

Department of Applied Mathematics
Syllabi for:

5 Yr. Integrated M.Tech in Mathematics & Computing
Effective from 2012-13



Indian School of Mines
Dhanbad- 826004
Jharkhand, India

Five Year Integrated M. Tech (Mathematics and Computing)
(Revised Course Structure)
Core Course Structure (I Semester)
(Effective from 2012-2013 Academic Sessions)

PHYSICS (GROUP-I)

Sr No	Course Number	Course offering Department	Name of the course	L	T	P	Total Credit Hours
			SEMESTER I – Physics Group				
			THEORY				
1	AMC 11101	AM	Mathematics-I	3	1	0	7
2	APC 11101	AP	Physics	3	0	0	6
3	MMC 11101	ME & MME	Engineering Graphics	1	4	0	6
4	EEC 11101	EE	Electrical Technology	3	1	0	7
5	MMC 11103	ME & MME	Engineering Mechanics	3	1	0	7
6	GLD/CMD 11301	AGL & ESE	Earth System Science (S) [AGL 2-0-0 & ESE 1-0-0]	3	0	0	6
7	HSC 12305	HSS	Value Education, Human Rights and Legislative Procedure (S)	3	0	0	6
			PRACTICAL				
8	APC 12201	AP	Physics Practical	0	0	3/2	1.5
9	EE 12201	EEC	Electrical Technology Practical	0	0	3/2	1.5
			Total	19	7	3	48

Modified Core Course Structure (I Semester)
(Effective from 2012-2013 Academic Sessions)

CHEMISTRY (GROUP-II)

Sr No	Course Number	Course offering Department	Name of the course	L	T	P	Total Credit Hours
			SEMESTER I – Chemistry Group				
			THEORY				
1	AMC 11101	AM	Mathematics-I	3	1	0	7
2	ACC 11101	AC	Chemistry	3	0	0	7
3	MMC 11102	ME & MME	Manufacturing Process	1	4	0	6
4	ECE 11101	ECE	Electronics Engineering	3	0	0	6
5	CSE 11301	CSE	Computer Programming (S)	3	0	0	6
6	DMS/AP 11301	DMS & AP	Disaster Management [DMS 2-0-0] & Energy Resources [AP 1-0-0] (S)	3	0	0	6
7	HSC 11103	HSS	English for Science & Technology	3	0	0	6
			PRACTICAL				
8	ACC 12201	AP	Chemistry Practical	0	0	3/2	1.5
9	ECE 11201	ECE	Electronics Engineering Practical	0	0	3/2	1.5
10	CSE 12301	CSE	Computer Programming Practical (S)	0	0	2	2
			Total	19	5	5	48

Modified Core Course Structure (II Semester)
(Effective from 2012-2013 Academic Sessions)
CHEMISTRY (GROUP-I)

Sr No	Course Number	Course offering Department	Name of the course	L	T	P	Total Credit Hours
			SEMESTER II – Chemistry Group				
			THEORY				
1	AMC 12101	AM	Mathematics-II	3	1	0	7
2	APC 11101	AP	Physics	3	0	0	6
3	MMC 11101	ME & MME	Engineering Graphics	1	4	0	6
4	EEC 11101	EE	Electrical Technology	3	1	0	7
5	MMC 11103	ME & MME	Engineering Mechanics	3	1	0	7
6	GLD/CMD 11301	AGL & ESE	Earth System Science (S) [AGL 2-0-0 & ESE 1-0-0]	3	0	0	6
7	HSC 12305	HSS	Value Education, Human Rights and Legislative Procedure (S)	3	0	0	6
8	SWC 12701	DSW	Co-Curricular Activities (Only for Second Semester)	0	0	0	(3)
			PRACTICAL				
9	APC 12201	AP	Physics Practical	0	0	3/2	1.5
10	EE 12201	EEC	Electrical Technology Practical	0	0	3/2	1.5
			Total	19	7	3	48 + (3)

Modified Core Course Structure (II Semester)
(Effective from 2012-2013 Academic Sessions)
PHYSICS (GROUP-II)

Sr No	Course Number	Course offering Department	Name of the course	L	T	P	Total Credit Hours
			SEMESTER II – Physics Group				
			THEORY				
1	AMC 12101	AM	Mathematics-II	3	1	0	7
2	ACC 11101	AC	Chemistry	3	0	0	7
3	MMC 11102	ME & MME	Manufacturing Process	1	4	0	6
4	ECE 12101	ECE	Electronics Engineering	3	0	0	6
5	CSE 11301	CSE	Computer Programming (S)	3	0	0	6
6	DMS/AP 11301	DMS & AP	Disaster Management [DMS 2-0-0] & Energy Resources [AP 1-0-0] (S)	3	0	0	6
7	HSC 11103	HSS	English for Science & Technology	3	0	0	6
8	SWC 12701	DSW	Co-Curricular Activities (Only for Second Semester)	0	0	0	(3)
			PRACTICAL				
9	APC 12201	AP	Chemistry Practical	0	0	3/2	1.5
10	ECE 12201	ECE	Electronics Engineering Practical	0	0	3/2	1.5
11	CSE 12301	CSE	Computer Programming Practical (S)	0	0	2	2
			Total	19	5	5	48 + (3)

Third semester				
Sl. No.	Course No.	Name of the courses	L-T-P	Cr. Pts
1.	AMC13101	Probability & Statistics	3-1-0	7
2.	AMC 3102	Object Oriented Programming	3-0-0	6
3.	AMC13103	Numerical Methods	3-1-0	7
4.	AMC13104	Ordinary and Partial Differential Equations	4-1-0	9
5.	EIR 13101	Digital Electronics	3-0-0	6
6.	HSR 13102	HSS (Optional) (S)	3-0-0	6
7.	AMC 13201	Statistics Lab	0-0-3	3
8.	AMC 13202	Object Oriented Programming Lab	0-0-3	3
9.	AMC 13801	Project and Seminar	0-0-2	2
		Total	19-3-8=30	49
Fourth Semester				
1.	AMC 14101	Discrete Mathematics	3-0-0	6
2.	AMC 14102	Statistical Inference	3-1-0	7
3.	AMC 14103	Data Structures	3-0-0	6
4.	AMC 14104	Computer Organization	3-1-0	7
5.	HSC 14306	HSS Paper: English for Professional Communication (S)	3-1-0	7
6.	MSC 52104	Project Management	3-1-0	7
7.	AMC 14203	Data Structures Lab	0-0-3	3
8.	AMC 14204	Computer Organization Lab	0-0-3	3
9.	AMC 14802	Project and Seminar	0-0-2	2
10.	AMC14501	Composite Viva Voce	0-0-0	4
11.	SWC 14701	CCA	0-0-0	3
		Total	18-4-8=30	55
Fifth Semester				
1.	AMC 15101	Design and Analysis of Algorithm	3-0-0	6
2.	AMC 15102	Modern Algebra	3-0-0	6
3.	AMC 15103	Computer Networks	3-0-0	6
4.	AMC 15104	Real Analysis	3-1-0	7
5.	AMC 15105	Operation Research(S)	3-0-0	6
6.	AMC 15106	Operating System	3-0-0	6
7.	AMC 15201	Design and Analysis of Algorithm Lab	0-0-3	3
8.	AMC 15206	Operating System Lab	0-0-3	3
9.	AMC 15803	Project and Seminar	0-0-4	4
		Total	18-1-10=29	47
Sixth Semester				
1.	AMC 16101	Data Base Management Systems	3-0-0	6
2.	AMC 16102	GPU Computing with CUDA	3-0-0	6
3.	AMC 16103	Linear Algebra	3-0-0	6
4.	AMC 16104	Complex Analysis and Measure Theory	3-1-0	7
5.	EIC 14102	Signals and Systems	3-1-0	7
6.	AMC 16201	Data Base Management Systems Lab	0-0-3	3

7.	AMC 16202	GPU Computing with CUDA Lab	0-0-3	3
8.	EIC 14202	Signals and Systems Lab	0-0-3	3
9.	AMC 16804	Project and Seminar	0-0-4	4
10.	AMC16502	Composite Viva Voce	0-0-0	4
		Total	15-2-13=30	49
Seventh Semester				
1.	AMC17101	Number Theory and Cryptography	3-1-0	7
2.	AMC17102	Computer Graphics	3-1-0	7
3.	AMC17103	Functional Analysis	3-1-0	7
4.	AMC17104	Theory of Computation	3-1-0	7
5.	AME171xx	Elective-I	3-1-0	7
6.	AMC17202	Computer Graphics Lab	0-0-3	3
7.	AMC 17805	Project and Seminar	0-0-6	6
8.	AMC17901	*Industrial/Vocational Training	0-0-0	6
		Total	15-5-9=29	50
Eighth Semester				
1.	AMC18101	Advanced Numerical Methods	3-1-0	7
3.	AMC18102	Graph Theory	3-1-0	7
4.	AMC18103	Topology	3-0-0	6
5.	CSC 16104	Language Processor	3-1-0	7
6.	AME181xx	Elective-II	3-1-0	7
7.	AMC18201	Advanced Numerical Methods Lab	0-0-2	2
8	CSC 16204	Language Processor Lab	0-0-3	3
9.	AMC18806	Project and Seminar	0-0-6	6
10.	AMC18503	Composite Viva Voce	0-0-0	4
11.	AMC18902	**Industrial Visit	0-0-0	4
		Total	15-4-11=30	53
Ninth Semester				
1.	AMC19101	Software Engineering	3-1-0	7
2.	AMC19102	Integral Transforms	3-0-0	6
3.	AMC19103	Information and Coding Theory	3-0-0	6
4.	APC 31103	Quantum Mechanics-I	3-1-0	7
5.	EEE 51104	Soft Computing Techniques	3-0-0	6
6.	AMC19201	Software Engineering Lab	0-0-3	3
7.	AMC19807	Project and Seminar	0-0-8	8
		Total	15-2-11=28	43
Tenth Semester				
1.	AMC10801	Project/Dissertation	0-0-0	20
2.	AMC10901	Seminar on Project/Dissertation	0-0-0	5
3.	AMC10802	Viva-Voce on Project/ Dissertation	0-0-0	10
4.	AMC10902	Evaluation of Teaching Assignment and Development Work etc.	0-0-5	5
		Total	0-0-5	40

*It is a part of Course Curriculum of Sixth semester.

**It is a part of Course Curriculum of Seventh Semester

xx: Two digits for Elective Code

List of Electives:

Elective I			
1.	AME17101	Advanced Algebra	3-1-0
2.	AME17102	Celestial Mechanics	3-1-0
3.	AME17103	Sampling Theory	3-1-0
4.	AME17104	Stochastic Processes	3-1-0
5.	AME17105	Non-Linear Dynamics and Chaos	3-1-0
6.	AME17106	Fluid Dynamics	3-1-0
7.	AME17107	Mechanics of Solids	3-1-0
8.	AME17108	Wavelets: Theory and Applications	3-1-0
9.	AME17109	Computational Geometry	3-1-0
10.	AME17110	Fuzzy Set Theory and its Applications	3-1-0
11.	AME17111	Hydrodynamics and Application to Groundwater	3-1-0
12.	AME17112	Internet Technology	3-1-0
13.	AME17113	Mathematical Modeling and Simulation	3-1-0
14.	AME17114	Computational Fluid Dynamics	3-1-0
15.	CSC 17102	Parallel and Distributed Computing	3-1-0
16.	MSC 51101	Management and Organizational Behavior	3-1-0
Elective II			
1.	AME18101	Combinatorics	3-1-0
2.	AME18102	Artificial Intelligence	3-1-0
3.	AME18103	Computer Algebra	3-1-0
4.	AME18104	Theory of Compiler Design	3-1-0
5.	AME18105	Image Processing	3-1-0
6.	AME18106	Financial Mathematics	3-1-0
7.	AME18107	Software Reliability	3-1-0
8.	AME18108	Finite Element Method: Theory and Applications	3-1-0
9.	AME18109	Sobolev Spaces	3-1-0
10.	AME18110	Industrial Statistics	3-1-0
11.	AME18111	Mathematical Ecology	3-1-0
12.	AME18112	Wave Propagation and Fracture in Solids	3-1-0
13.	AME18113	Operator Theory	3-1-0
14.	AME18114	Design of Experiments	3-1-0
15.	AME18115	Magneto Hydrodynamics	3-1-0
16.	AME18116	Time Series Analysis	3-1-0
17.	AME18117	Optimization Techniques	3-1-0

CORE COURSE SYLLABI
(Effective from 2012-2013)
I & II SEMESTERS

AMC 11101

MATHEMATICS- I

(3-1-0)

Calculus-I: Successive differentiation of one variable and Leibnitz theorem, Taylor's and Maclaurin's expansion of functions of single variable, 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, Curvature and asymptotes, concavity, convexity and point of inflection, Curve tracing.

Calculus-II: 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, Leibnitz rule.

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.

Trigonometry of Complex Number, 3D Geometry and Algebra: Function of complex arguments, Hyperbolic functions and summation of trigonometrical series.

3D Geometry: Cones, cylinders and conicoids, Central conicoids, normals and conjugate diameters.

Algebra: Convergency and divergency of Infinite series. Comparison test, D' Alembert's Ratio test, Raabe's test, logarithmic test, Cauchy's root test, Alternating series, Leibnitz test, absolute and conditional convergence, power series, uniform convergence.

AMC 12101

MATHEMATICS- II

(3-1-0)

Vector Calculus and Fourier Series:

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, 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.

Fourier Series: Periodic functions, Euler's formulae, Dirichlet's conditions, expansion of even and odd functions, half range Fourier series, Parseval's formula, complex form of Fourier series.

Matrix Theory: 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, 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.

Differential Equations: 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, Linear differential equations of second order with variable coefficients; Removal of first derivative (Normal form), Change of independent variable, Applications of higher order differential equations in solution of engineering problems.

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.

Recommended books for Mathematics I & II:

1. Higher Engineering Mathematics by B.V. Ramana, Tata McGraw-Hill.
2. Advanced Engineering Mathematics by R.K. Jain and S.R.K. Iyengar, Narosa Publishing House.
3. Calculus and Analytic Geometry by G.B. Thomas and R.L. Finney, Narosa Publishing House.
4. Advanced Engineering Mathematics by M.D. Greenberg, Pearson.
5. Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers.

Thermal Physics: Concepts of distribution of molecular velocities; Distribution laws and statistics MB, FD and BE, mean free path; Transport phenomena-viscosity, diffusion; thermal conductivity, measurement of thermal conductivity; periodic and aperiodic flow of

heat; Wiedemann-Franz law. Heat radiation; black body and black body radiation; Planck's distribution law and its application to classical distribution (Rayleigh-Jeans and Wiens) and total radiation (Stefan-Boltzmann) laws.

Modern Physics: Brief idea of molecular spectra; Rigid rotator, spectra of simple molecules, rotation and rotation-vibration spectra. Brief idea of wave packet and wave function, Schrödinger equation, Particle in a Box. Free electron theory; qualitative idea of band theory of solids and Hall effect, Laser and laser systems (He-Ne and Ruby Lasers).

Electromagnetics and Electrical Phenomena in Rocks: Maxwell's field equation, Equation of electromagnetic field, Propagation of electromagnetic waves in different isotropic media, energy of electromagnetic waves, Poynting's theorem & Poynting's vector. Rocks and minerals as dielectrics, electrical conductivity and electrical phenomena in rocks, Piezo-, ferro-, tribo-, and pyro-electricity.

Recommended Books:

1. Heat And Thermodynamics; Brij Lal & Subrahmanyam; S Chand & Co Ltd; 2001
2. Thermal And Statistical Physics; R B Singh; New Age Publications; 2009
3. An Introduction To Thermal Physics; Schroeder; Dorling Kindersley India; 2007
4. Thermal Physics And Statistical Mechanics; Roy & Gupta; New Age Publications; 2001
5. Concepts Of Modern Physics; Beiser; McGraw-Hill Science; 2010
6. Modern Physics; Sivaprasath & Murugesan; S. Chand Publisher; 2009

APC11201/APC12201

PHYSICS PRACTICAL

(0-0-3/2)

Measurement of thermal conductivity of bad conductors, Optical experiments on Diffraction using diffraction grating, Experiments on Semi-conductors – Measurement of band gap and Hall Effect, experiments using He-Ne Laser - Diffraction Experiments to measure diameter of circular aperture, Polarisation Experiments to measure Brewster's angle & refractive index.

ACC11101 / ACC11102

CHEMISTRY

(3- 0- 0)

Cement: Manufacturing, composition, setting and hardening of cement.

Glass : Types of Glasses, Manufacturing & properties of Glasses.

Polymer : Classification, structure-property relationship, conductive polymers.

Solid Fuel : Structure of coal, classification of coal, Effect of heat on coal, carbonization and pyrolysis. Recovery and purification of byproducts obtained from coke ovens; Distillation of coal tar; coal.

Liquid fuel: Composition of crude oil, processing of crude oil, distillation, sweetening and cracking (basic concepts), octane number, Cetane number. Additives to improve the quality of diesel and petrol, bio-diesel.

Gaseous fuel: Characteristics of good fuel; calorific value, theoretical calculations of calorific value of a fuel, natural gas and hydrogen gas.

Phase rule & Phase equilibrium: Phase rule; degree of freedom, one and two component systems, temperature and composition diagrams, liquid-liquid and liquid-solid phase diagrams.

Lubricants: General characteristics of lubricants, chemistry of lube oil and greases. Reclamation of lubricants.

Equilibrium: Electrochemistry; Electric potentials at interfaces, electrodes, batteries. electrochemical cells and their applications.

Corrosion: Chemical and electrochemical corrosion, classification, factors affecting corrosion, Form of corrosion and general methods of corrosion prevention.

ACC12101 / ACC12102

CHEMISTRY PRACTICAL

(0- 0- 3/2)

1. Standards of HCl by Standard Sodium Carbonate solution
2. Determination of Temporary Hardness of tap water.
3. Estimation of Total Hardness of water.
4. Determination of Iron in Ferrous Ammonium Sulphate solution (Redox titration).
5. Determination of Copper in crystallized Copper-Sulphate.
6. Estimation of available Chlorine in Bleaching Powder.
7. Determination of Molecular Weight of Organic Acid by Titration method.
8. Estimation of Sodium Carbonate and bicarbonate in a mixture.
9. To determine the saponification number of an oil.
10. To determine the rate of hydrolysis of methyl /ethyl acetate.
11. To prepare Chrome Alum.

Recommended Books:

1. A Textbook of Engineering Chemistry-Sashi Chawla
2. Applied Chemistry: A Textbook for Engineers and Technologists - H.D.Gesser.
3. Engineering Chemistry - P.C.Jain & Monika Jain
4. Engineering Materials - K.G. Budinski

Introduction: Drawing instruments and their uses; Indian standards for drawing. Lettering and Types of lines used in engineering graphics.

Curves used in engineering practice: Conic sections, ellipse, parabola, hyperbola, cycloid, epicycloid, hypocycloid, involutes and spiral.

Projections: Orthographic projection, projection of points in different quadrants, projection of lines, projection of lines parallel to one and inclined to the other reference plane, projection of lines inclined to both the reference planes.

Multi view orthographic projections: First angle and third angle projections, conventions used, Conversion of three-dimensional views to orthographic views.

Projection of Solids and Development of surfaces

Isometric projections: Isometric views, conversion of orthographic views to isometric views.

Recommended Books:

1. Engineering Drawing - N D Bhatt
2. Engineering Graphics - S C Sharma & Naveen Kumar
3. Engineering Drawing - P S Gill
4. Engineering Drawing with Auto-CAD - Parvez, Khan & Khalique

Carpentry:- Classification of timber, seasoning & preservation to wood, description and application of the various tools used in carpentry, different joints and their practical uses.

Forming-Introduction to deformation and forming, types of forming processes and their applications, safety rule.

Casting: Introduction to foundry. pattern making, types of casting processes, purpose of runner and riser. application of casting, defects in casting. safety rules.

Fitting: Introduction to fitting jobs, fitting tools and their uses. safety rules.

Welding: Welding types, accessories. weldments.

Machine Tools: Types of cutting tools, types of machine tools and their specifications, safety rules.

Measurement: Use of measuring instruments etc for product measurement.

Recommended Books:

1. Workshop Technology part I, II & I IJ----- W A J Chapman
2. Workshop lechnology part I & II ----- Hazra Chowdhary
3. Workshop Technology part I & II ----- Raghuvanshi
4. Workshop Technology ----- S.K. Garg
5. Manufacturing Technology ----- P. N. Rao
6. A Text book of Workshop Technology ----- R S Khurmi & J K Gupta

EEC 11102/12102**ELECTRICAL TECHNOLOGY****(3 - 0 - 0)**

Concepts of circuit elements: active and passive elements; resistance, inductance, capacitance; mutual inductance and coupling. Network theorems (KCL, KVL, Thevenin, Norton, Maximum power transfer). Mesh and nodal analysis of DC circuits.

Single-phase AC circuits and concept of phasor diagram, series and parallel resonance. Three-phase AC circuits with balanced and unbalance loads. Measurement of three-phase power by two-wattmeter method.

Single-phase transformer: construction, types, e.m.f equation, equivalent circuit diagram, hysteresis and eddy current losses, efficiency, applications.

DC Machines – construction and types, e.m.f and torque equation. DC generator – operation, e.m.f. equation, OCC, losses and efficiency, applications. DC motor – operation, torque equation, starting, losses and efficiency, applications.

Three-phase induction motor: construction, types, operation, torque equation, torque slip characteristics, starting methods, applications.

Recommended Books:

1. Electrical Engineering Fundamentals - V Del Toro.
2. Basic Electrical Engineering (Special Indian Edition) - J J Cathey, S A Nasar, P Kumar.
3. Hughes Electrical and Electronic Technology - E Hughes, I M Smith, J Hiley, K Brown.
4. Basic Electrical Engineering - D P Kothari and I J Nagrath.
5. Electric Machinery - A E Fitzgerald, C Kingsley, S D Umans.

EEC11201/12201**ELECTRICAL TECHNOLOGY PRACTICAL****(0 - 0- 3)**

Experiments on Thevenin's theorem, R-L-C series circuit, Single phase power measurement, Characteristics of fluorescent lamp and incandescent lamp, OC and SC tests of single phase transformer, Open- circuit characteristics of DC separately excited generator, External Characteristics of separately excited DC generator, Three-point starter of DC shunt motor, Speed control of DC motor.

ECC 11101/12101 ELECTRONICS ENGINEERING (3-0-0)

Semiconductor Diodes and Applications – Introduction Characteristics, dc and ac resistances of a diode. Half wave and Full wave rectification. Zener Diodes and then use as regulators, Clippers and Clampers.

Bipolar Junction Transistor – Introduction, Transistor operation CB, CE and CC configuration, dc Biasing, Operating Point, Fixed Bias Circuit, Emitter – Stabilized Bias Circuit. Voltage Divider Bias.

BJT Transistor – Amplification in ac domain, Equivalent transistor model. Hybrid Equivalent model, RC coupled amplifier and its frequency response.

Operational Amplifiers – Introduction, Differential and Common Mode Operation, OPAMP Basics, Practical OPAMP Circuits.

Introduction to Field Effect Transistors and their applications.

Digital Electronics – Review of Basic Gates and Boolean Algebra, Introduction to Combinatorial Logic Design. Standard Representations of Logical Functions and their simplification. Combinatorial Logic Design, Half Adder and Full Adder.

Recommended Books:

1. Electronic Device and Circuit Theory - Boylestad & Nashelsky
2. Digital Principles & Applications - Malvino & Leach

ECC 11201/12201 ELECTRONICS ENGINEERING (LAB) (3-0-0)

1. Study of Electronic Equipment & Components.
2. Study of diode characteristics.
3. Study of regulated power supply.
4. Study of BJT characteristics.
5. Study of op-amp characteristics.
6. Implementation of Boolean algebra using logic gates.
7. Adder Circuits.

MMC 11103/MMC12103 ENGINEERING MECHANICS (3-1-0)

Fundamentals of Mechanics: Equivalent force systems, Equilibrium of rigid bodies.

Introduction to structural mechanics: Trusses, Frames, Machines, Beams, and Cables.

Friction force analysis: Sliding and Rolling friction, Screw, Belt and Collar friction

Properties of surfaces: Centroid of composite bodies, Pappus-Guldinus theorem, moment of inertia of composite bodies, parallel axis theorem, product of inertia, principal axes, Mohr's circles for moments and products of inertia.

Virtual work: Principle and applications, Stability of equilibrium.

Kinematics and kinetics of particles: Curvilinear motion, Dynamic equilibrium, Angular momentum, Revision of Conservation of Energy, Energy and Momentum methods for Single Particle and for a System of Particles, Impulsive motion.

Kinematics of rigid bodies: General plane motion, Instantaneous center of rotation, Planer motion relative to a rotating frame, Coriolis acceleration, Frame of reference in general motion.

Kinetics of rigid bodies: Application of the principle of impulse and momentum to the 3D motion of a rigid body, Kinetic energy in 3D, Euler's equations of motion, Motion of a Gyroscope, Eulerian angles.

Recommended Books:

1. Vector Mechanics for Engineers - Statics & Dynamic: Beer, Johnston.
2. Vector Mechanics - Statics & Dynamics: Nelson, Best, McLean.
3. Vector Mechanics - Statics & Dynamics: Shames. Rao, Pearson.
4. Engineering Mechanics: Timoshenko & Young.

CSC 11101/CSC 12101 COMPUTER PROGRAMMING(S) (3-0-0)

Programming in C

C Fundamentals: Introduction to C, Data types, Constants and variable declaration, Scope, Storage classes, Data input and output functions, Sample programs.

Operators & Expressions: Arithmetic, Relational, Logical, Bitwise operators, Conditional, Assignment, Library functions.

Control & Looping Statements: if, while, for, do-while, switch, break and continue statements, nested loops.

Arrays: Declaration, Initialization, Processing an array, 1D, 2D and multidimensional arrays, Strings and their Operations.

Functions: Defining functions, Function prototypes, Accessing a function, Passing arguments, Passing arrays and Recursive functions.

Pointers: Declaration, Operations on pointers, Passing pointers to a function, Pointers and arrays, Array of Pointers.

Structures & Unions: Defining a structure, Processing a structure, User defined data types, Structure and pointers, Passing structure to a function, Self referential structures, Unions.

File Management: File operations, Creating and processing a data file, Command line arguments.

Programming in JAVA

Fundamentals of Object-Oriented Programming: Basic concepts, Objects and classes, Data abstraction and encapsulation, Inheritance, Polymorphism and Dynamic binding.

JAVA Evolution: Java features, Java versus C and C++, Creating, compiling and running a Java program, Constants, Variables, Data types, Operators and Expressions, Decision making and branching, Decision making and looping, Classes, objects, and methods, Sample programs.

Recommended Book:

- 1) "Programming with C by Byron Gottfried", *Second edition, Schaum's Outline Series*, 1998
- 2) "C programming by Kernighan and Ritchie", *Second edition, Prentice Hall*, April 1, 1988
- 3) "Java: The complete reference – Herbert Schildt", *Eight edition, McGraw – Hill*, 2011.
- 4) "The *C Programming* Language by Bjarne *Stroustrup*", *Pearson Education, 2000.*
- 5) "C: The complete reference – Herbert Schildt", *Fourth edition, McGraw-Hill*, 2000.
- 6) "Programming With *Java* by *E Balaguruswamy*", *4th Edition, Tata McGraw-Hill*, 2008
- 7) "*Let us C* – by *Yashwant Kanitkar*", *BPB publications, 2008.*

CSC11201/CSC12201 COMPUTER PROGRAMMING PRACTICAL (0–0–2)

Laboratory experiments will be based on the materials covered in the theory of this paper emphasizing the following topics.

1. Control statements
2. Arrays with applications
3. String Handling
4. Structure with applications
5. Pointers with applications
6. File handling in C
7. Programs on Java

(GLD/CMD)(11301/12301) EARTH SYSTEM SCIENCE (S) (3 0 0)

Part A :

AGL

(2-0-0)

Space Science : Solar System, Age of the Earth, Origin of Solar system. Meteors and Meteorites.

Earth Dynamics : Interior of the Earth, Composition of the Earth, Seismic waves, Seismograph, Plate Tectonics, Basics of Earthquake Engineering, Landslides, Volcanoes.

Geological Oceanography: Sea waves, Tides, Ocean currents, Geological work of seas and oceans, Tsunami and its causes, Warning system and mitigation.

Hydrogeology: Water table, Aquifer, Groundwater fluctuations and groundwater composition, Hydrologic cycle.

Glaciology: Glacier types, Different type of glaciers, Landforms formed by glacier.

Geological bodies and their structures: Rock, mineral, batholith, dyke, sill, fold fault, joint, unconformity.

Part B :

ESE

(1-0-0)

Earth's Atmosphere : Structure and composition of atmosphere, Atmospheric circulation, Geological work of wind, Greenhouse effect and global warming, Carbon dioxide sequestration. Steps to maintain clean and pollution free atmosphere with governing laws, precautionary measures against disasters.

Biosphere: Origin of life, Evolution of life through ages, Geological time scale, biodiversity and its conservation.

Natural Resources : Renewable and non-renewable resources, Mineral and fossil fuel resources and their geological setting, mining of minerals and conservation, effect of mining on surface environment.

Recommended Books :

1. Earth's Dynamic Systems – W. Kenneth and Eric H. Christiansen
2. Exploring Earth: An introduction to Physical Geology – John P. Davidson
3. Holmes Principles of Physical Geology – A. Holmes (Revised Ed. Doris L. Holmes)
4. A Textbook of Geology – P K Mukherjee
5. Earth System Science from biogeochemical cycles to global changes – M. Jacobson, R.J. Charlson, H. Rodhe and G.H. Orians (2002)
6. Fundamentals of Geophysics – W. Lowrie.

DMS11301/DMS12301

DISASTER MANAGEMENT & ENERGY RESOURCES
DISASTER MANAGEMENT(S)

(2-0-0)

Concepts of Disaster, Types of Disaster and Dimensions of Natural and Anthropogenic Disasters (cyclone, flood, landslide, subsidence, fire and earthquake);

Principles and Components of Disaster Management, Organizational Structure for Disaster Management, Disaster Management Schemes;

Introduction to Natural Disasters and Mitigation Efforts: Flood Control, Drought Management, Cyclones, Terror Threats;

Pre-disaster risk and vulnerability reduction; Post disaster recovery and rehabilitation; Disaster related Infrastructure Development;

Role of Financial Institutions in Mitigation Effort;
Psychological and Social Dimensions in Disasters;
Disaster Management Support Requirements – Training, Public Awareness.

APD11301/APD12301

ENERGY RESOURCES

(1-0-0)

Classification of energy resources and their availability; Renewable and non-renewable energy sources; World energy prospects; Environmental impacts; Energy, power and electricity; Energy scenario in India: Availability of conventional and nonconventional energy resources and future energy demand; Indian reserves and resources of natural oil and gas, coal and nuclear minerals; Potential of hydroelectric power, solar energy, thermal, nuclear, wind, tidal wave and biomass based power in India; Introduction to hydrogen energy and fuel cells.

Books Recommended:

1. Non-Conventional Energy Sources by G.D.Rai, Khanna Publishers.
2. Fundamentals of Renewable Energy Resources by G.N. Tiwari & M.K. Ghosal, Alpha Science International.
3. Solar Energy: Fundamentals and Applications by H P Garg & J Prakash, Tata McGraw-Hill Publishing Company Ltd.
4. Solar Energy: Principles of Thermal Collection and Storage by S P Sukhatme, Tata McGraw-Hill Publishing Company Ltd.

HSS11305/HSS 12305

VALUE EDUCATION, HUMAN RIGHTS AND

LEGISLATIVE PROCEDURE

(3-0-0)

Social Values and Individual Attitudes, Work Ethics, Indian Vision of Humanism, Moral and Non-moral Valuation, Standards and Principles, Value Judgements.

Rural Development in India, Co-operative Movement and Rural Development.

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

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

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

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

Vigilance: Lokpal and Functionaries.

HSS 11101/HSS12101 ENGLISH FOR SCIENCE AND TECHNOLOGY (3-0-0)

Language Resource Development : Using appropriate grammatical lexical forms to express meaning-accuracy, range and appropriacy in grammatical lexical exercises.

Reading, Interpreting and Using Written, and Graphic Information : Using (reading and writing) academic texts, articles in technical journals, instruction manuals/laboratory instruction sheets, safety manuals and regulations, and reports; Using maps, graphs, plan diagrams, flow-charts, sketches, tabulated and statistical data.

Writing Appropriately in a Range of Rhetorical Styles i.e. Formal and Informal : Writing instructions, describing objects and processes; defining, narrating, classifying exemplifying, comparing, contrasting, hypothesizing, predicting, concluding, generalizing restating, and reporting; Note making (from books/journals); Writing assignments; summarizing, expanding, paraphrasing; Answering examination questions; Correspondence skills; Interpreting, expressing and negotiating meaning; Creating coherent written texts according to the conventions.

Receiving and Interpreting the Spoken Word : Listening to lectures and speeches, listening to discussions and explanations in tutorials; Note taking (from lectures); Interacting orally in academic, professional and social situation; Understanding interlocutor, creating coherent discourse, and taking appropriate turns in conversation; Negotiating meanings with others (in class room, workshop, laboratory, seminar, conference, discussion, interview etc.).

Recommended Books:

1. Robert, E. Dewey and Robert, H, Hurlbutt III. An Introduction to Ethics, Macmillan Publishing co. int., New York, 1977.
2. Radakrishnan, S. Mahatma Gandhi: Essays and Reflections. Jaico Publishing House, Mumbai, 1957.
3. Gandhi, M K. An Autobiography; The Story of My Experiment with Truth. Navjeevan Trust, Ahmadabad, 1927.
4. Leah Levin. Human Rights: Questions and Answers, National Book Trust, New Delhi, 1998.
5. Basu, Durga Das, Introduction to Constitution of India, Prentice Hall of India Pvt. Ltd., New Delhi, 1994.

Solution of wave equation and unsteady heat equation in homogeneous, non-homogeneous cases.

EIR 13101 Digital Electronics 3-0-0

Boolean Algebra, logic gates and switching functions, truth tables and switching expressions, Minimization of completely and incompletely specified switching functions- Karnaugh map and Quine-McCluskey method, Decoders, multiplexers, Clocks, Flip-flops, Latches, Counters and shift registers, synthesis of synchronous sequential circuits, Minimization and state assignment, Timing circuits.

HSR 13302 HSS (Optional) 3-0-0

HSE 13301 History of Science and Technology

Introduction to the History of Science- Emergence and Character of Science, Science in the Ancient world, The Dawn of History: Babylon-China-India, Classical Science. Greek and Romans, Science during the Medieval Age, The Dark Age, The Arabian and the Indian Science, Birth of Modern Science: Renaissance and Scientific Revolution, Eighteen-Century Science, Application of Science, Industrial Revolution, Causes and Consequences, Present Day Science, Impact of Science on Society, Growth of Indian Mineral Industry, including Mining and Petroleum Industry.

HSE13302 Philosophy of Science

Introduction: Rationale for study of Philosophy of Science prevalence of imbalances; General Approach, Nature, Scope and Relation of the subject with Historical Development.; Science and Philosophy vis-à-vis need for Intellectual and Moral Balance. Scientific and Philosophical approaches to knowledge development and Knowledge application (Emphasis on Earth and Mineral Sciences)

Foundations of Philosophy: Nature, Concept, Scope, Methodology, Divisions and Implications.

Concept and Nature of Science: Origin/Aim, Methodology, Scope and Development: Nature of Scientific Methods; Movements; Scientific Thought; Divisions of Science; Scientific Laws and Scientific Explanations.

Convergence of Science and Philosophy: Unified Theory; Space Time Relationship; Patterns of Change; Deeper issues and broad involvements of Science; Status of Scientific Proposition and Concepts of Entities, Epistemic and Ontological aspects.

Philosophical Analysis and Scientific Practice: Philosophical Base of Eastern Thought and their parallel in Science; The Essential of Unity between Eastern Thought Pattern and Western Science, Need for harmony between Intuitive Thought and Rational Knowledge; Philosophers of Science with reference to Western Thought, Philosophers of Science – Western and Eastern.

Inter-relationship of Science and Culture: Science and Aesthetics, Science and Human Values, Science in the full tradition, Science vis-à-vis Human Conduct and Social Affairs; Social Significance of Science; Implications of Philosophy of Science for a new peaceful Social Order, Synthesis of Eastern “World View” and Western “Materialism”.

HSE13303 Gandhian Studies

Introduction to Gandhi's Life and Philosophy; Fundamentals of Gandhian Economics; Gandhi's Concept of Human Nature, Perfectibility of Man; Ethical Ideas of Gandhi- Truth, Ahimsa, Brahmacharya, Non-stealing, Non-possession and Voluntary Poverty. Gandhi's Interpretation of History and Society.

Public Welfare and Sarvodayo Philosophy – Antyodaya; Sarvodayo Socialism and Capitalism; Nature of Sarvodaya's Economy from Gandhi to Vinobha; Concept of Production and Distribution in Sarvodaya Economy and its Utility in our Socio-economic and Scientific/ Technical Development; Non- violent Economy vis-à-vis Centralized Industrial Economy and Rural Economy. Study of the Current Industrial Problems and Priorities as against the Gandhian Ideology. Gandhian approach to Man-power Management, Prospects, Co-operative Production and Consumption, Rural Entrepreneurship, Finance, Plan changes for helping the disadvantaged sections of the society. Man and machine- Problems of Automation and Gandhi's View. Gandhi's Political Views: The State as an organ of Violence, Political Sovereignty of the People, Decentralization of Political Power, Concept of Freedom, The Idea of Political Condition- Ram Rajya. Satyagraha: The Importance of Truth Force, Self Suffering, Winning over the opponent by Love. Relevance of Gandhian Ideas in the contemporary Economic and Political situation.

Note: Use of Video Films shall be made to support the classroom teaching.

Oral Communication Skills

HSE13304 Oral Communication Skills

The nature, purpose and characteristics of good conversation, Phonological forms to use in speech, Developing conversation skills with a sense of stress, intonation , and meaning, Use of question tags, Starting, maintaining and finishing conversations, Standard conversational exchange, Spoken language idioms, Effective listening and attention to others, Gestures and body language, Do's and Don'ts in conversation, Telephonic conversation, Functions of English in conversation: introductions, greetings, clarifications, explanations, interruptions, opinions, Agreement and disagreement, complaints, apologies, Participating in informal discussions and situations, Using information to make some decision, i.e., making social arrangements with friends, Reproducing information in some form (question/answer summarizing, oral reporting, etc.)

HSE13305 Oral Presentation Skills

Characteristics of good presentation, Assessing the audience and its needs, Planning a presentation, Different presentation styles, Using the presentation matrix, The informative presentation, The demonstrative presentation, The persuasive presentation, Presentation structure and design, Materials and logistics, Visual aids and their development and use, Rehearsing and delivering, Using performance techniques, Overcoming anxiety and stress, Opening and closing, Getting and maintaining audience attention, Using language to optimal effect, Body language and gestures, Linguistic aspects: introducing, sequencing, signaling, quoting, clarifying and summarizing, Handling questions

HSE13306 Literary Communication

Exposer to recent literary and creative trends in English and their relation with the values, culture and norms of behaviour; linguistic and cultural process. What and how of literary communication for improvement of proficiency in the use of English language. Analysis and interpretation of five to six recent short stories from different parts of the world to make the sensitive and different intensification of the skills of conceiving the ideas, situations and solutions, and rendering them into appropriate expression on a higher plane of finish.

HSE 13307 Present History of India

Idea of a Nation: Defining Nation, Citizenship Duties, Profession, Society, Modern Nation-State as it emerged after 1789, The Socio-Economic context of the new 'Nation'.

The Modern Individual: Transition from pre-modern definition and social location of Individuals to the growth of idea of free Individual, Social Contract, The Duties of an Individual, Atomization of Individual and a critique to it.

Colonial Rule in India: Colonial redefinition of Nation, Individual, Society in India- a critique of Pre-colonial mode of life by the colonial theorists, The 'Progressive' colonial alternatives, the ambiguity in colonial 'Image' of India.

Nation and the Nationalists: The Ideological Contestation of Colonial Images by the Nationalists, Critique of Colonialism by Gandhi, Nehru, Tagore, S.C. Bose, Aurobindo Ghosh, M.N. Roy, J.P. Narayan. Problematizing Colonial Ideas, Impact of Colonialism in India, Problems with the Nationalist Critique of Colonialism. Colonialists and Nationalists on the idea of 'Science', 'Modernity' and 'Development'.

Re-inscribing Indian Feminity: Changing Views of Indian Feminity vis-à-vis female Sexuality.

Threats of Neo-Colonialism: The Challenges to the Nation, Post Colonial Critique of Colonialism and Nationalism, Individual and Society in a Changing World Order.

AMC 13201

Statistics Lab

0-0-3

Computation of various measures of central tendency, dispersion, skewness and kurtosis, Fitting of binomial, Poisson, Normal distributions, Computation of correlation coefficient, multiple and partial correlation coefficients, rank correlation and intra-class correlation coefficients, Determination of regression lines and plane of regressions, computation of correlation coefficient for bi-variate data.

AMC 13202

Object Oriented Programming Lab

0-0-3

Laboratory experiments will be set in consonance with the materials covered in AMC53102. It includes programming assignments for practicing and designing on different programming.

FOURTH SEMESTER

AMC 14101 **Discrete Mathematics** **3-0-0**

Permutation, Combination, Use of generating function as enumerator of permutation and combination, Ordering of permutations and combination, Principle of Inclusion and Exclusion. Recurrence Relations and their solutions using generating function, Language and Grammar, Relation, Partial Ordering Relations and Lattices, Introduction to Graph Theory, Introduction to Tree, Spanning Tree, Boolean Algebra, Propositional and Predicate Calculus.

AMC 14102 **Statistical Inference** **3-1-0**

Estimation: Criteria of a good estimator, related theorems and results. Uniformly minimum variance unbiased estimation, Rao-Blackwell theorem, Cramer-Rao inequality, Methods of estimation, Interval estimation. 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). 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. Analysis of Variance: One-way and two-way classifications.

AMC 14103 **Data Structures** **3-0-0**

Introduction to data structures, Introduction to complexity of algorithms, Linear data structures viz. Array, Stacks, Queues, Linked List, Nonlinear data structures : Trees and Graphs, 2-tree and Height balanced tree, Binary search trees, Searching Algorithms, Sorting Algorithms, Hashing and Hash functions, File organization methods.

AMC 14104 **Computer Organization** **3-1-0**

Data Representation; Register, Transfer and Microoperations, Basic Computer Organization. Programming the Basic Computer. Microprogrammed Control. CPU, Instruction Cycle / Format, Addressing, Computer Arithmetic, I/O Organization, Memory Organization, Concepts, Memory Hierarchy, Main, Auxiliary and Associative Memories, Cache Memories, Cache Mapping, Virtual Memories, Multiprocessors.

HSC 14306 **English for Professional Communication** **3-1-0**
Part I Professional Oral Communication
Course Introduction:

Professional Communication: Need, principle, channels, forms and barriers; Speaking for professional Purposes: Nature of Oral Communication, Oral Communication Process, and characteristics of Oral Communication

Group Discussion: Group Discussion(GD): nature, uses and importance; Leadership function in Gd; developing leadership qualities and positive group behavior; Starting discussions: opening the discussion, stating objectives, suggesting good group procedure (Time management, speaking procedure, etc); Giving opinions, asking for opinions and supporting opinions in GD; Making suggestions and asking for suggestions; Balancing points of view, expressing advantages, disadvantages and consequences; Some pitfalls in discussions, fallacies in argument and rebuttal, concluding and controlling discussions.

Job Interview: The interviewing process, types of interviews and interview formats; Pre-interview preparation techniques, self-analysis, skills assessment, company analysis, job analysis, practice, developing interview file; Projecting success: The beginning, the middle and the end of the interview; Interview Strategies; Upholding the personality and overcoming interviewing hazards

Part II Professional Writing

Report Writing: Report Writing: Characteristics of business reports, reports and other forms of communication, features of good reports; Types of reports (Formal/informal); Structure of formal reports: Front matter, main body and back matter; Style of reports: Readability of reports, choice of words and phrases, construction and length of sentences and paragraphs.

Business Correspondence: Official communication: nature and principles of business correspondence; Structure of business letters; Business letter formats; Letter giving instructions; Letters of requests and inquiries; Letters of complaints; Employment letters and applications; CV and resume writing; Business memos: Forms and structure; Writing an effective memo

MSC 52104

Project Management

3-1-0

Project Management – an Overview; Project Life Cycle, Feasibility Study; Market and Demand Analysis; Technical Analysis; Financial Analysis; Social Cost-Benefit Analysis; Detailed Project Report. Project Planning and Scheduling: Planning Time Scales, Project Planning using Network techniques, Scheduling of Project with Limited Resources, Implementation and Control; Project Organization, Project Management Information Systems, Basics of Software Project Management.

AMC 14203

Data Structures Lab

0-0-3

Laboratory experiments will be set in consonance with the materials covered in AMC54103. This will include problems on arrays, stacks and queues, linked lists (insertion, deletion, polynomial addition, etc), sorting and searching, and traversal techniques of trees and graphs.

AMC 14204

Computer Organization Lab

0-0-3

Laboratory design will be set based on the materials covered in AMC54104. It includes design of registers, shift registers, ALU, memory sub-systems, CPU (based on the choice of word size, instruction format, datapath and control unit), Introduction to hardware description languages and programming.

FIFTH SEMESTER

AMC 15101 Design and Analysis of Algorithm 3-0-0

Preliminaries: Introduction to algorithms; Analyzing algorithms: space and time complexity; growth of functions; summations; recurrences; sets, etc. Greedy Algorithms: General characteristics; Graphs: minimum spanning tree; The knapsack problem; scheduling. Divide and Conquer: Binary search; Sorting: sorting by merging, quickset. Dynamic Programming: Elements of dynamic programming; The principle of optimality; The knapsack problem; Shortest paths; Chained matrix multiplication. Graph Algorithms: Depth-first search; Breadth-first search; Backtracking; Branch-and-bound. Polynomials and FFT: Representation of polynomials; The DFT and FFT; Efficient FFT implementation. Heuristic and Approximate Algorithms: Heuristic algorithms; Approximate algorithms; NP-hard approximation problems.

AMC 15102 Modern Algebra 3-0-0

Groups: Binary operation, and its properties, Definition of a group, Examples and basic properties. Subgroups, Coset of a subgroup, Lagrange's theorem. Cyclic groups, Order of a group. Normal subgroups, Quotient group. Homomorphisms, Kernel Image of a homomorphism, Isomorphism theorems. Permutation groups, Cayley's theorems. Direct product of groups. Group action on a set, Semi-direct product. Sylow's theorems. Structure of finite abelian groups. Applications.

Rings: Definition, Examples and basic properties. Zero divisors, Integral domains, Fields, Characteristic of a ring, Quotient field of an integral domain. Subrings, Ideals, Quotient rings, Isomorphism theorems. Ring of polynomials. Prime, Irreducible elements and their properties, UFD, PID and Euclidean domains. Prime ideal, Maximal ideals.

AMC 15103 Computer Networks 3-0-0

Introduction and layered network architecture, circuit switching, packet switching. Data link protocols ,stop and wait, sliding window, HDLC, Queuing systems and other Markov systems, Delay analysis in data network. LAN protocols, CSMA/CD, token ring. FDDI, ATM analysis. Network layer-routing, Repeaters, bridges, gateways. TCP/IP. Internet protocols.

AMC 15104 Real Analysis 3-1-0

Real number system and set theory: Completeness property, Archimedean property, Denseness of rationals and irrationals, Countable and uncountable, Cardinality, Zorn's lemma, Axiom of choice. Metric spaces: Open sets, closed sets, Continuous functions, Completeness. Functions of several variables: Differentiation, inverse and implicit function theorems. Riemann-Stieltjes integral: Definition and existence of the integral, Properties of the integral, Differentiation and integration, Fundamental theorem of integral calculus. Sequence and Series of functions: Uniform convergence, Uniform convergence and

SIXTH SEMESTER

AMC 16101	Data Base Management Systems	3-0-0
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Database concepts, Entity relationship model, relational network and hierarchical data models. Relational database design, functional and multivalued dependency. Normal form, data description languages, relational algebra and calculus, SQL, query facility and query optimization. Introduction to distributed databases implementation issues. Storage media and storage structure, file and index organization. Heap file, indexed file, B+ tree file, denie index, file with variable length records. Performance and evaluation.

AMC 16102	GPU Computing with CUDA	3-0-0
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Introduction to GPUs and CUDA: data parallelism, CUDA program structure, device memories and data transfer, kernel functions. CUDA Threads: thread organization, synchronization and transparent scalability, thread assignment, thread scheduling and latency tolerance. CUDA Memories: Importance of Memory Access Efficiency, CUDA Device Memory Types, a Strategy for Reducing Global Memory Traffic, Memory as a Limiting Factor to Parallelism. Performance Considerations: More on Thread Execution, Global Memory Bandwidth, Dynamic Partitioning of SM Resources, Data Prefetching, Instruction Mix, Thread Granularity. Floating Point Considerations: Floating-Point Format, Representable Numbers, Special Bit Patterns and Precision, Arithmetic Accuracy and Rounding, Algorithm Considerations. Graphics-Interoperability, Atomics: Compute Capability, Atomic Operations Overview. Streams: Single CUDA Stream, Multiple CUDA Streams, GPU Work Scheduling. CUDA C on Multiple GPUs: Zero-Copy Host Memory, Multiple GPUs, Portable Pinned Memory. Applications of GPU Computing.

AMC 16103	Linear Algebra	3-0-0
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Fields and linear equations, Vector spaces. Linear transformations and projections, Determinants. Elementary canonical forms and some applications, Inner product spaces, Selfadjoint, Unitary and normal operators, Orthogonal projections. Bilinear forms, Symmetric, Skew-symmetric, Positive and semi-positive forms etc.

AMC 16104	Complex Analyses and Measure Theory	3-1-0
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Complex Analysis: Functions of a complex variable, their continuity and differentiability, Analytic functions, 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, Identity Theorem, Maximum Modulus Principle, Schwarz's Lemma, Calculus of residues, Contour integrals, Argument principle, Rouché's Theorem, Conformal mappings.

Measure Theory: Lebesgue measure, Measurable sets and functions, Egoroff's theorem, Lusin's Theorem, Lebesgue integration, Convergence theorem, Fatou's Lemma, Monotone

SEVENTH SEMESTER

AMC 17101 Number Theory and Cryptography 3-1-0

SOME TOPICS IN ELEMENTARY NUMBER THEORY: Time estimates for doing arithmetic. Divisibility and the Euclidean algorithm. Congruences. Some applications to factoring.

FINITE FIELDS AND QUADRATIC RESIDUES: Finite fields. Quadratic residues and reciprocity.

CRYPTOGRAPHY: Some simple cryptosystems. Enciphering matrices. PUBLIC KEY: The idea of public key cryptography. Classical versus public key. Hash functions. RSA. Discrete log. Diffie-Hellmann key exchange system. The Massey-Omura cryptosystem for message transmission. The ElGamal cryptosystem. Digital signature standard. Knapsack problems.

ELLPTIC CURVES: Introduction to elliptic curves. Basic facts. Elliptic curve cryptosystems. Elliptic curve primality test.

AMC 17102 Computer Graphics 3-1-0

Graphics hardware and display devices; graphics primitives- drawing lines and curves; 2d and 3d transformations; segments and their applications; generating curves, surfaces and volumes in 3d, wire-frame models, Bezier and spline curves and surfaces; geometric modeling- elementary geometric algorithms for polygons, boundary representations, constructive solid geometry, spatial data structures; hidden surface and line elimination; rendering- shading, light models, realistic image synthesis techniques, textures and image-based rendering; video games and computer animation.

AMC 17103 Functional Analysis 3-1-0

Metric spaces, complete metric spaces, Banach contraction mapping theorem. Banach spaces; bounded linear functionals and bounded linear operators, dual spaces, Hahn-Banach theorem, uniform boundedness principle, open mapping and closed graph theorems., weak convergence, Hilbert spaces, orthonormal sets, Riesz representation theorem, bounded linear operators on Hilbert spaces.

AMC 17104 Theory of Computation 3-1-0

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. Recursive and recursively enumerable sets models: Turing machines, grammars, recursive functions, their equivalence. Church's thesis. Properties: closure, decidability, undecidability/non-computability, notion of reductions. Context-free languages models: grammars (including different normal forms), pushdown automata, and their equivalence. Properties: closure, iteration theorems, parsing.

Programming for generating lines, curves and rendered surfaces. Interactive graphics programming- modeling and updating objects in an object hierarchy, video games, computer animation and realistic image synthesis. Programming environments: OpenGL (or equivalent), Java graphics environments, X windows (or equivalents).

EIGHTH SEMESTER

AMC 18101 Advanced Numerical Methods 3-1-0

Solution of tridiagonal system, Complex root of non-linear equation, solution of simultaneous non-linear equations, Numerical evaluation of double and triple integrals with constant and variable limits and its application, Solution of integral equations, Solution of initial-value problem by single and multistep methods, Solution of linear and non-linear boundary-value problems, Solution of Characteristics value problems, Solution of Laplace and Poisson equations in two variables by five point formula, Solution of Laplace equation in two variables by ADI method, Solution of mixed boundary value problem, Algorithm for elliptic equation in three variables, Solution of parabolic partial differential equation in two variables by explicit and implicit methods, Solution of parabolic equation in three variables by ADE and ADI methods, Solution of hyperbolic equation in two variables by explicit and implicit methods and algorithm for hyperbolic equation in three variables, Stability of finite difference schemes for parabolic and hyperbolic equations.

AMC 18102 Graph Theory 3-1-0

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, Kuratowski's graphs, detection of planarity, dual graphs. 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 partitioning, matching, covering, four color problem. DIRECTED GRAPHS: Different types, directed path, and connectedness, Euler digraphs, trees, matrix representation, tournament. GRAPH THEORETIC 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.

AMC 18103 Topology 3-0-0

Definition and examples of topological spaces; Closed sets, Closure, Dense sets, neighborhoods, interior, exterior, and boundary, Accumulation points and derived sets; Bases and sub-bases; Subspaces and relative topology; Kuratowski closure operator; Continuous functions and homeomorphism; First and second countable spaces; Separable spaces; Connectedness; Compactness, local compactness and One-point compactification; Product and quotient topology; Separation axioms.

CSC 16104 Language Processor 3-1-0

Introduction to compiler, phases and passes of a compiler, Cousins of compilers: loaders and assemblers; Lexical analysis: Role, tokens, regular expressions, transition diagrams, Design of lexical analyzer generator; Syntax analysis: Role, context free grammars,

ambiguity, top down parsing, bottom up parsing, operator precedence parsing, LR parsers (SLR, LALR, LR); Syntax-Directed Translation (SDT): Scheme, Implementation of SDT, postfix notation, SDT to postfix code; Intermediate code generation: Intermediate language, translation of assignment statements, Boolean expressions, casestatements; Error Detection and Recovery: Lexical-phase errors, Syntactic-phase errors; Code optimization: Sources, optimization of basic blocks, loops in flow graphs, loop optimization; Code generation: Issues, target machine, runtime storage management, basic block and flow graphs, next use information, a simple code generator, register allocation, DAG representation of basic blocks, peephole optimization, code generation from DAGs.

AMC 18201

Advanced Numerical Methods Lab

0-0-2

This will be based on the topics covered in the course AMC58101, which emphasis to write the programs for Numerical Techniques.

CSC 16204

Language Processor LAB

0-0-3

Laboratory experiments are based on the materials covered in CSC16104. It includes programming assignments to build a compiler for a subset of a c-like programming language, using of tools as Lex and Yacc.

NINTH SEMESTER

AMC 19101 Software Engineering 3-1-0

The software process, computer based system engineering, project management, requirement and specification, software prototyping, software design, software reliability, software reuse, safety critical software, verification and validation, computer aided software testing, software cost estimation, quality management, process improvement, software maintenance, configuration management, software re-engineering.

AMC 19102 Integral Transform 3-0-0

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. 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. Z-Transform and Its applications.

AMC 19103 Information and Coding Theory 3-0-0

Communication processes. Channel matrix. Probability relation in a channel. The measure of information. Entropy function – Properties of entropy function. Channel capacity. Special types of channels. Binary symmetric channel. Encoding. Block code. Binary code. Binary Huffman code. Shannon – Fano Encoding procedure. Noiseless coding theorem. Shannon's first theorem. Error – correcting codes. Examples of codes. Hadamard matrices and codes. Binary Colay code. Matrix description of linear codes. Equivalence of linear codes. The Hamming codes. The standard array. Syndrome decoding. Cyclic codes.

APC 31103 Quantum Mechanics –I 3-1-0

Short-overview: Why QM? Empirical basis, wave-particle duality, electron diffraction, notion of state vector and its probability interpretation; Operators and observables, significance of eigenfunctions and eigenvalues, commutation relations, uncertainty principle, measurement in quantum theory. Schrodinger Equation: Time-independent Schrodinger equation, stationary states and their significance, time-dependent Schrodinger equation: Potential Problems: Potential barrier and tunnelling; simple harmonic oscillator, motion in a central potential: hydrogen atom. Linear Vector and Representation Theory: Linear vector space, Dirac notations of Bra - Ket, Matrix representation of Observables and states, Determination of eigenvalues and eigen state for observables using matrix representations for harmonic oscillator, Change of representation and unitary transformations, Coordinate and momentum representations, Equations of motion in Schrodinger and Heisenberg pictures, equivalence Theory of Angular Momentum: Symmetry, invariance and conservation laws, relation between rotation and angular momentum, commutation rules, Matrix representations, addition of angular momenta and

Clebsch-Gordon coefficients, spin-orbit coupling and fine structure, Pauli spin matrices. Time-Independent Perturbation theory: Time-independent Perturbation theory (non-degenerate and degenerate) and applications to fine structure splitting, Zeeman effect (Normal and anomalous), Stark effect, and other simple cases. Scattering Theory: Differential and total Scattering cross-sections laws, phase shifts, partial wave analysis and application to simple cases; Integral form of scattering equation, Born approximation validity and simple applications.

EEE 51104 **Soft Computing Techniques** **3-0-0**

Neural Networks: Overview of biological Neuro-system, Mathematical models of neurons, ANN architecture, Learning rules; Learning paradigms - Supervised, Unsupervised and Reinforcement learning; ANN training algorithms - perceptions, Training rules, Delta, Back propagation algorithm; Multilayer perceptron model; Applications of artificial neural networks; Competitive learning networks; Kohonen self organizing networks; Hebbian learning; Hopfield networks; Associative memories; Boltzman machine; Fuzzy Logic: Introduction to Fuzzy logic; Classical and Fuzzy sets: Overview of classical sets, Membership function, Fuzzy rule generation; Operations on Fuzzy sets: Compliment, Intersections, Unions, Combinations of operations, Aggregation operations; Fuzzy arithmetic: Fuzzy numbers, Linguistic variables, Arithmetic operations on intervals and numbers, Lattice of Fuzzy numbers, Fuzzy equations; Fuzzy logic: Classical logic; Genetic Algorithms; Evolution Strategies; Evolutionary Programming; Genetic Programming; Selecting, crossover, mutation, schema analysis, analysis of selection; Markov & other stochastic models; Simulated Annealing; Tabu Search; Ant Colony based optimization.

AMC 19201 **Software Engineering Lab** **0-0-3**

Laboratory experiments will be set to supplement the theory taught in AMC59103, including programming and implementation for software design, testing and verification, Preparation of Test Cases etc. Working with the various CASE Tools like Caliber RM, Together Solo, Star Team etc.

TENTH SEMESTER

AMC10801	Project/Dissertation	0-0-0
AMC10901	Seminar on Project/Dissertation	0-0-0
AMC10802	Viva-Voce on Project/ Dissertation	0-0-0
AMC10902	Evaluation of Teaching Assignment and Development Work etc.	0-0-5

Syllabus of Elective Papers

ELECTIVE I

AME 17101 **Advanced Algebra** **3-1-0**

Fields: Definition and examples. Ring of polynomials over a field. Field extensions. Algebraic and transcendental elements, Algebraic extensions. Splitting field of a polynomial. Algebraic closure of a field, Uniqueness. Normal, separable, purely inseparable extensions. Primitive elements of a field extension – simple extensions. Fundamental theorem of Galois. Solvability by radicals – Solutions of cubic and quartic polynomials, Insolubility of quintic and higher degree polynomials. Geometric constructions. Cyclotomic extensions. Finite fields. Cyclotomic polynomials and its properties. Traces and norms.

Modules: Definition, examples and basic properties. Free modules, submodules and quotient modules, isomorphism theorems. Direct sum and direct products. Noetherian and Artinian rings and modules, structure of Artinian rings, Hilbert basis theorem. Jordan - Holder theorem. Radicals of modules, Nakayama lemma.

AME 17102 **Celestial Mechanics** **3-1-0**

The Two Body Problem: Formulation of the two body problem. Integrals of area, angular momentum and energy. Equation of the relative orbit and its solution. Kepler's equation and its solution. Heliocentric and geocentric co-ordinates, computation of ephemeris. Parabolic and hyperbolic orbits. f and g series. Orbit computation by Laplace and Gauss methods. The Three Body problem: Lagrange's solution for the motion of three bodies. Restricted three body problem . Surfaces of zero relative velocity. Double points. Stability of straight line and equilateral triangle solutions. N - Body problem: The ten integrals of motion of the n-body problem. Transfer of origin to one of the particles. The perturbing function. Virial theorem..

AME 17103 **Sampling Theory** **3-1-0**

Finite population sampling: Basic principles of sample surveys, simple random sampling with and without replacement, probability proportional to size sampling, Hurwitz-Thompson estimator, ordered and unordered estimates, stratified random sampling, allocation problems, post-stratification, ratio, regression and product method of estimation, double sampling, cluster sampling, two-stage sampling and systematic sampling. Non-sampling errors, non-response problems, Warner's randomized response technique for sensitive characteristics, measurement errors in sample surveys.

AME 17104 **Stochastic Processes** **3-1-0**

Definition and classification of general stochastic processes. Markov Chains: definition, transition probability matrices, classification of states, limiting properties. Markov Chains with Discrete State Space: Poisson process, birth and death processes. Renewal Process: renewal equation, mean renewal time, stopping time. Markov Process with Continuous State

Space: Introduction to Brownian motion, Congestion Process: Queuing Process, M/M/1 Queue.

AME 17105 **Non-Linear Dynamics and Chaos** **3-1-0**

Dynamical systems- Central manifold and Normal form, attractors, SIC, 1D map, Logistic map, Poincare' maps, generalized Baker's map, circle map. Bifurcations- Saddle-node, Transcritical, pitchfork, Hopf-bifurcation, Global bifurcations, Melnikov's method for homoclinic orbits. Strange attractors & fractals dimensions. Henon map and Rossler system, Box-counting, pointwise and correlation, hausdorff dimensions. Lyapunov exponent, Horseshoe map and symbolic dynamics, chaotic transitions, intermittency, crisis, quasiperiodicity, controlling & synchronization of chaos.

AME 17106 **Fluid Dynamics** **3-1-0**

Equations of motion for viscous fluid, similarity of flows, Reynolds number, Flow between parallel flat plates, steady flow in pipes, Flow between two concentric cylinders, Application of parallel flow theory, Unsteady flow over a flat plate, Boundary layer concept, Boundary layer equations in two-dimensional flow, Boundary layer flow along the flat plates: Blasius solution, Shearing stress and Boundary layer thickness, Boundary layer on a surface with pressure gradient, Momentum integral theorems for Boundary layer, The Von Karman integral relation, Application of Momentum integral equation to Boundary layers: Von Karman-Pohlhausen method, Separation of boundary layer flow, Boundary layer control, Methods of Boundary layer control, Introduction to turbulent flow: Origin of turbulence, Reynold's modification of Navier-Stoke's equations for turbulent flow, Semi-empirical theory of turbulence.

AME 17107 **Mechanics of Solids** **3-1-0**

Analysis of stress, principal stresses, principal planes, maximum shearing stresses, Mohr's circle diagram, equations of deformation and strain, strain in form of displacement, compatibility concept, need and physical significance, stress-strain relation, Generalized Hook's Law, different types of symmetry, density function, Airy's stress function, wave propagation in unbounded elastic medium

AME 17108 **Wavelets: Theory and Applications** **3-1-0**

Fourier Analysis: Fourier and Inverse Fourier Transforms, Continuous-Time Convolution and the Delta Function, Fourier Transform of Square Integrable Functions, Fourier Series. Basic Convergence Theory and Poisson's Summation Formula. Wavelet Transforms and Basic Properties: The Gabor Transform. Basic Properties of Gabor Transforms. The Integral Wavelet Transforms, Dyadic Wavelets and Inversions. Basic Properties of Wavelet Transforms. The Discrete Wavelet Transforms. Orthonormal Wavelets, Wavelet frames & Multiband, Curvelets. Scaling Functions and Wavelets: Definition of Multiresolution Analysis and Examples. Properties Scaling Functions and Orthonormal Wavelet Bases. Construction of Orthonormal Wavelets. Daubechie's Wavelets and Algorithms.

AME 17109

Computational Geometry

3-1-0

Introduction: Historical perspective, Towards Computational Geometry, Data Structures, Geometric Preliminaries. Convex Hulls: Problem statement and lower bounds, Graham's scan, Jarvis's march, Quick hull technique, Divide-and-conquer algorithm, Dynamic convex hull algorithm, Extension and Applications. Point Searching: Point location problems, Location of a point in a planar subdivision, The slab method. Proximity: A collection of problems, Locus Approach, Voronoi diagram and its construction, Delaunay triangulations, Proximity problems solved by Voronoi diagram. Orthogonal Range Searching: 1-dimensional range searching, Kd-trees, Range trees, Higher-dimensional range trees. Window Searching: Interval Trees, Priority search trees, Segment trees. Polygon Triangulations: Art Gallery Problem, Guarding and triangulations, Triangulating a monotone polygon. Some Applications in VLSI / robotics etc. Sweep Techniques: Trapezoidalization, Intersection of segments, Union of rectangles.

AME17110

Fuzzy Set Theory and its Applications

3-1-0

Basic concepts of fuzzy sets and fuzzy logic, Motivation, Fuzzy sets and their representations, Membership functions and their designing, Operations on fuzzy sets, Convex fuzzy sets, Alpha-level cuts, Geometric interpretation of fuzzy sets, Fuzzy numbers and Linguistic variables, Fuzzy rules, Composition of fuzzy relations, Arithmetic operations on fuzzy numbers, Fuzzy reasoning.

Fuzzy mapping rules and fuzzy implication rules, Fuzzy rule-based models for function approximation, Types of fuzzy rule-based models (the Mamdani, TSK, and standard additive models), Fuzzy implications and approximate reasoning. Fuzzy logic and probability theory, Possibility versus probability, Probability of a fuzzy event, Baye's theorem for fuzzy events, Probabilistic interpretation of fuzzy sets. Decision making in Fuzzy environment, Fuzzy Decisions, Fuzzy Linear programming, Fuzzy Multi criteria analysis, Multiobjective decision making theory.

AME 17111

Hydrodynamics and Application to Groundwater

3-1-0

Groundwater and its contamination, Sources of Groundwater Contamination, Aquifer, Types of aquifer, Properties of aquifer, Hydrodynamic Dispersion Equation, Simple Hydrodynamics dispersion problems with concentration type, Flux type and Mixed type boundary conditions, Confined groundwater flow between two water bodies, Unconfined flow by Dupit's assumption, Unconfined flow with recharge, One dimensional Dupit's flow with and without recharge, Wells, Steady flow into a well-confined and unconfined flow, Unsteady flow in a confined aquifer. Groundwater Resources, Groundwater Resources of India.

AME 17112

Internet Technology

3-1-0

Introduction to Internet: Internet Architecture, Evolution and Internet Network Architecture, OSI Reference Model, TCP/IP; Internet Protocols: Introduction to IPv4 and IPv6, Need of

Internet Protocols, Addressing Scheme, Subnet Masking, ICMP, Transport Layer Protocol: TCP, UDP; Internet Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP, RARP, BOOTP, DHCP, DNS; Mail Server & E-mail Protocol: SMTP, MIME, POP; Client-Server Approach: Client-Server Models; Voice & Multimedia over IP: Introduction to Real-Time Traffic, VoIP. Mobile IP: Introduction and Need of MIP, Agent Discovery, Registration, Data Transfer, Inefficiency in MIP; HTML Web Tools: Introduction to HTTP, HTTP Transaction, HTTP Request and Response Message, Introduction to WWW, Browser Architecture, HTML Page Creation (Static and Dynamic); JAVA Programming: Introduction to JAVA, Features of JAVA, Difference between Application and Applets, Creation and Compilation of Application and Applets.

AME 17113 Mathematical Modeling and Simulations 3-1-0

Deterministic and stochastic models, Characteristics, Classifications, tools, techniques, modeling approaches, Modeling diagram. Compartmental models, Dynamical systems and its mathematical models. Models from systems of natural sciences: single and interacting populations, prey-predator, competition, Epidemic models. Modeling of physical, Atmospheric and mining systems: Models of Heating and Cooling, Henon-Heiles System, Models for traffic flow, computer data communications, Stock Market, Modeling El Nino, Lorenz's model for global atmospheric circulation, Model for detecting land mines, modeling the ventilation system of a mine, Model for thermal environment of underground shopping Mall. Modeling Engineering systems: Models from Mechanical and Electronics systems. Models for vehicle dynamics, Hunt's oscillator, Kicked Harmonic oscillator, RLC Circuit, Chua Circuit, MLC Circuit. Matlab programs to study the dynamics of the developed model systems.

AME17114 Computational Fluid Dynamics 3-1-0

Governing equation of Fluid Dynamics, conservation form, simple CFD techniques, Lax-Wendroff technique, Mac Cormack's techniques, finite volume method, application to Euler equations, upwind difference scheme, viscous flow solutions, staggered grid, SIMPLE Algorithm, SOLA Algorithm, boundary element method and application to potential flows.

CSC 17102 Parallel and Distributed Computing 3-1-0

Need, Parallelism in uniprocessors systems; Models of Parallel computation; Topology of interconnection networks; review of pipelining, pipelined vector processing methods, Embedding other networks, Parallel algorithm design; Performance and scalability; Algorithms for array processors: sum, prefix computation, matrix multiplication; parallel sorting: odd-even transposition sorting, odd-even merging, enumeration sorting, bitonic sorting, odd-even merging network; Communication algorithms: One-to-all, all-to-one, all-to-all, Multiprocessor interconnection networks and algorithms; Dataflow computers; Parallel algorithms on systolic array; Reconfigurable processor array. Models of distributed computation; Design issues; Operating systems for distributed computing: Distributed algorithms and applications, Clock synchronization algorithms; Distributed memory

systems; Message passing; Middleware; Point- to-point communication; Fault Tolerance; Fault tolerant routing.

MSE 51101 Management and Organizational Behaviour 3-1-0

Management: Definition, The Evolution of Management Thought, Recent Contributors to Management Thought; Task & Responsibilities of a Professional Manager; Functions of a Manager; Management Style; Managerial Decision Making; Corporate Social Responsibility; Introduction to corporate governance; Ethics in Management. Organizational Theory: Definition; Dimensions of Organizational Structure; Types; Determinants; Organisational Behaviour - significance and scope, individual and group processes, managing emotions at work place.

ELECTIVE-II

AME 18101 Combinatorics 3-1-0

Counting principles, multinomial theorem, set partitions and Stirling numbers of the second kind, permutations and Stirling numbers of the first kind, number partitions, Lattice paths, Gaussian coefficients, Aztec diamonds, formal series, infinite sums and products, infinite matrices, inversion of sequences, probability generating functions, generating functions, evaluating sums, the exponential formula, more on number partitions and infinite products, Ramanujan's formula, hypergeometric sums, summation by elimination, infinite sums and closed forms, recurrence for hypergeometric sums, hypergeometric series, Sieve methods, inclusion-exclusion, Mobius inversion, involution principle, Gessel-Viennot lemma, Tutte matrix-tree theorem, enumeration and patterns, Polya-Redfield theorem, cycle index, symmetries on N and R , polyominoes

AME 18102 Artificial Intelligence 3-1-0

Problem solving, search techniques, control strategies, game playing (minimax), reasoning, knowledge representation through predicate logic, rule-based systems, semantic nets, frames, conceptual dependency formalism; Planning. Handling uncertainty: Bayesian Networks, Dempster-Shafer theory, certainty factors, Fuzzy logic; Learning through Neural nets -- Back propagation, radial basis functions, Neural computational models - Hopfield Nets, Boltzman machines. PROLOG programming, Applications of Artificial Intelligence.

AME 18103 Computer Algebra 3-1-0

Algebraic numbers, Primes and factoring, Trapdoors and public key, Pseudo-random numbers. The finite Fourier transforms. The fast Fourier transform., Polynomial rings in several variables, Complexity with respect to multiplication, Shift registers and coding, Finite Boolean algebras, Equivalence classes of switching functions, Monoids and automata.

Tempered distributions, , Applications of distributions theory and Fourier transform to differential equations. Hilbert Space, The Sobolev Space $H^{m,p}(\Omega)$, The Sobolev Space $H^s(\mathbb{R}^n)$, Product and Convolution in $H^s(\mathbb{R}^n)$, The space H^{-s} , The Sobolev Space $H^1(\Omega)$, L^p – Sobolev Space of order s .

AME18110 Industrial Statistics 3-1-0

Control charts for variables and attributes, acceptance sampling by attributes, single, double and sequential sampling plans, OC and ASN functions, AOQL and ATI, acceptance sampling by variables, tolerance limits. Reliability analysis: Hazard function, distribution with DFR and IFR, series and parallel systems, life testing experiments.

AME 18111 Mathematical Ecology 3-1-0

Single species models, Exponential, logistic, Gompertz growth, Harvest model, Discrete-time and Delay model, Interacting population model, chemostate, prey-predator, competition & mutualism models, Dynamics of exploited populations, spatially structured models, Age-structured models, sex-structured models, models of spread, two sex models, Leslie matrix.

AME 18112 Wave Propagation and Fracture in Solids 3-1-0

Section A: Wave Propagation

Study of propagation of waves in elastic, visco-elastic and poro elastic medium, Waves in anisotropic medium, thermo elastic medium, study of surface waves (Raleigh & Love waves) in Elastic and visco-elastic medium including layered medium reflection and refraction of waves in isotropic elastic medium

Section B:

Fracture of Solids Fracture theories (ductile and brittle materials), Von-Misses, Tresca and Griffith fracture criterion, Initiation and Propagation of elastic plastic come, creep and relaxation

AME 18113 Operator Theory 3-1-0

Spectral Theory of Linear Operators in Normed Spaces, Spectral Theory in Finite Dimensional Normed Spaces, Basic Concepts, Spectral properties of Bounded Linear Operators, Further Properties of Resolvent and Spectrum, Use of Complex Analysis in Spectral Theory. Banach Algebras, Further properties of Banach Algebra. Gelfand - Naimark theorem.

AME 18114 Design of Experiments 3-1-0

Design of experiments: Analysis of variance two-way classified data with m observations per cell, Basic principles of design of experiments, completely randomized design (CRD), randomized block design (RBD) and latin square design (LSD). Estimation of missing

observations in RBD and LSD, incomplete block design and balanced incomplete block design (BIBD). Factorial experiments: 2^2 , 2^3 , 3^2 and 3^3 factorial experiments. Confounding in factorial experiments, Split-plot and simple lattice designs

AME 18115 **Magneto Hydrodynamics** **3-1-0**

Basic concepts of Magneto-hydrodynamics, Lorentz force, Frame of reference, Electromagnetic Body force, Fundamental equations of MHD, Derivation of magnetic induction equation, Ohm's law for a moving conductor, Hall and Conduction currents, Kinematic aspects of MHD. Electromagnetic Radiation. Magnetic Pressure, Pointing vector, Alfven's theorem, Alfven's wave, Magnetic energy, Dissipative effect, Plane polarized waves, MHD waves in compressible fluid, Electromagnetic boundary conditions, One-dimensional flows: MHD channel Flows, MHD Stokes flow, MHD Rayleigh's Flow, MHD Flow in Rotating Medium, MHD Heat Transfer.

AME 18116 **Time Series Analysis** **3-1-0**

Discrete parameter stochastic processes, strong and weak stationary, autocovariance and autocorrelation. Moving average, autoregressive, autoregressive moving average and autoregressive integrated moving average processes. Box-Jenkins models. Estimation of the parameters in ARIMA models, forecasting. Periodogram and correlogram analysis

AME 18117 **Optimization Techniques** **3-1-0**

Stochastic programming: Chance constrained programming and two-stage programming. Dynamic programming, Queuing Theory: Introduction, Characteristics, Probability distribution, Models (M/M/1): (∞ /FCFS), (M/M/1):(N/FCFS), (M/M/ ∞):(∞ /FCFS), Deterministic (With no shortage, With shortage) and probabilistic Inventory Control, Network Problems: CPM & PERT, Maximal flow Problem, Goal Programming: Problem formulation, Algorithms and their applications.