Course Syllabi
Department of Sciences and Humanities

SCL101 PREPARATORY MATHEMATICS
(15 Lectures)
Pre-requisite: NIL.

Contents:
Differential Calculus
Set theory, concept of functions, types of functions, limit, continuity, differentiability of functions and graphical representation of functions.

Integral Calculus
Basic concepts, Integration as a limit of sum, Elementary methods of integration (Integration by parts, by substitution and by partial fraction) Define Integral basic rules, properties of definite integrals.

Geometry
Two dimensional geometry; straight lines, circle, conic sections.

Text Books:

SCL102 APPLIED MATHEMATICS-I (3-2-0-4)
Pre-requisite: NIL.

Contents:
Differential Calculus
Functions of single variable: Limit, continuity and differentiability. Mean value theorems: Rolle’s Theorem, Lagrange’s theorem, Cauchy’s theorem, Taylor’s theorem with remainders, indeterminate forms, curvature, curve tracing.

Integral Calculus
Fundamental theorem of Integral calculus, mean value theorems, evaluation of definite integrals, Applications in Area, length, volumes and surface of solids of revolutions, Improper integrals: Beta and Gamma functions, differentiation under integral sign.

Infinite series
Sequences, Infinite series of real and complex numbers, Cauchy criterion, tests of convergence, absolute and conditional convergence, improper integrals, improper integrals depending on a parameter, uniform convergence, power series, radius of convergence.

Matrices
Rank of matrix, consistency of a system of equations, linear dependence and independence, linear and orthogonal transformations, Eigen values and Eigen vectors, Cayley – Hamilton theorem, reduction to diagonal form, Hermitian and skew Hermitian matrices, Quadratic forms.

Text Books:

Additional Books:

SCL103 APPLIED MATHEMATICS-II (3-2-0-4)
Pre-requisite: NIL.

Contents:
Limit, continuity and differentiability of functions of several variables, partial derivatives and their geometrical interpretation. Euler’s theorem on homogeneous functions, Total differentiation, chain rules, Jacobian, Taylor’s formula, maxima and minima, Lagrange’s method of undetermined multipliers.

Multiple Integrals: Double and triple integrals, change of order of integration, change of variables, application to area, volumes and C.G.

Vector Calculus
Scalar and vector fields, gradient of scalar point function, directional derivatives, divergence and curl of vector point function, solenoidal and irrotational vector fields.

Vector integration: line, surface and volume integrals, Green’s theorem, Stokes’ theorem and Gauss divergence theorem (without proof)

Ordinary Differential Equations
First order differential equations: Exact equation, Integrating factors, Reducible to exact differential equations, Linear and Bernoulli’s form, orthogonal trajectories, First order simultaneous differential equations.

Solutions of second and higher order linear equation with constant coefficients, Method of variation of parameters, Solution of Cauchy’s equation, Application of first and second order differential equations.

Fourier Series
Fourier series for general interval, Fourier series for even and odd functions, half range sine and cosine series expansions, exponential form of Fourier series.

Text Books:

Additional Books:

SCL104 APPLIED PHYSICS (3-0-2-4)
Pre-requisite: NIL.

Contents:
Mechanics of solids (formulation of particles) and fluid, Quantum mechanics, mechanics wave nature of a particles uncertainty principal.

Postulates of quantum theory, Schrodinger equation and operators, Electromagnetics, interaction with electrons, electrostatic tense, electron gun cyclotron, Waves, Mechanical waves.

Optics: Diffraction, interference, thin films, photonic crystals, transmission through fibers, introduction to Lasers.

Solid state physics, Crystal structures, atomic packaging miller indices, band theory, hall effects, conduction in semiconductors and devices, diodes, drift current and diffusion current.

Practical: Practicals as per course contents.

Text Books:

Additional Books:

SCL105 APPLIED CHEMISTRY (3-0-2-4)
Pre-requisite: NIL.

Contents:

Physical chemistry, Kinetic theory reactions of various orders, Arrehnius equation, chain reaction enzyme kinetics, catalysis, Electrochemistry, Batteries and corrosion, Inorganic chemistry, Co-ordination chemistry, organometallic compounds, bio-inorganic compounds.

Synthesis of nano particles and nano molecules and Green chemistry.

Practical: Practicals as per course contents.

Text Books:

Additional Books:
Pre-requisite: NIL

Contents:

**Integral Transforms**

Fourier Transforms: Fourier integral theorem, Fourier transform, Fourier Sine and Cosine Transforms, Linearity, Scaling, frequency shifting and time shifting properties, Convolution theorem.


**Numerical Methods**

Solution of linear algebraic system of equations: LU Decomposition, Gauss-Seidel methods; solution of tridiagonal system.

Numerical Solution of first order differential equations and Simultaneous differential equations

Initial value problems: Taylor’s, Euler’s, Runge-Kutta methods, Finite difference approximations for derivatives, boundary value problems with explicit boundary conditions, implicit boundary conditions, Finite difference methods, Shooting method, Cubic splines and their application for solving two point boundary value problems.

**Complex Analysis**
Functions of a complex variable: continuity, differentiability, analytic functions, complex integration, Cauchy’s integral theorem, Cauchy’s integral formula, Taylor’s theorem, Laurent’s theorem, zeros of an analytic function, singularities, residue, Cauchy’s residue theorem, contour integration, the fundamental theorem of algebra.

Conformal transformation, Bilinear transformation, Transformation by elementary functions.

**Text Books:**

**Additional Books:**

**SCL201 ELECTRONIC AND ELECTROMAGNETIC MATERIALS (3-0-0-3)**

Pre-requisite: NIL

Contents:

Electrical Conduction: high conductivity and resistivity materials, effect of temperature and impurity on conductivity, resistivity of metals, conductivity of pure metals and alloys, temperature coefficient of resistivity, heating element, fuses, contact materials, connectors, switches, solders, fixed and variable resistor. Superconductivity and applications.

Polarization of Dielectrics: Polar and non-polar dielectrics, Basic concept of polarization, Types of polarization, Dielectric constant, Internal field in dielectrics, Ferroelectric, Spontaneous polarization, Curie-Weiss law. Piezoelectric and Pyro electric, Dielectric loss, Breakdown in dielectrics. Ceramic, dielectrics used in cables and transformers, Thin film Processes, Linear Capacitors.

Magnetic Properties of Materials: Atomic interpretation of diamagnetic, Paramagnetic, anti-ferromagnetic and ferromagnetic materials, Ferromagnetic domain, permanent magnets and non magnetic steels, nonmetallic magnetic materials, magnetic materials for ferromagnetic tape and memory devices, ferrites.

Industrial lasers: Basic concepts, properties of Lasers, Different types of laser, Industrial application of lasers, drilling, cutting, welding, heat treatment, Optical Fiber Communication.

**Text Books:**

**Additional Books:**

**SCL202 Probability and Numerical Methods (3-0-0-3) (CS/EC)**

Pre-requisite: NIL

Contents:

Random Variable & Probability Distributions

Random processes, continuous and discrete, deterministic, stationary, ergodicity etc., correlation functions, autocorrelation and cross-correlation, properties and applications of correlation functions.

**Numerical Methods**

Numerical Solution of first order differential equations and Simultaneous differential equations

Initial value programs: Taylor’s, Euler’s, Runge-Kutta methods, Finite difference approximations for derivatives, boundary value problems with explicit boundary conditions, implicit boundary conditions, Finite difference methods, Shooting method, Cubic splines and their application for solving two point boundary value problems.

**Text Books:**

**Additional Books:**

**SCL204 Discrete Mathematics (3-2-0-4) (CS/EC)**

Pre-requisite: NIL

Contents:


**Text Books:**

**Additional Books:**

**SCL402 Linear Algebra (3-0-0-3) (CS/EC)**

Pre-requisite: NIL

Contents:

Matrices: Review of Matrix Algebra; Rank of matrix, Row reduced Echelon form, Solution of the matrix Equation Ax = b, Gauss elimination method, Vector Space, Subspaces, Linear Dependence/Independence, Basis, Dimension, Range Space and Rank, Null Space and Nullity; Rank nullity theorem, Linear transformation, Matrix Representation of a linear transformation, Linear Operators on R^n and their representation as square matrices, Invertible linear operators, Inverse of a non-singular Matrix, Eigenvalues and eigenvectors of a linear operator; properties of eigenvalues and eigenvectors of Hermitian, skew-

82

NITUK Course Book-2016
SCL401 PROBABILITY THEORY AND STATISTICS (3-0-0-3) (Optional)

Pre-requisite: NIL

Contents:
Random Variable & Probability Distributions

Statistics

Text Books:

Additional Book:

SCL411 OPTOELECTRONICS AND MAGNETIC DEVICES (3-0-0-3)

Pre-requisite: NIL

Contents:

Text Books:

Additional Books:


SCL412 NUMERICAL METHODS FOR DIFFERENTIAL EQUATIONS (3-0-0-3)

Pre-requisite: NIL

Contents:

Text Books:

Additional Books:

SCL413 INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS (3-0-0-3)

Pre-requisite: NIL

Contents:
First Order PDEs: Introduction & Formation of PDEs, First order PDE: Classification of first order PDEs; Complete integral, General integral, singular integral; Solutions of linear first order PDEs: Lagrange's Method; First order Non-linear partial differential equation, Method of characteristic Compatible Systems; Charpit's method, special types of first order equations, Jacobi's Method for nonlinear first order equations. Second Order PDEs: Classification of second order PDEs; Canonical forms for Hyperbolic, Parabolic & Elliptic PDEs; Method of characteristics; boundary and initial value problems (Dirichlet and Neumann type) involving wave equation, heat equation, Laplace's equations (solutions by method of separation of variables and Fourier Transform).

Text Books:

Additional Books:

SCL414 ENGINEERING CHEMISTRY (3-0-0-3)

Pre-requisite: NIL

Contents:
Polymer Science: Nomenclature, Types of Polymerization, Classification of Polymers, bonding in polymers, Mechanism of Polymerization, stoichiometry of polymers, molecular weight of polymer, methods of polymerization-free radical, anionic, cationic and coordination polymerization, Characterization of...
polymers, thermoplastic (low and high density polythene PMMA) and thermosetting resins (bakelite, epoxy), PVC (Polyvinyl chloride), PVA (polyvinyl acetate), rubbers (natural and synthetic) Inorganic polymers- preparation and uses of silicates.

Water Chemistry: Sources, hard & soft water, Temporary & Permanent hardness, Units of Hardness, Disadvantages of hard water, Scale & Sludge formation in boilers, estimation of hardness by EDTA method, softening of water, zeolite process & demineralization by ion exchangers, specifications for drinking water, treatment of water for domestic use, desalination - Reverse Osmosis & Electro dialysis, industrial waste water treatment

Lubricants: Lubricants - Definition, theories of lubrication, characteristics of lubricants, viscosity, viscosity index, oiliness, pour point, cloud point, flash point, fire point, additives to lubricants, Solid lubricants.

Dyes: Introduction, Classification, Azo dyes, Triarylmethane dyes, Malachite Green, Rosanilin, Phenolphthalein, Alizarin, Methylene Blue, Other uses of Dyes.

Fuels: Fuels - Classification, examples, relative merits, types of coal, determination of calorific value of solid fuels, Bomb Calorimeter, theoretical oxygen requirement for combustion, Coal, Types of carbonization of coal, proximate & ultimate analysis of coal, manufacture of metallurgical coke, Petroleum, Cracking, Synthetic Petrol, Knocking, LPG, desulphurization of petrol.

Text Books:

Additional Books:

SCL415 CONVEX OPTIMIZATION (3-0-0-3)
Pre-requisite: NIL.

Contents:

Text Books:

SCL416 QUANTUM CHEMISTRY (3-0-0-3)
Pre-requisite: NIL.

Contents:
Mathematical concepts: Vectors, Vector product, linearly dependant and independent vectors, linear vector space (introduction only) and basis set of LVS, Matrix, Types of Matrix (Symmetric, skew-symmetric, Hermitian, skew-Hermitian, unit, diagonal, unitary, etc) and their properties, Matrix equations, concept of eigen value and eigen vectors. Quantum mechanics: Origin of Quantum mechanics, postulates of Quantum Mechanics, concepts of operators, Schrodinger equation, solution of the Schrodinger equation for simple systems viz. particle in a box, the harmonic oscillator, rigid rotor, the hydrogen atom, Born-Oppenheimer approximation. Variational theorem, linear variation principle. Perturbation theory (first order and non-degenerate). Application of perturbation theory to the Helium atom. Concept of Angular momentum. Eigen value of angular momentum operator, method of ladder operator, spin. Slater determinant wave functions. Term symbol (R-S and j-j coupling) and spectroscopic states. Molecular orbital theory, LCAO principle, formation of molecular orbitals from atomic orbital, construction of molecular orbitals of $H^+$ by LCAO principle, physical picture of bonding and anti-bonding molecular orbitals, VB and MO theory, Huckel theory of conjugated systems, application to ethylene, butadiene, cyclopropenyl system, cyclobutadiene, etc.

Text Books:

SCL417 REAGENT CHEMISTRY (3-0-0-3)
Pre-requisite: NIL.

Contents:
1. Organolithium reagents: Use of lithium in organic synthesis: Lithium diisopropyl amide (LDA)
2. Organocupper reagents: Use of Copper in organic synthesis: Gilman’s reagent
3. Organopalladium reagents: Use of Palladium in organic synthesis
4. Organosilicon Chemistry: Use of Silicon in organic synthesis: trimethylsilyl iodide
5. Organotin Chemistry: Use of Tin in organic synthesis: tri-n-butyl tin hydride
6. Organomagnesium Reagent: Use of Grignard reagents in organic synthesis
7. Oxidation reaction: Use of DDQ, Selenium dioxide, Osmium tetroxide in organic synthesis
8. Reduction Reaction: Use of complex metal hydrides, Wilkinson’s catalyst, Lithium aluminium hydride (LAH), Sodium Borohydride, Di isobutyl aluminium hydride (DIBAL-H) etc
9. Use of Baker’s Yeast, Phase transfer catalyst, DCC etc. in organic synthesis.

Text Books:

Additional Books:

HML101 SOCIAL SCIENCE (2-0-0-2)
Pre-requisite: NIL.

Contents:
Introduction
Social Sciences, Relationship between an individual and society, Utility for Engineers.

Humanities, history of Human civilization & brief history of science in India.
Society: Types & Characteristics.

Culture: Characteristics, Types & issues.

Industry and Society


Industrial Fatigue.Reasons & remedial methods.

Job stress

Industrial psychology-Selection, training and motivation of employees.

Organization behavior & Industrial Leadership.

Study of political organization

Indian Constitution, Fundamental Rights, directive principals and RTI.

Main Social Problems in India

Illiteracy, Over Population, Corruption & Public Perception, Shums, migration, Poverty, Youth movement, Violence, rise of religious fundamentalism and Terrorism.

Text Books:

Reference Books:

HML102 PRINCIPLES OF INDUSTRIAL MANAGEMENT AND PSYCHOLOGY (3-0-0-3)
Pre-requisite: NIL.

Contents:

Research requisite: [REQUISITE]

Text Books:

Additional Books:

SCL417 REAGENT CHEMISTRY (3-0-0-3)
Pre-requisite: NIL.

Contents:
1. Organolithium reagents: Use of lithium in organic synthesis: Lithium diisopropyl amide (LDA)
2. Organocupper reagents: Use of Copper in organic synthesis: Gilman’s reagent
3. Organopalladium reagents: Use of Palladium in organic synthesis
4. Organosilicon Chemistry: Use of Silicon in organic synthesis: trimethylsilyl iodide
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9. Use of Baker’s Yeast, Phase transfer catalyst, DCC etc. in organic synthesis.

Text Books:

Additional Books:

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Contents:
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Society: Types & Characteristics.

Culture: Characteristics, Types & issues.

Industry and Society


Industrial Fatigue.Reasons & remedial methods.

Job stress

Industri...
Contents:


Text Books:

Additional Books:

HML103 INDUSTRIAL PSYCHOLOGY AND HUMAN RESOURCE MANAGEMENT (3-0-0-3)
Pre-requisite: NIL

Contents:
Industrial Psychology, Basic concepts of Psychology, Learning, Perception and Motivation. Causes of Behavior, Individual differences, Intelligence and Personality, History of Industrial Psychology in India.

Human Resource Management, Participation in Decision making, Collective bargaining, Trade Union Movement in India, MBO and Quality Circle Movement, Wage and Salary Administration, H.R.M in Asia, Europe and U.S.A.

Text Books:

Additional Books:

HML104 INDUSTRIAL ECONOMICS (3-0-0-3)
Pre-requisite: NIL

Contents:
Industrial Economics its scope and utility Economics systems: Capitalist, Communist and mixed economy, Land system and agriculture, taxes, money and credit, trade and exchange rate, Population, size composition, quality and growth trend, occupational distribution, Division of Economy into private and public sector Role of public sector in Indian economy, Privatization, Urbanization, Westernization, Modernization and Globalization, Scope and significance of productivity, Measurement of productivity, Tools of productivity, Factors influencing on industrial productivity, National productivity council, Globalization India and WTO, Trade policy of government of India, Import and Export Policy, New trade policy IMF, World Bank and associates Economic planning in India, Employment and economics.

Text Books:

Additional Books:

HML105 INDUSTRY AND SOCIETY (3-0-0-3) Pre-requisite: NIL

Contents:
Factory as a social system, Formal and informal organization, Impact of social structure on industry, Impact of industry on society, Changing profile of labour, Labour management Relation Participative Management Industry Dispute and Trade union, Collective bargaining, Industrial health and safety, Impact of Industrialization on family, education, and stratification, Class and class conflict in industrial sector obstacles and limitation of industrialization, Migration of rural society to urban society, Industrial Policy, Workers welfare legislation in India, Human Relation in Industry, Management and development program and employee training, Politics and society in current scenario

Text Books:

Additional Books:

HML106 PERSONNEL MANAGEMENT AND INDUSTRIAL RELATION (3-0-0-3) Pre-requisite: NIL

Contents:
Human behavior of an individual as a member as a small group and as a member of an organization, Influence of culture organizational on individual. Analysis of dynamic behavior of organization by simulation structure of organization and flow of men, money, material, information capital, equipment and order, system models on the basis of policy of management to evolve effective policies for management. Scope and objectives of personnel management, personnel planning, labour market, recruitment training and placement. Job evaluation, merit rating wage incentives, employee health, security and welfare, morale and motivation, industrial disputes, voluntary and compulsory settlement trade unionism. Labour legislations, Performance appraisal and evaluation

Text Books:

Additional Books:

HML410 CREATIVE WRITING IN ENGLISH (2-2-0-3) Pre-requisite: NIL

Contents:
What is Creative Writing, Creativity, Imagination and Resistance, Writer and the Text, Processes of Creative Writing and Its Development, Reading and the Individual Writer, Composition of Creative Writing.

Fiction Writing: Writing Literary Fiction, Creative Non Fiction Story Writing, Short Story and the Novel, Plot, Character, Modes of Narration, Setting, Literature of Reality, Writing for Media: Print Media--Reportage, Feature

85

NITUK Course Book-2016
HML411 CORPORATE COMMUNICATION FOR TECHNOCRATS (2-2-0-3)

Pre-requisite: NIL

Contents:
Corporate Communication in Practice:
Comprehensions: Reading and Listening Comprehension; Précis Writing, Expansion (Paragraph Writing), Note-making, Professional Letter Writing; Research Writing: Articles for publication (Journals), writing abstract, dissertation, qualifications of research writing and documentation.
Presentation: PPT Presentation, Group Presentation, Solo Presentation, Poster Presentation: Picture/Placard/Advertisement; Netiquette: Concept, components and evolution, etc. Reading and Analyzing Texts: Chetan Bhagat: One Night @ Call Centre. Reading, reviewing, analyzing and summarizing and paraphrasing, VAT: Video Apperception Test, Reviewing Video Clips/Movies, etc.

Text Books:

Additional Books:

HML412 LITERATURE, THEATER AND CINEMA: THEORIES OF COMMUNICATION (3-0-0-3)

Pre-requisite: NIL

Contents:
1. Understanding of spoken and written English
2. Writing simple sentence
Practical Exercises:
1. Sentence: Structure, Types of Sentences
2. Parts of Speech
3. Tenses & Voice
4. Paragraph Construction
5. Reading and Listening Comprehension

Text Books:

Additional Books:

HMP102 SPOKEN ENGLISH (1-0-2-2)
Pre-requisite: NIL

Contents:
Listening Skills: Kinds of Listening, Hearing and Listening, Barriers in Listening, Enhancing Listening Skills.
Practical: Practicals as per course contents.

Text Books:

Additional Books:

HMP103 WRITTEN ENGLISH (1-2-0-2)
Pre-requisite: NIL

Contents:
Grammar: Parts Of Speech, Determiners, Modals, Tenses, Active Passive, Direct Indirect, Transformation of sentences, Sentence Structure, Error Finding, Vocabulary Building: Synonyms, Antonyms, One word substitutions, Word formation, Idioms and Phrases, Homophones, Prefix, Suffix and Vocabulary Usage, Spelling, Reading Comprehension

Text Books:

Additional Books:

HMP104 ENGLISH COMMUNICATIONS PROGRAM (0-1-0-0.5)
Pre-requisite: NIL

Contents:
I. Writing and Speaking of Compound and Complex Sentences
II. Efficiency in Spoken and Written English with Grammatical Accuracy

Practical Exercises:
1. Subject-Verb Concord, Moods of Verbs
2. Direct/ Indirect Speech, Using Non-finites, Tag-Questions
3. Clauses and its Types, Compound and Complex Sentences
4. Finding Common Errors and Misappropriations
5. Reading and Listening Comprehension- Advanced Level
6. Spoken Exercises and Activities-Advanced Level
7. Précis Writing, Essay Writing
8. Group Discussion

Text Book:

Additional Books:

HMP105 URBAN SOCIOLOGY (0-1-0-0.5)
Pre-requisite: NIL

Contents:
I. Introduction to Urban Sociology: Origin, Nature and scope, Relevance of the study of Urban Sociology
II. Basic concepts: The City, Urbanization, Urbanism, Urbanity, Suburb, Metropolitan
III. Theories of Urban Sociology:
(a) Classical sociological traditions as urban and city dimensions, Emile Durkheim, Karl Marx, Max Weber and Ferdinand Tonnies
(b) Urban community and spatial dimensions. Park, McKenzie
(c) George Simmel: Metropolis, Louis Wirth: Urbanism as a Way of Life and Redfield: Rural Urban Continuum.
(d) Concentric Zone Theory and Sector Theory.
(e) Richard Florida: The Creative Class
IV. Process of Urbanization in India: Growth of Urban Population in India, Emergence of Cities, Causes and Consequences of Urbanization
V. Urban Social Structure: Urban family, urban social stratification – Caste and Class, Occupational Divisions.
VI. Urban Slums: Problems and challenges, urban development programmes.

Text Book:

Additional Books:

Note: The practical exercise will be conducted based on course content.