. Discriminant and ramification, examples of quadaratic and cyclotomic integers.

E. Quadratic Reciprocity using Gaussian sum. (12L)

Module V

Analytic aspects :

A. Divergence of/p, Euler's theorem, zeta function, statement of prime number theorem, Bertrand's postulate.

B. Dirichlet's theorem on primes in Arithmetic progression. C. Dedekind's Zeta function, Class number formula for quadratic number fields (6L)

Module VI

Public Key cryptography, Diffie-Hellmann key exchange, Discrete logarithm-based cryptosystems, RSA crypto-system, Signature Schemes, Digital signature standard, RSA Signature schemes, Knapsack problem. Introduction to elliptic curves, Group structure, Rational points on elliptic curves, Elliptic Curve Cryptography. Applications in cryptography and factorization. (6L)

Books:

1. Nathanson, Melvyn B.: "Additive number theory; The classical bases", Graduate Texts in Mathematics, 164. Springer-Verlag, New York, 1996. 342 pp. ISBN 0-387-94656-X
2. Number-theoretic properties of partitions are included in the extensive book by Andrews, George E.: "The theory of partitions", Encyclopedia of Mathematics and its Applications, Vol. 2, Addison-Wesley Publishing Co., Reading, Mass.-London-Amsterdam, 1976. 255 pp.
3. W.S. Burnside and A.W. Panton, The Theory of Equation, 3rd Ed., S.Chand & Co.Ltd., New Delhi, 1979.

IMM 7003 Complex Analysis & Measure Theory (3-0-0-3)

Complex Analysis:

Module I

Review of functions of complex variables. Cauchy Goursat theorem, Taylor's And Laurent's series. Poison's Integral Formula, Residues and poles and its applications to solve improper and proper integrals containing branch cuts and branch points. (6L)

Module II

Conformal Mapping and its applications. Rouche's theorem, maximum modulus theorem, argumentprinciple. (6L)

Module III & IV

Entire and Meromorphic functions. Expansion of Meromorphic functions and application to trigonometric functions. Growth of Entire function, Weirstass's theorem, Jensen's inequality, Jensen's formula, hadamard's three circle's principle. Analytic continuation by power series. (12L)

Measure Theory :

Module V

Field, σ-field, Borel field, Measure, inner and outer measure, Measurable sets and Measurable functions, Measurable and Measure space, Extension of measures, Signed measures, Jordan-Hahn Decomposition Theorem (6L)

Module VI

Lebesgue measure, Lebesgue integral, Monotone Convergence theorem, Fatou's lemma, Dominated Convergence theorem, Absolute continuity, Radon Nikodin theorem, Product measures, Fubini's theorem. (6L)

Text Book :

1. Jain P.K. & V.P. Gupta, Lebesgue Measure And Integration, Wiley Eastern,3r ed.,1994.
2. R.V. Churchill and J.W. Brown Complex Variables and applications-, 7th edition, 2004, McGraw-Hill.

Reference Books

3. Inder Kumar Rana : Intro to Measure & Integration, Narosa, Delhi 1997.
4. Mcshane: Integration, Princeton Univ. Press, 1964.
5. Royden, Real Analysis, Prentice Hall, 1995.
6. A.D. Wunsch, Complex Variables with Applications, 3rd edition, Pearson Education, Inc.
7. M J Ablowitz and A S Fokas, Complex Variables Introduction and Applications Cambridge Texts, 2nd Ed.

IMM 7005 Reimannian Geometry & Differential Geometry (3-0-0-3)

Reimannian Geometry

Module I

Contravariant and covariant tensors, mixed tensors. Contraction, inner and outer product, quotient law. (6L)

Module II & III

Reimannian metric, Christoffel symbols. Differentiation of tensors. Gradient, divergence and curl in tensorial forms. (12L)

Differential Geometry

Module IV

Space Curves, Sereret Frenet Formulae, Spherical Indicatrix, sphericalm curvature, Bertrand Curves. Envelopes, developable surfaces, edge of regression. (6L)

Module V & VI

Curvilinear coordinates on a surface, fundamental magnitudes, Weingarten's relations. Lines of curvature, Euler's theorem, Rodrigue's formula, Joachimsthal's theorem. Asymptotic Lines, equation of Gauss and Codazzi, Geodesics. (12L)

Books:

Text Book:

1. Andrew Pressley : Elementary Differential Geometry, Springer-Verlag (2001)

Reference Books:

2. I. Vaisman - A First course in Differential geometry Marcel Dekker Inc. (1984)
3. H. Flanders-Differential forms with Applications to the Physical Sciences, Academic Press (1963)
4. A. Goetz, Introduction to Differentia Geometry, Addison-Wesley (1970)
5. R.L. Bishop & S.I. Goldberg -Tensor Analysis on manifolds, Macmillan co. (1968)
6. A Mischenke & A. Fomenku : A Course of Differential Geometry & Topology
7. S.T. Hu : Differentiable Manifolds
8. L.I., Nicolarscu : Lectures on the Geometry of Manufolds
9. J. Hoschek & D. Lasser : Computer - aided Geometric Design
10. W. Bochm & H. Prautzsch : Geometric concepts for Geometric Design.

CS 7103 Computer Graphics (3-0-0-3)

Module I

Introduction: Image Processing as Picture Analysis, The Advantages of Interactive Graphics, Representative Uses of Computer Graphics, Classification of Applications, Development of Hardware and Software for Computer Graphics, Conceptual Framework for Interactive Graphics. (6L)

Module II

Basic Raster Graphics Algorithms for Drawing 2D Primitives: Overview, Scan Converting Lines, Scan Converting Circles, Scan Converting Ellipses, Filling Rectangles, Filling Polygons, Filling Ellipse Arcs, Pattern Filling, Thick Primitives, Line Style and Pen Style, Clipping in a Raster World, Clipping Lines, Clipping Circles and Ellipses, Clipping Polygons, Generating Characters, SRGP_copy, Pixel, Antialising. (6L)

Module III

Graphics Hardware: Hardcopy Technologies, Display Technologies, Raster-Scan Display Systems, The Video Controller, Randam-Scan Display Processor, Input Devices for Operator Interaction, Image Scanners.

Geometrical Transformations: 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D Transformations, Composition of 2D Transformations, The Window-to-Viewport Transformation, Efficiency, Matrix Representation of 3D Transformations, Composition of 3D Transformations, Transformations as a Change in Coordinate System. (6L)

Module IV

Viewing in 3D: Projections, Specifying an Arbitrary 3D View, Examples of 3D Viewing, The Mathematics of Planar geometric Projections, Implementing Planar Geometric Projections, Coordinate Systems.

Input Devices, Interaction Techniques, and Interaction Tasks: Interaction Hardware, Basic Interaction Tasks, Composite Interaction Tasks.

Representating Curves and Surfaces : Polygon Meshes, Parametric Cubic Curves, Parametric Bicubic Surfaces, Quadric Surfaces. (6L)

Module V

Achromatic and Colored Light: Achromatic Light, Chromatic Color, Color Models for Raster Graphics, Reproducing Color, Using Color in Computer Graphics.

The Quest for Visual Realism: Why Realism?, Fundamental Difficulties, Rendering Techniques for Line Drawings, Rendering Techniques for Shaded Images, Improved Object Models, Dynamics, Stereosis, Improved Displays, Interacting with Our Other Senses, Aliasing and Antialiasing. (6L)

Module VI

Visible-Surface Determination: Functions of Two Variables, Techniques for Efficient Visible-Surface Algorithms, Algorithms for Visible-Line Determination, The z-Buffer Algorithms, List-Priority Algorithms, Area-Subdivision Algorithms, Algorithms for Octress,

Algorithms for Curved Surfaces, Visible-Surface Ray Tracing.

Illumination and Shading: Illumination Models, Shading Models for Polygons, Surface Detail, Shadows, Transparency, Interobject Reflections, Physically Based Illumination Models, Extended Light Sources, Spectral Sampling. (6L)
Computer Graphics

Text Book:

1. T1: James D. Foley, A. Van Dam, S.K. Feiner, and J.F. Hughes, Computer Graphics: Principles and practice, 2nd ed in C, Addision-Wesley Publishing Company, 1996.

Reference Books

2. Rogers B. " Mathematical elements of Computer Graphics" McGraw Hill, 1989.
3. D. Hearn and M.P. Baker, Computer Graphics, PHI, 1994
4. N Krishnamurthy, "Introduction to Computer Graphics", 1st Ed., TMH, 2002

CS 7104 Computer Graphics Lab (0-0-3-2)

MSH 1105 E-Commerce (3-0-0-3)

Module 1

Introduction to E-Business"-Commerce: Origin and Need of E-Commence", Factors affecting E-Commerce", Types of Electronic Commence Value Chains in Electronic Commence.

Module 2:

Internet and E-Business: Internet, World Wide Web, Internet Architectures, Internet Applications, Web Based Tools for Electronic Commerce, Intranet, Business Applications on Intranet, Extranets, Electronic Data Interchange, Components of Electronic Data Interchange, Electronic Data Interchange

Components of Electronic Data Interchange, Electronic Data Interchange Communication Process.

Module 3:

Security Threats to e-business: Security Overview, Electronic Commence Threats, Encryption, Cryptography, Public Kkey and Private Key Cryptography, Dikgital Signatures, Digital Certificates, HTTP, SSL, Firewall as Security Control, Public Key Infrastructure (PKI) for Security.

Module4:

Electronic Payment System: Concept of Money, Electronic Payment System, Types of Electronic Payment Systems, Sart Cards and Electronic Payment Systes, Electronic Fund Transfer.

Module5:

Indian Pwerspective: Benefits of E-Commerce: Drawbacks and limitations of E-Commerce; Emerging trends and technologies in E-Business; Web security; Introduction; Firewalls and transaction security.

Module6:

E-Business Applications & Strategies: Business odels & Revenue Models over Internet, Emerging Trends in e-Business, e-Governance, Digital Comerce, Mobile Commerce, Internet based Business Models.

Module7

E-Commerce and retailing: On-line retail industry dynamics On line mercantile models from customer perspective: Management challenges in on-line retailing. Supply chain management fundamentals Intranets and Supply Chain Management; Managing retail supply chains, Supply chain Application Software.

Text Books:

1. Whitley, Devid; E-Coence Strategy, Technologies and Applkications, Tata McGraw Hill.
2. Schneider Gary P. and Perry, James T: Electronic Commerce. Thomson Learning.
3. Bajaj, Kamlesh K and Nag, Debjani: E-Comerce: The cutting Edge of Business. Tata McGraw Hill, Publishing Company Ltd., New Delhi
4. Laudon and Traver-E-Commerce: Business, Technology, Society (Pearson Education)
5. Greenstein and Feinan – Internet securities

IMM 8001 Operations Research (3-1-0-4)

Module – I

Dynamic Programming

Deterministic Dynamic Programming: Forward and Backward Recursion, Selected DP Applications: Knapsack/Flyaway kit/Cargo loading models, Workforce size model, Equipment replacement models.

Stochastic Dynamic Programming: Investment Problem, Game of chance, maximization of the event of achieving a goal. (6L

Module – II

Inventory Models:

Deterministic Inventory Models: General Inventory Models, Static EOQ models: classical EOQ model, EOQ with price breaks, multi-item EOQ with storage limitation; Dynamic EOQ models: No set-up model; set-up model

Stochastic Inventory Models: Probabilistic EOQ models; Single period models, Multi period models. (6L)

Module – III

Decision Analysis and Games: Decision Trees, Utility theory, Decision making under certainty, Decision making under risk, Decision under uncertainty,

Game Theory: Optimal Solution of Two – person Zero-Sum games, Solution of mixed strategy games (6L

Module – IV

Queueing Systems: Queue, Elements of queueing model, Pure Birth and Death Models, Generalized Poisson Queueing models, Specialized Poisson queues: single server models, multiple server models, machine repair model; P-K Formulae (6L

Module – V

Reliability: Structure function of a system, System reliability, calculation of exact system reliability, bounds on system reliability, bounds on reliability based upon failure time. (6L)

Module – VI

Non Linear Programming Algorithms:

Unconstrained Algorithms: Direct Search method, Gradient method.

Constrained Algorithms: Separable programming, Quadratic Programming, Geometric Programming, stochastic Programming (6L)

Text Books:

1. Hamdy A Taha: Operations Research, 9th ed, Pearson Education, 2009

Reference Books:

2. Winston, Operations Research, 4th ed, Thomson Learning, 2007
3. Hiller and Lieberman, Operation Research, 8th ed, McGraw Hill, 2009
4. Ronald L. Rardin, Optimization in Operations Research, Pearson Education, First Indian Reprint 2002

IMM 8003 Classical Mechanics and Hydro Mechanics (3-1-0-4)

Classical Mechanics:

Module I

Motion in a Central Field, Planetary orbits.

D'Alembert's principle, The general equations of motion. Motion about a fixed axis, The compound pendulum, Center of percussion. (6L)

Module II & III

Lagrange's equations. Functionals, Euler's equations, Isoperimetric problems, Functional involving higher order derivatives. Hamilton's principle. Principle of least action. Fermat's principles. Derivation of Lagrange's equations Hamilton's principle. (12L)

Hydrodynamics:

Module IV

Rotating Liquids, equilibrium of fluids under given field of forces. Pressure of gases, convective equilibrium. (6L)

Module V

Equation of continuity in different co-ordinate system. Euler's dynamical equation. Bernoulli's equation. Pressure equation. (6L)

Module VI

Two dimensional motion, source, sink and doublet. Theorem of Blasius. Vortex motion, vortex pair, karman votex sheet. Motion of cylinders and spheres (simple problems). (6L)

1. Classical Mechanics- Goldstein , 3rd ed, Pearson Education India
2. Classical Mechanics: 2nd Ed., Herbert Charles Corben, Philip Stehle, DoverPublications
3. **A treatise on hydromechanics, part 1,**William Henry Besant Deighton, Bell, 1891
4. An elementary treatise on hydromechanics: with numerous examples:5th ed., Edward Albert Bowser, D. Van Nostrand, 1899

CS 6107 Computer Networks (3-0-0-3)

Module I

Foundations: Applications , Requrements, Network architecture, Implementing Network Software, performances. [5L]

Module II

Direct Link Networks: Hardware Building Blooks, Encoding (NRZ, NRZI, Manchester, 4B/5B), Framing, Error Detection, Reliable Detection. [6L]

Module III

Reliable Transmission, Ethernet(802.3), Token Rings(802.5,FDDI), wireless(802.11) Network Adaptors. [5L]

Module IV

Internetworking: Simple Internetworking(IP), Routing. [5L]

Module V

Global Internet, Multicast, Multiprotocol Label Swiching(MPLS). [5L]

Module VI

End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), Remote Procedure call. [5L]

Module VII

Congestion Control and Resources Allocation: Issues in Resources Allocation, Queuing disciplines, TCP Congestion Control, Congestion-Avoidance Mechanisms, Quality of Service. [5L]

Text Book:

1. L.L.Peterson and B.S.Devie: Computer Networks: A System Approach, 3rd Ed., Morgan Kaufman Pub., New Delhi, 2006.

Reference Books:

1. A. Forouzan: Data Communications and Networking, 4th Edition, Tata McGraw-Hill, New Delhi, 2006.
2. P.C.Gupta: Data Communications and computer Network, PHI, New Delhi 2006.

ARC 8037 **Disaster Management** **(3-0-0-3)**

Module 1

Natural Hazards and Disasters. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Types of Environmental hazards & Disasters: Natural hazards and Disasters, Earthquake Hazards/ disasters, - Causes of Earthquakes, - Distribution of earthquakes, - Hazardous effects of earthquakes, Earthquake Hazards in India, Human adjustment, perception & mitigation of earthquake. (8L)

Module II

Overview of Disaster Management – Distinguishing between an emergency and a disaster situation. Disaster Management Cycle – Phase I: Mitigation, and strategies; hazard identification and vulnerability analysis. Disaster Mitigation and Infrastructure, impact of disasters on development programmes, vulnerabilities caused by development, developing a draft countrylevel disaster and development policy (4L)

Module III

Disaster Management Cycle – Phase II: Preparedness, Disaster Risk Reduction(DRR), Emergency Operation Plan (EOP), Mainstreaming Child Protection and Gender in Emergency Planning, Assessment (4L)

Module IV

Disaster Management Cycle – Phases III and IV: Response and recovery, Response aims, Response Activities, Modern and traditional responses to disasters, Disaster Recovery, and Plan , Disasters as opportunities for development initiatives (6L)

Module V

Community based Initiatives in Disaster management, need for Community Based Approach, categories of involved organizations: Government, Nongovernment organisations (NGOs), regional and international organizations, panchayats, community workers, national and local disaster managers, Policy Makers, grassroots workers, methods of dissemination of information, Community based action plan, advantages/disadvantages of the community - based approach. (6L)

Books:

1. Carter, W. Nick, Disaster Management – A Disaster Manager's Handbook, A.D.B., Manilla, Philippines, 1991.
2. Cutter, Susan L. (Ed.): Environmental Risks and Hazards, Prentice Hall, New Delhi, 1999.
3. Garlake, Teresa, Dealing with Disasters, Oxfam, Oxford, 2000.
4. Government of India, An Action Plan to bring about Collaborative Relationship between Voluntary Organizations and Government, CAPART, Government of India, New Delhi, 1994.
5. Government of India/United Nations Development, Disaster Risk Management Programme (2002-07): Community Based Disaster Preparedness and Risk Reduction Through Participation of Committees and Local Self Governments.
6. Modh Satish Citizens Guide to Disaster Management: How to Save your own life and help others, McMillan India 2006.
7. Mutchopadhaya, A.K., Crisis and disaster management turbulence and aftermath, Newage International Publications, New Delhi, 2005.

IMM 9001 Stochastic Process and Simulation (3-0-0-3)

Module I & II

Definition and classification of stochastic processes, Poisson process, Flow of events, telegraph signal, Birth and death process, application in queues. (12)

Module-III & IV

Random walk, Markov chains, analysis of finite transient discrete Markov chain, finite and infinite ergodic chains. (12)

Module IV & VI

Branching process. Elements of continuous time, continuous state space processes, Brownian motion, Diffusion process. (12)

Books:

1. Simulation and the Monte Carlo method, Reuven Y. Rubinstein, Dirk P. Kroese, Wiley Interscience
2. Stochastic simulation, Brian D. Ripley, Wiley.com
3. Stochastic simulation: algorithms and analysis, Søren Asmussen, Peter W. Glynn spinger, 2007
4. Stochastic processes: odeling and simulation, D. N. Shanbhag, Calyampudi Radhakrishna Rao, North Holland.

IMM 9003 Functional Analysis (3-1-0-4)

Module – I

Review of Linear Algebra, Poset; ZORN's Lemma , Normed Linear Spaces; Banach spaces, l p – spaces; C [a, b], Further properties of nlss, Finite-Dimensional nlss; (6L)

Module- II & III

Riesz Lemma, Linear maps; rank – nullity theorem, Bounded Linear maps, Dual spaces, Hahn-Banach Theorems, Banach Adjoint, Reflexivity, Three famous theorems of Functional Analysis,Inner Product Spaces ,Hilbert spaces, (12L)

Module – IV & V

Orthogonal complements; ON Sets; Bessel's Inequality, Complete ON sets, Riesz Representation theorem, Hilbert Adjoint operator, Self – Adjoint, unitary and normal operators, Compact operators on nlss (12L)

Module-VI

Spectral theorem for finite-dimensional Hilbert spaces,Spectral Theorem for Compact Self-adjoint Operators,Projection operators Spectral Theorem for bounded, Self-adjoint operators

(6L)

Text-book :

1. Kreyzig., E., Introductory Functional Analysis with Applications, John Wiley (2001)

Reference Books:

2. Bachman G. and Narici L., Functional Analysis, Academic Press (1966)
3. Cryer Collin W., Numerical Functional Analysis, Oxford University Press
4. Elliot H. Lieb and Michael Loss, Analysis, Narosa Publishing House, New Delhi (1998)
5. Groetsch, Elements of Applicable Functional Analysis
6. Limaye, B.V., Functional Analysis, New Age International Ltd. (1996)
7. Krishnan, V.K., Textbook of Functional Analysis, Prentice-Hall of India (2001)
8. Pryce, J.D., Basic Methods of Linear Functional Analysis, Hutchinson & Co. Ltd. (1973)
9. Simmons, G.F., An Introduction to Topology and Modern Analysis, McGraw-Hill
10. Taylor, A.E., Introduction to Functional Analysis, Wiley (1958)
11. Wilansky, A., Functional Analysis, Blaisdell (1964)

CS 5101 Formal Languages and Automata Theory (3-1-0-4)

Module – I & II

Basic Mathematical Objects and Mathematical Induction: Sets, logic, Functions, Relations, Alphabets, Strings, Languages, Principle of mathematical induction, Recursive definition.

Regular Expressions and Finite Automata: Regular languages and Regular Expressions, Memory required to recognize a language, Finite Automata, capability & limitations of FSM, Deterministic Finite Automata, Non-Deterministic Finite Automata, NFA with e-moves, regular sets & regular expression, Equivalence of DFA and NDFA, NFA from regular expressions, regular expressions from DFA, Moore versus Mealy m/c, two way finite automata equivalence with one way, Kleen's Theorem, applications of finite automata. (12L)

Module – III

Regular and Non-regulr languages: Criterion for Regularity, Minimal Finite Automata, Pumping Lemma for Regular Languages, Decision problems, Regular Languages and Computers.

Context free Grammars: Introducjtion, definition, Regular Grammar, Derivation trees, Ambiguity, Simplified forms and Normal Forms, Applications. (6L)

Module-IV

Pushdown Automata: Definiktion, Moves, Instantaneous Descriptions, Lnguage recognised by PDA, Deterministic PDA, Acceptance by final state & empty stack, Equivalence of PDA, Pumping lemma for CFL, Interaction and Complements of CFL, Decision algorithms. (6L)

Module – V

Turing Machines: Definition and examples, Computing Partial Functions with Turing Machine ™, Combining TMs, Variations of TMs, Multi-tape TMs, Non-deterministic TM, Universal TM, Church Thesis. (6L)

Module – VI

Recursively Enumerable Languages: Recursively Enumerable and Recursive, Enumerating Language, Co text Sensktive and Chomosky Hierarchy.

Unsolvable Problems and Computable Functions: Nonrecursive Languae and unsolvable Problems, Halting Problem, Rice Theorem, Post Correspondance Problem.

Computation Complexity: DFiscussion on P, NP, NPC and NP-Hard Problems. (6L)

Text Books:

1. John Martin – "Introductionj to Languages and the Theory of Computation", 3rd edition, TMH.
2. K.L.P. Mishra & N. Chandrasekharan – "Theory of Computer Science", PHI
3. Hopcroft JE, and Ullman JD – "Introduction to Automata Theory, Languages & Computation", Narosa.
4. Lewis H.R. and Papadimitrou C. H – "Elements of the theory of Computation", PHI.

MSH 1109 Entrepreneurship & Small Business Management (3-0-0-3)

Module I

Introduction:

Definition, Concept of Entrepreneurship & Intrapreneurship, Characteristics and skills of entrepreneurs

Module II

Entrepreneurial Development:

Entrepreneurship & Economic development, Contribution of Small enterprises to the economy, Entrepreneurial environment, Types of Entrepreneurs.

Module III

Developing the Business Plan:

Identification of Business idea, Elements of a Business Plan, Building Competitive Advantage, Conducting feasibility Analysis.

Module IV

Sources of Finance

Equity vs. Capitl, Sources of Equity Finance, Instituktional finance, Venture Capital, Lease Finance,

Module V

Forms of Business Ownership

Sole Proprietorship, Parternership, Corporations and other forms of ownership

Module VI

Intellectual Property Management: Importance of innovation, patents & trademarks in small business, introduction relating to IPR in India.

Module VII

Instiktutional support for small businesses in India:

Support in ares of technology, finance, inputs & infrastructure, marketing, entrepreneurship development.

Text Books:

a) Hisrich & Peters, Entrepreneurship, Tata McGraw Hill
b) Norman M. Scarborough, Essentials of Entrepreneurship & Small Business Manageent 6th ed., Prenkticke Hall
c) Roy, Rajeev, Entrepreneurship, Oxford University Press
d) Dutta, Bholanath, Entrepreneurship management, Excel Books.

Elective I

IMM 7009 **Advanced Partial Differential equations** **(3-0-0-3)**

Module 1:

Introduction: Basic Concepts and Definitions, Mathematical Problems, Linear Operators, Superposition Principles, Classifications and constructions of first order differential equations, Geometrical interpretation of a first order differential equation, Canonical forms of first order differential equations, Classification of second order Linear Equations: Second order linear equations with two independent variables, canonical forms. (6L)

Module II & III:

Eigen Value Problems and Special Functions: Sturm- Liouville Systems, Eigen Values and Eigen functions, Eigen value expansions, Convergence in the Mean, Completeness and Parseval's Equality, Singular Sturm-Liouville systems, Boundary Value Problem involving Ordinary Differential Equations, Green's function for Ordinary Differential Equations, Construction of Green's function, The Scrodinger Equations and Linear Harmonic Oscillator. (12L)

Module IV & V

Green's Function for Boundary Value Problems and Applications: Boundary Value Problems, Maximum and Minimum Problems, Uniqueness and continuity problems, Dirichlet Problems for a Circle, Dirichlet Problems for a Circular Annulus, Neumann Problem for a Circle, Dirichlet problem for a rectangle, Dirichlet problem involving the Poisson Equations, The Neumann problem for a rectangle. The Dirac Delta Function, Properties of Green's function, Methods of Green's function, Dirichlet's Problem for the Laplace Operator, Dirichlet's Problem for the Helmholtz Operator .(12L)

Module VI:

Nonlinear Partial Differential Equations with Applications: One dimensional wave equations and method of characteristics, Linera Dispersive Waves, Nonlinear Dispersive Waves and Whitham's Equations, Nonlinear Instability, The Traffic Flow Model, Flood Waves in Rivers, Riemann's Simple Waves of Finite Amplitude, Discontinuous Solutions and Shock Waves, (6L)

Text Book:

1. Linear Partial Differential Equations for Scientists and Engineers, Lokenath Debnath and Tyn Myint U., Fourth Edition, Birkhauser, Boston.
2. I.N.Sneddon, Elements of Partial Differential Equations, **McGraw Hill, NewYork.**

IMM 7011 Mathematical Logic & Logic Programming (3-0-0-3)

Part I:

Module I

Programming Prolog: facts, simple queries, complex queries, rules, arithmetic operators, recursion, unification, lists, cut.

Propositional logic: Boolean functions and formulas, syntax, semantics, laws of deduction, normal forms, resolution, theorem proving, validity, soundness and completeness. (6L)

Module II & III

First order logic : conversion of commonsense sentences into the language of first order logic, universal and existential quantifiers : syntax, terms of predicate, model theoretic semantics, Harbrand universe, normal form, unification, Proof theory, mechanical theorem proving, incompleteness. (12L)

Part II:

Module IV & V

Formal theories, consequence and deduction.

Classical Propositional Calculus: Syntax, truth, validity, Adequacy of connectives, normal forms, applications to circuit design, Axiomatic treatment, deduction theorem, derived rules of inference, Soundness, Independence of axioms, Consistency, completeness, Completeness w.r.t. Boolean algebras. (12L)

Module VI

Computer-assisted formal proofs: tableaux, resolution. Classical first order theories: Syntax, satisfaction, truth validity, Axiomatic treatment, Equality. (6L)

1. **A Concise Introduction to Mathematical Logic** By Wolfgang Rautenberg,v Springer, 2009
2. **Introduction to Mathematical Logic** By Elliott Mendelson 4th Ed. Chapman & Hall, 1997
3. **Introduction to mathematical logic** Alonzo Church Princeton University Press, 1996

IMM 7013 Finite Element Method: Theory and Applications (3-0-0-3)

Module I & 11

Integral Formulations and Variational Methods:

Initial and Eigen value problems, Integral Relations, Functional, Base Functions, The Variational symbol, Formulation of Boundary value problems, Variational Methods of approximation-the Rayleigh-Ritz Method, the method of Weighted Residuals(Gelarkin's Method). (12)

Module III & IV

Finite Element Analysis of one-dimensional Problems: Second-order and fourth-order boundary value problems and their applications in Heat transfer, Fluid Mechanics and Solid Mechanics. Eigen value and Time-dependent problems. (12)

Module V & VI

Finite Element Analysis of Two-dimensional Problems:

Second –order equations for one scaler variable (e.g. torsion, heat transfer, solid Mechanics, Fluid mechanics). Interpolation Functions, Numerical Integration and Modelling Considerations, Triangular Elements, Rectangular Elements, The Serendipity Element. (12)

Books :

1. Energy and variational Methods in Applied mechanics by J.N. Reddy.
2. The Finite Element Method by O.C. Zienkiewicz.
3. Introductory methods of Numerical analysis; S S Sastry, Prentic Hall, INDIA
4. An Introduction to the Finite Element Method; J N Reddy ; McGraw Hill.

CS 7111 GENETIC ALGORITHMS (3-0-0-3)

Module I

Introduction to Genetic Algorithm, Genetic Algorithms, Traditional and Search Methods and their Differences, A Simple Genetic Algorithm.

Module II

Genetic Algorithms Revisited: The Fundamental Theorem, Schema Processing.

Module III

Two & k-Armed Bandit Problem, Hypothesis, Schemata and Revisited.

Module IV & V

Computer Implementation of A Genetic Algorithm: Data Structures, Reproduction, Crossover and Mutation, A Time to Reproduce, A Time to Cross, How Well Does It Work, Mapping Objective Functions to Fitness Form, Fitness Scaling, Coding, A Multiparameter Mapped, Fixed-Point Coding, Discretization, Constraints.

Module VI & VII

Applications of Genetic Algorithms: The Rise of Genetic Algorithms, Genetic Algorithm Applications of Historical Interest, De Jong and Function Optimization, Improvements in Basic Technique, Current Applications of Genetic Algorithms.

Genetics-Based Machine Learning, Whence It Came, What is Classifier System, Rule and Message, Genetic Algorithm.

Text Book:

1. D.E. Goldberg -Genetic Algorithms in Search Optimization and Machine Learning, Pearson Education, New Delhi, 2005.

Reference Books:

1. M. D. Vose – The Simple Genetic Algorithm, PHI, New Delhi, 2004.

CS 6109 Software Engineering (3-0-0-3)

Module I

Introduction: Some Definitions, FAQs about Software Engineering, the evolving role of Software characteristics, Software applications.

Software Process: Software Process Model, Water Fall Model, the prototyping model, Spiral model, RAD Model and Incremental Model. [5L]

Module II

Project Management: Management activities, Project Planing, Project Scheduling, Risk Management. [5L]

Module III

Software Requirements: Functional and non-functional Requirements, User Requirements, System Requirements, the Software Requirements document, IEEE standard of SRS, Quality of good SRS.

Requirements Engineering Process: Feasibility study, Requirement elicitation and analysis, Requirements validation, Requirement management. [6L]

Module IV

Software Design: Design concepts and Principles, Architectural Design, Object oriented Design, User interface Design.

UML: Class Diagram, Sequence Diagram, Collaboration Diagram. [5L]

Module V

Verification and Validation: Verification and Validation planing, Software inspection, static analysis.

Software Testing: Testing Functions, Test Case Design, White Box Testing, Black Box Testing, Unit Testing, Integration Testing, , System Testing, Reliability.

[5L]

Module VI

Management: Software cost estimation, Estimation Techniques, Algorithm cost modelling, Project duration and Staffing.

Quality Management: Quality Assurance and standards, Quality Planning, Quality control.

[5L]

Module VII

Software Change: Program Evaluation Dynamic, S/W Maintenance in detail. [5L]

Text Book:

1. I. Sommerville: "Software Engineering",, Pearson Ed. , 7th ed.

Reference Books:

1. R. S. Pressman "Software Engineering",, 5th Edn., MGH
1. J. J. F. Peters & W. Pedrycz: Software Engineering', John Wiley & Sons, Inc. 2000.
2. A. Bfurooz, F.J. Hudson "S/W Engineering Fundamentals", Oxford University Press.

Elective II

IMM 8007 Mathematical Modeling & Simulation (3-0-0-3)

Module I

Introduction

Models, reality, Properties of models, model classification and characterization, steps in building mathematical models, sources of errors, dimensional analysis.

Modeling using Proportionality, Modeling using Geometric similarity; graphs of a functions as models. (6L)

Module II

Model Fitting – Fitting models to data graphically, Analytic methods of model fitting, Applying the least square criterion,

Experimental Modeling – High order polynomial models, Cubic Spline models. (6L)

Module III

Discrete Probabilistic Modeling –Probabilistic modeling with discrete system; Modeling components & System Reliability; Linear Regression.

Discrete Optimization Modeling – Linear Programming – Geometric solutions, Algebraic Solutions, Simplex Method and Sensitivity Analysis. (6L)

Module IV

Modeling with a Differential Equations – Population Growth, Graphical solutions of autonomous differential equations, numerical approximation methods-- Euler's Method and R.K. Method.

Modeling with systems of Differential Equations – Predator Prey Model, Epidemic models, Euler's method for systems of Differential equations. (6L)

Module V & VI

Simulation Modeling – Discrete-Evvnt Simulation, Generating random numbers; Simulating probabilistic behavior; Simulation of Inventory model and Queueing Models using C program. Other Types of simulation—Continuous Simulation, Monte-Carlo simulation. Advantages, disadvantages and pitfalls of simulation

Case Study: Case Studies for various aspects of Modeling to be done. (12L)

Text Books

1. Frank R. Giordano, Mawrice D Weir, William P. Fox, A first course in Mathematical Modeling 3rd ed3 2003. Thomson Brooks/Cole, Vikas Publishing House (P) Ltd.
2. J.D. Murray, Mathematical Biology – I, 3rd ed2 2004, Springer International Edition
3. J.N. Kapoor, Mathematical Models in Biology and Medicine, 1985, East West Press, N. Delhi
4. Sannon R.E, System Simulation: The Art and Science, 1975, Prentice Hall, U.S.A
5. Simulation Modeling and Analysis-Averill M. Law & W. David kelton;Tata McGrawHill

IMM 8009 **Statistical Inference** **(3-0-0-3)**

Module I & II

Estimation: Criterions of a good estimator, related theorems and results. Uniformly minimum variance unbiased estimation, Rao-Blackwell theorem, Cramer-Rao inequality, Methods of estimation, Interval estimation. (12L)

Module III

Test of hypotheses: Definition of various terms. Neyman- Pearson's lemma, likelihood ratio test. Tests for mean and variance in normal distribution (one and two population case). (6L)

Module IV & V

Tests for correlation and regression coefficients, paired t-test, chi-square test for goodness of fit, contingency tables, large sample tests through normal approximations, test of independence. Sequential Analysis, Non-Parametric tests. (12L)

Module VI

Analysis of Variance: One-way and two-way classifications. (6L)

Books:

1. Statistical inference in science: By D. A. Sprott, Springer
2. Probability and Statistical Inference By Hogg Robert V, Pearson Education India
3. Probability theory and statistical inference: econometric modeling with…, By Aris Spanos, Cambridge University Press
4. Bayesian statistical inference, By Gudmund R. Iversen, SAGE
5. Bayes and Empirical Bayes methods for data analysis:2 ed., Bradley P. Carlin, Thomas A. Louis , Chapman & Hall/CRC, 2000

IMM 8011 Queueing models for Computer and Communication systems (3-0-0-3)

Module I & II

Elements of Queueing system, Queue Discipline, Service Patterns, states of queueing system, Kendall's Notation, Poisson Process and the Exponential distribution, Stochastic Processes and Markov Chains, Little's formula; Steady state Birth-Death Processes.

(12L)

Module III & IV

Steady-state solution for MIMI1 Model, Queues with parallel channels (M/M/C), Queues with parallel channels and Truncation (M/M/C/K), Queues with Unlimited service (M/M/∞). Finite source Queues, state dependent service, Busy period Analyses for MIMI1 and MIMIC problems. (12L)

Module V & VI

Bulk Input ($M^{[X]/}$ M/1), Bulk service (M/$M^{[Y]}$ /1) Erlangian Models (M/E_k/ 1, E_k /M /1). Priority Queue Discipline, Series Queues, Open Jackson Networks, Closed Jackson Networks, Cyclic Queues, Single server queues with Poisson Input and General Service (M /G /1)

(12L)

Text Books

1. Donald Gross, Carl M. Harris, (2002), Fundamentals of Queueing Theory – 3rd ed, John Wiley & Sons, Inc.
2. Klienrock L (1976), Queueing Systems. Vol. II-Computer Applications, John Wiley & Sons
3. Thomas L. Satty (1961), Elements of Queuing Theory with Applications: McGraw Hill, N. York
4. R. Nelson (1995), Probability, Stochastic Processes and Queuing Theory Springer-Verlag, N. York.

CS 7105 PARALLEL COMPUTING (3-0-0-3)

Module I

Introduction: Computational Demand of Modern Science, Advent of Practical Processing, Parallel Processing Terminology – Contrasting Pipelining and Data Parallelism, Control Parallelism, Scalability, Control-Parallel Approach, Data Parallel Approach, Data-Parallel Approach with I/O. [5L]

Module II

PARAM Algorithm: A Model of Serial Computation, The PRAM Model of Parallel Computation, PARAM Algorithm – Parallel Reduction, Prefix Sums, List Ranking, Preorder Tree Traversal, Merging Two Sorted Lists, Graph Colouring. Problem Defining Fast Solutions on PRAMS. [5L]

Module III

Processor Array, Multiprocessors and Multicomputers: Processor Organisation, Processor Arrays, Multiprocessors, Multicomputers, Flynn's Taxonomy, Speedup, Scaled Speedup, and Parallelizability, Problems Defying Fast solutions on PRAMS. [5L]

Module IV

Mapping and Scheduling: Mapping Data to Processors on Processor Arrays Multicomputers., Dynamic Load Balancing on Multicomputers, Static Scheduling on UMA Multiprocessors, Deadlock, [5L]

Module V

Elementary Parallel Algorithm: Classifying MIMD Algorithm, Reduction .

Matrix Multiplication: Sequential Matrix Multiplication, Algorithms for Processor Array, Algorithms for Multiprocessors, Algorithms for Multiprocessors. [5L]

Module VI

Solving Linear Systems: Terminology, Back Substitution, ODD-EVEN Reduction, Gaussian Elimination, The JACOBI Algorithm, The Gauss-Seidel Algorithm, Jacobi Overrelaxation and Successive Overrelaxation, Multigrid Methods, Conjugate Gradient. [5L]

Module VII

Sorting: Enumeration Sort, Lower Bounds on Parallel Sorting, BITONIC Merge, Quick sort Based Algorithms,

Graph Algorithms: Searching A Graph, Connected Components, All Pairs Shortest Path, Single-Source Shortest Path, and Minimum-Cost Spanning Tree. [6L]

Text Book:

1. M.J. Quinn- Parallel Computing – Theory and Practice 2/e Ed. McGraw Hill Inc. , N Y.

Reference Books:

1. A. Grama, et.al. Introduction to Parallel Computing, 2/e TMH, New Delhi, 2006
2. K. Hwang & F.A. Briggs-Computer architecture and Parallel Processing, TMH, ND, 2004
3. K. A. Barman & J. L. Paul – Sequencial and Parallel Algorithms, Thomson Learning, India Edition, 2003

IT 8101 DATA MINING & WARE HOUSEING (3-0-0-3)

Module - I

Data Mining : Introduction, Relational Databases, Data Warehouses, Transactional databases, Advanced database Systems and Application, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining. [5L]

Module - II

Data Warehouse : Introduction, A Multidimensional data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology, From Data warehousing to Data Mining. [5L]

Module - III

Data Processing : Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and concept Hierarchy Generation.

Data Mining Primitives, Languages and System Architecture : Data Mining Primities, DMQL, Architectures of Data Mining Systems. [5L]

Module – IV

Concept Description : Data Generalization & Summarization – Based Characterization, Analytical Characterization, Mining class Comparisons, Mining Descriptive Statistical Measures in Large Databases. [5L]

Module - V

Mining Association Rules in Large Databases : Association Rule Mining, Single – Dimensional Booloan Association Rules, Multilevel Association Rules from Transaction Databases, Multi Dimensional Association Rules from Relational Databases, From Association Mining to Correlation Analysis, Constraint – Based Association Mining. [5L]

Module - VI

Classification and Prediction : Classification & Prediction, Issues Regarding Classification & Prediction, Classification by decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification based on concepts & Association Rule, Other Classification, Prediction, Classification Accuracy. [5L]

Module - VII

Cluster Analysis : Types of Data in Cluster Analysis, Partitioning methods, Hierarchical methods, Density – Based Methods, Grid – Based Methods, Model – Based Clustering Methods, Outlier Analysis.

Mining Complex Types of Data. [6L]

Text Books :

1. Jiawei Han & Micheline Kamber - Data Mining Concepts & Techniques
   Publisher Harcout India. Private Linited.

Reference Books :

1. G.K. Gupta – Introduction to Data Mining with case Studies, PHI, New Delhi – 2006.
2. A. Berson & S.J. Smith – Data Warehousing Data Mining, COLAP, TMH, New Delhi – 2004
3. H.M. Dunham & S. Sridhar – Data Mining, Pearson Education, New Delhi, 2006.

Elective III (Free)

TSC 1103 Artificial Neural Network and Fuzzy Logic (3-0-0-3)

Artificial Neural Network

Module I

Introduction : Comparing real and artificial neural systems; Simplified neuron, normal artificial neuron, Artificial neural system definition, Brain versus computer processing. (4)

Module II

Foundation of artificial neural systems; processing elements, threshold functions, Topology characteristics, Memory recall, Learning, Stability and convergence. Supervised learning and feedback recall ANS, Brain-state in a Box (BSB), Supervised learning and feedforward recall ANS. Perception Adline/Madline, Backpropagation. (8)

Module III

Artificial Neural System implementation:

Artificial Neural System paradigm and their application and implementations.

Unsupervised learning and feedback recall ANS, Additivs Grosberg, shunting Grosberg, ART1, ART2, Discrete Autocorrelator, Continuous Hopfield, BAM, Radial Basis Network. (10)

Module IV

Unsupervised learning and Feedforward Recall ANS learning Matrix, Linear Associative Matrix, Optimal Linear associative memory, learning vector quantizer, counter propagation. (8)

Fuzzy Logic:

Module V

Basic fuzzy set theory, possibility theory, fuzzy logic uncertainty – based information, Approximate reasoning, fuzzy decision making, engineering application of fuzzy sets and logic. (10)

Books :

1. George J Klir and Bo Yuan (1997), Fuzzy sets and Fuzzy logic, Prentice-Hall of India, N.D.
2. Bose N.K and Liang P. (1998) Neural Network Fundamentals with graph, Algorithm and applications, Tata McGraw Hill Publication company ltd, N.D.
3. Haykin Simon, Neural network, Addison Wesley Longman Pvt. Ltd, Delhi.

EC 9005 Data Communication Techniques (3-0-0-3)

Module I

Data Transmission: The need for a Protocol Architecture, TCP/IP Protocol Architecture, Comparison of TCP/IP and OSI Models, Analog and Digital data transmission, Channel capacity, Guided and Unguided Transmission Media, Transmission line impairments. (4)

Module – 2:

Data Encoding and Digitkal Data Communication Techniques: Digital data encoding schemes like NRZ, Multilevel binary. Differential Manchester, Self clocking codes, Digital data to Analog Signals, ASK, FSK, kPSK, QPSK etc. Analogue data to Digital signals, PCM, DM etc, CODEC and MODEM, Backward and Forward error correction, rror detection techniques like CRC and Shift register implementation, Error correction, Block code principles, Interfacing standards like V-24/EIA-232F, CCITT-X.21 interface. (6)

Module – 3:

Data Link Control: Line Configurations, Flow control using Stop and wait ARQ, Sliding window protocol, Error control using Stop and wait ARQ, GO-back-to N ARQ, Selective Reject ARQ, Data Link Control protocol, HDLC, Frame structure and operation of HDLC, Data transparency control using bit. Stuffing, Utilization efficiency of a link, Point-to-Point Protocol (PPP), Introduction to LCP, PAP, CHAP, NCP and IPCP. (6)

Module –4:

Multiplexing: Frequency Division Multiplexing, Carrier Standards, Synchronous Time Division Multiplexing, TDM link control, Digital Carrier Systems, SONET/SDH, Statistical Time Division Multiplexing, Performance, Cable Modem, ADSL Design, Discrete multi tone XDSL, Concept of Spread spectrum, Frequency Hopping Spread Spectrum, Code. Division Multiple Access. (6)

Module – 5:

Switched Networks: Comparison of Circuit Switching, Message Switching and Packet Switching techniques, Digital switching concepts like Space division switching, 3-stage Space division switch, Control signalling, Common channel signalling, TDM bus switch, TSI switch, Time Multiplexed Switches, STS and TST, Routing in Cirkcuit switched networks. (6)

Module – 6:

Packet Switching: Datagram and Virtual Circuit Packet Switching, Use of least cost algorithms, Dijkstra's and Bellman-Ford algorithms, Routing characteristics, Routing strategies, Example system ARPANET (all 3 generations), Congestion, Congestionj control techniques, Traffic management, Congrestion control in packet switching networks, CCITT X.25 interface. (6)

Module – 7

ATM and Cellular networks: Protocol Architecture of ATM, ATM Cells, Transmission of ATM cells, ATM Service categories ATkM Adoption KLayer, ATM Traffic management, Cellular networks, First Generation Analog, Second Generation CDMA, Third Generation System. (6)

Text Book:

1. Data and Computer Communication 7/E by William Stallings.
2. Data Communication and Networking 3/E by Behrouz. A. Forouzan.
3. Data Communication by Prakash C. Gupta.

MCD-1105 ADVANCED DYNAMICS AND VIBRATIONS (3 – 0- 0- 3*)*

Module I
Introduction, Brief history of vibrations classification of vibration and vibrating system some basic definition
Axioms Hamilton principle, principle of virtual work, Lagrange equations. [6L]

Module II
Free Vibration analysis of single degree of freedom (SDF) Undamped transnational and tensional systems, Damped vibrations of SDF, Different types of damping used in practice. [6L]

Module III
Forced vibrations of SDF systems, formulations for rotating unbalance, whirling of rotating shaft base excitation, transmissibility and vibration isolations, introduction to vibration measuring instruments. [6L]

Module IV
Linear theory of free and forced vibrations of two – Degree-of-freedom systems, coordinate coupling, principal coordinates and orthogonality of modes. [6L]

Module V
Vibration analysis of multi – degree-of-freedom systems, influence coefficients, matrix formulation, numerical techniques in determination of natural frequencies multi-degree-of-freedom systems.
Free vibrations of continuous systems, strings, bars shafts and beams, Effect of rotary inertia. [6L]

Module VI
Approximate methods, Raleigh's method, Rayleigh – Ritz method, collocation method, Galerkin's method used to determine natural modes. [6L]

Text Books/Reference Books
1. Structural Dynamics, Theory and Computations: Mario Paz, CBS Publishers & Distributors, Delhi, 1987
2. Theory of Vibration with Application: W.T. Thomson
3. Mechanical Vibration Analysis: P. Srinivasan
4. Elements of Vibrational Analysis: Leonard Meirovitch, McGraw Hill Book Co, 1986

IPA 1019: Mathematical & Statistical Methods in Climate System (3-0-0-3)

Module 1:

Boundary value problems: singular and regular Sturm-Liouville problems, nonhomogeneous problems, Green's function, meteorological fields in terms of orthogonal functions, series of orthogonal functions, normal modes (6L)

Module 2:

Fourier- Legendre transforms, FFT; Asymptotic expansions: regular and singular perturbation methods, WKB method, method of multiple scales.applied to atmospheric motions, Calculus of variations and Rayleigh-Ritz method; (6L)

Module 3:

Probability, random variables and distributions, properties of distributions, covariance and correlation, multivariate distributions and analysis, multivariate linear regression model, principal component analysis, factor and time series analysis. (6L)

Module 4:

Application of Auto-correlation and auto regressive processes applied to monsoon rainfall data. Error Analysis, Sampling and Test of Hypothesis, Analysis of variance. (6L)

Module 5:

Numerical solution of Partial Differential Equations. Harmonic Analysis and Spectral Analysis, Numerical Integration schemes. (6L)

Module 6:

Artificial neural network and its application in atmospheric science problems (6L)

Books:

Fourier series and Boundary Value Problems, R.V. Churchill, McGraw Hill, New York, 1963.

Elementary Differential Equations and Boundary value Problems, W.E.,Boyce and R.C. DiPrima, John Wiley & Sons, New York, 1997.

Mathematical Methods for Physics and Engineering, Riley K.F., M.P. Hobson and S.J. Bence, Cambridge University Press, 1999.

Statistical Concepts and Methods, G.K. Bhattacharyya, and R.A. Johnson, John Wiley, New York, 1977.

Statistical Methods in the Atmospheric Sciences, D.S. Wilkes Academic Press, 1995.

IPA2005 Boundary layer Meteorology and Air Pollution (3-0-0-3)

Module 1:

Meaning and scope of micrometeorology. Divisions of the atmosphere. Importance of the lower region of the atmosphere. Distinctive features of micrometeorology compared with macro and mesometeorology. Distribution of important meteorological parameters in the boundary layer. (6L)

Module 2:

Profiles of temperature, humidity and wind under different stability conditions. Laminar and turbulent conditions; Reynold and Richardson number. Turbulent transfer of mass, momentum and energy. Concepts of exchange co-efficient, exchange coefficient relationships. Application of turbulent transfer processes to agricultural phenamena such as photosynthesis under field conditions. (6L)

Module 3:

Concept of boundary layer, governing equations, scaling laws, mean and turbulent quantities, atmospheric dispersion, surface fluxes, Monin-Obukhov similarity theory, boundary layer over land and ocean , boundary layer structure and its importance (6L)

Module 4

Boundary layer modeling and parameterization schemes, interaction between clouds and boundary layer. (6L)

Module 5:

Sources of air pollution; Classification of aerosols, Gases vapors, natural pollutants; Properties of air pollutants; Meteorological factors influencing dispersion of air pollutants; Gaussian plume model for dispersion of air pollutants and its applications; Effects on man, material, vegetation, art treasure. (6L)

Module 6:

Air pollution disasters; Economic Effects of air pollution; Global Effects of Air pollution; Air pollution Due to Automobiles and emission control; General concept of transport planning for prevention of air pollution; Control technology for particulate and gaseous pollutants. (6L)

Books:

Arya, S.P., 1988: Introduction to Micrometeorology. Academic Press, San Diego, 303 pp.

1. Garrratt, J.R., 1992: The Atmospheric Boundary Layer. Cambridge University Press,
2. Kaimal, J.C., and J.J.Finnigan, 1994: Atmospheric Boundary Layer Flows, Oxford University Press, New York/Oxford,
3. R. B. Stull, An Introduction to Boundary Layer Meteorology, Kluwer Academic Publishers, 1988.
4. Sorbjan, Z., 1989: The Structure of the Atmospheric Boundary Layer, Prentice Hall, Englewood Cliff, N.J.

T.R. Oke, Boundary Layer Climates, Roultedge Publications, Taylor & Fransis, 2nd ed., 2003

5. Sorbjan, Z., Structure of the Atmospheric Boundary Layer. Prentice-Hall, 1989.
6. Seinfeld J.H. and S. Pandis, Atmospheric Chemistry and Physics, John Wiley, 1998
7. Zannetti, P. Air Quality Modelling, Volume 1 fundamentals, EnviroComp Institute and Air & Waste Management Association, 2003.
8. Arya, S.P.S., Air Pollution Meteorology and Dispersion, Oxford Univ. Press, 1999.

Elective IV

IMM 9007 Advanced Operations research (OR) and Stocahstic methods in Industry **(3-0-0-3)**

Module I

Advanced topics in Linear programming- Duality Theory- Dual simplex method- Revised Simplex method- Sensitivity analysis, Integer programming- Cutting plane algorithm- Branch and bound technique- Travelling salesman problem. (6L)

Module II

Nonlinear programming-Kuhn-Tucker conditions- quadratic programming- Wolfe's algorithm. **(6L)**

Module III

Dynamic programming- Deterministic and stochastic examples. (6L)

Stochastic methods in Industry :

Module IV

Reliability Theory: replacements and maintenance, discounting, Group replacements- System reliability and availability- Simple Reliability models. (6L)

Module V & IV

Quality Control: Acceptance sampling for attributes and for variables, operating characteristic and average runlength; Single- Double and sequential plans, Control Charts, their construction and use. (12L)

Books :

1. Operation Research, Theory and Applications, J.K. Sharma.
2. Mathematical Models in Operation Research, J.K. Sharma.
3. Elementary Probability Theory with Stochastic process, kai Lai Chung, Narosa Publishing House, ND.
4. Elementary Probability Theory with Stochastic process, Srinivasan, S.K. and Metha K.M., Tata McGraw Hill, ND.
5. Elementary Probability Theory with Stochastic process, W.B. Davenport.

IMC 9009 Theory of Computation (3-0-0-3)

Module I & II

Regular languages models: finite state machines (deterministic and non-deterministic), regular

grammars, regular expressions, equivalence of deterministic and non-deterministic machines and

of the three models.

Properties: closure, decidability, minimality of automata, iteration theorems. (12L)

Module III & IV

Recursive and recursively enumerable sets models: turing machines, grammars, recursive

functions, their equivalence. Church's thesis.

Properties: closure, decidability, undecidablity/ noncomputability, notion of reductions.

(12L)

Module V & VI

Context-free languages models: grammars (including different normal forms), pushdown automata, and their equivalence.

Properties: closure, iteration theorems, parsing. (12L)

Books:

1. **The Theory of Computation,** By Moret, Pearson Education India
2. **Theory of computation,** Dexter Kozen, Birkhäuser, 2006
3. **Mathematical Theory of Computation,** Zohar Manna, Courier Dover Publications, 2003
4. **Theory of computation,** A.M. Natarajan, P. Balasubramani, New Age International, 2007
5. **Theory of Computation,** Dr. O. G. Kakde, Firewall Media, 2007

CS 7121 CRYPTOGRAPHY AND NETWORK SECURITY (3-0-0-3)

Module I

Security Services, Mechanisms and Attacks, The OSI Security Architecture, A Model for Network Security. Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotol Machines, Steganography. [5L]

Module II

Simplified DES, Block Cipher Principles, The Data Encryption Standard, The Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operation. [5L]

Module III

Finite Fields and Confidentiality : Groups, Rings, and Fields, Modular Arithmetic, Euclid's Algorithm, Finite Fields of the Form GF (p), Polynomial arithmetic, Finite Fields of the Form GF(2"), Placement of Encryption Function, Traffic Confidentially, Key Distribution, Random Number Generation. [5L]

Module IV

Encryption Standard and Ciphers : Evaluation criteria for AES, AES cipher, Multiple encryption and Triple DES, Block ciper Modes of operation, Stream ciphers and RCG. [5L]

Module V

Number Theory and Public-Key Cryptography: Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms, Principles of Public-Key Cryptosystems, The RSA Algorithm, [5L]

Module VI & VII

Message Authentication, Function, Algorithms and Digital System :Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and MACs, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication Protocols. [6L]

Text Book:

1. W.Stallings : Cryptography and Network Security : Principles and Practice, 4/e Pearson Education, New Delhi, 2006.

Reference Books:

1. B.A. Forouzan – Cryptography and Network Security, TMH, New Delhi, 2007
2. B. Schneier – Applied Cryptography, John Wiley, Indian Edition, 2006.

IMM 9011 Sampling Theory And Design of Experiemnt (3-0-0-3)

Module I

Basic principles of sample surveys. Advantages of sample surveys over complete census. Different steps in a large scale sample sutvey. Biases in surveys. (6L)

Module II & III

Technique of random sampling. Simple Random sampling. Stratified random sampling. Systematic sampling, Multistage sampling. Multiphase sampling. Double Sampling. Sampling with Probability proportional to size. Purposive sampling. Quote Sampling. (12L)

Module IV & V

Terminology in experimental design. Principles of design. Uniformity Trials, choise of size and shape pf plots and blocks. Completely Randomized design, Randomized Block, Lattin square Design. (12L)

Module VI

Factorial experiments: a 2^2 - expweriment, a 2^3 – experiment. A 2^n—experiment in 2^n blocks per replicate. A 3^n experiment. A 3^3 experiment. (6L)

Books:

1. Design of Sample Surveys- Darova Singh and Choadhary; McGraw Hill, 1972.
2. Probability and Statistics for Engineers and Scientists, Anthony Hayter, 3rd Edn. 2006, Thomson Learning.
3. Miller and Freund's Probability and Statistics for Engineers-Richard Johnson, 7^{th} Edn, PHI, 2006.
4. Sampling Techniques-Cocheran, W.G., John Willey, 1963.
5. The Design and Analysis of Experiment-Kempthorne, O, John Willey, 1965.
6. The Design of Experiments- Fisher, R.A., Oliver and Boyd, 1947

IMM 9013 Mathematical Biology (3-0-0-3)

Module I

Population dynamics. Growth and spatial spread of organisms. Fisher's equation. Single species models, Exponential, logistic, Gompertz growth, Harvest model, Discrete-time and Delay model, Interacting population model. (6L)

Module II & III

Epidemiology - the spread of plagues.
Reaction-Diffusion models: Turing mechanism for pattern formation. Mass transport; Taylor dispersion
Biomechanics: Blood circulation, animal locomotion: swimming, flight. Effects of scale and size.
Difference Equations : Nicholson-Bailey host parasitoid model, Roughgarden's R and K selection model. (12L)

Module IV

Dynamics of infectious disease: Use and abuse of fractals, Neural models of Pattern formation.
Chemostate, prey-predator, competition & mutualism models. (6L)

Module V & VI

Dynamics of exploited populations, spatially structured models, Age-structured Models, Sex-structured models, models of spread, two sex models, Leslie matrix.
Case studies (12L)

Books:

1. Mark Kot, Elements of Mathematical Ecology, Cambridge University Press, 2001, 464pages.
2. Simon A. Levin (Author), Thomas G. Hallam (Author), Louis J. Gross, Applied Mathematical Ecology, Springer, 1990, 491 pages.
3. Gerda de Vries, Thomas Hillen, Mark Lewis, Johannes Müller, and Birgitt Schönfisch, A Course in Mathematical Biology: Quantitative Modeling with Mathematical & Computational Methods, SIAM Publications, 309 pages, 2006.
4. J.D. Murray, Mathematical Biology, Vol. I & II-, 3rd Ed, Springer Verlag, 2004.
5. Nicholas F Britton, Essential mathematical Biology, Springer-Verlag, 2004.

Elective V(free)

SAM 3001 COMPUTATIONAL FLUID DYNAMICS (3-0-0-3)

Module I

Introduction: Computational Fluid Dynamics; Classification of Partial Differential Equation's; Linear and Non-linear Partial Differential Equation's; Model equations, Elliptic, parabolic and hyperbolic equation; System of 1st order Partial Differential Equation's; System of 2nd order Partial Difference Equation; Initial Conditions; Boundary Conditions. (6L)

Module II

Finite Difference Formulations: Introduction; Taylor Series Expansion; Finite Difference by Polynomial; Finite Difference Equations; Higher order derivatives; Multidimensional finite difference formulas; Applications, Finite Difference Approximation of Mixed Partial Derivatives; Stability Analysis: Discrete Perturbation Stability Analysis; Von Neumann Stability Analysis; Multidimensional problem; Error Analysis; Artificial Viscosity; (8L)

Module III

Solution Methods of Finite Difference Equations

Elliptic equations : Finite difference formulations, Jacobi Iteration Method, Point Gauss Seidel Iteration Method, Line Gauss Seidel Iteration Method, Point Successive Over Relaxation Method

Point Successive Over Relaxation Method, Alternating Direction Implicit Method, Applications.

Parabolic equation: Finite difference formulations, Explicit schemes, implicit schemes, Alternating Direction Implicit Schemes, Parabolic equations in two-space dimensions, Approximate factorization, Fractional Step methods.

Hyperbolic equations: Explicit and Implicit schemes, Splitting method, Multistep methods, Application to Linear Problem, Non-linear problems, Flux corrected Transport, Classification of Numerical Scheme, TVD formulations. Example problems : Heat conduction, Couette flow, Wave equation. (8L)

Module IV

Incompressible Navier-Stokes Equations

Introduction; Primitive variable and Vorticity Stream Function formulations; Poisson equations for pressure (Primitive variable and Vorticity Stream Function formulation); Numerical algorithm (Primitive Variable);

Artificial Compressibility

Solution on a Regular Grid; Crank Nicolson Implicit; Boundary conditions (Body Surface, Far Field, Symmetry, Inflow Outflow); Staggered grid; Marker and Cell Method;

Implementation of Boundary Condition; DuFort Frankel Scheme; Use of the Poisson Equation for Pressure; (8L)

Module V

Unsteady Incompressible Navier-Strokes Equation.

Euler Equation; Explicit Formulations(Steger and Warming Flux Vector Splitting,Van Leer Flux Vector Splitting, Runge Kutta formulation, T/D formulation); Implicit formulations

(steger and Warming Flux Vector Splitting); Boundary conditions; Global Time Step and Local Time Step;
Example problem (Diverging nozzle configuration, Shock tube or Reimann problem, supersonic channel flow). (6L)

BOOKS

1. Computational Fluid Dynamics (Vol. I & II): K. A. Hoffmann and S. T. Chinag
2. Numerical Computational of Internal and External Flows:
3. Volume 1: Fundamentals of Numerical Discretisation: Charles Hirsch
4. Volume 2: Computational Methods for Inviscid and Viscous Flows : Charles Hirsch
5. Computational Methods of Fluid Dynamics : J. H. Ferziger & M. Peric
6. An Introduction to Theoretical and Computational Aerodynamics : - Jack Moran
7. Numerical Grid Generation : - Thompson, Warsi and Mastin
8. Computational Fluid Dynamics : - Patrick J. Roache
9. Computational Methods of Fluid Dynamics (Vol I & II) : - C. A. J. Fletcher.
10. Fundamentals of CFD :- Lomax, Pulliam and Zingg.
11. Numerical Heat Transfer and Fluid Flow : - S. V. Patankar.
12. Computational Fluid Dynamics : - Anderson, John D., Jr.

MSR 2127 Computational Aerodynamics (3-0-0-3)

Module I

Boundary Integral or Panel Method:- Discretisation scheme in panel methods, errors due to Discretisation, application of Kutta condition, Airfoil and wing problems.

Brief outline of traditional solution procedure and full potential (FP) Methods: finite difference approach. (10)

Module II

Introduction to Boundary Layer Prediction Methods: Integral and differential, outline of viscous-inviscid matching. (8)

Module III

Solution of Euler Equation: finite volume and finite difference approaches, Explicit and Implicit algorithms, Shock capturing and shock fitting, Numerical boundary conditions, characteristics.

Outline of Navier-Stokes methods and Grid Generation: Compressible and Incompressible N-S equation, stream function-vorticity method for incompressible flow. Algebraic and elliptic grid. Generations. (22)

Books:

1. Houghton, E.L. (1974), Aerodynamics, Edwards Arnold Pub. London.
2. Anderson, J.D., Aerodynaamics, McGraw Hill, Newdelhi.
3. Aerodynamics, Sandev, L.I., N.Y.john,Wiley.
4. Aerodynamics, Karancheti,krishnamurthy,John,Willey,N.D.
5. Aerodynamics, Evans, Harry L., addision.Wesley
6. Aerodynamics, Schuh, H. Oxford, Perganon 1965.
7. Aerodynamics, Anderson,J.D. McGraw Hill, N.D.

TSC 2115 Wavlets And Application (3-0-0-3)

Module II

Fourier transform of square integrable function; Reisz – fisher theorem; Poisson summation formula. (12)

Module II

Continuous and discrete wavelet transform; Wavelets frames: Orthogonal bases of wavelets; multi resolution analysis. (12)

Module II

Compactly supported wavelets: Cardinal spline wavelets; Fast wavelet transform: Application to data compression and numerical analysis of differential equation; Wavelet Galerkin method. (16)

Books:

1. Sidnay Burrus C., Ramesh A., Gopinath and Hatio Guo (1998), Introduction to Waveletss and Wavelets transforms, Prentice hall, N.Y.,1977.
2. Chsarles K. Chui (1992), An introductio to Wavelets, Acadmic Press, Boston, U.S.A.

MCD-1009 FRACTURE MECHANICS AND THEORY OF FAILURES (3- 0-0-3)

Module 1:
Basic concepts: Crack in a structure; Griffith Criterion; Crack propagation;
Cleavage fracture, Ductile fracture, Fatigue cracking; Environment assisted cracking. [4L]

Module 2:
The Elasic crack-tip stress field: The Airy stress functions; Complex stress functions; Solution to crack problems; Effect of finite size; Special cases. [5L]

Module 3:
The crack tip plastic zone: Irwin plastic zone correction; Dugdale approach; Shape of plastic zone; Plane stress versus plane strain; Thickness effect. [5L]

Module 4:
Concepts of stress intensity and strain energy release rate: Stress intensity factor;
Energy release rate; Criterion for crack growth; Crack resistance (R curve); Compliance; Jintegral; Strain energy density. [6L]

Module 5:
Crack arrest & fracture toughness: Crack speed and kinetic energy; Dynamic stress intensity and elastic energy release rate; Principles of crack arrest; Dynamic fracture toughness; Standard test for plane strain fracture toughness. [5L]

Module 6: Elastic-Plastic fracture: Fracture beyond general yield; Crack tip opening displacement (CTOD); Experimental determination of CTOD; Parameters affecting the critical
CTOD; Use of J-integral. [5L]

Module 7:
Fatigue crack propagation and fracture case studies: Fatigue crack growth and stress intensity factor, Factors affecting crack propagation; Failure safety and damage tolerance;
Case studies. [6L]

Text Books:

1. Elementary Engineering Fracture Mechanics: David Broek (1984)

Reference Books:

2. Fundamentals of Fracture Mechanics: J.F. Knott (1973)
3. Fracture Mechanics : Nestor Perez (2004)
4. Deformation and Fracture Mechanics of Engineering Materials: R. W. Hertzberg (1996)
5. Fracture Mechanics: R. L. Carlson, Orient Longmans 1998.

SAM 3017 **Theory of Elasticity** **(3-0-0-3)**

Module I

Theory of stress, Types of External Forces, The stress tensor, Equations of motion and Equilibrium in terms of the components of the stress tensor, Equation of motion and equilibrium referred to Cartesian, Cylindrical, Polar Coordinate system. (8)

Module II

Determination of Principal stresses, Strain Compatability equations, Component of the small strain and rotation tensor referred to Cartesian, Cylindrical and Spherical Polar coordinates. Generalized Hook's law, Various cases of Elastic Symmetry of body, Complete system of fundamental equation in the theory of elasticity, Simple problems of the theory of elasticity, The plain problem in the theory of elasticity. Airy's stress function, Torson and Bending of Prismatic bodies,Two-dimensional problems in Elasticity. (16)

Module III

Application of Complex Variables to the Two dimensional problems of Elasticity. (8)

Module IV

Interior of the earth, Wave Motion, The body waves, Surface Waves, Propagation of elastic waves in different media, Love waves and Reyliegh Waves. Torsion and flexure of Beams, Bending of a circular pipe. (4)

Module V

Variational methods, Theorem of minimum Potential energy, Theorem of minimum Complementry energy, Theorem of Work and Reciprocity. (4)

Books:

1. Theory of Elasticity by Stephen Timoshenko, McGraw-Hill Companies; 3 edition (June 1970), 608 pages.
2. The Linearized Theory of Elasticity, Slaughter, William S., 2002, XVI, 543 p., 36 Illus.
3. S. Timoshenko and J.N. Goodier, Theory of Elasticity, McGraw-Hill, Inc., New York. 1951.
4. I.S. Sokolonikoff, The mathematical theory of Elasticity, McGraw-Hill, New York,. 1956.