

DEPARTMENT OF APPLIED MATHEMATICS

**Proposed Course Structure and Syllabus
Five Year M. Sc. Integrated (Mathematics and Computing)**

First and Second semesters courses are common with other B. Tech. courses

CORE COURSE STRUCTURE FOR I & II SEMESTER					
Sl.No.	Course No.	Course Offering Department	Name of the courses	L-T-P	Cr. Hrs
1.	AMC-11101	AM	Mathematics–I (Only for 1 st Semester)	3 – 1 – 0	7
2.	AMC-12101	AM	Mathematics–II (Only for 2 nd Semester)	3 – 1 – 0	7
3.	AP /AC	AP /AC	Physics/ Chemistry	3 – 1 – 0	7
4.	ME / MME	ME / MME	Engineering Graphics/Manufacturing Processes	1 – 3 – 0	5
5.	EE / EAI	EE / EAI	Electrical Technology / Electronics Engineering	3 – 1 – 0	7
6.	MEMME / HSS	MEMME / HSS	Engineering Mechanics /English for Science and Technology	3 – 1 – 0	7
7.	AGL & CME/ FME & CME	AGL & CME/ FME & CME	Earth System Science (S) / Global Energy Scenario & Energy Security of India (S)	3 – 0 – 0	6
8.	HSS / CSE	HSS / CSE	Value Education, Human Right and Legislative Procedure (S) / Computer Programming (S)	3 – 0 – 0	6
9.			*Practical		
10.	AP /AC	AP /AC	Physics/ Chemistry	0 – 0 – 3/2	1.5
11.	EE / EAI	EE / EAI	Electrical Technology / Electronics Engineering	0 – 0 – 3/2	1.5
12.	DSW	DSW	Counseling, Special Classes (Only for 1 st Semester)	0 – 0 – 0	(3)
13	DSW	DSW	Co-Curricular Activities (Only for Second semester)	0 - 0 - 0	(3)
			Total	19 – 7 - 3	48+(3)
Third semester					
Sl.No.	Course No.	Name of the courses		L-T-P	Total Cr. Hrs
1.	AMC 31101	Probability & Statistics		4-0-0	8
2.	AMC 93101	Discrete Mathematics		3-0-0	6
4	APC 93103	Waves and Oscillation		4-0-0	8
5	EIR 13101	Digital Electronics		3-0-0	6
	AMC93104	Numerical Methods(S)		3-0-0	6
6	HSR13102	HSS (Optional) (S)		3-0-0	6
7	AMC 31201	Statistics Lab		0-0-2	2
9	APC 93201	Physics-III Lab		0-0-3	3

		Total	20-0-5=25	45
Fourth Semester				
1.	AMC 94101	Object Oriented Programming	3-0-0	6
2.	AMC 32103	Statistical Inference	3-1-0	7
3	AMC 32104	Data Structures	3-0-0	6
4	AMC 94102	Computer Organization & Architecture	3-1-0	7
5.	HSC 14306	HSS Paper: English for Professional Communication (S)	3-1-0	7
6	MSR14151	Managerial Economics	3-0-0	6
7	AMC 94102	Object Oriented Programming Lab	0-0-2	2
8	AMC 32203	Statistical Inference Lab	0-0-2	2
9	AMC 32204	Data Structures Lab	0-0-2	2
10	AMC 94202	Computer Organization & Architecture Lab	0-0-2	2
		Composite Viva Voce	0-0-0	4
		Total	18-3-8=29	51
Fifth Semester				
1.	AMC 95101	Linear Algebra	3-1-0	7
2.	AMC 95102	Modern Algebra	3-1-0	7
3	AMC 95103	Operations Research	3-1-0	7
4	AMC31102	Ordinary and Partial Differential Equations	4-1-0	9
5.	AMC 95104	Mathematical Logic & Logic Programming	3-1-0	7
6	AMC 95105	Dynamics of Particle (S)	3-0-0	6
7	AMC 95204	Logic Programming Lab	0-0-2	2
8	AMC 95202	Operations Research Lab	0-0-2	2
		Total	19-5-4=28	47
Sixth Semester				
1.	AMC 32102	Data Base Management Systems	3-0-0	6
2.	AMC32105	Design and Analysis of Algorithm	3-0-0	6
3	AMC96101	Computer Networks	3-0-0	6
4	AMC96102	Dynamics of Rigid Body	3-1-0	7
5.	AMC 96103	Numerical Linear Algebra	3-1-0	7
7	AMC 32202	Data Base Management Systems Lab	0-0-2	2
8	AMC 32205	Design and Analysis of Algorithm Lab	0-0-2	2
9	AMC 96203	Numerical Linear Algebra Lab	0-0-2	2
10		Composite Viva Voce	0-0-0	4
		Total	18-2-6=26	48

Seventh Semester				
1.	AMC96101	Number Theory and Cryptology	4-1-0	9
2.	AMC96102	Computer Graphics	3-1-0	7
3.	AMC96103	Measure Theory and Calculus of Variation	4-1-0	9
4.	AMC96104	Real Analysis	3-1-0	7
6.		Elective-I	3-1-0	7
7.	AMC96202	Computer Graphics Lab	0-0-3	3
		Total	17-5-3=25	42
Eighth Semester				
1.	AMC97101	Parallel Computing	4-1-0	9
2.	AMC97102	Theory of Computation	3-1-0	7
3.	AMC97103	Graph Theory	4-1-0	9
4.	AMC97104	Complex Analysis	3-1-0	7
5.		Elective-II	3-1-0	7
6.	AMC97201	Parallel Computing Lab	0-0-3	3
8.		Composite Viva Voce	0-0-0	4
9.		Industrial Visit	0-0-0	4
		Total	17-5-3=25	50
Ninth Semester				
1.	AMC33101	Integral Transform and Integral Equations	3-1-0	7
2.	AMC33102	Functional Analysis	3-1-0	7
3.	AMC33103	Software Engineering	4-1-0	9
4.	AMC33104	Optimization Techniques	4-1-0	9
5.		Elective-III	3-1-0	7
6.	AMC33203	Software Engineering Lab	0-0-3	3
7.		Seminar on Project	0-0-0	4
		Total	17-5-3=25	46
Tenth Semester				
1.	AMC34101	Operating System	3-1-0	7
2.	AMC34102	Advance Numerical Methods	3-0-0	6
3.	AMC34103	Topology	3-1-0	7
4.		Elective-IV	3-1-0	7
5.		Elective-V	3-1-0	7
6.	AMC34201	Operating System Lab	0-0-3	3
7.	AMC34202	Advance Numerical Methods Lab	0-0-3	3
8.		Seminar on Project	0-0-0	4
9.		Project/Dissertation	0-0-0	6
		Total	15-4-6=25	50

List of Electives:

Elective I			
1	AME96101	Stochastic Calculus for Finance	3-1-0
2	AME96102	Combinatorics	3-1-0
3	AME96103	Symbolic Computation	3-1-0
6	AME96104	Pattern Recognition	3-1-0
5	AME96105	Computer Algebra	3-1-0
Elective II			
1	AME97101	Theory of Compiler Design	3-1-0
2	AME97102	Advanced Algebra	3-1-0
3	AME97103	Machine Learning	3-1-0
4	AME97104	Econometrics	3-1-0
5	AME97105	Statistical Pattern Recognition	3-1-0
Elective III			
1	AME33101	Hydrodynamics	3-1-0
2	AME33102.	Mathematical Modeling	3-1-0
3	AME33103	Celestial Mechanics	3-1-0
4	AME33104	Special Functions	3-1-0
5	AME33105	Sampling Theory	3-1-0
6	AME33106	Artificial Intelligence	3-1-0
7	AME33107	Stochastic Processes	3-1-0
Elective IV			
1	AME34101	Finite Element Method: Theory and Applications	3-1-0
2	AME34102.	Theory of Linear Systems	3-1-0
3	AME34103	Internet Technology	3-1-0
4	AME34104	Data Mining	3-1-0
5	AME34105	Non-Linear Dynamics and Chaos	3-1-0
6	AME34106	Sobolev Spaces	3-1-0
7	AME34107	Time Series Analysis	3-1-0
8	AME34108	Fluid Dynamics	3-1-0
8	AME34109	Industrial Statistics	3-1-0
10	AME34110	Mechanics of Solids	3-1-0
Elective V			
1	AME34111	Computational Fluid Dynamics	3-1-0
2	AME34112	Mathematical Ecology	3-1-0
3	AME34113	Advanced Finite Element Computations	3-1-0
4	AME34114	Software Reliability	3-1-0
5	AME34115	Wavelets: Theory and Applications	3-1-0
6	AME34116	Wave Propagation and Fracture in Solids	3-1-0
7	AME34117	Operator Theory	3-1-0
8	AME34118	Design of Experiments	3-1-0
9	AME34119	Computational Geometry	3-1-0
10	AME34120	Heat and Mass Transfer	3-1-0
11	AME34121	MagnetoHydrodynamics	3-1-0

Detail Syllabus of First and Second Semester

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.

AP

Physics

3-1-0

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 a periodic 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, Shrodinger 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.

AC

Chemistry

3-1-0

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

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

Polymers: Classification, structure – property relationship, conductive polymers.

Solid Fuels: Structure of coal, classification of coal, Effect of heat on coal, carbonization and pyrolysis. Recovery and purification of by-products obtained from coke ovens; Distillation of coal tar; coal chemicals.

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

Properties of surfaces: First moment of area and the centroid, Second moment and product of area, Transfer theorem, Polar moment of inertia.

Introduction of variational mechanics,

Kinematics of particles: Velocity and acceleration calculations, Relative motion.

Particle dynamics: Rectilinear translation, Rectangular and cylindrical coordinates.

Energy methods: Conservation of mechanical energy, Work energy equations.

Linear momentum and moment of momentum: Impulse and momentum relations for a particle,

Moment of momentum equation for a single particle and for a system of particles.

Introduction to kinematics and kinetics of rigid bodies.

Mechanical vibration of single degree of freedom system.

HSS11101

English for Science and Technology

3-1-0

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

AGL & CME

Earth System Science

3-0-0

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, Landslides, Volcanoes.

Geological Oceanography : Sea waves, Tides, Ocean Current, Geological Work of seas and Oceans, Tsunami and its Causes, Warning system and mitigation

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

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

Geological bodies and their structures: Rock, Mineral, Batholith, Dyke, Sill, Fold, Fault, Joint, Unconformity.

CME(1 0 0)

Earth's Atmosphere : Structure and composition of atmosphere, Atmospheric circulation, Geological work of wind, Greenhouse effect and Global Warning, 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 fossils fuel resources and their geological setting; Mining of minerals and conservation, Effect of mining on surface environment.

FME & CME Global Energy Scenario and Energy Security of India

3-0-0

Definition of Energy; Primary and Secondary Energy; Difference between Energy, Power and Electricity;

Renewable and Non-Renewable Sources of Energy; The concept and Significance of Renewability;

Social, Economic, Political and Environmental Dimension of Energy;

Major Types and Sources of Energy at the Global and at the National Level;

Global and Indian Reserves and Resources of Natural Oil and Gas, Coal and Nuclear Minerals;

Potential of Hydroelectric Power, Solar Energy, Wind, Wave and Biomass Based Power and Energy: Globally and in India;

Energy Sources and Power Generation: Thermal, Nuclear, Hydroelectric, Solar, Wind and Wave; General Principles; Relative Merits and Demerits including, Conversion Efficiency, Generation Cost and Environmental Impact: Concepts of Open and Combined Cycles, Co-generation: Clean Coal Initiatives;

Power Transmission and Distribution: General Principles; Demand Side Management; Social, Political, Economic and Legal Issues Involved in the Generation Transmission Distribution of Power in India:

Current Scenario and Future Prospects of Carbon Sequestration, Coal Gasification and CBM;

Current Scenario and Future Prospects of Solar Power, Hydrogen Power and Fuel Cells;

Energy cum Power Scenario of India vis-à-vis China, South Africa and the USA;

Global Energy Politics.

HSC12305 Value Education, Human Right 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 Judgments.

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

CSE **Computer Programming** **3-0-0**

Introduction to Computer Software, Introduction to Programming, Data Types, Variables, Operator and Expressions, Assignments, Input/Output, Control statements and iterations, Arrays and subscripted variables, String Manipulation, Functions, Recursions, Structures and unions, Pointers, Dynamic memory allocation, Linked Structure, File Handling, Language Preprocessor and Command line arguments. Introduction to Object Oriented programming in C++.

Practicals:

AP **Physics** **0-0-3**

Measurement of thermal conductivity of bad conductors, Optical experiments on Diffraction using diffracting grating. Experiments on Semi-conductors – measurement of band gap and Hall effect Experiments using He-Ne Laser – Diffraction Experiments to measure Brewster's angle & find refractive index.

AC **Chemistry** **0-0-3**

List of Experiments

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.

EE **Electrical Technology** **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, 3 point starter of DC shunt motor, Speed control of DC motor.

EAI **Electronics Engineering** **0-0-3**

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
8. Flip Flops.

Third Semester

AMC 31101 **Probability & Statistics** **4-0-0**

Concept of a frequency distribution. Probability: Addition, Multiplication, Baye's theorem. Moment generating and Characteristic function. Probability inequalities. Law of large numbers. Central Limit Theorem. Discrete and Continuous Probability distributions. Chi-square, t and F. Distribution of order statistics and range. Correlation and regression. Multiple and partial correlation. plane of regression, rank correlation and intra class correlation.

AMC 93101 **Discrete Mathematics** **3-0-0**

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

APC 93103**Waves & Oscillation****4-0-0****Waves:**

Waves in a one-dimensional chain of particles, classical wave equation, wave velocity, boundary conditions and normal modes, dispersion relations, dispersive waves, acoustic and optical modes, Waves in continuous media, Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves, typical measurements, dispersion in waves, group velocity and phase velocity, their measurements, Superposition of waves, Linear homogeneous equations and the superposition principle, interference in space and energy distribution; beats and combination tones.

Ultrasonic: Production, detection and applications of ultrasonic waves.

Oscillations:

Free oscillations of simple systems: Equilibrium, concept of potential well, small oscillations, approximate solutions, linear and transverse oscillations of a mass between two springs, diatomic molecule, reduced mass concept, Damped and forced oscillations: Damped oscillations; critical damping, Q of an oscillator. Forced oscillator with one degree of freedom; Transient and steady state oscillations, resonance energy absorption, low and high frequency responses, Free oscillations of system with two degrees of freedom: Two dimensional oscillator; normal modes, longitudinal and transverse oscillation of coupled masses, energy transfer between modes, coupled pendulum, Fourier analysis: Fourier series and Fourier coefficients; simple examples, use of exponential representation for harmonic oscillations, expression for Fourier coefficients. Non-periodic disturbance; representation by Fourier integral, Fourier transform & applications, Case of a wave train of finite length, constancy of $\Delta x \cdot \Delta k$ (the uncertainty product).

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.

AMC 93102**Numerical Methods(S)****3-0-0**

Numerical Solution of algebraic and transcendental equations, Generalized Newton's method for multiple roots, Solution of system of linear simultaneous equations by numerical Methods, Ill conditioned equations, Matrix inversion by numerical method, Largest and Least eigenvalues and corresponding eigen vectors by Power method, Interpolation and Extrapolation, Cubic splines, Numerical differentiation and Integration, Numerical Solution of first order ordinary differential equations, Numerical Solution of Second order ordinary differential equations with initial and boundary conditions.

HSE

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 Sarvadoyo Philosophy – *Antyodaya*; *Sarvadoya* Socialism and Capitalism; Nature of *Sarvodaya*’s Economy from Gandhi to Vinobha; Concept of Production and Distribution in *Sarvodaya* Economy and it’s 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

Exposure 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 Femininity: Changing Views of Indian Femininity 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 31201

Statistics Lab

0-0-2

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.

APC 93201

Physics III Lab

0-0-3

List of experiments

Determination of Wavelength of sodium light by Newton's ring.

Determination of Wavelength of sodium light by Fresnel's bi-prism.

Determination of Refractive index of prism by Spectrometer.

Determination of frequency of tuning fork by Melde's experiment.

Determination of velocity of sound in the material of the given rod with a Kundt's tube.

Fourth Semester

AMC 94101

Object Oriented Programming

3-0-0

Basic concepts of OOPs; C++ preliminaries, Arrays; Functions; Classes and Objects; Constructors and Destructors, Function overloading; Operator overloading and Type

consequences; Some pitfalls in discussions, fallacies in argument and rebuttal, concluding and controlling discussions

Job Interview

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

MSR14151

Managerial Economics

3-0-0

Nature, scope and methods of managerial economics, Managerial Economic Concepts – Incremental concept, Opportunity Cost concept, Equi-marginal concept, Discounting concept; Risk & Uncertainty, Law of Diminishing Marginal Utility, Demand Analysis – Meaning & type, Law of Demand – features, Exceptions, Market Demand Schedule & Curve, Elasticity of Demand – Price elasticity, cross elasticity & income elasticity, Indifference Curve approach and its properties, Supply – its law, elasticity & curve, Types of markets, Pricing under various market conditions – Perfect competition, imperfect competition & monopolistic competition, Profit & Profit measurement, Inflation – meaning, Demand-pull, cost-push inflation, Inflationary gap, Causes and steps to control inflation, National Income – Concepts & methods of measurement, Difficulties in measuring national income.

AMC 94201

Object Oriented Programming Lab

0-0-2

Laboratory experiments will be set in consonance with the materials covered in AMC94101. It includes programming assignments for practicing and designing on different programming.

AMC 32203

Statistical Inference Lab

0-0-2

Computation of estimates based on various properties, computation of interval estimates. Practical based on tests of hypotheses: one population and two population cases, tests of

person zero sum games with and without saddle-points, pure and mixed strategies, graphical and simplex method of solving game problem.

AMC 31102

Ordinary and Partial Differential Equations

4-1-0

Section A: Ordinary Differential Equations

Initial value problems, Existence and Uniqueness theorem, Series solution around an ordinary point and a regular singular point, the method of Frobenius, Bessel, Legendre and Hypergeometric equations, Confluent Hypergeometric equation, Self adjoint eigen value problems, Green's functions, Second order boundary value problems, Sturm Liouville problems.

Section B: Partial Differential Equations

Fourier series, 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.

AMC 95105

Mathematical Logic & Logic Programming

4-0-0

Part I:

Programming Prolog: facts, simple queries, complex queries, rules, arithmetic operators, recursion, unification, lists, cut. Propositional logic: syntax, semantics, laws of deduction, normal forms, resolution, theorem proving, validity, soundness and completeness. 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, Herbrand universe, normal form, unification, Proof theory, mechanical theorem proving, incompleteness.

Part II:

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

AMC 95106

Dynamics of Particle(S)

3-0-0

Velocities and acceleration along radial, transverse directions, tangential and normal directions, Simple harmonic motion, Elastic strings, Motion on smooth and rough plane curves, Motion in a resisting medium, Motion of particles of varying mass, Central Orbits, Kepler's laws of motion, Motion of a particle in three dimensions, Acceleration in

terms of different coordinate systems.

AMC 95203 Operations Research Lab 0-0-2

Laboratory experiments will be set based on the materials covered in AMC 95103.

AMC 95204 Logic Programming Lab 0-0-2

Laboratory experiments will be set based on the materials covered in AMC 95104. It includes programming assignments for practicing and designing on different programming.

Sixth Semester

AMC 32102 Data Base Management Systems 3-0-0

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 32105 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, quicksort. 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 96101 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.

AMC96102 Dynamics of Rigid Body 3-1-0

Dynamics of Rigid Bodies: Moments and products of inertia, The Momental Ellipsoid, Equimomental Systems, Principal axes, D'Alembert's principle, The general equations of motion

schemes, Knapsack problem. Introduction to elliptic curves, Group structure, Rational points on elliptic curves, Elliptic Curve Cryptography. Applications in cryptography and factorization.

AMC 96102

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 96103

Measure Theory & Calculus of Variation

4-1-0

Section A: 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, Lebesgue measure, Lebesgue integral, Monotone Convergence theorem, Fatou's lemma, Dominated Convergence theorem, Absolute continuity, Radon Nikodin theorem, Product measures, Fubini's theorem.

Section B: Functionals, Euler's equations, Isoperimetric problems, Functional involving higher order derivatives, Variational problems with fixed and moving boundary, Rayleigh-Ritz method, Galerkin's method, Hamilton's principle, Lagrange's equations.

AMC 96104

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 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 continuity, Uniform convergence and integration, Uniform convergence and differentiation. Equicontinuity, Ascoli's Theorem.

AMC 96202

Computer Graphics Lab

0-0-3

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 97101

Parallel Computing

4-1-0

Parallel algorithms, addition of numbers, matrix multiplication, evaluation of arithmetic expressions, Parallel algorithm design, processor arrays, Multiprocessors, Parallel programming Language, Scalability, Mapping, Scheduling, Matrix linear systems, Distributed issues of parallel algorithms, SIMD, MIMD, Processors, Scientific applications.

AMC97102

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.

AMC 97103

Graph Theory

4-1-0

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 97104

Complex Analysis

3-1-0

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, Analytic continuation.

AMC97201

Parallel Computing Lab

0-0-3

This will be based on the topics covered in the course AMC 97101, which emphasis on the simulation and implementation of the parallel algorithms (on a PC-cluster under Linux platform).

Ninth Semester

AMC 33101 Integral Transform and Integral Equations 3-1-0

Section A: 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.

Section B: 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, Eigen values and eigen functions of a Fredholm alternative, Construction of Green's function for BVP, Singular integral equations.

AMC 33102 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 33103 Software Engineering 4-1-0

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 33104 Optimization Techniques 3-1-0

Stochastic programming: Chance constrained programming and two-stage programming. Dynamic programming: Single stage and multi-stage programming, forward and backward process, deterministic and probabilistic dynamic programming models. Interior point methods: Projective and scaling method for linear programming. Network Problems: Spanning Tree Algorithms, PART& CPM, Maximal flow Problem, Goal Programming: Problem formulation, Algorithms and their applications, Simulation Modelling, Monte Carlo Technique.

AMC 25202

Software Engineering Lab

0-0-3

Laboratory experiments will be set to supplement the theory taught in AMC33103, 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

AMC 34101

Operating System

4-1-0

Introduction to Operating System, Operating System Structures, Processes, Threads, Process Synchronization, CPU Scheduling, Deadlock, Memory Management, File System Implementation, I/O System.

AMC 34102

Advance Numerical Methods

4-1-0

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 34103

Topology

3-1-0

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

AMC 34201

Operating System Lab

0-0-3

It includes experiments that supplement the theory taught in AMC34101.

AMC 34202

Advance Numerical Methods Lab

0-0-3

This will be based on the topics covered in the course AMC34102, which emphasis to write the programs for Numerical Techniques.

Syllabus of Elective Papers

Elective I

AME96101

Stochastic Calculus for Finance

3-1-0

Stochastic processes, filtrations, conditional expectations, martingales and stopping times, Brownian motion and its properties; Itô-integral and its extension to wider classes of integrands, isometry and martingale properties of the integral; Itô-calculus, Itô-formula and its application in calculating stochastic integrals; Stochastic differential equations, existence and uniqueness of solutions; Risk-neutral measure, Girsanov's theorem for change of measure, martingale representation theorems, representation of Brownian martingales, Feynman-Kac formula; Stock prices as geometric Brownian motions, Black-Scholes option pricing, delta hedging, derivation of the Black-Scholes differential equation, the Black-Scholes formula and simple extensions of the model; Application of Girsanov's theorem to Black-Scholes dynamics, self-financing strategies and model completeness, risk neutral measures, the fundamental theorem of asset pricing; The Black-Scholes model, the Black-Scholes option pricing formula and the market price of risk. Continuous time optimal stopping and pricing of American options.

AME96102

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, Möbius inversion, involution principle, Gessel-Viennot lemma, Tutte matrix-tree theorem, enumeration and patterns, Polya-Redfield theorem, cycle index, symmetries on N and R , polyominoes

AME96103

Symbolic Computation

3-1-0

Introduction - Elimination methods for solving system of nonlinear equations - Symbolic techniques in modelling and simulation - Symbolic and parallel adaptive methods for partial differential equations - Symbolic reduction of polynomial systems - Computation of rational function approximation.

AME96104

Pattern Recognition

3-1-0

Introduction, Overview of different approaches, Decision boundaries, Discriminant functions (linear and non-linear), Bayesian classification, Training and test sets, Parametric and nonparametric learning, Minimum distance classifiers, k-NN rule, Unsupervised learning, Basic hierarchical and non-hierarchical clustering algorithms, Dimensionality reduction, Similarity measures, Feature selection criteria and algorithms, Principal component analysis, Some applications.

AME96105

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,

AME34103**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.

AME34104**Data Mining****3-1-0**

Introduction : Basic Data Mining Tasks, Data Mining Issues, Data Mining Metrics, Data Mining from a Database Perspective. Data Mining Techniques : A Statistical Perspective on Data Mining, Similarity Measures, Decision Trees, Neural Networks, Genetic Algorithms. Classification : Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms, Neural Network-Based Algorithms, Rule-Based Algorithms, Combining Techniques. Clustering : Similarity and Distance Measures, Hierarchical Algorithms, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes. Association Rules : Basic Algorithms, Parallel and Distributed Algorithms, Incremental Rules, Advanced Association Rule Techniques, Measuring the Quality of Rules. Advanced Techniques : Web Mining, Spatial Mining, Temporal Mining.

AME34105**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.

AME34106**Sobolev Spaces****3-1-0**

Distributions—Test function spaces and distributions, convergence distributional derivatives.

Fourier Transform— L^1 -Fourier transform. Fourier transform of a Gaussian, L^2 -Fourier transform, Inversion formula. L^p —Fourier transform, Convolutions.

Sobolev Spaces—The spaces $W^{l,p}_\infty(\Omega)$ and $W^{l,p}(\Omega)$. Their simple characteristic properties, density results. Min and Max of $W^{l,p}$ -functions. The space $H^1(\Omega)$ and its properties, density results.

Imbedding Theorems—Continuous and compact imbeddings of Sobolev spaces into Lebesgue spaces. Sobolev Imbedding Theorem. Rellich–Kondrasov Theorem.

Other Sobolev Spaces—Dual Spaces, Fractional Order Sobolev spaces, Trace spaces and trace theory.

Weight Functions-Definition, motivation, examples of practical importance. Special weights of power type. General Weights.

Weighted Spaces—Weighted Lebesgue space $P(\Omega,\sigma)$ weighted Sobolev spaces $W^{k,p}(\Omega,\sigma)$, $W_0^{k,p}(\Omega,\sigma)$, and their properties.

Domains—Methods of local coordinates, the classes C^0 , $C^{\alpha,k}$, Holder's condition, Partition of unity, the class $K(x_0)$ including Coneproperty.

Inequalities—Hardy inequality, Jensen's inequality, Young's inequality, Hardy–Littlewood-Sobolev inequality, Sobolev inequality and its various versions.

AME34107**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

AME34108**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.

AME34109**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.

supported orthogonal wavelets, Orthogonal wavelet packets, orthogonal decomposition of wavelet series.

AME34116 **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

AME34117 **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.

AME34118 **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

AME34119 **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.

AME34120 **Heat and Mass Transfer** **3-1-0**

Convective Diffusion Transfer: Differential Transfer equations, Thermodynamics of Transfer Processes, Multicomponent Mixtures, Derivation of Transfer Equations from the Kinetic Theory of Gases, Transfer Equation for Asymmetric Fluids, Heat Conduction: Differential Equation of heat Conduction, Heat Consumption Calculation Methods, Methods of Solving Heat-conduction Problems, Steady-State Temperature Field, Solution of Steady-state Problems, One-Dimensional Unsteady-State Field (Plate, Sphere, Cylinder), Convective Heat transfer: Heat and Mass

Transfer in a Flow Plate, Heat and Mass Transfer in Pipe Flows, Free Convection, Thermo convective Waves. Conjugate Heat-Transfer Problems, unsteady-State Heat Transfer with Laminar Flow of Incompressible Fluid in Plane and Circular Tubes.

AME34121

MagnetoHydrodynamics

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.