# SYLLABUS

## For

## Librarian (Level-9A) (01202216) & Librarian (Level-10) (01202217)

**Unit – I**

1. Data, Information, Knowledge and Wisdom.
2. Information Life Cycle - Generation, Collection, Storage and Dissemination.
3. Role of Information in Planning, Management, Socio-economic, Cultural, Educationaland Technological Development.
4. Information Science - Relationship with other subjects, Information Society andKnowledge Society.
5. Communication – Concept, Types, Theories, Models, Channels and Barriers; Trendsin Scholarly Communication.
6. Information Industry - Generators, Providers and Intermediaries.
7. IPR and Legal Issues - Categories, Conventions, Treaties, Laws.
8. Plagiarism: Concept and Types.
9. Right to Information Act (RTI); Information Technology Act.
10. National Knowledge Commission; National Mission on Libraries.

**Unit – II**

1. Historical Development of Libraries in India; Committees and Commissions onLibraries in India.
2. Types of Libraries – Academic, Public, Special and National.
3. Library Legislation and Library Acts in Indian States; The Press and Registration of Books Act; The Delivery of Books and Newspapers (Public Libraries) Act.
4. Laws of Library Science.
5. Library and Information Science Profession - Librarianship as a Profession, Professional Skills and Competences; Professional Ethics.
6. Professional Associations - National – ILA, IASLIC, IATLIS; International – IFLA, ALA, CILIP, ASLIB, SLA; Role of UGC, RRRLF and UNESCO in Promotion and Development of Libraries.
7. Library and Information Science Education in India.
8. Library Public Relations and Extension Activities.
9. Type of Users - User Studies, User Education.
10. Information Literacy - Areas, Standards, Types and Models; Trends in Information Literacy.

**Unit – III**

1. Information Sources - Nature, Characteristics, Types and Formats.
2. Sources of Information - Primary, Secondary and Tertiary; Documentary and Non-Documentary.
3. Primary Information Sources (Print and Electronic) - Journals, Conference Proceedings, Patents, Standards, Theses & Dissertations, Trade Literature.
4. Secondary Information Sources (Print and Electronic) - Dictionaries, Encyclopedias, Bibliographies, Indexing & Abstracting, Statistical sources, Handbooks and Manuals.
5. Tertiary Information Sources (Print and Electronic)- Directories, Year Books, Almanacs.

6. Reference Sources - Bibliographical, Biographical, Educational, Language and Geographical.
7. Electronic Information Resources - Subject Gateways, Web Portals, Bulletin Boards, Discussion Forums /Groups.
8. Databases: Bibliographic, Numeric, Full text, Multimedia; Open Access Databases.
9. Institutional and Human Resources.
10. Evaluation of Reference Sources and Web Resources.

## Unit - IV

1. Community Information Services.
2. Reference Service – Concept and Types; Referral Services
3. Alerting Services - CAS, SDI, Inter Library Loan and Document Delivery.
4. Mobile based Library Services and Tools – Mobile OPAC, Mobile Databases, Mobile Library Website, Library Apps, Mobile Library Instructions, Augmented Reality, SMS Alerts, Geo-Location, Reference Enquiry.
5. Web 2.0 and 3.0 - Library 2.0- Concept, Characteristics, Components; Instant Messaging, RSS Feeds, Podcasts, Vodcasts, Ask a Librarian
6. Collaborative Services- Social Networks, Academics Social Networks, Social Tagging, Social Bookmarking.
7. Web – Scale Discovery Services
8. National Information Systems and Networks: NISCAIR, DESIDOC, SENDOC, ENVIS, INFLIBNET, DELNET, NICNET, ERNET, National Knowledge Network (NKN), Biotechnology Information System Network
9. International Information Systems and Networks: INIS, AGRIS, INSPEC, MEDLARS, BIOSIS, ERIC, Patent Information System (PIS), Biotechnology Information System (BIS).
10. Library Resource Sharing and Library Consortia – National and International.

## Unit - V

1. Universe of Knowledge - Nature and Attributes; Modes of Formation of Subjects.
2. Knowledge Organisation - Classification – Theories, Cannons, and Principles; Simple Knowledge Organisation System (SKOS), Taxonomies, Folksonomy, Trends in Classification.
3. Mapping of Subjects in Library Classification Schemes – DDC, UDC and CC.
4. Knowledge Organisation: Cataloguing - Cannons and Principles; Centralized and Co-operative Catalogue; Library Cataloguing Codes: CCC and AACR - II.
5. Standards of Bibliographic Record Formats and Description – ISBD, MARC 21, CCF, RDA, FRBR, Bibframe.
6. Standards for Bibliographic Information Interchange & Communication – ISO2709, Z39.50, Z39.71.
7. Metadata Standards: Dublin Core; MARC21, METS, MODES, EAD.
8. Indexing Systems and Techniques: Assigned - Pre-coordinate; Post-Coordinate; Derived- Title-based; Vocabulary Control.
9. Abstracting – Types and Guidelines.
10. Information Retrieval System – Features, Components, Models and Evaluation.

## Unit - VI

1. Management - Principles, Functions and Schools of thought.
2. Library and Information Centers Management - Book Selection Tools and Principles;

Library Acquisition, Technical Processing, Circulation, Serial Control, Maintenance and Stock Verification; Preservation and Conservation; Hazards and Control Measures of Library Materials.

3. Human Resource Management – Planning, Job Analysis, Job Description, Job Evaluation, Selection, Recruitment, Motivation, Training and Development, Performance Appraisal; Staff Manual.
4. Financial Management in Libraries - Sources of Finance, Resource Mobilisation, Budgeting Methods; Cost Effective and Cost Benefit Analysis, Annual Reports & Statistics; Library Authority and Committee.
5. Project Management - SWOT, PEST, PERT / CPM.
6. Total Quality Management (TQM) - Concepts, Principles and Techniques, Six Sigma; Evaluation of Services of Libraries and Information Centers.
7. Library Building, Furniture and Equipments; Green Library Building; Information Commons; Makers Space; Security and Safety.
8. Management Information System (MIS), MBO, Change Management, Disaster Management, Crisis Management.
9. Knowledge Management – Principles, Tools, Components and Architecture.
10. Marketing of Library Products and Services – Plan, Research, Strategies, Mix, Segmentation, Pricing and Advertising; Management Consultancy.

**Unit - VII**

1. Computer Technology - Character Representation (ASCII, ISCII, Unicode); Computer Hardware, Software; Storage Devices; Input and Output Devices.
2. Types of Software - System Software, Application Software.
3. Programming Languages – Object Oriented, Procedural, High Level, Scripting; Web Languages.
4. Telecommunication - Transmission Channels, Mode, and Media, ISDN, PSDN, Multiplexing, Modulation, Standards and Protocols.
5. Wireless Communication – Media, Wi-fi, Li-fi, Satellite Communication, Mobile Communication.
6. Computer Networks - Topologies, Types of Networks – LAN, MAN, WAN.
7. Internet - Web browsers, WWW, E-mail; Search Engines, Meta and Entity Search engines.
8. Internet Protocols and Standards – HTTP, SHTTP, FTP, SMTP, TCP/IP, URI, URL.
9. Hypertext, Hypermedia, Multimedia, Video conferencing, Virtual Reality, Augmented Technologies.
10. Data Security, Network Security, Firewalls, Cryptographic Techniques, Anti-virus software, Anti-spyware, Intrusion Detection System.

**Unit – VIII**

1. Library Automation – Areas, Planning, Selection of Hardware and Software, Implementation and Evaluation; Standards for Library Automation.
2. Barcode, RFID, QR Code, Biometric, Smartcard: Features and Applications.
3. Digitization – Planning, Selection of Materials, Hardware, Software, Process, Issues.
4. Digital Library: Genesis, Characteristics, Types, Architecture; Standards, Formats and Protocols, DOI.
5. Digital Preservation - Need, Purpose, Standards, Methods, Techniques, Projects(National and International).
6. Digital Library Initiatives – National and International.
7. Institutional Repositories - Need, Purpose, Types and Tools; Institutional Repositoriesin India; ROAR, DOAR, SHARPA-ROMIO.

8. Content Management Systems – Architecture, Data Integration, CMS Software – Selection, Implementation and Evaluation.
9. Application of Artificial Intelligence, Expert Systems and Robotics in Libraries;Social Mobile Analytics Cloud (SMAC); Cloud Computing.
10. Ontology – Tools (RDF, RDFS, Potege); Semantic Web, Linked Data, Big Data, Data Mining, Data Harvesting.

## Unit – IX

1. Research - Concept, Purpose, Functions, Scope and Ethics; Types of Research – Basic and Applied, Interdisciplinary and Multidisciplinary.
2. Research Methods: Historical, Descriptive, Experimental and Delphi.
3. Research Design - Selection of Research Problem, Review of Literature; Formulation of Research Problem; Hypothesis – Formulation, Types and Testing; Sampling Techniques.
4. Methods of Data Collection: Questionnaire, Interview, Observation, Library Records, Scales and Checklist.
5. Data Analysis and Interpretation - Presentation of Data; Statistical Methods/ Techniques.
6. Statistical Packages – Spreadsheet, SPSS, Bibexcel, 'R' Statistics.
7. Research Report Writing and Citation Tools – Structure, Style, Contents, Guidelines; Style Manuals; Online Citation Tools; Reference Style Management Tools; Anti- plagiarism Tools; Evaluation of Research Report.
8. Metric Studies in LIS - Bibliometrics, Scientometric, Webometrics, Altmetrics;
9. Impact Factors – Journal, Institutional and Authors;  h-Index, g-Index,  i10 Index.
10. Trends in Library and Information Science Research.


## Unit –X

1. Academic Library and Information System.
2. Public Library and Information System.
3. Special Library and Information System.
4. Health Science Library and Information System.
5. Corporate Library and Information System.
6. Agricultural Library and Information System.
7. Engineering and Technological Library and Information System.
8. Archive, Museums and Oriental Libraries.
9. Community Information System.
10. Information Services and System for Persons with Disability, Children and Women.

# SYLLABUS

# For

| CE | Civil Engineering |
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## Section 1: Structural Engineering

**Engineering Mechanics**: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and its applications; Centre of mass; Free Vibrations of undamped SDOF system.

**Solid Mechanics**: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, Transformation of stress; buckling of column, combined and direct bending stresses.

**Structural Analysis**: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis.

**Construction Materials and Management**: Construction Materials: Structural Steel – Composition, material properties and behaviour; Concrete - Constituents, mix design, short-term and long-term properties. Construction Management: Types of construction projects; Project planning and network analysis - PERT and CPM; Cost estimation.

**Concrete Structures**: Working stress and Limit state design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete beams.

**Steel Structures**: Working stress and Limit state design concepts; Design of tension and compression members, beams and beam- columns, column bases; Connections - simple and eccentric, beam-column connections, plate girders and trusses; Concept of plastic analysis -beamsand frames.

## Section 2: Geotechnical Engineering

**Soil Mechanics**: Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Seepage through soils – two - dimensional flow, flow nets, uplift pressure, piping, capillarity, seepage force; Principle of effective stress and quicksand condition; Compaction of soils; One- dimensional consolidation, time rate of consolidation; Shear Strength, Mohr's circle, effective and total shear strength parameters,Stress-Strain characteristics of clays and sand; Stress paths.

**Foundation Engineering**: Sub-surface investigations - Drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes – Finite and infinite slopes, Bishop's method; Stress distribution in soils – Boussinesq's theory; Pressure bulbs, Shallow foundations – Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations – dynamic and static formulae, Axial load capacity of piles in sands and clays, pile load test, pile under lateral loading, pile group efficiency, negative skin friction.

## Section 3: Water Resources Engineering

**Fluid Mechanics**: Properties of fluids, fluid statics; Continuity, momentum and energy equations and their applications; Potential flow, Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth; Concept of lift and drag.

**Hydraulics**: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, gradually varied flow and water surface profiles.

**Hydrology**: Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, surface run- off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's Law.

Irrigation: Types of irrigation systems and methods; Crop water requirements - Duty, delta, evapo-transpiration; Gravity Dams and Spillways; Lined and unlined canals, Design of weirs on permeablefoundation; cross drainage structures.

## Section 4: Environmental Engineering

Water and Waste Water Quality and Treatment: Basics of water quality standards – Physical, chemical and biological parameters; Water quality index; Unit processes and operations; Water requirement; Water distribution system; Drinking water treatment.

Sewerage system design, quantity of domestic wastewater, primary and secondary treatment. Effluent discharge standards; Sludge disposal; Reuse of treated sewage for different applications.

Air Pollution: Types of pollutants, their sources and impacts, air pollution control, air quality standards, Air quality Index and limits.

Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment anddisposal).

## Section 5: Transportation Engineering

Transportation Infrastructure: Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments.

Geometric design of railway Track – Speed and Cant.

Concept of airport runway length, calculations and corrections; taxiway and exit taxiway design.

Highway Pavements: Highway materials - desirable properties and tests; Desirable properties of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible and rigid pavement using IRC codes

Traffic Engineering: Traffic studies on flow and speed, peak hour factor, accident study, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Traffic signs; Signal design by Webster's method; Types of intersections; Highway capacity.

## Section 6: Geomatics Engineering

Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Horizontal and vertical curves. Photogrammetry and Remote Sensing - Scale, flying height; Basics of remote sensing and GIS.

# SYLLABUS

## For

## Junior Engineer (Civil) (01202213)

**Building Materials:** Physical and Chemical properties, classification, standard tests, uses and manufacture/ quarrying of materials e.g. building stones, silicate based materials, cement (Portland), asbestos products, timber and wood based products, laminates, bituminous materials, paints, varnishes.

**Estimating, Costing and Valuation**: estimate, glossary of technical terms, analysis of rates, methods and unit of measurement, Items of work – earthwork, Brick work (Modular & Traditional bricks), RCC work, Shuttering, Timber work, Painting, Flooring, Plastering, Boundary wall, Brick building, Water Tank, Septic tank, Bar bending schedule, Centre line method, Mid-section formula, Trapezodial formula, Simpson"s rule, Cost estimate of Septic tank, flexible pavements, Tube well, isolates and combined footings, Steel Truss, Piles and pile-caps. Valuation – Value and cost, scrap value, salvage value, assessed value, sinking fund, depreciation and obsolescence, methods of valuation.

**Surveying:** Principles of surveying, measurement of distance, chain surveying, working of prismatic compass, compass traversing, bearings, local attraction, plane table surveying, theodolite traversing, adjustment of theodolite, Levelling, Definition of terms used in levelling, contouring, curvature and refraction corrections, temporary and permanent adjustments of dumpy level, methods of contouring, uses of contour map, tachometric survey, curve setting, earth work calculation, advanced surveying equipment

**Soil Mechanics**: Origin of soil, phase diagram, Definitions-void ratio, porosity, degree of saturation, water content, specific gravity of soil grains, unit weights, density index and interrelationship of different parameters, Grain size distribution curves and their uses Index properties of soils, Atterberg"s limits, ISI soil classification and plasticity chart Permeability of soil, coefficient of permeability, determination of coefficient of permeability, Unconfined and confined aquifers, effective stress, quick sand, consolidation of soils, Principles of consolidation, degree of consolidation, pre-consolidation pressure, normally consolidated soil, e-log p curve, computation of ultimate settlement Shear strength of soils, direct shear test, Vane shear test, Triaxial test Soil compaction, Laboratory compaction test, Maximum dry density and optimum moisture content, earth pressure theories, active and passive earth pressures, Bearing capacity of soils, plate load test, standard penetration test

**Hydraulics**: Fluid properties, hydrostatics, measurements of flow, Bernoulli"s theorem and its application, flow through pipes, flow in open channels, weirs, flumes, spillways, pumps and turbines

**Irrigation Engineering**: Definition, necessity, benefits, 2II effects of irrigation, types and methods of irrigation, Hydrology – Measurement of rainfall, run off coefficient, rain gauge, losses from precipitation – evaporation, infiltration, etc Water requirement of crops, duty, delta and base period, Kharif and Rabi Crops, Command area, Time factor, Crop ratio, Overlap allowance, Irrigation efficiencies Different type of canals, types of canal irrigation, loss of water in canals Canal lining

– types and advantages Shallow and deep to wells, yield from a well Weir and barrage, Failure of weirs and permeable foundation, Slit and Scour, Kennedy"s theory of critical velocity Lacey"s theory of uniform flow Definition of flood, causes and effects, methods of flood control, water logging, preventive measure Land reclamation, Characteristics of affecting fertility of soils, purposes, methods, description of land and reclamation processes Major irrigation projects in India

**Transportation Engineering**: Highway Engineering – cross sectional elements, geometric design, types of pavements, pavement materials – aggregates and bitumen, different tests, Design of flexible and rigid pavements – Water Bound Macadam (WBM) and Wet Mix Macadam (WMM), Gravel Road, Bituminous construction, Rigid pavement joint, pavement maintenance, Highway drainage, Railway Engineering- Components of permanent way – sleepers, ballast, fixtures and fastening, track geometry, points and crossings, track junction, stations and yards Traffic Engineering – Different traffic survey, speed-flow-density and their interrelationships, intersections and interchanges, traffic signals, traffic operation, traffic signs and markings, road safety

**Environmental Engineering**: Quality of water, source of water supply, purification of water, distribution of water, need of sanitation, sewerage systems, circular sewer, oval sewer, sewer appurtenances, sewage treatments Surface water drainage Solid waste management – types, effects, engineered management system Air pollution – pollutants, causes, effects, control Noise pollution – cause, health effects, control

**Structural Engineering**:

Theory of structures**:** Elasticity constants, types of beams – determinate and indeterminate, bending moment and shear force diagrams of simply supported, cantilever and over hanging beams Moment of area and moment of inertia for rectangular & circular sections, bending moment and shear stress for tee, channel and compound sections, chimneys, dams and retaining walls, eccentric loads, slope deflection of simply supported and cantilever beams, critical load and columns, Torsion of circular section

**Concrete Technology**: Properties, Advantages and uses of concrete, cement aggregates, importance of water quality, water cement ratio, workability, mix design, storage, batching, mixing, placement, compaction, finishing and curing of concrete, quality control of concrete, hot weather and cold weather concreting, repair and maintenance of concrete structures

**RCC Design**: RCC beams-flexural strength, shear strength, bond strength, design of singly reinforced and double reinforced beams, cantilever beams T-beams, lintels One way and two way slabs, isolated footings Reinforced brick works, columns, staircases, retaining wall, water tanks (RCC design questions may be based on both Limit State and Working Stress methods)

**Steel Design**: Steel design and construction of steel columns, beams roof trusses plate girders

# SYLLABUS

## For

<span style="background-color: cyan">**Senior Mechanic (Mechanical & Automation Engineering) (01202211)**</span>

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|---|---|
| **ME** | **Mechanical Engineering (Max. Marks : 100)** |

### Section 1: Applied Mechanics and Design

**Engineering Mechanics:** Free-body diagrams and equilibrium; friction and its applications including rolling friction, belt-pulley, brakes, clutches, screw jack, wedge, vehicles, etc.; trusses and frames; virtual work; kinematics and dynamics of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations; Lagrange's equation.

**Mechanics of Materials:** Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; concept of shear centre; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

**Theory of Machines:** Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.

**Vibrations:** Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.

**Machine Design:** Design for static and dynamic loading; failure theories; fatigue strength and the S- N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

### Section 2: Fluid Mechanics and Thermal Sciences

**Fluid Mechanics:** Fluid properties; fluid statics, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings; basics of compressible fluid flow.

**Heat-Transfer:** Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan- Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis

**Thermodynamics:** Thermodynamic systems and processes; properties of pure substances, behavior of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations.

**Applications:** *Power Engineering*: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. *I.C. Engines*: Air-standard Otto, Diesel and dual cycles. *Refrigeration and air-conditioning*: Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes. *Turbomachinery*: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines; steam and gas turbines.

# Section 3: Materials, Manufacturing and Industrial Engineering

**Engineering Materials:** Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

**Casting, Forming and Joining Processes:** Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

**Machining and Machine Tool Operations:** Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming.

**Metrology and Inspection:** Limits, fits and tolerances; linear and angular measurements; comparators; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly; concepts of coordinate-measuring machine (CMM).

**Computer Integrated Manufacturing:** Basic concepts of CAD/CAM and their integration tools; additive manufacturing.

**Production Planning and Control:** Forecasting models, aggregate production planning, scheduling,materials requirement planning; lean manufacturing.

**Inventory Control:** Deterministic models; safety stock inventory control systems.

**Operations Research:** Linear programming, simplex method, transportation, assignment, networkflow models, simple queuing models, PERT and CPM.

# SYLLABUS

## For

| EC | Electronics and Communications (Max. Marks : 100) |
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### Section 1: Networks, Signals and Systems

Circuit analysis: Node and mesh analysis, superposition, Thevenin's theorem, Norton's theorem, reciprocity. Sinusoidal steady state analysis: phasors, complex power, maximum power transfer. Time and frequency domain analysis of linear circuits: RL, RC and RLC circuits, solution of network equations using Laplace transform. Linear 2-port network parameters, wye-delta transformation.

Continuous-time signals: Fourier series and Fourier transform, sampling theorem and applications.

Discrete-time signals: DTFT, DFT, z-transform, discrete-time processing of continuous-time signals. LTI systems: definition and properties, causality, stability, impulse response, convolution, poles andzeroes, frequency response, group delay, phase delay.

### Section 2: Electronic Devices

Energy bands in intrinsic and extrinsic semiconductors, equilibrium carrier concentration, direct and indirect band-gap semiconductors.

Carrier transport: diffusion current, drift current, mobility and resistivity, generation and recombination of carriers, Poisson and continuity equations. P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode and solar cell.

### Section 3: Analog Circuits

Diode circuits: clipping, clamping and rectifiers.

BJT and MOSFET amplifiers: biasing, ac coupling, small signal analysis, frequency response.Current mirrors and differential amplifiers.

Op-amp circuits: Amplifiers, summers, differentiators, integrators, active filters, Schmitt triggers andoscillators.

### Section 4: Digital Circuits

Number representations: binary, integer and floating-point- numbers. Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders.

Sequential circuits: latches and flip-flops, counters, shift-registers, finite state machines, propagation delay, setup and hold time, critical path delay.

Data converters: sample and hold circuits, ADCs and DACs.

Semiconductor memories: ROM, SRAM, DRAM.

Computer organization: Machine instructions and addressing modes, ALU, data-path and control unit, instruction pipelining.

### Section 5: Control Systems

Basic control system components; Feedback principle; Transfer function; Block diagram

representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag- lead compensation; State variable model and solution of state equation of LTI systems.

## Section 6: Communications

Random processes: autocorrelation and power spectral density, properties of white noise, filtering of random signals through LTI systems.

Analog communications: amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, superheterodyne receivers.

Information theory: entropy, mutual information and channel capacity theorem.

Digital communications: PCM, DPCM, digital modulation schemes (ASK, PSK, FSK, QAM), bandwidth, inter-symbol interference, MAP, ML detection, matched filter receiver, SNR and BER.

Fundamentals of error correction, Hamming codes, CRC.

## Section 7: Electromagnetics

Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector.

Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth.

Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart.

Rectangular and circular waveguides, light propagation in optical fibers, dipole and monopole antennas, linear antenna arrays.

# SYLLABUS

# For

| CS | Computer Science and Information Technology (Max Marks : 100) |
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### Section 1: Digital Logic

Boolean algebra. Combinational and sequential circuits. Minimization. Number representations and computer arithmetic (fixed and floating point).

### Section 2: Computer Organization and Architecture

Machine instructions and addressing modes. ALU, data-path and control unit. Instruction pipelining, pipeline hazards. Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).

### Section 3: Programming and Data Structures

Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

### Section 4: Algorithms

Searching, sorting, hashing. Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph traversals, minimum spanning trees, shortest paths

### Section 5: Theory of Computation

Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and contex-free languages, pumping lemma. Turing machines and undecidability.

### Section 6: Compiler Design

Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation. Local optimisation, Data flow analyses: constant propagation, liveness analysis, common subexpression elimination.

### Section 7: Operating System

System calls, processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU and I/O scheduling. Memory management and virtual memory. File systems.

### Section 8: Databases

ER-model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.

### Section 9: Computer Networks

Concept of layering: OSI and TCP/IP Protocol Stacks; Basics of packet, circuit and virtual circuit-switching; Data link layer: framing, error detection, Medium Access Control, Ethernet bridging; Routing protocols: shortest path, flooding, distance vector and link state routing; Fragmentation and IP addressing, IPv4, CIDR notation, Basics of IP support protocols (ARP,

DHCP, ICMP), Network Address Translation (NAT); Transport layer: flow control and congestion control, UDP, TCP, sockets; Application layer protocols: DNS, SMTP, HTTP, FTP, Email.

# SYLLABUS

## For

Theory:

Atomic structure;

Electronic configurations of the atoms e.g Ca, Mg, Mn, Cl etc.

Shapes of s, p and d atomic orbitals, Stability of half-filled and completely filled orbitals,

Fajan's rules,

hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, Eg like methane, ammonia water, carbon di oxide, etc.

Inductive Effect, Electromeric Effect (example based), Homolysis and Heterolysis.

Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals.

Hückel's rule. Example of aromaticity

Aliphatic hydrocarbons: Wurtz reaction, Kolbe's synthesis, from Grignard reagent.

(Saytzeff's rule);

Addition of HX (Markownikoff's and anti-Markownikoff's addition), Statement of Third Law of thermodynamics

Strong, moderate and weak electrolytes,Solubility and solubility product of sparingly soluble salts Simple example formula based

Williamson's ether synthesis,ReimerTiemann Reaction, Gattermann-Koch Reaction,

Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction

Phases, components and degrees of freedom of a system definition with examples

Concept of EMF of a cell.Electrochemical series.( example as per reduction potential)

Carbohydrates: Classification,

Twelve principles of Green Chemistry

Experimental, Surface tension and its determination using stalagmometer.

Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer,

Synthesis of urea formaldehyde polymer( type of polymerization and compound used.)

Titration eg acid base, complexometric, iodometric titration , use of indicator.

**Experiments:**

**Titration: Titrant and titrate ,Indicator range (Methyl orange and Phenolphthalien), ,Acid base titration,**

**Structure of EDTA, Hardness of water(types of hardness), Aspirin**

**Synthesis of polymers e.g., Urea formaldehyde polymer, Nylon,(   compounds used in synthesis)**

**Ph and conductivity of water samples, viscosity and surface tension (formula, definition)**

**Normality, Molarity, Molality, Equivalent weight, Primary and secondary standard substance in lab.**

**Argentometric titrations. Iodometric titration. complexometric.**

# SYLLABUS

## For

**Theory of Machines and Machine Design:**

Concept of simple machine, Four bar linkage and link motion, Flywheels and fluctuation of energy, Power transmission by belts – V-belts and Flat belts, Clutches – Plate and Conical clutch, Gears – Type of gears, gear profile and gear ratio calculation, Governors – Principles and classification, Riveted joint, Cams, Bearings, Friction in collars and pivots

**Engineering Mechanics and Strength of Materials:**

Equilibrium of Forces, Law of motion, Friction, Concepts of stress and strain, Elastic limit and elastic constants, Bending moments and shear force diagram, Stress in composite bars, Torsion of circular shafts, Bucking of columns – Euler‟s and Rankin‟s theories, Thin walled pressure vessels

**Thermal Engineering:**

**Properties of Pure Substances**: p-v & P-T diagrams of pure substance like $H_2O$, Introduction of steam table with respect to steam generation process; definition of saturation, wet & superheated status Definition of dryness fraction of steam, degree of superheat of steam H-s chart of steam (Mollier‟s Chart)

**1st Law of Thermodynamics**: Definition of stored energy & internal energy, 1st Law of Thermodynamics of cyclic process, Non Flow Energy Equation, Flow Energy & Definition of Enthalpy, Conditions for Steady State Steady Flow; Steady State Steady Flow Energy Equation

**2nd Law of Thermodynamics**: Definition of Sink, Source Reservoir of Heat, Heat Engine, Heat Pump & Refrigerator; Thermal Efficiency of Heat Engines & co-efficient of performance of Refrigerators, Kelvin – Planck & Clausius Statements of 2nd Law of Thermodynamics, Absolute or Thermodynamic Scale of temperature, Clausius Integral, Entropy, Entropy change calculation of ideal gas processes Carnot Cycle & Carnot Efficiency, PMM-2; definition & its impossibility

**Air standard Cycles for IC engines**: Otto cycle; plot on P-V, T-S Planes; Thermal Efficiency, Diesel Cycle; Plot on P-V, T-S planes; Thermal efficiency.

IC Engine Performance, IC Engine Combustion, IC Engine Cooling & Lubrication

**Rankine cycle of steam:** Simple Rankine cycle plot on P-V, T-S, h-s planes, Rankine cycle efficiency with & without pump work, Boilers; Classification; Specification; Fittings & Accessories: Fire Tube & Water Tube Boilers Air Compressors & their cycles; Refrigeration cycles; Principle of a Refrigeration Plant; Nozzles & Steam Turbines

**Fluid Mechanics & Machinery:**

**Properties & Classification of Fluid:** ideal & real fluids, Newton"s law of viscosity, Newtonianand Non-Newtonian fluids, compressible and incompressible fluids

**Fluid Statics**: Pressure at a point

**Measurement of Fluid Pressure**: Manometers, U-tube, Inclined tube

**Fluid Kinematics**: Stream line, laminar & turbulent flow, external & internal flow, continuityequation

**Dynamics of ideal fluids**: Bernoulli"s equation, Total head; Velocity head; Pressure head;Application of Bernoulli"s equitation

**Measurement of Flow rate Basic Principles**: Venturimeter, Pilot tube, Orifice meter

 **Hydraulic Turbines**:

Classifications, Principles

**Centrifugal Pumps**:

Classifications, Principles,

**Performance Production**

**Engineering:**

**Classification of Steels** : mild steal & alloy steel, Heat treatment of steel, Welding – Arc Welding,

Gas Welding, Resistance Welding, Special Welding Techniques i.e. TIG, MIG, etc (Brazing & Soldering), Welding Defects & Testing; NDT, Foundry & Casting – methods, defects, different casting processes, Forging, Extrusion, etc, Metal cutting principles, cutting tools, Basic Principles of machining with (i) Lathe (ii) Milling (iii) Drilling (iv) Shaping (v) Grinding, Machines, tools & manufacturing processes.

# SYLLABUS

## For

**Basic concepts**: Concepts of resistance, inductance, capacitance, and various factors affecting them Concepts of current, voltage, power, energy and their units

**Circuit law:** Kirchhoff"s law, Simple Circuit solution using network theorems

**AC Fundamentals**: Instantaneous, peak, RMS and average values of alternating waves, Representation of sinusoidal wave form, simple series and parallel AC Circuits consisting of RL and C, Resonance, Tank Circuit Poly Phase system – star and delta connection, 3 phase power, DC and sinusoidal response of R-Land R-C circuit

**Measurement and measuring instruments**: Measurement of power (1 phase and 3 phase, both active and re-active) and energy, 2 wattmeter method of 3 phase power measurement, Measurement of frequency and phase angle Ammeter and voltmeter (both moving oil and moving iron type), extension of range wattmeter, Multimeters, Megger, Energy meter AC Bridges Use of CRO, Signal Generator, CT, PT and their uses Earth Fault detection

**Electrical Machines** :

a) DC Machine – Construction, Basic Principles of DC motors and generators, their characteristics, speed control and starting of DC Motors Method of braking motor, Losses and efficiency of DC Machines

b) 1 phase and 3 phase transformers – Construction, Principles of operation, equivalent circuit, voltage regulation, OC and SC Tests, Losses and efficiency Effect of voltage, frequency and wave form on losses Parallel operation of  1 phase /3 phase transformers Auto transformers

c) 3 phase induction motors, rotating magnetic field, principle of operation, equivalent circuit, torque-speed characteristics, starting and speed control of 3 phase induction motors Methods of braking, effect of voltage and frequency variation on torque speed characteristic, Fractional Kilowatt Motors and Single Phase Induction Motors: Characteristics and applications

**Synchronous Machines** - Generation of 3-phase emf armature reaction, voltage regulation, parallel operation of two alternators, synchronizing, control of active and reactive power Starting  and applications of synchronous motors

**Generation, Transmission and Distribution** – Different types of power stations, Load factor, diversity factor, demand factor, cost of generation, inter-connection of power stations Power factor improvement, various types of tariffs, types of faults, short circuit current for symmetrical faults Switchgears – rating of circuit breakers, Principles of arc extinction by oil and air, HRC Fuses, Protection against earth

leakage / over current, etc Buchholtz relay, Merz-Price system of protection of generators & transformers, protection of feeders and bus bars Lightning arresters, various transmission and distribution system, comparison of conductor materials, efficiency of different system Cable – Different type of cables, cable rating and derating factor

**Estimation and costing** : Estimation of lighting scheme, electric installation of machines and relevant IE rules Earthing practices and IE Rules

**Utilization of Electrical Energy** : Electric heating, Electric welding, Electroplating, Electric drives and motors

# SYLLABUS

## For

**Electronic Components & Materials**
Conductors, Semi conductor& Insulators; Magnetic materials; Jointing & Cleaning materials for U/G copper cable & OFC; Cells and Batteries (chargeable and non chargeable); Relays, Switches, MCB & Connectors.

**Electronic Devices and circuits**
PN Junction diodes, thyristor; Diode and triode circuits; Junction Transistors; Amplifiers; Oscillator; Multivibrator, counters; Rectifiers; Inverter and UPS.

**Digital Electronics**
Number System & Binary codes; Boolean Algebra & Logic gates; Combinational & Sequential logic circuits; A/D & D/A converter, counters; Memories

**Linear Integrated Circuit**
Introduction to operational Amplifier; Linear applications; Non Linear applications; Voltage regulators; Timers; Phase lock loop.

**Microprocessor and Microcontroller**
Introduction to microprocessor, 8085 microprocessor working; Assembly Language programming; Peripherals & other microprocessors; Microcontrollers

**Electronic Measurements**
Measuring systems; Basic principles of measurement; Range Extension methods; Cathode ray oscilloscope, LCD, LED panel; Transducers

**Communication Engineering**
Introduction to communication; Modulation techniques; Multiplexing Techniques; Wave Propagation, Transmission line characteristics, OFC; Fundamentals of Public Address systems, Electronic exchange, Radar, Cellular and Satellite Communication.

**Data communication and Network**
Introduction to data communication; Hardware and interface; Introduction to Networks and Networking devices; Local Area Network and Wide area network; Internet working.

**Computer Programming**
Programming concepts; Fundamentals of 'C' and C ++; Operators in 'C' and C ++; Control Statements; Functions, Array String & Pointers, File Structure; Data Structure and DBMS

**Basic Electrical Engg.**
DC Circuits; AC fundamentals; Magnetic, Thermal and Chemical effects of Electric current; Earthing - Installation, Maintenance, Testing,

# SYLLABUS

## For

**PC Software** : MS-Windows, MS-Word, MS-Excel & MS-Power Point

**Computer fundamentals** : Evolution of Computers, Hardware & Software, Internet.

**C Language** : Structure, Loop, Control Statements, Arrays, Pointers, Functions, Structure and Union, Files

**Computer Organisation** : Number Systems, Logic Gates, Flip-Flops, Boolean Algebra, DMA, Instruction Sets.

**Information Systems** : Information concepts, Hardware & Software, Overview of Communication Systems, E-Commerce

**Data Structure using C**++ : Object oriented Programming, Data Structures, Stack, Queue, Pointers, Linked List, Searching & Sorting Algorithms

**DBMS fundamentals** : BASIC, Data Models, RDBMS, Relational Algebra, SQL, DDL, DML and DCL Statements, Creating Tables, Equi-Joints, Self Joins, PL/SQL, Functions, Cursor and Triggers.

**System Programming** : Back-ground, Assemblers, Loaders and Linkers, Macro Processors, Compilers

**Operating System using LINUX** : Operating System, Types, Features & Basic Architecture of Unix/Linux System, Unix File System & Structure, Linux Commands for files and directories, Filters and Pipes, Process, Creating and Editing Files with VI Editor, System Administration, Role of System Administrator, Managing User Accounts.

**Web Technologies and Programming :** Internet & Intranet, Hardware & Software like Bus, Ethernet, LAN, Routers, Gateways, Bridge, Switches, Subnet etc. Internet Service Provider, Backbones, NAPs, URL, Domain Names, Email, Web Server and Proxy Server, Web Caches, Web Browser like Internet Explorer, Internet Viruses, Internet Security Issues, Firewall, Data Encryption, Digital Signatures and Certificates, Creating the Website and Home Page, HTML Programming Basics, Syntax and Rules, Search and Search Engine for Internet, Outlook Express and Front Page.

**System Analysis and Design:** System components; system planning: Fact finding techniques: Tools for documenting procedure and decisions; Structured Analysis: Data flow analysis; flow diagrams; Data dictionary; Application Prototype: System Design: software development specification; Design - Input, output, files, control. Procedure, Program specification etc: Design of computer output & its presentation.

**Data and Network Communication:** Data Communication - Distributed processing network criteria, protocol and standards. Topologies etc. OSI model, layers. TPC/IP protocol. Digital to Digital Conversion, Digital to analog Conversion, Digital data transmission. Standards, Modems, Cable Modem. Transmission media Guided & Unguided Media, Performance, Wave length; Multiplexing, DSL. Error detection and correction, VRC, LRC, CRC, Ethernet, Token Bus, Token Ring.

**Java Programming:** JAVA and Internet: Support systems and environment; JVM: Data Type: program structure. Constants & Variables, Type Casting; Operators, Class, Creating Objects, Class Members, Constructors, Overloading, Inheritance, Arrays. Creating Threads: Threads Class; Thread Methods; Thread Priority; Synchronization. Applets: Executable Applet, Adding Applet to HTML, File; passing Parameters to Applets.

**Software Engineering:** Software Process - life cycle models; system engineering: Software Requirements - Functional and non-functional; prototyping; verification; validation. Design Concepts

and Principles - design heuristic; architectural design; user interface design; system design; SCM process. Software testing - types of test; testing strategies; integration and validation testing system testing and debugging. Software Project Management - Measures and measurements; cost estimation; Task Network; Error Tracking; CASE tools.

# SYLLABUS

## For

Afbau Principle, hunds rule, pauli exclusion principle,heisenburg uncertaininty principle.(formula based question)

Periodic trends in periodic table,Electronegativity, /ionization potential etc.

Ionozation enthalpy, electronegativity, atomic radii, ionic bond, covalent bond,melting point and boiling points.boyle's law, Charles Law,avagadro number, ideal gas equation,

Internal energy and enthalpy, hess law,

Buffer solution, strong and weak acid and bases.

Oxidation and reduction simple definition and examples

Preparation of sodium chloride, sodium carbonate,

Carbocations, carbanions.electrophiles, nucleophiles examples.

Acid rain, global warming green house gases( gases responsible for these)


Experiments:

Titration: Titrant and titrate ,Indicator range (Methyl orange and Phenolphthalien), ,Acid base titration,

Structure of EDTA, Hardness of water(types of hardness), Aspirin
Synthesis of polymers e.g., Urea formaldehyde polymer, Nylon,(   compounds used in synthesis)

Ph and conductivity of water samples, viscosity and surface tension (formula, definition)

Normality, Molarity, Molality, Equivalent weight, Primary and secondary standard substance in lab.

Argentometric titrations. Iodometric titration. complexometric.

# SYLLABUS

# For

**Chapter–1:** Physical World

Physics-scope and excitement; nature of physical laws; Physics, technology and society.

## Chapter–2: Units and Measurements

Need for measurement: Units of measurement; systems of units; SI units, fundamental and derived units. Length, mass and time measurements; accuracy and precision of measuring instruments; errors in measurement; significant figures.

Dimensions of physical quantities, dimensional analysis and its applications.

## Chapter–3: Motion in a Straight Line

Frame of reference, Motion in a straight line: Position-time graph, speed and velocity.

Elementary concepts of differentiation and integration for describing motion, uniform and non- uniform motion, average speed and instantaneous velocity, uniformly accelerated motion, velocity - time and position-time graphs.

Relations for uniformly accelerated motion (graphical treatment).

## Chapter–4: Motion in a Plane

Scalar and vector quantities; position and displacement vectors, general vectors and their notations; equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors, relative velocity, Unit vector; resolution of a vector in a plane, rectangular components, Scalar and Vector product of vectors.

Motion in a plane, cases of uniform velocity and uniform acceleration- projectile motion, uniform circular motion.

## Chapter–5: Laws of Motion

Intuitive concept of force, Inertia, Newton's first law of motion; momentum and Newton's second law of motion; impulse; Newton's third law of motion.

Law of conservation of linear momentum and its applications.

Equilibrium of concurrent forces, Static and kinetic friction, laws of friction, rolling friction, lubrication.

Dynamics of uniform circular motion: Centripetal force, examples of circular motion (vehicle on a level circular road, vehicle on a banked road).

## Chapter–6: Work, Energy and Power

Work done by a constant force and a variable force; kinetic energy, work-energy theorem, power.

Notion of potential energy, potential energy of a spring, conservative forces: conservation of mechanical energy (kinetic and potential energies); non-conservative forces: motion in a vertical circle; elastic and inelastic collisions in one and two dimensions.

## Chapter–7: System of Particles and Rotational Motion

Centre of mass of a two-particle system, momentum conservation and centre of mass motion. Centre of mass of a rigid body; centre of mass of a uniform rod.

Moment of a force, torque, angular momentum, law of conservation of angular momentum and its applications.

Equilibrium of rigid bodies, rigid body rotation and equations of rotational motion, comparison of linear and rotational motions.

Moment of inertia, radius of gyration, values of moments of inertia for simple geometrical objects (no derivation). Statement of parallel and perpendicular axes theorems and their applications.

### Chapter–8: Gravitation

Kepler's laws of planetary motion, universal law of gravitation. Acceleration due to gravity and its variation with altitude and depth.

Gravitational potential energy and gravitational potential, escape velocity, orbital velocity of a satellite, Geo-stationary satellites.

## Chapter–9: Mechanical Properties of Solids

Elastic behaviour, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear modulus of rigidity, Poisson's ratio; elastic energy.

## Chapter–10: Mechanical Properties of Fluids

Pressure due to a fluid column; Pascal's law and its applications (hydraulic lift and hydraulic brakes), effect of gravity on fluid pressure.

Viscosity, Stokes' law, terminal velocity, streamline and turbulent flow, critical velocity, Bernoulli's theorem and its applications.

Surface energy and surface tension, angle of contact, excess of pressure across a curved surface, application of surface tension ideas to drops, bubbles and capillary rise.

**PRACTICALS**
i)      **Wavelength of He-Ne laser.**
ii)     **Determine the numerical aperture(NA)of a optical fibre**
iii)    **Energy gap of semi conductor diode.**
iv)     **Time period of bar pendulum**
v)      **Determine planck's constant**
vi)     **Dispersive power of prism**
vii)    **To study the hall effect**
viii)   **Determine the frequency by melde's method**
ix)     **Vi characterstics P-n junction diode**
x)      **Vi characteristics Zener diode**
xi)     **Thermal conductivity of poor conductor by lee's dick method**
xii)    **Charging and discharging of capacitor,**
xiii)   **Vi characteristics of solar cell.**
xiv)    **Refractive index of prism.**