PRE-ASSESS Syllabus

Aptitude

English Usage:

      a.   Reading Comprehension
      b.   English Grammar
- Articles and Prepositions
- Voice
- Tenses and Gerunds
- Sentence Correction
- Speech

      c.   Verbal Ability
- Vocabulary
- Synonyms and Antonyms
- Spelling
- Sequencing
- Phrases and Idioms

Analytical Reasoning

      a.   Flowcharts
      b.   Visual Reasoning
      c.   Statements and Conclusions
      d.   Attention to Details
      e.   Coding Decoding
      f.   Series
      g.   Arrangement & Sequencing, Relationships
      h.   Case Puzzles

Numerical Reasoning

      a.   Time and Work
      b.   Speed and Distance
      c.   Algebra and Equations
      d.   Progressions
      e.   Mensuration
      f.   Mathematical Modeling, Functions and Graphs
      g.   Permutations and Combinations
      h.   Ratio and Proportions
      i.   Interest
      j.   Profit and Loss
      k.   Data Interpretation

Domain Syllabus

1. Aerospace Engineering

   a. Dynamics for Aerospace Engineering
      - Dynamics of rigid bodies
      - Principle of virtual work and Lagrangian mechanics
   b. Flight Vehicle Controls
      - Basic Control actions and response of control systems
      - Analysis and designing of control systems in state space,
      - Root locus analysis and design of system by root locus method
      - Frequency response analysis, PID controls
   c. Thermodynamics and Aerospace Propulsion System
      - Basic Principles of Propulsion and classification and characteristics of Aerospace Propulsive Devices
      - Thermodynamic and Real Cycle Analysis, Aviation Fuels
      - Theory of Propellers, Centrifugal Compressor and its performance
   d. Aerospace Structural Analysis
      - Thin-walled structures based on elasticity approach, Torsion
      - Bending and shear of open and closed thin-walled cells
      - Structural instability
      - Buckling
   e. High Speed Aerodynamics
      - Linearized subsonic and supersonic flow theory
      - Applications to aerofoils and wings
      - Supersonic panel methods
   f. Mechanics of Flight
      - Aircraft components and their function (aerodynamic, propulsive and control)
      - Aircraft performance
      - Unsteady flight performance, high-speed aircraft, helicopters
   g. Theory of Jet propulsion
      - Turbojets
      - Axial Compressor and its performance
      - Elementary Theory of Turbines; Injectors and Fuel Injection
      - Combustion Chamber performance
      - Design Procedure
   h. Aircraft Stabilty and Control
      - Longitudinal static stability
      - Control and maneuvering in steady level flight;
      - Lateral/directional dynamic stability
      - Response of the aircraft to control inputs
      - Dynamic stability; Response to gusts

2. Agriculture and Food Engineering
   a. Soil Technology
      - Physics of Soil
      - Mechanics of Soil
      - Soil Tillage
      - Soil Management
   b. Crop Production Technology
      - Crop Production
      - Cropping system for major agro-ecological regions
      - Farm planning and management
      - Management of dryland agriculture.
      - Crop Simulation
      - Crop response to climate change
      - Uncertainty and risk evaluation
   c. Post Harvest Technology
      - Psychrometry
      - Principles of grain drying
      - Mathematical modeling of crop drying systems
   d. Food Science and Technology
      - Food Technology: Technological processes for industrial manufacture of selected foods of commercial importance from plants and animal sources
      - Food Laws and Standards
   e. Irrigation and Drainage
      - Farm Water Delivery System and Control
      - Measurement of Irrigation Water
      - Irrigation Requirement: Measurement
   f. Designing of Machine Elements
      - Design considerations in machine parts, Materials of construction, Factor of Safety, Fits and tolerances, Design of machine elements, couplings
      - Clutches, brakes, flywheel, belt drives, gear drives, chain drives. Rivetted
      - Joints, Welded connections.Design of cultivators, rotavator, thresher, sprayer
   g. Land and Water Resources
      - Hydrograph Analysis
      - Unit Hydrograph
      - Flood routing
   h. Agricultural Machinery
      - Equipment design
      - Farm operations
      - Field efficiency
      - New techniques: Application of computer vision and GIS in farm equipments

3. Biotechnology and Biochemical Engineering
   a. Biochemical Reaction Engg and Bioenergetics
      - Kinematics of homogenenous reactions and enzyme catalysed reactions
      - Chemical mechanisms of biological energy conversion in mitochondria and choloplasts
      - Experimental studies and theories photosynthesis energy transfer kinetics
      - Cytochrome c oxidase (Cytochrome Oxidase Oxygen Heme) or photosystem II (Photosystem II Manganese Oxygen); bacteriorhodopsin proton pumping)
      - DNA base recognition and replication fidelity; Gibbs Free Energy; Protein folding and stability
      - Ligand binding; Protein-Protein and Protein-DNA interactions;
      - Osmosis, Dialysis; Donnan Effect; Practical techniques e.g.: Isothermal Calorimetry (ITC); Spectroscopy; Fluorescence and Scanning Microscopy; X-ray diffraction
   b. Biochemistry
      - Chemistry and metabolism of biopolymers (Carbohydrates; lipids; proteins; nucleic acids and nucleoproteins), vitamins and hormones. Amino acid, Primary, Secondary, tartiary and quaternary structure of proteins.
      - Nutritional aspects of lipids; carbohydrates and proteins. Physiological functions of vitamins; minerals and hormones. Enzymes and co-enzymes. Glycolytic pathway and TCA cycle
      - Electron transport and oxidative phosphorylation. Plant and microbial biochemistry - photosynthesis, Difference in respiratory mechanisms of aerobes and anaerobes
   c. Microbiology
   d. Cell and Molecular Biology
   e. Chemical process calculations
      - Numerical techniques for solving material & energy balance equations
   f. Genetics
      - Chromosomal variations
      - Bacterial and viral gentic systems
      - Application of molecular genetic techniques
   g. Environmental Biotechnology
   h. Mass Transfer
   i. Plant cell Tissue Culture
   j. Bioinformatics
      - Data bank
      - Data Analysis
   k. Immunology
   l. Protein Engineering

4. Chemical Engineering
    a. Fluid Mechanics
        - Fluid Statics
        - Internal Incompressible Viscous Flow
        - Calculation of Head Losses in pipes and fittings
        - Converging and diverging nozzles
        - Solution of single and multi-path pipe flow systems
        - External Incompressible Viscous FlowHeat Transfer
    b. Heat Transfer
        - Convection-Dimensional analysis
        - Heat exchangers
        - Evaporators
        - Process design and performance evaluation of Double Pipe, Shell and Tube, Plate, Spiral Heat Exchangers
        - Process design data sheets
        - Heat pumps
    c. Mass Transfer
        - Counter-current and co current multistage operations
        - Crystallisation
        - Drying
        - Liquid-Liquid Extraction
    d. Reaction Engineering
        - Isothermal reactor design
        - Chemical reactor analysis
        - Multiphase reactions: Gas-liquid, liquid-liquid, gas-solid, solidliquid-gas
    e. Instrumentation and Process Control
        - Calibration experiments and their analysis
        - Experiments on dynamic behavior for interacting and non-interacting tank level system, filled in system thermometers
        - Control performance studies on pressure process, tank level system, heat exchanger
    f. Transport Phenomena
        - Navier-Stokes equation
        - Unsteady state viscous flow
        - Momentum, energy and mass transport in boundary layer with relevant analogies
        - Transport in turbulent flow-time
        - Interphase momentum, heat and mass transfer

5. Civil Engineering
    a. Transportation
        - Roadway Alignment
        - Geometric Design of Highways
        - Introduction to Railways and Airports
        - Soil stabilization
        - Concrete pavements
        - Drainage
    b. Water Resources
        - Concepts of hydrologic cycle
        - Design of canals
        - Design and drawing of Gravity and Earth dams
    c. Solid Mechanics
        - Stress Analysis-Strength of material approach
        - Beams on Elastic Foundation
        - Curved members, rings
    d. Probability and Statistics
        - Classical, relative frequency and axiomatic definitions of probability
        - Random variables
        - Estimations
    e. Design of Steel Structures
        - Introduction to Building System
        - Design of Industrial Structures
        - Design of Flexural Members
        - Design of Plate Girder and Gantry Girder
    f. Structural Analysis
        - Energy Method (Ritz) and Error Orthogonalization (Galerkin) for indeterminate beams
        - Matrix Force and Displacement Method for Frames
        - Introduction to Finite element Method for Trusses
    g. Soil Mechanics
        - Formation of soils
        - Normally and over consolidated soil
        - Methods of determining coefficient of permeability
        - Shear strength of soils
        - Earth pressure theories
    h. Foundation Concepts
        - Introduction, examples of foundation problems
        - Stress distribution in soil
        - Test pile and pile load test

6. Computer Science and Engineering
   a. Programming and Data Structures
      - Array, Link list, String, Pointer, C/C++ operator, Inheritance
   b. Discrete Structures
      - Sets, Graph, Permutation and combination, Mathemetical logic
   c. Software Engineering
      - ISO 9001, Cost Estimation, Process Model, Software availability
   d. Formal Language and Automata Theory
      - Turing machine, Language, FSA, DFA & NFA, Reguler expression
   e. Computer Organisation and Architecture
      - Cache memory, Memory Architecture, Pipelining
   f. Compilers
      - Parser, LR0, LR1, Syntax tree, Register Allocation
   g. Algorithms
      - Recurrence Relation, Hashing, Tree & Graph
   h. Operating Systems
      - CPU Scheduling, Semaphore, Paging, Page Replacement policies, Deadlock
   i. Computer Networks
      - Media Access control, Flow and Error Control, Switching
   j. Switching Circuits and Logic Design
      - Counter, Analog and digital Transmission

7. Electrical Engineering
   a. Electrical Machines
      - Transformer
      - Three-phase induction motor
      - DC machine
      - Stepper Motor
      - Single-phase induction motor
   b. Signals and Networks
      - Bode plot
      - O/C, S/C test
      - Energy meter
   c. Measurement
      - Galvanometer
      - High frequency transformer
   d. Control System
      - Signal flow graph
      - Feedback system
      - Compensators
   e. Power Electronics
      - Inverters
      - Converter circuit
      - Power conversion
      - SCR
      - Rectifiers
      - Thyristor
      - Choppers

f. Power System
   - HVDC transmission
   - Losses
   - Steady state stability
   - Power system protection
g. Analog Circuits
   - Transistor
   - Amplifier
   - Current mirror
h. Embedded Systems
   - Microprocessor and Microcontroller

8. Instrumentation Engineering
   a. Measurement and Instrumentation
      - Servo motor
      - Stepper motor
      - Quartz Crystal
      - Voltmeter, Potentiometer, Wattmeter
   b. Control System
      - Feedback, Nyquist Plot, Resonant Circuit
   c. Instrumentation Devices
      - Pyrometer, Resistant Thermometer, Signal compression
   d. Data Communication
   e. Analog Electronics
      - Bipolar junction transistors
      - Direct and Indirect band gap semiconductors
      - Operational Amplifier
      - Zener Diode
   f. Digital electronic circuits
      - Counters, Logic Gates, Flips flops, Memory Elements
   g. Embedded System
      - Microcontrollers and Microprocessors

9. Electronics and Electrical Communication Engineering
   a. Introduction to electronics, analog electronics and semiconductor device
      - Bipolar junction transistors
      - Direct and Indirect band gap semiconductors
      - Operational Amplifier
      - Zener diode

   b. Digital Electronics Circuits
      - Counters
      - Logic gates
      - Flip-flops
      - Memory Elements
   c. Digital Signal processing and Signal Systems
      - LTI System
      - Laplace transform
      - Analog to digital converters
   d. Network Theory
      - Transient and steady state response of RC, RL and RLC circuits using Laplace transform.
      - Circuit interpretation of network using appropriate models
      - KVL, KCL, Mesh analysis, Node analysis
   e. Electromagnetic Engineering
      - Propagation of uniform plane waves in unbounded medium
   f. Control System
      - Open loop poles and zeroes
      - Root Locus
   g. Analog and digital communication
      - Baseband transmission
      - Fourier transformation.
      - Autocorrelation
   h. RF and microwave engineering
      - Microwave transmission
      - Cavity resonator
   i. Microcontroller and Embedded Systems
      - Microprocessor and Microcontroller programming.
      - Microprocessor peripherals
   j. VLSI
      - CMOS fundamentals
      - CMOS fabrication

10. Industrial Engineering
   a. Operations research
      - Duality theory and its applications
      - Linear Programming
      - Non Linear Programming
      - Probabilistic Models
   b. Production planning and control
      - Long and short term demand forecasting methods
      - Plant location and scheduling
      - Material requirement and shop scheduling
   c. Work system design
      - Ergonomics fundamentals
      - Design of manual handling tasks
      - Design of physical environment
   d. Quality design and control
      - Management of quality
      - Control chart principles
      - Specifications and tolerances
      - Acceptance sampling
   e. Engineering economy, costing and accounting
      - Non engineering economy
      - Accounting
      - Introduction to job costing
   f. Management of inventory systems
      - Types of inventory
      - Problem solving and case study
      - Concept of MRP and JIT
   g. Machine tools and machining
      - Kinematic systems and structures of conventional machine tools
      - Classification and specification of machine tools
      - Working principle and application of CNC machine
   h. Logistics and supply chain management
      - Transportation
      - Storage
      - Introduction to SCM
      - Physical distribution planning, Material handling, Facility and warehousing decision
      - Business Logistics/Supply Chain Management

11. Mechanical Engineering
    a. Designing of machine elements
        - Welded Joints
        - Shafts
        - Clutches
        - Brakes
    b. Materials engineering
        - Microstructure of pure metals
        - Types of alloys
        - Concept of heat treatment of steels
    c. Fluid Mechanics
        - Bernoulli's equation and its applications
        - Kinematics
        - Boundary layer concept
    d. Dynamics of Machines
        - Forced Vibration
        - Conservative and non conservative forces
        - Resonance and Q factor
        - Properties of inertia and stiffness matrices
    e. Heat Transfer
        - Modes of heat transfer
        - Heat Exchangers
        - Thermal Radiation
    f. Machining Tools and Machining
        - Classification and specification of the machine tools
        - Principle and application of the automatic and semi-automatic lathes
        - Cutting tool materials
        - Special techniques and advanced techniques of the machining and grinding
    g. Kinematics of Machines
        - Kinematics pairs
        - Velocity and accelaration analysis
        - Fundamental law of gearing
    h. Thermodynamics
        - First and Second Law
        - Air standard cycles
        - Vapour cycles

12. Manufacturing Science and Engineering
    a. Operations Research
        - Behavioral versus quantitative decision making
        - Linear algebra
        - Duality Theory and its application
        - Transportation and assignment problems
    b. Kinematics of machines
        - Introduction to mechanisms
        - Kinematic analysis of planar mechanisms
        - Cams
    c. Heat Transfer
        - Combined modes of heat transfer
        - Forced convection
        - Condensation and Boiling
    d. Material Engineering
        - Solid Engineering Materials- their classification and characteristic properties
        - Microstructure of pure metals
        - Concept of heat treatments of steel
    e. Casting, Forming and Welding
        - Casting
        - Welding Study
        - Study of heat flow and temperature distribution in welding
    f. Machine tools and Machining
        - Kinematic systems and structures of conventional machine tools
        - Machining: Tool geometry, mechanism of chip formation
        - Cutting fluid applications
    g. Robots and Computer controlled machines
        - Electrical and hydraulic systems
        - Single loop and multi-loop
        - AC and DC drives, Servo drives using voltage control
        - Sensors
    h. Non-traditional manufacturing process
        - Machine tool
        - Machining needs
        - Concept of surface integrity

13. Metallurgical and and Materials Engineering
    a. Computer applications in metallurgical process
        - So Numerical solution of differential equations, process related numerical problemslution of linear, non-linear algebraic equations
        - Stress analysis
        - Optimization and control
    b. Iron making and steel making
        - Testing of raw materials used in Blast Furnace for iron making.
        - Design of furnace, refractories
        - Aerodynamics, various zones in the furnace and reactions, charging, gas cleaning and hot blast stoves etc
        - State of oxidation, basicity and fluidity of steel making slag.
        - Kinetics of slag-metal reaction
    c. Mechanical working of materials
        - Mechanics of metal working
        - Friction and lubrication
        - Wire and Tube drawing
    d. Creep, Fatigue and fracture
        - Mechanical tests
        - Design of materials for elevated temperature application
        - Creep-fatigue interaction
        - Ceramics and polymers
    e. Heat treatment of materials
        - Diffusion in solids
        - Precipitation from solid solution
        - Iron-carbon alloy system
        - Conventional heat treatment of steels
    f. Transport phenomena in metallurgical process
        - Newtonian and Non-newtonian fluids
        - Heat transfer with change of phases, solidification and melting problems.
        - Heat exchange in transparent and absorbing medium
        - Mass transfer in moving boundary problem
    g. Metallurgical thermodynamics and kinetics
        - Internal energy, First law of thermodynamics
        - Second law of thermodynamics, entropy
        - Introduction to metallurgical kinetics
        - Concept of Third law

14. Mining Engineering
    a. Rock Mechanics
        - Elastic and time dependent behavior
        - Mechanics of rock burst and bumps
        - Basics of numerical methods in geomechanics with applications
    b. Solid Mechanics
        - Stress Analysis-Strength of material approach
        - Anisotropy
        - Plasticity
        - Visco-elasticity (Kelvin, Voigt, 3-element)
        - Thermo-elasticity theories of failure
    c. Development of mineral deposits
        - Conventional and special methods of shaft sinking, shaft lining, deepening and widening of shafts
        - Raising and winzing
    d. Mine Surveying
    e. Underground coal mining and metal mining
        - Pillar mining methods
        - Techno-economic analysis on choice of stoping methods, high productivity methods
        - Stope fills
    f. Ventilation and climate control
        - Design of air cooling systems
        - Mine gases
    g. Mining Machinery
        - Elements of mechanical power transmission-gears
        - Winning machines-surface and underground
        - Aerial rope ways, belt conveyors, rope haulage and locomotives
        - Underground man riding systems
    h. Applied Rock Engineering and Mine hazards
        - Methods for constructing underground tunnel, caverns and storage facilities
        - Explosions from firedamp and coal dust
        - Rescue and recovery
        - Inundation of mines and dewatering
        - Mine illumination.
    i. Surface Mining
        - Ground Preparation for Excavation
    j. Economics and Mining Enterprises
        - Mining finance
        - Statutory provisions relating to mineral legislations
        - Taxation system applied to mining industry

15. Ocean and Naval Engineering
    a. Marine Construction and Welding
       - Steel material preparation
       - Plate cutting methods
       - Plate and section forming
       - Fusion welding and types of power source and their characteristics, welding methods
    b. Solid Mechanics
       - Theories of failure
       - Columns and struts
    c. Hydrostatics and Stability
       - Basics of ship hydrostatics
       - Stability of fully submerged body : stability regulations
    d. Marine Hydrodynamics and Thermodynamics
       - Lifting surfaces
       - Kutta Joukowski Theorem
       - Surface gravity waves
       - Thermodynamics of Reactive Systems
    e. Vibration of Floating Structures
       - Vibration induced in floating elastic structures
       - Selection of engine and propeller based on vibration considerations of machine shafts
       - Design of engine mounts.
    f. Ship Strength
       - Forces acting on ship structure
       - Idealization of ship structure as hull girder
       - Longitudinal bending of hull girder and buoyancy curves
    g. Concepts of Ocean Engineering
       - Offshore structures
       - Ocean energy and fundamental principles of energy extractions from sea waves
    h. Marine Design
       - Classification of marine vehicles on the basis of mission
       - Analysis
       - Properties of cargo
       - Engineering economic criteria and complexities
       - Design spiral, concept design, objectives and constraints, preliminary design
    i. Seakeeping and maneuvering
       - Recapitulation of surface gravity waves
       - Irregular waves
       - IMO maneuvering standards

16. Chemistry
    a. Physical Chemistry
        - Phase equilibrium in pure substances; Simple mixtures; Phase equilibrium in mixtures; Chemical Equilibrium; Equilibrium electrochemistry
        - Kinetic Theory of Gases
        - Thermodynamics of Surfaces
    b. Organic Chemistry
        - Oxidation, Reduction, Addition, Elimination, Substitution reactions and their mechanisms
    c. Inorganic Chemistry
        - Acids and bases. HSAB theory. Chemistry of hydrogen, nitrogen and oxygen
        - d-block elements
        - Inorganic ring, chain, cluster of s,p,d-block elements. Boranes, Carboranes, Siloxanes, phosphazine, Borazine and Metal clusters
    d. Quantum Chemistry and Spectroscopy
        - Schrodinger wave equation, Eigenfunction, eigenvalues and operators, Interpretation of wavefunctions, Free particle, Particle-in-a-box, Rigid rotor, Harmonic oscillator, Hydrogen atom
        - Self Consistent Field Theories; Valence Bond and Molecular Orbital theories
        - Molecular spectroscopy: absorption, emission and resonance
    e. Molecular Thermodynamics and Kinetics
        - Third law of thermodynamics and residual entropy
        - Statistical thermodynamics
        - Thermodynamic quantities from partition functions; Applications to gases, solids, atomic liquids and polymers
        - Chemical equilibrium
        - Chemical kinetics and molecular reaction dynamics
        - Theories of chemical reaction rates
    f. Analytical and Environmental Chemistry
        - Precision and Accuracy, Figures of Merit.
        - Measurement Fundamentals
        - Introduction to Chromatographic Separations
        - Liquid Chromatography
        - Gas Chromatography
        - Thermal & surface techniques: TG, DTA/DSC, Auger, XPS, SEM/TEM
    g. Organic Synthesis
        - Ideal synthesis
        - Fundamentals of retrosynthesis, symmetry, stereochemistry, conformation analysis, molecular mechanics, stereocontrol, ring formation, reactivity, selectivity, catalysis, organometalic reactions. Functional group transformations, umpolung and protecting groups
        - Synthetic strategies and selected total syntheses
    h. Computational Chemistry
        - Classical Molecular Dynamics (MD)
        - Classical Monte Carlo (MC)
        - Analysis of simulated trajectories: Estimation of various distribution functions and transport properties of simulated model systems. Special techniques for simulation of biomolecules and polymers. Ab-initio computing
    i. Organometallics and Biorganic Chemistry
        - Bonding models in sigma and pi-complexes. 18-electron formalism and isolobal principle. Wades/Mingos/Jemmis rule.

- Basic concepts guiding the synthesis and stability of transition metal alkyls, carbonyls, alkenes, alkynes, arenes, allyls, carbenes, and metallocenes. Basic organometallic reactions: oxidative-addition, reductive elimination, transmetallation, insertion, nucleophilic attach on coordinated ligand
- The biochemistry of iron and copper: Dioxygen binding, transport and utilization in hemoglobin, hemocyanin and hemerythrin. Biological and synthetic dioxygen carriers. Metal-sulfide proteins: Ferredoxin and nitrogenases.
- Metalloporphyrins and Respiration: Cytochromes. Electron transfer reactions.
- Metalloenzymes: Carbonic anhydrase, carboxypeptidase and vitamin B12

j. Solid State Chemistry
- Crystal structure of solids
- Crystal diffraction by X-rays, Neutrons and Electrons
- Band Theory, Semiconductors (intrinsic & extrinsic), and Devices, Measurement of Band Gaps, Fermi level
- Imperfections in Solids
- Phase Stability
- Colour Centers, Traps, Phosphors; Electrical and Magnetic Properties (Hall Effect); BCS-type superconductivity

17. Applied Geology
   a. Minerology of Solid Earth
   b. Basics of Paleontology
   c. Thermodynamics of Geological Systems
   d. Metamorphic Petrology
   e. Geochemistry
   f. Igneous petrology, sedimentology, stratigraphy
   g. Geophysical Prospecting, Ore Geology
   h. Groundwater Geology
   i. Applied Micropaleontology

18. Exploration Geophysics
    a. Mechanics
        - Kinematics
        - Stree-strain relationship
        - Wave Mechanics
    b. Transform Calculus
    c. Physics of Solid Earth
    d. Structural Geology
    e. Paleontology and stratigraphy
    f. Basics of Living System
        - Cellular biology
        - Biology of proteins
        - Bio-Thermo-Fluidics and Transport Processes
        - Impact of Biology on Society and Mankind
    g. Geophysical field theory
    h. Mineral resources
    i. Measurements of electronics instruments
    j. Gravity, electromagnetic and magnetic methods of prospecting
    k. Geophysical signal processing and inverse theory, Nuclear geophysics
    l. Siesmic methods of prospecting and Seismology

19. Economics
    a. Micro Economics
        - Theory of Demand-Supply Curve, Marginal Utility, Indifference Curve Analysis, Price Effect as a Combination of Income and Substitution Effects, Elasticity of Demand, Production Function- Laws of Returns and Laws of Returns to Scale, Cost of Production-Theory of Firm, Market- Price and Output Determination under Perfect Competition, Law of Supply, Stability of Equilibrium, Pure Monopoly, Discriminating Monopoly, Multiplant Monopoly, Multi-product Monopoly, Bilateral Monopoly.
        - Market Structure - Monopolistic Competition and Oligopoly, Cost-Plus Pricing and Mark-up Pricing, Average Cost pricing
        - Public Sector Pricing, Limit Pricing, Baumolas theory of Sales Revenue Maximization
        - Pricing of the Factors- Marginal Productivity Theory, Theories of Wage, Rent, Interest and Profits
        - Factor pricing under Perfect and Imperfect Competitions
        - Introduction to static input-output model
    b. Macro Economics
        - National Income Accounting; Aggregate Demand and Aggregate Supply- Classical, Theory of Employment, Keynesian Theory of Effective Demand
        - Consumption and Investment Functions, Multiplier, Accelerator, Multiplier-Accelerator Interaction, IS-LM Analysis.
        - Keynesian Fixed Price Open Economy (Mundell-Fleming) Model, Keynesian Flexible Price (AD-AS) Model
        - The Income Level and Consumption Spending: Four Hypotheses, Supply Side Economics, New Classical and Keynesian Economics, Inflation- Definition, Measures and Effects
        - Inflation and Unemployment
        - The Phillips Curve, Deflation,The Great Depression,Theories of Business Cycle, Incomes Policy, Fiscal and Monetary Policies,New Institutional Economics
        - India's Macro Economic Scenario: Post-Reforms Policies and their Implications

c. Statistics for Economics
   - Theory of Sampling; Analysis of Variance – Definition and Sources of Variation, Techniques in One-way and Two-way Classifications of Data, Nonparametric
   - Tests in ANOVA; Statistical Quality Control - Types of Quality Measures, Control Charts, Tolerance Limits, Sampling Inspection, Elements of Reliability, Total Quality Management; Index Number - Meaning and Types, Methods of Construction and Problems, Tests of Index Number, Chain Base Methods, Cost of Living Index, Base Shifting, Splicing and Deflation; TimeSeries Analysis - Components of a Time-Series, Measurement of Secular Trend and Seasonal Fluctuations, Changing Seasonal Patterns, Measurement of Cyclical Fluctuations, Harmonic Analysis, Moving Average and Cyclical Fluctuations, Randomness, Serial Correlation and Correlogram
   - Vital Statistics: Introduction, Rates of Vital Events, Measurement of Mortality, Life Table, Fertility, Population Growth and Morbidity. Concept of regression, Simple linear regression, multiple linear regression, model adequacy checking, transformations and weighting to correct model inadequacies, diagnostics for leverage and influence.
   - Polynomial regression models, orthogonal polynomials. Classical techniques of Time Series Analysis, Different Smoothing Techniques, General linear process, Autoregressive Processes AR(P), Moving average Process Ma(q): Autocorrelation, Partial autocorrelation and Spectrum, Identification in time domain, Forecasting, Estimation of Parameters, Model diagnostic checks, Elements of ARCH and GARCH models
   - Use of time series techniques in Finance.
d. Public Finance and Policy, Indian Economy
   - Nature and Scope of Public Finance; Resource Scarcity and Inter-sector Allocation; The Concept of Public Goods, Club Goods, Local Public Goods; Reasons for Governmental Allocation Intervention- Externalities and Government Policies, Government Subsidies and Income Support for the Poor; Imperfect Competition, Asymmetric Information
   - Political Economy: Voting and Rent Seeking; Principle of Maximum Advantage; Public Sector Revenues- Distributional Equities in Taxation, The Ability to pay Principle, The Benefit Principle-; Tax Shifting and Incidence; Classification and Choice of Taxes; Effect of Taxation- Taxes and Individuals, Taxes and Industries, Environmental Taxes; Public Expenditure- Wagners Law of Increasing Governmental Activities, Wiseman-peacock Hypothesis, Types and Canons of Public Expenditure; Public Budget, Public Sector Debts- Effects, Debt Redemption, Issues in Debt Management; Social Security and Social Insurance; Indian Federal Finance and Tax Systems: New Directions; Public Debts in India.
e. Financial Management
   - Accounting principles, US GAAP vs. Indian GAAP, analysis of transactions and regulatory stipulations, the flow through into balance sheet income statement and cash flow construction and appraisal; Efficiency and effectiveness of financial statements are examined through study of ratios, working capital management, concepts and methods of classification of assets, liabilities, income expenditure and the reporting of financial flows, earning per share, interim and find submissions, and on segments within or a part of business enterprises; Focus provided on modalities and issues of planning capital structure, theories of capital structure , traditional and modigliani miller position, forms of capital structure, cost of capital and dividend policies, elements of international finance

f. International Trade and Finance
  - Theories of International Trade- Theory of Absolute Advantage, Theory of Comparative Advantage, Heckscher-Ohlin Trade Model; Factor Mobility and Trade; Gains from Trade; Alternative Theories of Trade; Economic Growth and International Trade; Technical Progress and International Trade; The Terms of Trade; Tariffs under Optimal Market Conditions; Balance of Payments; International Economic Policies and adjustment Mechanism; Fixed Vs Flexible Exchange Rates; Free Trade and Protectionism, Political Economy and International Trade; Trade Policies with special reference to Developing Countries; Role of World Trade Organization.
  - International Financial Environment: Multinational Financial Management, International Flow of Funds, International Financial Markets, Exchange Rate Determination, Currency Derivatives; Exchange Rate Behaviour: Government Influence on Exchange Rate, International Arbitrage and Interest Rate Parity, Relationship between Inflation, Interest Rate and Exchange Rates
  - Exchange Rate Risk Management: Forecasting Exchange Rate, Measuring Exposure to Exchange Rate Fluctuations,
  - Managing Transaction Exposure, Managing Economic and Translation Exposure; Foreign Direct Investment, Foreign Institutional Investment, Multinational Capital Budgeting, Multinational Restructuring, Country Risk Analysis, Multinational Cost of Capital and Capital Structure, Long-term Financing
  - Short-Term Asset-Liability Management
g. Econometrics
  - Nature of Statistical Relationships; Simple and General Linear Regression Model (LRM) and their Uses for Estimation, Forecasting and Testing of Hypotheses; Extension of LRM Errors in Variables, Autocorrelation, Heteroscedasticity, Multi-collinearity; Dummy variable Models: LPM, Logit, Probit and Tobit, Non-linear regression models

20. Mathematics and Computing
  a. Transform Calculus
  b. Probabilty and Statistics
  c. Linear Algebra, Real Analysis
  d. Measure Theory and Intergration
  e. Operation Research
    - Graphical method for solving two and three variable problems, simplex method
    - Big M method, degenerate LP problem, product form of inverse of a matrix, revised simplex method, duality theorems, complementary slackness principle
    - Primal-dual simplex algorithm, sensitivity analysis, parametric programming
    - Linear integer programming problem, Gomory cutting plane method, branch and
    - Bound algorithm, 0-1 implicit enumeration, transportation problem, assignment problem with their solution methodologies
  f. Advanced Numerical Techniques
    - Explicit and Implicit schemes - Crank-Nicolson scheme, tri-diagonal system, Laplace equation using standard five point formula and diagonal five point formula. ADI scheme, hyperbolic equation, explicit scheme, method of characteristics
    - Solution of one dimensional heat conduction equation by Schmidt and Crank Nicolson methods
    - Solution of wave equation
  g. Stochastic Processes
  h. Integral Equations and Variational Methods

     i. Data Structures and Operating Systems Design
- Stack, Queue, Link list, java, Mp & Mc Programming
     j. Design and Analysis of Algorithms
     k. Discrete Mathematics
     l. Computer and Architecture and Basic Electronics
     m. Switching and finite automata
     n. Theory of operating system, File organization and Database

21. Physics

a. Atomic and Molecular Physics
- Spectra of alkali atoms
- Vector atom model
- LS and jj couplings
- Normal and anomalous Zeeman effect
- Stark effect
- Hartree-Fock method
- Born-Oppenheimer approximation
- Fine structure of spectral lines
- Nuclear spin and hyperfine structure
- Spectra of diatomic molecules
- Polyatomic molecules
- Raman Spectroscopy
- Magnetic resonance
- ESR and MNR spectra

b. Nuclear and Particle Physics –I
- Nuclear properties
- Nuclear models
- Nuclear reactions
- Radioactive decay
- Alpha decay
- Beta decay
- Fermi and Gamow
- Gamma decay
- Detectors and Accelerators
- Modern Accelerators
- Synchrotrons
- Linear accelerators

c. Nuclear and Particle Physics –II
- The Deuteron problem
- Shell model and magic numbers
- Collective models
- Compound nucleus formation and decay
- Nuclear scattering processes
- Neutron - proton Scattering at low energies
- Proton - proton scattering at low energies and general nature of   nuclear force
- Particle Phenomenology
- Classification of particles
- Quark model
- Elementary ideas of QED

- Tree-level processes
- Mandelstam variables and plot
- Compton scattering and Bhabha scattering
- Parity violation in weak interaction
- Kaon+ decay
- The V-A interaction weak current
- Muon decay, pion deacy
- Cabbibo angle
- CP violation in neutral Kaon decay
- Kaon oscillations

d. Classical Mechanics-I
- Brief survey of the Newtonian Mechanics
- Lagrangian and Hamiltonian Mechanics
- The central force problem
- Rigid body dynamics
- Small oscillations

e. Classical Mechanics -II
- Review of Lagrangian and Hamiltonian formulation
- Canonical invariants
- Infinitesimal canonical transformations and conservation laws
- Angular momentum PB relations
- Hamilton-Jacobi theory, characteristic function, action-angle variables
- Connections with geometricaloptics and wave mechanics
- Michelson-Morley experiment
- Postulates of special relativity
- Lorentz transformations and its consequences
- 4-vectors and 4-tensors
- Lorentz group
- Relativistic mechanics of a particle in an external electromagnetic field
- Equation of motion and its applications
- Newtonian gravity
- Principle of equivalence
- General covariance
- Gravity as curvature of spacetime
- Metric tensor and affine connection
- Geodesic equation and deviation
- Newtonian limit
- Gravitational redshift

f. Quantum Mechanics -I
- Particle in a box
- Isotropic oscillator
- Angular momentum
- Rigid rotator
- Hydrogen atom
- Stern-Gerlach experiment and spin
- Spin-half particle in a magnetic field
- Dirac bra-kets
- Hilbert space of state vectors
- Unitary transformations
- Addition of angular momenta

- CG coefficients
- Approximation methods: time independent perturbation theory (non-degenerate and degenerate cases), Zeeman and Stark effects, variational method, WKB approximation

g. Quantum Mechanics
- Identical Particles and Spin
- Time dependent perturbation theory
- Fermi s Golden rule
- Transition probabilities
- Quantum theory of scattering - cross sections, partial wave analysis, phase shifts , optical theorem
- Schrodinger's equation as an integral equation
- Green's function
- Coulomb scattering
- Relativistic wave equations - KleinGordon and Dirac equations
- Covariant form of Dirac equation
- Bilinear covariants
- Discrete symmetries of Dirac equation
- Fine structure of Hydrogen atom
- Interaction picture, S-matrix, T- matrix

h. Physics
- Theory Component: Overview of vibrations with emphasis on damped and forced oscillations, resonance, coupled oscillations, normal modes
- Wave Motion: longitudinal and transverse waves, wave equation, plane waves, phase velocity, superposition wave packets and group velocity, two and three dimensional waves, polarization
- Electromagnetic Waves: Maxwell's equations, wave equation, plane electromagnetic waves, energy-momentum, Poynting's theorem, electromagnetic boundary conditions, reflection and refraction, interference, Young's experiment, interferometers, diffraction, Fraunhofer diffraction (single slit), dispersion, radiation
- Wave Mechanics: failure of classical physics, qualitative review of relevant experiments, de Broglie waves, uncertainty principle, wave function and Schrodinger equation, probability interpretation, particle on a chain, potential barrier and quantum tunneling, potential well, qualitative summary of simple harmonic oscillator and Hydrogen atom. Occupation probability and examples.
- Review of wave mechanics
- Particle in a box in different dimensions
- Potential step and barrier
- Tunneling and nuclear alpha-decay
- Quantum harmonic oscillator
- Quantum theory of the Hydrogen atom
- Normal Zeeman effect
- Radiative transitions and selection rules
- Electron spin
- SternGerlach experiment
- Spin-orbit coupling
- Exclusion principle
- Symmetric and antisymmetric and wave functions
- Electron configurations in many electron atoms
- Total angular momentum
- LS and jj couplings

- One and two electron spectra
- X-ray spectra
- Molecular formation
- Electron sharing
- Rrotational and vibrational energy levels
- Electronic spectra
- Maxwell--Boltzmann statistics
- Molecular energies in an ideal gas
- The laser
- Quantum statistics
- Photon gas
- Specific heat of solids
- Free electrons in a metal
- Density of states
- Crystalline and amorphous solids
- Crystal defects
- Ionic and covalent crystals
- Van der Waals forces
- Metallic bond
- Ohm's law
- Band theory of solids
- Brillouin zones and forbidden bands
- Effective mass
- Semiconductors and semiconductor devices

i. Statistical Physics
   - Ensemble-micro canonical
   - Ensemble and thermodynamic connection
   - Two state system and Einstein model of vibrating lattice
   - Canonical ensemble
   - Density matrix
   - Partition function
   - Thermodynamic function and equilibrium
   - Ideal gas-translational, vibrational and rotational motion
   - Para- , orthohydrogen, equipartition of energy
   - Negative temperature
   - Grand canonical ensemble : ideal , Fermi and Bose gas, statistics of photon and phonon gas imperfect gases, Virial expansion and Van der Waal s equations of state, approximate method for free energy, phase transition in model systems, transport equation, Langevin , Fokker-Planck equation , linear response and correlation functions
   - Landau theory of phase transition
   - Gaussian fluctuation and Ginzburg criterion
   - Time dependent GL theory
   - Gross-Pitaevskii equation
   - Scaling and universality
   - Universality classes renormalization
   - Fixed point and RG flow
   - Macroscopic Quantum Phenomena – Super-fluidity, Magnetic exchange, Noise and stochastic processes, thermal fluctuation, Nyquist noise, Brownian motion, diffusion, Einstein relation, fluctuation and dissipation
   - Probability and distribution, Gaussian and Poisson distribution, central limit theorem, shot noise

j. Condensed Matter Physics
- Structure of solids, lattice translation, symmetry, unit cell, simple crystal structures, diffraction - Bragg s law, structure factor, different methods for structure determination, point defects, dislocation
- Crystal binding - ionic, covalent, weak bonding
- Cohesive energy and compressibility
- Vibration of lattice - mono- and di-atomic chains , periodic lattice, phonons, phonon spectrum , heat capacity
- Thermal expansion and resistivity, free electron theory
- Periodic potentials in one dimension, electrons in weak periodic potential, tight binding approximation, bands , Brillouin zone, motion in magnetic field
- Semiconductors: intrinsic and extrinsic semiconductors, hole, effective mass, impurity band conduction, p-n junction, Schottky barrier, quantum Hall effect
- Optical properties, dielectric, ferroelectric, displasive and soft mode, magnetism, dia- , para-magnetism, Curie-Weiss law, Van Vleck and Pauli paramagnetism, ferro- , anti- and ferrimagnetism
- Exchange interaction, spin wave, resonance absorption, dilute magnetic alloys
- Superconductivity: phenomenology, GL theory and some ideas of microscopic origin

k. Electrodynamics
- Electrostatics and magneto statics in vacuum and in media
- Maxwell's equations
- Poynting vector
- Wave equation
- Polarisation
- Reflection and refraction of electromagnetic waves at the interface between dielectric media
- Brewster's law
- Reflection from conducting surfaces
- Potential formulation, gauge transformations, Lorentz and Coulomb gauge, wave equation, electromagnetic waves. Retarded potentials, field of a uniformly moving charge, Lienard-Wiechert potentials
- Radiation from oscillating electric and magnetic dipoles and antennas
- Optical dispersion in materials, resonant absorption, anomalous dispersion
- Frequency dispersion characteristics of dielectrics, conductors and plasmas
- Causality in the connection between D and E, Kramer's - Kronig relations
- Maxwell field as a classical 4-vector field
- Electromagnetic field tensor; homogeneous Maxwell equations
- Lorentz invariants
- Wigner rotation and Thomas precession
- Lagrangian formulation of the free Maxwell field
- Stress-energy-momentum tensor
- Field angular momentum
- Conserved quantities
- Inhomogeneous Maxwell equations

- 4-dimensional Greens function of the wave equation for the 4- potential in the Lorentz gauge
- Radiation from accelerated charges in the comoving frame

l. Optics
  - EM waves in anisotropic media
  - Dielectric interfaces
  - Goos-Hanschen shift
  - Waves in periodic layers and absorbing media
  - Polarization
  - Dichroism
  - Liquid crystals
  - Fresnel and Fraunhofer diffraction
  - Kirchhoffs theory
  - Limits of resolution
  - Fourier optics
  - Spatial frequency filtering
  - Phase contrast microscopy
  - Fourier transform holograms
  - Theory of coherence
  - Coherence and interferometry
  - Low coherence interferometry
  - Fourier domain
  - LCI
  - Induced optical effects
  - Strain optic tensor
  - Induced birefringence
  - Electro-optic effects
  - Modulators and switches
  - Acousto-optic interaction
  - Raman-Nath and Bragg regime
  - Co- and contra-directional coupling
  - A-O devices
  - Magneto-optic interaction
  - Basic guided wave optics
  - Laser systems basics
  - Linewidth
  - Mode locking and Q-switching
  - Confocal resonators

m. Thermal Physics
  - Laws of thermodynamics: zeroth, first, second & third
  - Entropy, free energy, enthalpy, and their implications and applications, Maxwells thermodynamic relations
  - Heat engines, Carnot engine, thermodynamic phase transitions, Clausius-Clapeyron equation, phase equilibrium and Gibbs phase rule, blackbody radiation (Stefans law), thermodynamic description of magnetism, superconductivity and ionic phenomena, Joule-Thomson effect
  - Kinetic Theory of gases: Brownian motion, Maxwell-Boltzmann distribution law, collision parameters and its experimental determination

- Transport phenomena: diffusion, effusion, thermal conduction; viscosity, relaxation time, principle of equipartition of energy, specific heat capacity of solids and gases, classical theory of specific heat of solids

22. Masters in Business Management
  a. Financial Accounting
     - Basic Financial Statements. Basic concepts and conventions in Financial Accounting
     - Science of Accounting
     - Introduction to Accounting for Inventories, Accounting for Receivables, Fixed Assets, Depreciation and Amortization.Accounting for Liabilities, Accounting for Shareholder Equity.Accounting for Limited Companies, Company Final Accounts, Income Statement and Balance Sheet.Annual Report and its Contents; Statement of Cash Flows, Operating Cash Flow, Investment Cash Flow, Financing Cash Flow.Analysis of Financial Statements, Comparative Statements; Common Size Statements; Ratio Analysis, Du-Pont Analysis, Earnings Quality Analysis
  b. Statistical Methods for Management
     - Presentation of statistical data
     - Theory of linear correlation and regression (simple and multiple
     - Theoretical frequency distribution of one variable (discrete and continuous
     - Testing of goodness of fit
     - Small sampling distribution
     - Analysis of variance (one way) Non-parametric tests
  c. Marketing Management
     - Product Management, Product Characteristics and classification, Differentiation, Product and Brand Relationships, Packaging
     - Branding, Brand equity, Building, Measuring and Managing Brand equity; Branding Strategy, Brand positioning. Marketing Strategies and different sages across the Product Life Cycle.
     - New Product Development, New product Development Process, Theory of Diffusion of Innovation. Services Marketing, Marketing strategies for Service Firms, Managing Service Quality. Setting the Price, Adapting the Price, Initiating and responding to price cuts. Marketing Channels and Value Networks, Role of Marketing Channels, Channel Design Decisions, Channel Management Decisions, Channel Integration, Channel Conflict, E-Commerce. Wholesaling Types of retailers, Retail Formats, Strategic Decisions in Retail
     - Global trends in Retailing. Logistics management Developing and Managing an Advertising Program
     - Public Relations
     - Direct Marketing
     - Personal selling and Sales Force Management Rationale for Global Marketing; Key decisions in Global Marketing, Strategy for Global Markets
  d. Operation Management
     - Different production processes, batch, assembly, continuous etc, process analysis
     - Forecasting Methods, time series, moving average, exponential smoothing, linear regression and causal relationship forecasting using multiple regression, technological forecasting. ïWork analysis and measurement, job design , work measurement, work methods, socio-technical systems, Layout designing, product, process and cellular layout, assembly line balancing, service layouts.
     - Aggregate plans and master production schedules, MRP, MRP II, lot-sizing, MPS, operations scheduling, priority rules and techniques, work centre and personnel

scheduling.ïInventory management, types, models, systems, inventory control.ïProjects Management, network planning models, PERT/CPM, time-cost models, resource management. Fundamentals of quality management, TQM philosophy, introduction to six-sigmaïDesign and use SQC charts [process capability, x-bar, R, p and c-charts, acceptance sampling.
- Facets of world class manufacturing, lean manufacturing aspects
  e. Economics for Management
    - Fundamentals of Microeconomics and Macroeconomics, Demand and Supply Analysis, Utility Analysis, Production Analysis and Cost Analysis Market Analysis Public Goods and Externalities Asymmetric Information Measurement of Macroeconomic Variables Income and Employment Determination National Income Accounting Aggregate Demand and Aggregate Supply Demand for Money and Supply of Money Inflation and Deflation, Monetary and Fiscal Policies Investment Analysis Foreign Trade and Balance of Payments, Foreign Exchange and Foreign Direct Investment
  f. Human Resource Management
    - Job analysis and job design Human resource planning Recruitment and selection processes Placement, Induction, Internal mobility and separation Career planning for the employees Training and development methods HRD in India Techniques of performance appraisal Job evaluation Wage and salary administration Employee welfare, safety and health Job stress, counseling and Mentoring

23. Masters in Human Resourse Management
  a. Marketing Management
    - Introduction to Communication Modes of Communication: Verbal, non verbal and digital Barriers to communication Listening International and intercultural communication Group and team communication Communicating in meetings Persuasive communication: Negotiation and conflict management Communicating for leadership & organizational change

  b. Business Economics
    - Nature and scope of business economics; Demand and supply analysis; Notion of elasticity- theoretical concepts and managerial applications; Market equilibrium; Stability of equilibrium; Analysis of comparative statics; Demand forecasting; Theory of production and costs; Measurement of productivity; Optimal allocation of resources- output maximization subject to cost constraint, cost minimization subject to output constraint, and profit maximization; Price and output decisions under different market forms; Pricing under uncertainty; Cost-plus pricing and mark-up pricing; Average cost pricing; Managerial theories of firms; Linear programming and input-output analysis; Project evaluation.

  c. Financial Management
    - Analysis of transactions and regulatory stipulations, the flow through into balance sheet income statement and cash flow construction and appraisal; Efficiency and effectiveness of financial statements are examined through study of ratios, working capital management, concepts and methods of classification of assets, liabilities, income expenditure and the reporting of financial flows, earning per share, interim and find submissions, and on segments within or a part of business enterprises; Focus provided on modalities and issues of planning capital structure, theories of capital structure , traditional and modigliani miller position, forms of capital structure, cost of capital and dividend policies, elements of international finance

d. Organisation Structure and Management
   - Organization theory and design and the external environment; organizational structure and design; Organization size, life cycle, and design; Fundamentals of organizational structure; Organizational design process: innovation process, resistance to change, change agents, information systems and control, organizational culture; Managing dynamic processes: decision making process, power and politics; Inter-departmental relations
e. Individual and Group Dynamics
   - Organizational behaviour: nature, scope, and model, research in OB; Perception: perceptual selectivity, perceptual organization, social perception, attribution process; Attitudes and values: sources and change; Personality: determinants, assessment, and self-development; Learning: sources, principles applicable training; Motivation: theories and applications; Human resourcefulness, skills and competencies; Transactional analysis: ego states, types of transaction, games; Group behaviour: group development, group decision making; Power and politics: bases of power, political implications of power; Leadership: theories, effectiveness; Conflict resolution and negotiation
f. Business Communication
   - Communication in business: communication and organizational effectiveness; formal and informal communication systems; communication networks and communication technology; Written: Effective business writing (style, wordusage, organization, mechanics, and forms) for specific purposes; business report writing, meeting, agendas and minutes; employment-process communication (cover letter, resume, follow up writing); Oral: Speaking and listening skills; conversation skills, interview and group discussion skills; public presentation (research, organization and delivery); business etiquette and protocol; Nonverbal and technical: voice and delivery, body language basics, emails and web pages
g. Strategic Management
   - Basic concepts: Definition and framework of strategy, Concept of business model,ïDimensions of strategic decisions and different types of strategies, strategic management process, strategic business unitsïStrategic Direction, Vision, Mission and Objectives, Strategic analysis, Definition of environmental scanning, analysis of macro and micro environment, PEST analysis, scenario analysis; ïAnalysis of industry environment, the structural analysis of competition, strategic groupïAnalysis of Company Resources and Competitive Capabilities; Identifying firmâs capabilities, SWOT analysis, core competence; ïStrategic Choices, Generic Strategies, The value chain analysis, five generic competitive advantages; Grand Strategies, Long term objectives, balance score card, internal growth strategies, external growth strategies;ïStrategies for Competing in Global Market, The difference of global competition, cross country differences, strategic advantage of nations. ïStrategic Implementation: Organizational structure and design, organizational culture and leadership, management of change and communication, restructuring and reengineering, benchmarking.ïStrategic Evaluation, Monitoring and Control, Seeking sustainable competitive advantage, establishing strategic controls, Corporate Governance and Social Responsibility. Knowledge management, Technology management, managing innovation and creativity, learning organization
h. Production and Operation Management
   - Linkage between operational efficiency in producing and distributing goods and competitive advantage is stressed upon. Course Deliverables: ïOperations strategy, operation and competitivenessïDifferent production processes, batch, assembly, continuous etc, process analysisïForecasting Methods, time series, moving average, exponential smoothing, linear regression and causal relationship forecasting using multiple regression, technological forecasting. ïWork analysis and measurement, job

design, work measurement, work methods, socio-technical systemsïLayout designing, product, process and cellular layout, assembly line balancing, service layouts.ïAggregate plans and master production schedules, MRP, MRP II, lot-sizing, MPS, operations scheduling, priority rules and techniques, work centre and personnel scheduling. Inventory management, types, models, systems, inventory control.ïProjects Management, network planning models, PERT/CPM, time-cost models, resource management.ïFundamentals of quality management, TQM philosophy, introduction to six-sigmaïDesign and use SQC charts [process capability, x-bar, R, p and c-charts, acceptance sampling. Facets of world class manufacturing, lean manufacturing aspects.

i. Manpower Economics
    -   Nature and scope; Human capital formation; Employment and manpower utilization: supply of and demand for labour, pricing of labour under various market forms, labour unions and collective bargaining, compensating wage differentials, labour market discrimination; Concepts and patterns of unemployment and underemployment; Emergence of education as a work prerequisite; Returns to investment in education; Economics of training and motivation; Manpower planning: quantitative and âqualitative techniquesâ Forecasting and auditing of manpower; Manpower planning and total quality management; Comparative manpower planning and development policies of selected countries

j. Human Resource Systems
    -   Issues in employee management; Job analysis and job design; Human resource planning; Recruitment and selection, career planning; Performance appraisal; Wage and salary administration; Employees welfare, safety and health; HR Audits; Human resource information system; Strategic HRM; International

k. Industrial Relations
    -   Evolution of industrial relations, IR system in India; Labour-management relations: trade unionism, collective bargaining, employee grievances, employee discipline, industrial conflict, labour welfare and social security; Workers' participation in management; India and international labour standards; Judicial activism, alignment, labour policy and industrialization, strategies; New paradigms of industrial relations

l. Research Methodology
    -   Hypothesis: sources, types and characteristics; Sample survey: sample and census survey, probability, nonprobability and mixed sampling; Methods of data collection: historical method, case study, observation, ethnographic methods, interview, questionnaire, focus group discussion, participatory rural appraisal, experimental method, pretesting, and pilot survey; Scaling techniques different scales, item analysis, reliability, validity; Method of secondary data collection: sources, sample criteria, characteristics; Data analysis: descriptive statistics, mean difference test, analysis of variance and experimental design; Bivariate and multivariate correlation and regression; Factor analysis, Cluster analysis, Discriminant analysis, Structural equation modelling, non-parametric statistics, Content analysis; Report writing: review, qualitative, and empirical article writing

24. Masters in Medical Science and Technology
    a. Quantitative Techniques in Medicine
       - Elementary matrix theory and inverse of a matrix, solutions of system of linear equations its application in bioscience.
       - Bayes' Theorem, Binomial, Poisson and Normal distributions and its applications in medicine
       - Categorical and numerical data, Box-Whisker's plot, Stem-and-leaf plot and histogram, central tendency and dispersion. Diagnostic and prognostic studies, scatter plots, correlation analysis, linear and logistic regression techniques with ANOVA and
       - model goodness of fit
    b. Medical Biotechnology
       - Techniques for analyzing protein structure and function, gene expression, protein-protein interactions and the proteome
       - The correlation of protein structure and expression to various diseases
       - The principles and practices of initiation, cultivation, maintenance, preservation of cell lines and applications
    c. Physics for Medicine and Biology
       - Wave Mechanics
       - Statistical Mechanics
    d. Medical Imaging
       - Spiral/ Helical CT
       - Ultrasound Imaging:Ultrasound (US) - Nature, propagation, attenuation & reflection, acoustic impedance
       - US Transducers
       - Microscopic Imaging
    e. Medical Electronics
       - Concepts of frequency, signal and noise
       - Oscillators: Special case of feedback system
       - Operational amplifier
       - Digital Electronics
    f. Medical Instruments
       - Transducers and electrodes:
       - Origin of bio-potential electrodes, Electrode theory, Different types of electrodes, Hydrogen electrode, Calomel electrode, Ag/AgCl electrode, pH, pCO_2 electrodes.
       - Interference and Shielding & Guarding, Patient Safety.
       - Instrumentation for Clinical Laboratory: Measurement of pH value of blood, ESR measurement, hemoglobin measurement, oxygen and carbon-di-oxide concentration in blood
       - Therapeutic and Prosthetic Devices