

Scheme of P.S.T. for recruitment to the posts of Lecturer in 12 disciplines (Civil Engineering, Electrical Engineering, Mechanical Engineering, Computer Science & Technology, Electronics & Telecommunication Engineering, Electronics & Instrumentation Engineering, Survey Engineering, Physics, Chemistry, Mathematics, Humanities & Chemical Engineering) for Govt. Polytechnics in the W.B.G.S under the Technical Education & Training Department scheduled to be held on the 24th February, 2019 in two sessions.

1. Type of Test : MCQ Type

2. Full Marks : 100

3. No. of questions : 100 multiple choice questions carrying 1 marks each.

There shall be negative marking for each wrong answer @ $\frac{1}{3}$ mark for each.

4. Duration of Test : 1 hour 30 minutes.

24
syllabus for recruitment to the post of Lecturer in **Computer Science & Technology/Computer Software Technology for Government Polytechnics**

Digital Logic Design :

Fundamentals of Boolean Algebra
Basic gates & Universal gates
Logic minimization techniques
Difference between combinational & sequential logic
Flip-flops, Counter, Shift register etc.

Circuit theory :

DC circuits : linear & non-linear, Kirchoff's law
Impedance and reactance
Superposition theorem, Reciprocity theorem, Thevenin's theorem,
Norton's theorem, Maximum Power Transfer etc.

Basic Electronics :

Elementary semiconductor physics
P-N junction diode, Zener diode,
BJT, FET, MOSFET, CMOS, Operational amplifiers

Computer Organization & Architecture :

Memory interface, cache memory, virtual memory, replacement algorithm,
Arithmetic circuits, Adder, Subtractor, Multiplication, Division
Floating point arithmetic
Input-output interface techniques, DMA, Interrupt.
Pipeline architecture, instruction pipeline, arithmetic pipeline Hazards
RISC & CISC architecture concept

Data Structure

Array, Link list, Stack, Trees, Binary trees, Binary search tree. Tree traversals,
Heap, Sorting & searching techniques and their complexity analysis, Hashing
technique

Programming Languages :

Concepts of C and C++ programming including pointers, malloc, calloc,
realloc, free etc.

Microprocessor & Microcontrollers :-

Difference between microprocessor and microcontrollers 8-bit microprocess (8085 as an example)
Addressing modes, Instruction set, Instruction cycles, machine eye Interrupts, DMA, Parallel interface, Serial interface
Introductory concept of 16 bit processor on 8086

Operating system :

Concepts of synchronization : Semaphore, Critical region, Inter process communication etc.
Process management : Different scheduling techniques.
Memory management & File Management
Deadlock detection, prevention and avoidance.

System Software:

Assembler, Macros, Loader, Linker etc. concept.

Computer Network :

ISO/OSI stack, Ethernet & Token ring architecture, Error control mechanisms, TCP/UDP and sockets, JP(V4), IP(V6) Concept of Hub, Gateway, Switch and router Network security, Cryptography, secret key and public key digital signature, Firewall etc.

Graph Theory :

Graph, Multigraph, Degree of a vertex, Path, Connectivity Complete graph, Regular graph, Bipartite graph, spanning tree, Kruskal's algorithm, Prim's algorithm, euler tour, Hamiltonian graph. Travelling Salesman problem.

Database Design :

E-R diagram, Data flow diagram, Data models: Relational & Hierarchical query Language, Relational algebra, Predicate calculus, Functional dependencies, Normal forms 1NF, 2NF, 3NF, BCNF Transaction & concurrency control.



Proposed arrangement of questions and Syllabus for Lecturer in **Electronics & Instrumentation Engg**

(Noted in the Syllabus Committee meeting held on 29.7.16)

TOPICS

A.

- i) Fundamentals of Electronics
 - ii) Circuit Theory
 - iii) Fundamentals of Instrumentation
 - iv) Analog Electronics
 - v) Digital Electronics
- } 8 – 12 questions

B.

- i) Electrical Measurement & Measuring Instruments
 - ii) Process Instrumentation
 - iii) Electronic Measuring Instruments
 - iv) Process Control
 - v) Industrial Electronics
 - vi) Microprocessor
 - vii) Analytical Instrumentation
 - viii) Electronic Communication Fundamentals
- } 8 – 10 questions

C.

- i) Optical Instrumentation
 - ii) Biomedical Instrumentation
- } 4 questions

~~Maximum number of questions – 26~~

~~Proposed Total marks – Min. 90, Max. 144~~

recruitment to the post of Lecturer in

• Syllabus for **Electronics and
Communication Engineering**

Physical Electronics

Crystal structure, Semiconductor Statistics, Semiconductor Physics, Electron transport.

Computer Programming and Numerical Analysis

Computer programming, Numerical analysis,

Circuit Theory

Graph theory, Circuit elements, Circuit equations, Laplace transforms and related topics, Transient analysis, Sinusoidal steady state analysis, Network theorems.

Electron Device

Metal-semiconductors Junction, Semiconductor-semiconductor junction, Breakdown mechanisms in p-n junctions, Bipolar transistors, Junction field effect transistor (JFET), Insulated gate field effect transistor (IGFET), Power semiconductor devices, Basic optoelectronic devices,

*Compared with prototype/draft approved Syllabus
in file no. 15-31/2013 (Pt. III)
K. Chakraborty
15/5/15*



Electromagnetic Theory Network Synthesis

LC Filter Design,

Signal Theory & Noise

Introduction, Signal definition, different type of signals, Basis function and concept of generalized Fourier series, Sources of noise Noise calculations, Mathematical representation of noise,

Digital logic Circuits

Sequential Circuits flip-flops SR, JK, D and T. Registers, Counters, Interface circuits.

Analog Circuits-I

Diode Circuits, BJT Circuits, Regulated Power supply, FET Circuits, OPAMP Circuits, Feedback amplifier Circuits,

Analog Circuits-II

Digital Circuits & Systems

Analysis and synthesis of sequential circuits, Fault detection and location in combinational circuits, Digital system design, Timing circuits, Arithmetic circuits, Semiconductor Memory.

Analog Communication Systems

Signal transmission through linear systems, Amplitude modulation, Frequency and phase modulation, Demodulation, Radio receiver, System noise calculation.

Transmission Lines and Waveguides

Micro Processors and Microcontrollers

Control Engineering,

Digital Communication Systems

Signal detection, Formatting in base band transmission techniques, Digital modulation techniques, Information theory and coding.

Antennas & Propagation

Antenna, Propagation.

IC Technology

Crystal growth techniques and wafer preparation,

Computer Organization and Architecture IC Design

Introduction Discrete and Integrated Circuit, VHDL and VERILOG Basic language elements, FPGA Design and Architecture.

Communication Switching Systems

Circuit switching, 3 stage matrix switching, resonant transfer method, Time slot interchange technique limitation, Digital space switching Time space time switch, Distributed switching network, Traffic engineering,

Digital Signal Processing

Signal and Systems, Sequences, LTI Systems, Fast Fourier Transform, Typical DSP Hardware,

Digital Control Systems

Z-transforms

Instrumentation and Measurements

Classification of transducers, Digital instruments, CRO, measurement of voltage frequency and phase, Pulse measurement,

Computer Communication Networks

VLSI Design

CMOS circuit design

Microwave Engineering

Microwave passive components and subsystem

Microwave Sources

Microwave Measurement

Wireless Communication Systems

Optical Fiber Communication

Embedded Systems

Advanced Electron Device

Optoelectronic and Display Devices,

High Frequency Devices

Quantum devices

Industrial/Power Electronics

Regulated power supply, SMPS Silicon Controlled rectifier, Single phase, Polyphase, Triggering Circuits, D.C. Motor control, PLC, TRIAC, Power F Inverters using SCRs, UPS, Industrial timer circuits, Induction and Dielect heating ,

Optical Networks

SONET/SDH- multiplexing.

Advanced Mobile Communications

Modulation techniques in wireless communications,

GSM, GPRS, 3G UMTS,

Wireless LAN, IEEE 802.11, WiMAX standard.

Mobil IP, MIP, agent Advertisement and discovery, Tunneling, Encapsulatio
Reverse Tunneling , MIP v6.

Monolithic Microwave Integrated Circuits

Rader & Navigation.

Satellite Communication, Digital Imag
Processing.

ELECTRICAL ENGINEERING :

Paper - I :

Electrical Circuits and Network :

Circuit components, network graphs, KCL, KVL.

Circuit analysis methods : nodal analysis/mesh analysis, basic network theorems and applications.

Transient analysis : RL, RC and RLC circuits.

Sinusoidal steady state analysis, resonant circuits and applications.

Coupled circuits and applications.

Balanced 3-phase circuits.

Two-port networks.

Signals & Systems :

Representation of continuous-time and discrete-time signals & systems, Analysis of signals & systems by Laplace Transform and Z-Transform, Poles & Zeros, Fourier Transform, Sampling and Reconstruction of Signals, analysis of discrete time signals by DFT and FFT.

Field Theory :

Electric Field : Gauss's Integral Law, Electric Dipole Fields, Electric Polarisation and its relation to the Permittivity of Di-electric media, Gauss's Law in differential form, Poisson's and Laplace Equations in different co-ordinates, Energy stored in Electric Field.

Magnetic Field : Ampere's Law and Biot-Savart's Law, Faraday's Law of Electromagnetic Induction, Self & Mutual Inductance, Energy in Magnetic Field, Force due to Magnetic Field.

Maxwell's equations, Wave propagation in bounded media, Boundary Conditions, Reflection and Refraction of Plane Waves, Distributed Parameter circuits.

Analog & Digital Electronics :

Characteristics and equivalent circuits (large and small-signal) of Diode, BJT, JFET and MOSFET.

Diode circuits : Clipping, clamping and rectifiers.

Biasing and bias stability of BJT.

Amplifiers : Single and multi-stage, differential, operational, feed-back and power.

OPAMP circuits, Active Filters.

Sinusoidal oscillators : transistor and OPAMP configurations.

Function generators and wave-shaping circuits.

Boolean algebra; minimization of Boolean functions; logic gates.

Digital IC families (TTL, MOS, CMOS).

Combinational circuits : Arithmetic circuits, code converters, multiplexers and decoders.

Sequential circuits : latches and flip-flops, counters and shift-registers.

Comparators, timers, multivibrators.

Sample and hold circuits, ADCs and DACs.

Semiconductor memories.

Logic implementation using MUX / DMUX and programmable devices (ROM, PLA, FPGA).

Measurement and Instrumentation :

Error analysis, measurement of current, voltage, power, energy, power-factor, resistance

	<p>inductance, capacitance and frequency, bridge measurement, Use of CT and PT.</p> <p>Electronic measuring instruments : multimeter, CRO, digital voltmeter, frequency counter, Q-meter.</p> <p>Transducers : Thermocouple, thermistor, RTD, LVDT, strain-gauge, piezo-electric crystal, use transducers in measurements of non-electrical quantities.</p> <p>Data acquisition systems.</p> <p>Control System :</p> <p>Elements of control systems, block-diagram representation, open-loop & closed-loop systems, principles and applications of feed-back.</p> <p>LTI systems : time-domain and transform-domain analysis.</p> <p>Stability : Routh Hurwitz criterion, root loci, Nyquist's criterion, Bode plots.</p> <p>Design of lead-lag compensators.</p> <p>Proportional, PI, PID controllers.</p> <p>State-variable representation and analysis of control systems.</p> <p>Principles of discrete-control system.</p> <p>Microprocessors and Microcontrollers :</p> <p>Microprocessor architecture, Address/Data and Control lines, Timing Diagram, Internal Register Interrupt mechanism (hardware/software), Memory interfacing, I/O interfacing, Programmable Peripherals, Microcontrollers and Embedded Processors - its architecture.</p>
<p>Paper - II :</p>	<p>Electrical Machines :</p> <p>Principles of electromechanical energy conversion : Torque and emf in rotating machines.</p> <p>DC machines : characteristics and performance analysis, starting and speed control of motors.</p> <p>Transformers : principles of operation, analysis, regulation, efficiency. 3-phase transformers.</p> <p>3-phase induction machines and synchronous machines : characteristics, performance analysis, speed control and braking.</p> <p>Special machines : Stepper motors, brushless DC motors, permanent magnet motors, sing induction motors, AC series motors.</p> <p>Power Electronics & Electric Drives :</p> <p>Semi-conductor power devices : diode, transistor, thyristor, triac, GTO and Power MOSFET characteristic and principles of operation.</p> <p>Diode rectifiers, phase control rectifiers, triggering circuits.</p> <p>Bridge converters: fully-controlled and half-controlled.</p> <p>Principles of choppers and inverters.</p> <p>Basic concepts of speed control of dc and ac motor drives.</p> <p>Linear power supplies and SMPS.</p> <p>Power Systems and Protection :</p> <p>Construction and parameters of overhead lines and underground cables, π and T model principles of active and reactive power transfer, per unit representation, load flow analysis, voltage, active and reactive power, frequency control, tie-line control, economic operation, symmetrical and unsymmetrical faults.</p> <p>Concept of power system stability : rotor angle stability and voltage stability, swing equation, criterion.</p> <p>Line compensation, static VAR system, basic concepts of HVDC transmission and Transmission System (FACTS).</p> <p>Power system protection : principles of overcurrent, differential and distance protection, lines, transformers, busbars and generators.</p>

Circuit breaker : principles of current interruption and arc quenching, restriking voltage, making capacity and breaking capacity, different types of circuit breakers.

Introduction to energy control centre : SCADA and RTUs.

Distribution system : radial and ringmain systems, calculation of voltage drop.

Analog & Digital Communication :

Signals and Spectra: properties of Signals and Noise.

Power Spectral Density and Autocorrelation, Random Signals, Random Process.

Analog modulation Techniques : AM, FM and PM.

Pulse Amplitude modulation and digital communication : PAM, Delta, ASK, PSK, MSK.

Performance of communication systems corrupted by Noise : signal-to-noise ratio, C/I ratio.

Energy Sources :

Present Electrical Power Scenario of West Bengal & India (Generation & Utilisation).

Main components of Thermal and Hydel Power Plant.

Basic theory of small Hydropower, Solar (thermal and photovoltaic), Wind & Bio-energy and other renewable sources.

Pollution from energy sources.

Energy Conservation & Storage.

Energy Management and Audit.

Electrical Utilisation & Illumination Engineering :

Electric heating. Resistance, Arc & Induction Furnaces - basic principles and application, Dielectric Heating - principles & application.

Radiometric and Photometric quantities, Laws of Illumination, Photometry.

Lamps : incandescent, discharge and solid-state types, their efficacies, features and applications.

Magnetic choke and glow starter operation in TL circuit. Difference between electronic and magnetic ballast.

Luminaire - its functions.

General indoor lighting design by Lumen method.

GEOGRAPHY :

Paper - 1 :

PRINCIPLES OF GEOGRAPHY (GROUP - A : PHYSICAL GEOGRAPHY)

Geomorphology

Nature and composition of earth's crust; Structure of earth's interior; Origin, distribution and permanency of Continents and Ocean Basins; Theories of isostasy, continental drift, and plate tectonics; Earth movements - types and effects; Fundamental concepts in geomorphology; Gradational processes - weathering and masswasting; Landforms due to fluvial, glacial, aeolian, coastal and karst processes; Evolution of landscape - cyclic and non-cyclic models; Global hydrological cycle.

Climatology

Atmosphere - nature, composition and structure; Elements and factors of weather and climate, Insolation and Heat-budget; General circulation of winds, Jet Streams and Monsoons; Condensation and Precipitation; Airmass and fronts; Tropical and Extra-tropical cyclones; Thunderstorm and tornado; Climatic classification - principles and application (Koppen, Thornthwaite, Trewartha); Global climatic changes.

Oceanography

Origin of continents and ocean basins; Bottom topography of ocean basins: Indian, Pacific & Atlantic Oceans; Nature, origin and characteristics of continental shelves and slopes, submarine canyons and coral reefs and atolls; Ocean currents: Indian, Pacific and Atlantic oceans; Physical and Chemical properties of ocean water: temperature, salinity and density; TS Diagram and Watermass; Ocean Deposits; Marine Resources.

SYLLABUS FOR PRILIMINARY SCREENING TEST FOR RECRUITMENT TO THE POST OF LECTURER IN
MECHANICAL ENGINEERING FOR GOVT. POLYTECHNICS IN THE W.B.G.S.
UNDER THE TECHNICAL EDUCATION & TRAINING DEPARTMENT

1. ELECTRICAL TECHNOLOGY

Electrical Units, and dimensions. Electro magnetism, Magnetic circuits, D.C.generators and motors, speed control. Starters. Electrical measuring instruments- principles of operation and construction.

2. MATHEMATICS

Function of a single variable: Successive differentiation. Rolle's theorem. Mean value theorems. Taylor's theorem and Maclaurin's series. Maxima and minima. Indeterminate forms. Tangent, normal and curvature.

Functions of several variables; limit and continuity. Partial derivatives. Differentials. Partial derivatives of a composite function. Implicit function. Jacobian. Taylor's theorem. Maxima and minima. Lagrange's method.

Reimann integration : Definition, Properties. Fundamental theorem of integral calculus. Improper integrals. Gamma and Beta functions.

Multiple integrals : Existence of integrals (statement only) Properties of double integral. Evaluation of double integral. Change of the order of integration and change of variables.

3. ENGINEERING MECHANICS

Laws of Coulomb's friction, equilibrium of rigid bodies, principle of virtual work, application of friction in machines, properties of surfaces, centre of mass, and centre of gravity, shear force and bending moment diagrams.

Introduction to elasticity, problems in uni-axial stress field.

Thin-walled beams, unsymmetrical bending, energy principles, Castigliano's theorems, curved beams, thick-walled cylinders under radial pressure. Lamé's equation, theories of failure.

Work-energy principle, momentum principle, central force motion.

P.T.O.

4. PHYSICS

Angular momentum and torque. Moment of inertia. Parallel and perpendicular axes theorem. Calculation of moment of inertia of some common solids. Rotational dynamics of a rigid body.

Newton's law of Gravitation. Calculation of gravitational field and potential of a spherical distribution of mass. Motion under a central force. Kepler's laws.

5. THERMODYNAMICS

Microscopic & Macroscopic viewpoints in Thermodynamics; Fundamental concepts of system, control volume, state, properties, equilibrium, processes etc. Zeroth Law; Survey of units & Dimensions; Forms of energy and energy interactions, heat & work;

Ideal & Real Gases; Equations of state; Compressibility Factor; Generalised compressibility chart; First Law of Thermodynamics for closed systems internal energy;

First Law for Control Volumes; Steady flow & unsteady flow applications.

Definitions of Heat Engine, Heat Pump, Thermal Efficiency, COP; Carnot Cycle.

Second Law of Thermodynamics; Statements and Corollaries; Entropy; Concept of Reversibility and irreversibility.

Second Law analysis of Control Volumes; Concept of Entropy Generation. Reversible work, availability & Irreversibility.

T-ds relations; Maxwell equations; Clapeyron Equation; Clausius-Clapeyron equation, Joule-Thompson Coefficient; Compressibility & expansion co-efficient.

6. MATERIALS & METALLOGRAPHY

Unit cells, packing efficiency and co-ordination number, bonds and bond energy, plastic deformation and mechanical testing of metallic materials.

Strengthening mechanism, heat treatment of steels, cast iron and carbon steels, important alloy steels, important non-ferrous alloys.

7. STRENGTH OF MATERIALS

Thin pressure vessels, torsion of circular shafts, close-coiled helical springs, stresses in beams due to bending and shear.

Deflection of beams, combined bending and torsion, concept of elastic stability with particular reference to buckling of columns. Strain energy.

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10. DYNAMICS OF MACHINES (CONTD.)

Vibration of spring-mass systems, introduction to vibrations of elastic bodies-transverse vibration of beams and critical speed of shafts, Torsional vibration with multiple discs.

11. I.C. ENGINES & GAS TURBINE

Principle of working; basic engine types; comparison of air standard cycles; air cycle analysis with variable specific heats; introduction to fuel air cycle analysis; actual cycles, mep; thermal efficiency.

Combustion calculations related to I.C.Engine fuels. Desirable characteristics for fuels for I.C.engine.

Mixture requirement for S.I.Engine; carburetion pressure drop-flow relation; fuel air-ratio; complete carburetor. Petrol injection. Ignition system in S.I.Engine-Battery, Magneto, and Electronic ignition systems; ignition timing and spark advance.

Fuel oil injection in C.I.Engine-requirements; fuel injection systems; injection pumps and nozzels.

Supercharging I.C.Engine-requirements; supercharging limits; Turbocharging. Scavenging of I.C.Engines-two stroke S.I. and C.I.Engines; scavenging parameters; ideal scavenging processes; actual scavenging; scavenging pumps.

12. MACHINE TOOLS

Machine tool design : Features of construction, function and principles involved in the design of machine tool elements : layout of speeds for various machine tool drives; hydraulic and electric drives; design of gear boxes for speed and feed changes; rigidity and vibration analysis of machine frames: columns, beds and spindles.

Economics of machine tool selection : economic tool life.

Syllabus for recruitment to the post of Lecturer in **Civil Engineering** for Govt. Polytechnics in West Bengal General Service.

I. Theory and Design of Structures

(a) Theory of structures and strength of materials :-

(i) Solid Mechanics - Properties of material, Mohr's circle of stress-strain, plain stress & strain, combined stress, Elastic theories of failure, simple bending, shear, torsion of circular and rectangular sections, columns and struts, moving loads and influence lines for shear force and bending moment for simple and continuous beams and frames.

(ii) Structural Analysis - Analysis of determinate structures. Different methods of analysis of indeterminate structures - moment distribution, slope-deflection, column analogy, strain energy method, three moment theorem, Muller Breslau Principle and application, etc. Analysis of determinate and indeterminate arches.

(b) Steel Design - (Design of Steel Structures) :-

Principle of working stress method, Design of all types of connection, Simple members, Built up sections and frames, Design of Industrial structures and Multistoried frames, Design of steel bridges and tanks of different types, Design of tubular structures, codal provisions for design of all those steel structures including foundation.

Principle of ultimate load design; Plastic design of continuous frames and portals.

(c) Design of Reinforced Concrete and Masonry structures :-

Limit state method of design. Codal provisions for design. Working stress method of design. Concrete mix design & Quality control. Principles of prestressed concrete design, materials, methods of prestressing, losses in prestressing, anchorages. Design of Brick masonry as per I.S. codes.

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Fluid Mechanics and Hydraulics

Fluid properties and definitions, Flow kinematics, continuity momentum and energy equations applicable to fluid flow, Bernoulli's theorem, flow through conduits, flow through open channels, Hydraulic jump, flow through pipes and losses in pipe flows, siphons, pipe network, forces in pipe ends, hydraulic energy grade line, water hammer. Viscosity, definition of ideal fluid.

III. Soil Mechanics and Foundation Engineering :-

- (1) Properties of soils, classifications and interrelationship; definitions of terms used; soil testing in laboratory and in-situ; compaction behaviour, methods of compaction and their choice; permeability and seepage, flow nets, flow under hydraulic structure, uplift and quicksand condition inverted filters, unconfined and direct shear stress, triaxial test, shearing resistance, Earth pressure theories, stability of slopes; compressibility and consolidation. Theories of consolidation, pressure distribution in soils, soil stabilization, soil exploration and penetration tests, Pore water pressure.
- (2) Types of foundation, selection criteria, bearing capacity settlement, laboratory and field tests, codal provisions in all types of foundation including testing of piles etc. Types of piles and their design and layout; Foundations on expansive soils, swelling and its prevention, Design of retaining walls, wells, sheet piles and caissons, Reinforced earth technique and its use.

IV. Surveying :-

Classification of surveys, scales, accuracy; Measurement of distances-by direct and indirect methods, optical and electronic devices, Measurement of directions, Prismatic compass, local attractions; Theodolites-types, Measurement of elevations, trigonometric levelling, contours, Establishment of control by triangulations and traversing. Measurement and adjustment of observation, Computation of coordinates; Errors and their corrections of measurement of length, bearing horizontal and vertical angles and levelling operation, Correction due to refraction and curvatures, Map preparation by plane tabling and photogrammetry; Field astronomy, concept of global positioning system; Remote sensing concepts, map substitutes; Setting out directions and grades; types of curves, setting out of curves and excavation lines for building foundation.

V. Construction Materials, Practices, planning and Management :-

- (1) Building Materials specifications, tests, uses and code provisions.
- (2) Concrete technology - Cement its properties, classification and specification - provisions in I.S. code. Properties of coarse and fine aggregates - provisions in I.S. code, concrete mix design, Laboratory concrete, Ready mixed concrete, field tests for quality control of concrete, concreting equipments.

Earth-moving machineries and pile driving equipments.

Construction planning and management - Bar chart, linked bar chart, work break down structures, Activity-on-arrow diagrams, critical path, probabilistic activity durations, Event-based network, PERT Network, Time Cost study, crashing, Resource allocation, Rescheduling of construction programme.

- (5) Quantity surveying; Methods of valuation, pricing and measurement of works; Rudiments of legal and technical aspects of engineering contracts.

VI. Highway Engineering including Traffic Engg.

Planning of Highway systems, its classification, objects and principles, Geometric design of highway alignment, gradients, super-elevation, camber, sight distances, etc. Horizontal and Vertical curves, Transition curves, grade separations; Segregation of traffic and intersection design. Materials of highway construction its properties and tests. Subgrade and pavement components. Types of pavements & Road drainage. Principles of highway financing. Design of pavements, evaluation of pavement failure and strengthening. Construction methods and quality control measures for highway embankment, subgrade, pavement courses and bituminous surfacings. Elements of Design and construction of highway - Bridges and culverts including their maintenance. Principles of transportation planning; forecasting techniques, origin and destination study; Highway capacity; Arterial routes; one-way roads and bye-pass roads; Ribbon development; Traffic control devices; Traffic study and parking surveys, speed, volume and delay studies; Accident characteristics; Traffic signal; Traffic projection factor.

VII. WATER RESOURCES ENGINEERING

- (1) Hydrology - Hydrologic cycle, Measurements, Computations and statistics; Run off and stream flow, Measuring techniques and computations; Hydrographs, Computations and interpretation; ground water, Estimation, Measurements, Characteristics.

- (2) Irrigation Engineering - Types of irrigation systems and their detail description, soil-water-crop relationship; Types of soils; water requirement of crops; Delta and duty.

Classification of rivers; River Regime Theory; Effects of dams on river regime; River training works.

Irrigation channels; Design principles of irrigation canals, Drainage channels and Navigation canals; canal linings; canal outlets.

Water logging and salt efflorescence, land reclamation.

- (3) Hydraulic structures - Storage Reservoirs; Different types of dams and their design principles; weirs, barrages and their design principles; spillways, Energy dissipation by hydraulic jump; different types of energy dissipation. Headworks; cross drainage works; Falls and Regulators.

II. ENVIRONMENTAL ENGINEERING :-

(1) Water Supply Engineering -

Water uses; Quantity requirements; potable water quality, sources of water, ground water hydraulics; Development of surface source; Reservoir volume, Transmission of water.

Treatment of water; Typical flow-sheets for surface and ground sources; sedimentation, coagulation and flocculation, filtration, disinfection, hardness and chemical softening; Rudiments of Ion-exchange; Elements of rural water supply and removal of Iron, Arsenic and salinity from water.

principles and methods of design of distribution systems, service reservoirs, and intakes for urban and rural water supply.

(2) Waster Water Engineering -

Sanitary Waster Water and stormwater run off ; Quantity estimation, Sewerage systems and their design principles; Sewer construction materials; structural design of sewer; sewer appurtenances; characteristics of domestic sewage; Typical flow-sheets for primary and secondary treatment; Bio-filter, Activated sludge process and Septic tank, Elements of industrial sewage and its treatment; Rural Sanitation its principles and practices.

(3) Environmental pollution and control -

Atmospheric pollution ; Types of pollutants, Natural & man-made sources, Effects of air pollution, unit systems Rudiments of control methods; Elements of noise pollution; Community solid wastes; Sources, Quantity and characteristics, Methods of disposal, Reuse and cycling.

Water quality management; Quality criteria for major of water; Applied stream sanitation.

Syllabus for

Lecturer in **Survey Engg.**

- Measurement of distance
- Chain Surveying
- Compass & Chain Surveying
- Theodolite and Compass Traversing
- Plane table surveying
- Computation of area & Volume
- Levelling & contouring
- Trigonometrical leveling
- Tacheometric Surveying
- Setting out Curves & Building
- Basic Principle of remote sensing & Photogrametry
- Special Instruments

Syllabus for recruitment to the post of Lecturer in
Physics for Govt. Polytechnics in West Bengal General Service.

SYLLABUS

1. **Classical Mechanics** :
Newton's laws of motion; Mechanics of a single particle; Rotational Motion; Gravitation.
2. **General Properties of matter** :
Elasticity; Surface Tension; Viscosity.
3. **Vibrations and Waves** :
Simple Harmonic Motion; General Wave Equations; Vibrations of Strings.
4. **Heat** :
Kinetic theory of gases; Equations of state; Brownian Motion.
5. **Thermodynamics** :
First and second Laws Entropy, Thermodynamic Functions.
6. **Optics** :
Geometrical Optics; eye pieces; physical optics; Interference; Diffraction, resolving power, polarisation.
7. **Electricity and Magnetism** :
Magnetic effects of currents
Varying currents
Alternating currents.
8. **Electronics** :
P - n Junctions, transistors and uses.
9. **Modern Physics** :
Bohr's theory
Millikan's experiment
X-rays, Moseley's Laws, Bragg reflection
Radio-activity, alpha, beta, gamma rays.

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M. A. N.
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Group - A Organic Chemistry

1. **Bonding in organic molecules :**
 σ and π bonds, bond distance, bond angle, and bond energy. Dipole moment of organic molecules. Inductive, resonance and hyperconjugative effect. Hydrogen bond. Tautomerism, Aromaticity, Huckel's rule, aromatic, non aromatic and aromatic compounds. Effects of structure, substituents and solvent on acid and base strength.
2. **Stereo Chemistry of carbon compounds :**
Elements of symmetry. Chirality, Enantiomerism and diastereo isomerism. Optical purity, racemization, resolution. Projection structure of stereoisomers - Fischer, Sawhorse, Newman, Flying - wedge DL, RS and EZ notations. Examples of enantiotopic and diastereotopic ligands and faces. Conformations of alkanes (upto 4 carbon), Cyclohexane, dimethylcyclohexanes and 1, 2 - glycols. Stereoisomerism in allenes and biphenyls (excluding RS notation).
3. **Reaction mechanism :**
General methods of study of mechanism of organic reactions illustrated by examples - use of isotopes, cross-experiment, intermediate trapping, kinetic studies, stereochemistry. Energy profile diagrams of simple organic reactions. Thermodynamic and kinetic control of reactions.
4. **Reactive intermediates :**
Generation, geometry, stability and reactions of carbocations, carbanions, free radicals, carbenes and benzyne.
5.
 - a) **Substitution reaction** - S_N1 , S_N2 , S_Ni and N ϕ P. Electrophilic and nucleophilic substitution of aromatic compounds.
 - b) **Elimination reaction** - E_1 , E_2 , E_1cB and Syn - elimination.
 - c) **Addition reaction** - electrophilic addition to C=C and C \equiv C, nucleophilic addition to C=O, conjugated olefins and carbonyls.
 - d) **Rearrangement reaction :**
Pinacol-pinacolone, Hofmann, Beckmann, Claisen, Baeyer-Villiger, Favorskii.
6. **Chemistry and mechanism of :**
Aldol condensation, Claisen condensation, Perkin reaction, Knoevenagel reaction, Wittig reaction, Michael reaction, Alder reaction, Dieckmann condensation, Friedel-Craft reaction and Von Richter reaction.
7. **Synthetic uses of reagents :**
 OsO_4 , HIO_4 , $Pb(OAc)_4$, SeO_2 , $LiAlH_4$, $NaBH_4$, B_2H_6 , NBS, PCC, Na or Li in liq-NH $_3$, Alkyl lithium, Lithium dialkylcuprate, Lithium diisopropylamide, Aluminium isopropoxide.
8. IUPAC nomenclature. Synthesis and reactions of alkanes, alkenes, alkynes, alkyl halides, ethers, alkanols, alkanones, alkanoids, alkanic acids, esters, amides, nitriles and amines.
9. **Pericyclic reaction :**
Definition and classification. FMO approach of electrocyclic, cycloaddition reactions and sigmatropic H-shifts.
10. Basic principles and applications of UV, IR, and NMR spectroscopy of simple organic molecules. Road-map problem related to spectroscopy and organic reactions.

- 2 -

Group - B Inorganic Chemistry

1. **Chemical bonding :**
 - a) **Ionic bonding :**
polarizing power and polarizability, ionic potential, Fajan's rules.
 - b) **Covalent bonding :**
Lewis structures, VSEPR theory, Valence Bond theory (Heitler-London approach), Directional character of covalent bonds, hybridization, Bent's rule, concept of resonance. Molecular orbital theory (MO) elementary approach sigma and pi bonds, multiple bonding, MO diagrams of simple homonuclear and heteronuclear diatomic molecules and simple triatomic molecules like BeH_2 , CO_2 , BF_3 , bond order, bond energy.
Shapes of the molecules and ions containing lone pairs and bond pair.
 - c) **Weak Chemical forces :**
Vander Waals forces; Hydrogen bonding, Effects of chemical forces on physical properties.
 - d) **Metallic bonding :**
Qualitative ideas of band theory, Conducting, Semiconducting and insulating properties.
2. **Chemical periodicity :**
 - a) **Periodic Table :**
Classification of elements on the basis of electronic configuration, Modern periodic Table (current IUPAC version)
 - b) **Atomic and ionic properties :**
Effective nuclear charge, screening effect, Slater rules, atomic radii, ionic radii, covalent radii, ionization energy, electron affinity, electro-negativity, inert pair effect.
3. **Acid-Base Concepts :**
Bronsted and Lowry's concept, Lewis concept, HSAB principle.
4. **Non-aqueous solvents :**
Liquid ammonia and liquid sulphur dioxide.
5. **Coordination Compounds :**
Double and complex salts, Werner's theory, Chelate complexes, nomenclature of complex compound, stereo chemistry, coordination number, isomerism of coordination compounds – geometrical and optical isomers in respect of coordination numbers 4 and 6.

Bonding in coordination compounds : valence bond descriptions and its limitations, crystal field theory (elementary), Crystal field stabilization energies in weak and strong field cases mainly of octahedral and tetrahedral complexes.
6. **Magnetism and Colour :**
Origin of magnetic moments, paramagnetism, diamagnetism, ferro and antiferromagnetism, orbital and spin contribution, spin only moments of $3d^n$ ions.

Theoretical aspects of d-d spectra (elementary idea) selection rules for spectral transitions.
7. **Organo metallic compounds :**
Definition and classification, Metal-Carbon bonded complexes of transition metals – their preparation, properties and stability. Application of 18 electron rule to carbonyl, nitrosyl and cyanides of transition metals.
8. **The Chemical elements and its compounds :**
 - (a) (i) Group trends and periodic trends of effective nuclear charge, atomic and ionic radii, ionisation energies, electron affinity and electronegativity with respect to s-, p-, d- block elements.
 - (ii) General trends of variation of electronic structures, elemental forms, oxidation states, catenation and properties of important class of compounds such as oxides, oxyacids, halides and formation of complex compounds with reference to the following groups of (i) Li, Na, K (ii) Be, Mg, Ca, Sr and Ba (iii) B, Al, Ga, In, Tl (iv) C, Si, Ge, Sn, Pb (v) N, P, As, Sb, Bi (vi) O, S, Se, Te (vii) F, Cl, Br, I and (viii) Chemistry of noble gases.
9. **Extraction/Preparation/Isolation of the following elements :**
 - (i) Extraction and purification of Li, Mg, Sn, Pb.
 - (ii) Extraction and purification of Ti, V, Cr, Mn, Pt, Ag, Au, U.
 - (iii) Manufacture of Steel, Alloy Steels.
10. **Radioactivity and Atomic structure :**
 - (a) **Radioactivity** : Radioactive decay, half-life, Average life of radio elements, radioactive equilibrium, Group displacement law, isotopes (uses of isotopes), isobars and isotones.
 - (b) **Atomic nucleus** : Fundamental particles of atomic nucleus, nuclear stability, neutron-proton ratio, nuclear binding energy, Nuclear forces.

Transmutation of elements, fission, fusion reactions.

Group - C

Physical Chemistry

1. **Quantum Theory :**

Black-body radiation and Planck's Law, photo-electric effect and photon concept of light, wave particle duality, de Broglie hypothesis, Heisenberg uncertainty principle, Schrodinger's wave equation (time independent), Interpretation of wave function particle in one-dimensional box, quantum numbers, hydrogen atom wave functions separation of radial and angular part, shapes of s, p and d orbitals.

2. **The Gaseous State :**

Kinetic theory of gases, equation of state of real gases, intermolecular interactions, liquefaction of gases and critical phenomena, Maxwell's distribution of speeds, features of kinetic energy distribution, mean speed, root mean square speed, most probable speed, principle of equipartition of energy, specific heats of gases, intermolecular collisions, collision number and mean free-path, viscosity of gases and mean free-path.

3. **The Liquid State :**

Nature of liquid state, surface tension, capillary rise, spreading of liquid over other surface, temperature dependence of surface tension. Measurement of surface tension, viscosity of liquids, origin of viscosity of gases and liquids, determination of viscosity coefficient, Poiseuille's equation, temperature dependence of viscosity coefficients of gases and liquids.

4. **Solid State :**

Forms of solids, laws of crystallography, crystal lattices, crystal systems and crystal classes, Bragg's Law, X-ray diffraction by crystals, crystal structure of NaCl, KCl, structure of diamond and graphite, Lattice energy, Born-Haber Cycle, Einstein equation for heat capacity of solids, Debye equation (elementary concept).

5. **Thermodynamics :**

a) Thermodynamic systems, states, processes, work, heat and internal energy, first law of thermodynamics, work and heat absorbed in different types of processes. Reversible and irreversible process, energy and entropy changes in various processes and their temperature dependence.

b) Second law of thermodynamics, Carnot's cycle and Carnot's theorem, absolute scale of temperature, entropy, state function, entropy change in various processes, entropy – reversibility and irreversibility, Free-energy function criteria for spontaneity and equilibrium, physical concept of entropy, entropy and probability.

c) Application thermochemistry, laws and their applications, Kirchhoff's relation, Maxwell relation, $C_p - C_v$ relation, Joule-Thomson expansion, thermodynamic equation of state, Gibbs-Helmholtz equation, Clausius-Clapeyron relation and phase transition, colligative properties of dilute solutions.

6. **Reaction equilibrium :**

a) Homogeneous equilibrium, relationship K_p, K_c, K_x . Van't Hoff's reaction isotherm (deduction using the Gibbs free energy). Temperature dependence of equilibrium constant, Le-Chatelier's principle, response of equilibrium to different conditions.

b) Ionic equilibrium, solubility product, dissociation constant of weak acids, ionic product of water, pH, buffer solutions, indicators, hydrolysis of salt solutions.

7. **Electrochemistry :**

a) Electrical conductance, weak and strong electrolytes, variation of equivalent conductance with dilution, Kohlrausch law, transport number, determination of transport number by moving boundary method, theory of strong electrolytes, applications of conductance measurements.

b) Galvanic cells, thermodynamic derivation of E.M.F. of chemical cells with examples, Transference cell, liquid junction potential and salt bridge, measurement of e.m.f. of cells and its applications, fuel cells and batteries.

8. **Chemical Kinetics :**

Concentration dependence of rate of reaction, differential and integral rate equations for zeroth, first, second order reactions, rate equations involving reverse, parallel, consecutive and chain reactions, effect of temperature and pressure on rate constant, collision and transition state theories of reaction rates.

9. **Photo Chemistry :**

Absorption of light, Lambert-Beer's law, laws of photochemistry, quantum yield, some typical photochemical reactions: decomposition, CH_3CHO -decomposition, $\text{H}_2 - \text{Br}_2$ reaction, photosensitized reaction, Fluorescence and phosphorescence.

10. **Surface phenomenon and Catalysis :**

Adsorption from gases and solutions on solid adsorbents, adsorption isotherms – Langmuir and B.E.T. isotherm, determination of surface area. Gibbs adsorption isotherms, surfactants, micelle formation. Characteristics and mechanism of homogeneous and heterogeneous catalytic reactions Enzyme catalysis.

SYLLABUS FOR PRELIMINARY EXAMINATION FOR RECRUITMENT TO THE POSTS (LECTURER/~~ASSISTANT PROFESSOR~~ IN MATHEMATICS)

Complex Number : De Moivre's theorem, its applications.
Exponential, Sine, Cosine, Logarithm of a Complex Number.

Theory of Equations : Relation between roots and co-efficients, symmetric function of roots, transformation of equation, multiple root.

Determinant and matrix : Properties and applications.

Inequality : $AM \geq GM \geq HM$ and its applications.

Set Theory :

Basic concepts, mapping, group, ring, field.

Boolean Algebra :

Basic concepts. Boolean variables and functions and their truth tables. NOT, OR and AND gates. Binary systems.

Vector :

Vector addition, Scalar and vector product. Application of vector algebra in geometrical and trigonometrical problems.

Calculus :

Differential Calculus - Sequence, series, Limit, continuity, differentiability, Successive derivatives. Rolle's theorem, Mean value theorem.

Integral Calculus - Indefinite integral, definite integral and its properties, definite integral as limit of sum. Beta and Gamma functions.

Application of Calculus :

Tangent & normal, curvature, pedal equation, curve-tracing, area, rectification.

Differential Equation :

Linear equation, Clairaut's equation, Complementary function, particular integral of higher order. Linear equations with constant Co-efficient.

Geometry :

Translation and rotation of axes. Reduction into Canonical form. Pair of straight lines. Circle, Parabola, ellipse, hyperbola - simple properties.

Equation of straight lines in space, equation of plane.

Numerical Analysis :

Errors in numerical computation - gross error, round off, truncation error, significant figure, absolute, relative, percentage error. Operators - $\Delta \nabla E$

Difference table, Newton's forward and backward interpolation formula.

Probability :

Basic concepts, addition and multiplication rule of probabilities. Conditional probability, Bay's theorem.

Dynamics :

Motion in a straight line under variable acceleration, motion under inverse square law, motion in resisting medium. Impact of elastic bodies, loss of KE in direct and oblique impact.

PUBLIC SERVICE COMMISSION, WEST BENGAL
SYLLABUS FOR RECRUITMENT TO THE POSTS OF LECTURER IN HUMANITIES
IN GOVT. POLYTECHNICS IN W.B.G.S.
UNDER THE TECHNICAL EDUCATION & TRAINING DEPARTMENT, GOVT. OF
W.B.

MODULE – I : FINANCIAL ACCOUNTING

- ❖ Nature of accounting; Users of accounting information; Financial & Management accounting; Qualitative characteristics of accounting information.
- ❖ Double entry book keeping system – Basic accounting equation, meaning of assets, liabilities, equity, revenue and expenses. Accounting Cycle - Recording of transaction: Journal, Ledger and preparation of Trial Balance.
- ❖ Basis of accounting; cash basis and accrual basis.
- ❖ Basic concepts and conventions: entity, money measurement, going concern, cost, realization, accruals, periodicity, consistency, prudence (conservatism), materiality, matching and full disclosures.
- ❖ Reserves and provisions: Meaning; Objective; Types & Accounting
- ❖ Preparation of financial statements: of sole proprietorship
- ❖ business entities from a trial balance – Manufacturing,
- ❖ Trading, P/L A/c and Balance Sheet,
- ❖ Preparation of financial statements: from incomplete records of non-profit organization

MODULE – II : INFORMATION TECHNOLOGY & E-COMMERCE

Fundamentals of Computer

Classification of computers, generation of computers, block diagram of digital computer system, basics of computer hardware components – micro-processor, registers, CPU, I/O devices, storage devices. Translator – Assembler, Compiler and Interpreter, Relationship between hardware and software.

- (a) Computer Memory Hierarchy – primary, secondary and others.
- (b) Basic concept of software. Types of software: System software – Operating systems [characteristics & functions, uses of GUI based O.S.], Application/ Utilities/ General purpose software. Language levels.

Data organization and Data Base Management System

Data organization: Character, field, record, file and database. Types of Data Processing Systems [Serial, Batch, Real-time, Online, Centralized, Distributed], File Organizations [Sequential, Direct, Indexed-Sequential, Relative], Traditional file organization Vs. Database File organization.

- (a) *Data Base Management System:* Concept of Data Base Management System, Important terms of Database [including Entity, Attribute, Primary Key, Foreign Key, Candidate Key, Referential integrity, Table, Views, Data Dictionary]. Types of database [hierarchical, network and relational], Concept of Query and Reports.

Introduction to Internet

Concepts of Internet, Intranet and Extranet, IP Address (IPv4, IPv6), URL, DNS, www.

- (a) Internet Protocols - TCP/IP, UDP, FTP, TELNET, (brief ideas only).
- (b) Language - HTML, DHTML AND XML. (concepts only).
- (c) Email, Creation of email ID, sending and receiving of group mails, surfing of net, search engines, saving and printing of emails.

Security Issues

Network security need, Security threats - Virus, Trojan, Hacking, Spam.

(a) Security Measures - Firewall, Antivirus software.

e-commerce

- a) Meaning. Importance in the context of today's business. Advantages of e-commerce (as compared with traditional system of commerce). E-commerce and e-business. Internet and its relation to e-business. Mobile Commerce-Basic Idea.
- b) Business to Consumer (B to C) model – Basic idea, major activities, major challenges. Models of B to C [portals, e-tailer, content provider, transaction broker] Business to Business (B to B) model – Basic idea, major activities, types of B to B market [independent, buyer oriented, supplier oriented, vertical and horizontal e-market place]. Other models – Business to Government (B to G), Consumer to Consumer (C to C), Consumer to Business (C to B).
- c) Types of E-Payment – Payment card [credit card and debit card], Electronic or digital cash. Electronic or digital wallet. Stored value card [smart card], Basic idea of online banking [core banking solution or CBS]

MODULE – III : COST & MANAGEMENT ACCOUNTING

- ❖ **Introduction:** Definition of Costing, Cost Accounting and Management Accounting. Objectives of Cost Accounting; Importance of Cost Accounting to Business Concern. Relationship between Cost Accounting, Financial Accounting, Management Accounting and Financial Management; Advantages of a Cost Accounting system, Installing a Cost Accounting System, Essentials of a good Cost Accounting System.
- ❖ **Cost concepts, terms and classification of costs:** Cost, Cost object, Cost units and Cost Centres, Types of costs, classification of costs, cost sheet (introduction only), total costs and unit costs. **Costing Methods and Techniques** (introduction only).
- ❖ **Material Costs :** *Purchase of materials:* Purchasing needs and organisation, purchase procedure, documentation, material costs (direct and indirect).
- ❖ **Storage of materials:** Need for storage, location and types, functions of a storekeeper.
- ❖ Various methods of pricing materials issues; Advantages and disadvantages of each method; Comparative analysis; Stock Valuation for Balance Sheet. Treatment of Normal and Abnormal Loss of Materials; Accounting and control of Waste, Scrap, Spoilage and Defectives.
- ❖ **Employee Cost-** Introduction, Recording labour cost: Attendance and payroll procedures (Time-keeping, Time-Booking, Payroll procedure, Payment of wages, Overview of statutory requirements), Idle time (causes and treatment in Cost Accounting), Overtime (its effect and treatment in Cost Accounting), Labour turnover-Causes and methods of calculating labour turnover; cost of labour turnover.
- ❖ **Incentive Systems** –Main Principles for sound system of wage incentive schemes; labour utilisation; Distinction between direct and indirect labour cost; System of Wage Payment and Incentives; System of Incentive Schemes for Indirect Workers; Component of wages cost for costing purpose; Absorption of wages; Efficiency rating procedures.
- ❖ **Overhead :** *Introduction* Definition, Classification of Overhead- Element-wise, Functional and Behavioural; Need for of classifying overhead into fixed and variable; various types of overheads.

- ❖ **Manufacturing Overheads:** Allocation and apportionment of Overhead; Absorption of Overhead: various methods and their application; Treatment of under absorption/over
- ❖ absorption of overheads; Basic concepts of different Capacities.
- ❖ **Activity Based Costing:** Problems of traditional costing; meaning of Activity Based Costing; cost analysis under ABC; advantages and disadvantages; factors influencing application of ABC; installation of ABC.
- ❖ **Marginal Costing and Management Decisions** – Marginal Costing vis-à-vis Absorption Costing; Marginal Costing Techniques; Marginal Cost and Product Pricing; Product Mix and Make or Buy Decisions, Shut Down Decisions (with simple type of problems on different areas of decision making) [14 Classes / 10 Marks]
- ❖ **Budgetary Control:** Budget and Budgetary Control; The budget manual, principal budget factor, preparation and monitoring procedures, preparation of functional budgets (Production, Sales, Materials), cash budget, (idea of master budget), flexible budget.

MODULE – IV : INDIAN FINANCIAL SYSTEM AND FINANCIAL MARKET OPERATIONS

- ❖ **Financial System** : Meaning and significance; Role of finance in an economy, Components (institutions, instruments, markets, etc.), Role of Regulatory Bodies; kinds of finance – Rudimentary finance, Direct and Indirect finance; Role of financial intermediaries. The structure of Indian Financial System
- ❖ **Money and Indian Banking System** : Functions; Alternative measures to money supply in India – Their different components; Commercial Banks – Importance and functions; Structure of Commercial banking system in India; Distinction between Commercial and Central bank; Credit Creation Process of Commercial banks; High powered money – meaning and uses – Concept of Money Multiplier. The Reserve Bank of India: Functions; Instruments of Monetary and Credit control, Main features of Monetary Policy since independence.
- ❖ **Money Market** : Concept, Structure of Indian Money Market, Acceptance Houses, Discount Houses, Call money market, Recent trends of Indian money markets
- ❖ **Capital Market** : Concept, Security market, Primary & Secondary markets- Functions & Role, Functionaries of stock exchanges-Brokers, Sub- Brokers, Jobbers, Consultants, Institutional Investors & NRIs

MODULE – V : BUSINESS COMMUNICATION

- ❖ **Introduction:** definition, objectives, importance, elements, process, forms, models; levels of analysis of business communication; principles of effective communication, barriers to Communication and remedial measures, role of communication in conflict resolution
- ❖ **Types of Communication:** formal and informal communication; grapevine; characteristics of corporate communication; communication network
- ❖ **Tools of Communication:** emergence of communication technology; modern forms of communication – Fax, E-mail, Video Conferencing
- ❖ **Drafting** – notice, circular, resolution, minutes, report; CV writing, business letter writing – offer letter, quotation, status enquiry, confirmation, execution, refusal and cancellation of order, recommendation, credit collection, claim, bank loan

MODULE – VI : ECONOMICS

Theory of Production : Production Function – The Law of variable proportions – Relationships among TP, AP, and MP. Concept of Isoquant and Isocost – Finding the optimal employment of inputs – Ridge lines: the economic region of production – Output expansion path and homogeneous production function.

Theory of Cost : Cost analysis – Different concepts – Accounting and Economic costs, Opportunity cost, Private and social costs; Short run and long run costs. (Lectures 6 / Marks 6)

MODULE – VII : FUNDAMENTALS OF BANKING

Primary functions:

A) Accepting deposits : Demand deposits: Current and Savings; Time deposits-Recurring and Fixed deposits

B) Granting Loans and Advances- Term Loan, Short term credit, Overdraft, Cash Credit, Purchasing, Discounting of bills,

Secondary functions:

A) Agency Functions- Payment and Collection of Cheques, Bills and Promissory notes, Execution of standing instructions, Acting as a Trustee, Executor.

B) General Utility Functions: Safe Custody, Safe deposit vaults, Remittances of funds, Pension payments, Acting as a dealer in foreign exchange.

MODULE – VIII : BUSINESS REGULATORY FRAMEWORK

Consumer Protection And Business Ethics

- ❖ Consumer - Meaning & Concept- Definition-Features
- ❖ Consumerism - Meaning, objectives, Benefits- Consumerism in India
- ❖ Three dimensional concept of consumer.
- ❖ Consumer as a King
- ❖ Consumer as a King-pin of democracy
- ❖ Consumer as a Capital
- ❖ Rights and Responsibilities of Consumers
- ❖ Consumer Movement-Meaning-Definition- Importance, Scope- Features-Need- Objectives
- ❖ Role of Consumer Movement – Government and Consumer Movement- Barriers in development of Consumer Movement in India .
- ❖ Consumer Education -Meaning-Definition-Objectives-Methods& Techniques of Consumer Education.
- ❖ Future of Consumer Movement in India.

MODULE – IX : Business Regulatory Framework

Law of contract 1872 : Nature of contract – Classification – Offer and acceptance, Capacity of parties to contract – Free consent – Consideration – Legality of Objectives – Agreement declared as void – Performance of contract – Discharge of contract – Remedies for breach of contract.

The Indian Companies Act 2013 : Meaning – Scope – Regulatory authorities – Kinds of companies – Formation of companies Limited by shares – Documents related with in corporation – Share capital management and administration.

MODULE – X : TAXATION

(a) Basic Concepts and Definitions under IT Act : Assessee, Previous Year, Assessment Year, Sources of Income, Heads of Income, Gross Total Income, Total Income, Tax Evasion, Tax Avoidance, Tax Planning

(b) Residential Status and Incidence of Tax : Residential Status of Individual only
Heads of Income and Provision Governing Heads of Income : Salaries, Income from House Property.

Heads of Income and Provisions Governing Heads of Income
(a) Profits and Gains from Business and Profession (Individual only) Special Emphasis on sec. 32, 35, 35D, 36, 37, 40A(3), 43B.

(b) Capital Gains Meaning and Types of Capital Assets, Basic Concept of Transfer, cost of Acquisition, Cost of Improvement and Indexation, Computation of STCG and LTTCG, exemptions u/s 54 and 54F, taxability of STCG and LTTCG.

Deductions from Gross Total Income
Basic Concepts, Deductions u/s 80C, 80CCC, 80D, 80DD, 80DDB, 80E, 80G.

ECONOMICS SYLLABUS

- 1. Introduction of Economics:** Central Problems; Basic Economics Concepts; Methods of Economic Analysis
- 2. Micro Economics:** Theory of Consumer Behaviour: Demand Function and Concept of Elasticity; Consumer Equilibrium; Indifference Curve Analysis; Theory of production and Theory of Costs; Market Structure: Various Forms of Market ; Perfect Competition, Theory of Monopoly; Theory of Monopolistic Competition; Oligopoly ; Pricing in Factor Markets: Marginal Productivity; Rent, Interest and Profit
- 3. Macro Economics:** Circular Flow and National Income; National Income Measurement ; Approaches to Employment ,Income and Interest Rate determination: Classical, Keynes (IS-LM) curve, Neo classical synthesis and New classical, Theories of Interest Rate determination and Interest Rate Structure; Demand for and Supply of Money: Money Multiplier Quantity Theory of Money ; Inflation and Unemployment
- 4. Public Finance and its Role in Market Economy:** In stabilization of supply, allocation of resources and in distribution and development. Sources of Govt. revenue, forms of Taxes and Subsidies, their incidence and effects. Limits to taxation, loans, crowding-out effects and limits to borrowings. Public Expenditure and its effects.
- 5. International Economics:** Free trade theory: The Pure Theory of International Trade; Theories of Absolute Advantage; Ricardian Comparative Advantage and Opportunity Cost; Heckscher-Ohlin Theorem and its Extensions; The Stolper-Samuelson Theorem; The Factor-Price Equalisation Theorem; The Rybczynski Theorem; Empirical Testing of Comparative Cost and the Heckscher-Ohlin Theorems. ; Balance of Payments: The Current Account, The Capital Account, The Remaining Items in the Balance of Payments; Autonomous and Accommodating Balance; Deficit and Surplus in the Balance of Payments: The Basic Balance; Gains from trade and welfare; Instruments and theories of trade protection; Multilateralism and WTO; International financial institutions and external debt; Trade and development ; Regional trading blocks
- 6. Growth and Development:** Theories of growth: Harrod's model, Lewis model of development with surplus labour; Balanced and Unbalanced growth, Human Capital and Economic Growth; Research and Development and Economic Growth; Process of Economic Development of Less developed countries: Myrdal and Kuznets on economic development and structural change: Role of Agriculture in Economic Development of less developed countries; Economic development and International Trade and Investment, Role of Multinationals; Planning and Economic Development: changing role of Markets and Planning, Private- Public

Partnership; Welfare indicators and measures of growth - Human Development Indices. The basic needs approach; Development and Environmental Sustainability - Renewable and Non Renewable Resources, Environmental Degradation, Intergenerational equity development.

7. Indian economy : Indian Economy under the British rule ; National composition- structural changes - measurement of National Income; Indian Plans ; Agriculture and economic development - cropping patterns in various parts of the country, different types of irrigation and irrigation systems, storage, transport and marketing of agricultural produce. Technological changes in Agriculture; Agricultural Prices- farm subsidies and minimum support prices; Public Distribution System- objectives, functioning, limitations, issues of buffer stocks and food security; Food processing - scope and significance, location, upstream and downstream requirements, supply chain management; economics of animal-rearing; Land reforms in India; Effects of liberalization on the economy, changes in industrial policy and their effects on industrial growth; Infrastructure: Energy, Ports, Roads, Airports, Railways, etc.; Science and Technology - developments, indigenization of technology and developing new technology. Intellectual Property Rights ; Income and expenditures of the Government- Centre State Fiscal arrangement, Union Budget; Monetary Policy and Banking- RBI, Nationalization of banks and reforms, NPA, Financial inclusion; India's trade and development since independence; Conservation, environmental pollution and disaster management; Linkages between development, extremism and security

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SYLLABUS FOR TESTING APTITUDE FOR THE ENGLISH LANGUAGE FOR POST OF
LECTURER IN HUMANITIES IN GOVT. POLYTECHNICS IN W.B.G.S.

Marks allotted for this portion : 40

Recommended Level of questions: English General at undergraduate

Section I

- A short prose comprehension passage with multiple choice questions— 8
- An unseen poem with multiple choice questions —8
- Identifying figures of speech in given sentences- 4

Section II

- Vocabulary - 8
 1. Word meanings
 2. synonyms
 3. antonyms
 4. homonyms
- Grammar -- 8
 1. Parts of speech
 2. Converting one part of speech to another (noun to verb/adjective etc)
 3. Tense
 4. Voice
 5. Types of sentences and conversion
 6. Articles, conjunctions & prepositions
- Rewriting jumbled sentences in the correct order-4

Syllabus for Chemical Engineering
Cons. with P.S.T for recall to the post of
Lecturer in Chemical Engineering for Govt
colleges

Material Technology

Selection process of engineering materials (General aspects) - Chemical and physical properties of materials - chemical structure: Micro and macro structure - corrosion resistance - chemical activity.

Mechanical properties - stress, strain, strength, hardness, malleability, ductility-elasticity-plasticity-toughness, thermal stability. Types of deformation: Plastic, viscous; plastic deformation of single crystal, poly crystalline metals - slip, twinning, dislocations - visco elasticity - creep in metals, amorphous materials

Chemical Process Calculation

Units and dimensions, temperature, concept of mole. Composition of mixtures, basis of calculations. Fuels, types of fuel, flue gas, Orsat analysis, theoretical air, excess air Partial saturation and humidity, types of humidity.

Material balance nonreactive system - Basic concepts involved in material balance calculations. Material balance problems without chemical reactions: mixing, drying, crystallization, membrane separation, distillation and extraction. Basic concepts of recycle, bypass and purge streams. Material balances for non reactive systems with recycle stream.

Material balance for reactive systems - Chemical equation and stoichiometry, limiting reactant, excess reactant, conversion, selectivity, yield. Material balances for processes with reactions.

Energy balance - Heat capacity, empirical equations for heat capacities, mean heat capacities of gases, Kopp's rule, sensible heat and latent heats, calculation of enthalpy. Heat of formation, standard heat of combustion, law of Hess, calculation of the standard heat of reaction from heats of formation or combustion Enthalpy changes in reactions with different temperatures, calculation of theoretical flame temperature.

Fluid Flow

Flow of fluids incompressible and compressible, hydrostatic equilibrium, manometers, potential flow, boundary layer, the velocity field, laminar flow, Newtonian and non-Newtonian fluids, Newton's law of viscosity, turbulence, Reynolds number and transition from laminar to turbulent flow, Eddy viscosity, flow in boundary layers, laminar and turbulent flow in boundary layers, boundary layer formation in straight tubes, unsteady flows, dimensional analysis

Streamlines and stream tubes, equation of continuity, Euler equation, Bernoulli equation, pump work in Bernoulli equation. Flow of incompressible fluids in conduits and thin layers: friction factor, relationships between skin-friction parameters, average velocity for laminar flow of Newtonian fluids, Hagen-Poiseuille equation, hydraulically smooth pipe, von Karman equation, roughness parameter. Friction-factor chart, equivalent diameter, form friction losses in Bernoulli equation,arcy-Weibach relation, Couette flow

Flow past immersed bodies - Drag, drag coefficients, drag coefficients of typical shapes, Ergun equation, terminal settling velocity, free and hindered settlings, Stokes' law, Newton's law, criterion for settling regime, fluidization, conditions for fluidization, minimum fluidization velocity.

Transportation of fluids - Pipe and tubing, joint and fittings, stuffing boxes, mechanical seals, gate valves and globe valves, plug cocks and ball valves, check valves.

Classification and selection of pumps, blowers and compressors. Pumps - developed head, power requirement, suction lift and cavitation, NPSH, constructional features and working principle of single suction volute centrifugal pump, characteristic curves of a centrifugal pump, reciprocating pumps, comparison of devices for moving fluids, constructional features and working principle of jet ejectors, compressors.

Metering of fluids - Constructional features and working principles of: venturi meter, orifice meter, rotameters, pitot tube, target meters, vortex-shedding meter, turbine meter, magnetic meters. Application of Bernoulli equation to venturi meter and orifice meter, flow rate calculations from the readings of venturi meter, orifice meter and pitot tube.

Mechanical Operation

Particulate solids - Characterization of solid particles, particle shape, particle size, mixed particle sizes and size analysis, specific surface of mixture, average particle size, screen analysis: standard screen series, screen effectiveness, capacity and effectiveness of screens. Size measurements with fine particles.

Size reduction - Principles, energy and power requirements in size reduction, crushing efficiency. Rittinger's and Kick's laws, Bond crushing law and work index. Types size-reduction equipment. Crushers: jaw crushers, gyratory crushers. Grinders: hammer mills and impactors, tumbling mills, action in tumbling mills. Ultrafine grinders: fluid energy mills. Cutting machines: knife cutters. Open-circuit and closed circuit operation.

Separation due to motion of particle in fluids- Principles of Gravity settling processes, gravity classifiers, sorting classifiers: sink-and-float methods, differential settling methods. Clarifiers and thickeners, flocculation, batch sedimentation, rate of sedimentation. Equipment for sedimentation: thickeners. Clarifier and thickener design, sedimentation zones in continuous thickeners. Cyclones, hydrocyclones, centrifugal decanters.

Filtration - Principles and fundamentals of filter - compressible and incompressible filter cakes, filter-medium resistance, constant pressure filtration, continuous filtration, constant rate filtration, working principle of centrifugal filters. Working of filter press, continuous vacuum filter, rotary drum filters, centrifugal filter, filter-media, filter aids, principles of cake filtration, pressure drop through filter cake.

Agitation of liquids - Principles of agitation, agitation equipment, flow patterns: prevention of swirling, draft tubes. Power consumption, power correlation, significance of dimensionless groups, effect of system geometry, calculation of power consumption in Newtonian liquids. Blending and mixing: blending of miscible liquids, blending in process vessels, stratified blending in storage tanks, jet mixers, motionless mixtures, mixer selection.

Heat Transfer

Heat conduction - Introduction to various modes of heat transfer, Fourier's law of heat conduction, effect of temperature on thermal conductivity, steady-state conduction, compound resistances in series, heat flow through a cylinder, spheres, critical radius of insulation in pipes. Introduction to unsteady state conduction.

Convective heat transfer - Concept of heat transfer by convection, natural and forced convection, application of dimensional analysis for convection, heat transfer to fluids without phase change: heat transfer coefficient calculation for natural and forced convection. Overall heat transfer coefficient, LMTD, individual heat transfer coefficients, relationship between individual and overall heat transfer coefficients.

Heat exchanger equipment - Typical heat exchange equipment, counter current and parallel-current flow, enthalpy balances in heat exchangers. Double pipe exchanger, single-pass 1-1 exchanger, 1-2 parallel counter flow exchanger, 2-4 exchanger, heat-transfer coefficients in shell-and-tube exchanger, coefficients for crossflow, correction of LMTD for crossflow.

Boiling & condensation - Types of boiling, boiling flow regime in pool boiling. Film and dropwise condensation, Nusselt's theory of condensation and its application.

Radiative heat transfer - Basic concept of thermal radiation, emissive power, black body radiation, Kirchhoff's law, Stephen - Boltzman's law, energy exchange between two large parallel planes, two parallel planes of different emissivity. Radiation intercepted by a shield, spheres or cylinders with spherical or cylindrical enclosures.

Evaporator - types - single- and multiple- effect operation, long tube vertical evaporators, agitated film evaporators, evaporator capacity, evaporator economy. Multiple effect evaporators, methods of feeding, capacity and economy of multiple effect evaporators, multiple effect calculations.

Mass Transfer

Molecular diffusion, steady state molecular diffusion in fluids at rest and in laminar flow, molecular diffusion in gases-steady state diffusion of A through nondiffusing B, equimolar counter diffusion, in multicomponent mixtures. Molecular diffusion in liquids-steady state diffusion of A through nondiffusing B, equimolar counter diffusion. Effect of temperature and pressure on diffusivity

Interphase mass transfer - Mass transfer coefficients, film theory, penetration theory, surface-renewal theories. Interphase mass transfer: equilibrium, diffusion between phases, local two-phase mass transfer, local overall mass-transfer coefficients.

Material Balances - Steady State cocurrent Processes, Steady state counter current processes, Stages.

Humidification operation - Definitions, adiabatic saturator, Humidity chart, use of humidity chart, wet-bulb temperature, theory of wet-bulb temperature, psychrometric line and Lewis relation, equations for gas-liquid contacts, air-water system, adiabatic humidification, application of HTU method, water cooling towers

DRYING - Importance of drying in processes, principles of drying, equilibrium and free moisture, bound and unbound water, constant drying conditions, constant-rate period, critical moisture

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content and falling-rate period, porous solids and flow by capillarity, calculation of drying time under constant drying conditions. Classification of dryers, solids handling in dryers, equipments for batch and continuous drying processes: working principle of tray driers, tower driers, rotary driers, spray driers. Concept of freeze drying.

Absorption - Introduction, types of tower packing's, contact between liquid and gas, pressure drop and limiting flow rates, material balances, limiting gas-liquid ratio, rate of absorption, calculation of tower height, number of transfer units, alternate forms of transfer coefficients, absorption in plate columns, absorption with chemical reaction.

Distillation - Stage wise contact operation. Methods of distillation: batch, continuous, flash, steam, vacuum, molecular distillations. McCabe-Thiele and Ponchon-Savarit methods. Azeotropic and extractive distillation. Elements of multi component distillation.

Leaching & extraction - General principles of leaching & extraction. working principle of moving-bed leaching equipments, Bollman extractor, Hildebrandt extractor. General principles of extraction, working principle of extraction equipments: mixer-settlers, spray and packed extraction towers, agitated tower extractors. Percentage extraction calculation for single stage and multistage cocurrent operations when liquids are insoluble. Minimum solvent rate and number of theoretical stages for continuous countercurrent, multistage extraction operation when liquids are insoluble.

Adsorption - Introduction to adsorption, adsorbents and adsorption processes, adsorption equipment: fixed-bed adsorbers, gas-drying equipment. Pressure-swing adsorption, adsorption from liquids: adsorption isotherms.

Membrane processes - Concepts of osmosis, electro dialysis, types of membranes, their applications, elementary concept of thermal diffusion, sweep diffusion, foam separation process. Ion-exchange principles and industrial application of ion exchange, types of ion exchange resins.

Thermodynamics

Basic & 1st law of thermodynamics - Work, energy, heat, internal energy, extensive and intensive properties, state and path functions, equilibrium, the reversible process, enthalpy etc.

Properties of fluids, equations of state - PVT behavior of pure substances, the ideal gas, equations for process calculations - isothermal process, isobaric process, isochoric process, adiabatic process, and polytropic process. Ideal gas equation, virial equations of state, Application of the virial equations, introduction to cubic equations of state: Vander Waals equation, Redlich/Kwong equation, theorem of corresponding states; acentric factor.

2nd law of thermodynamics - Statements, heat engines, Carnot's theorem, ideal-gas temperature scale; Carnot's equations, concept of entropy, entropy changes of an ideal gas undergoing a mechanically reversible process in a closed system, mathematical statement of the second law, entropy balance for open systems.

3rd law of thermodynamics - Statement.

Refrigeration and liquefaction - Principles of refrigeration, Carnot refrigerator, vapor-compression cycle, absorption refrigeration, heat pump. Liquefaction processes: Linde liquefaction process, Claude liquefaction process.

Systems of variable composition - Ideal behavior: fundamental property relationships, chemical potential and phase equilibria, ideal gas mixtures, ideal solution. Non-ideal behavior: Partial molar properties and their evaluation Fugacity and fugacity coefficient of pure substances and components in solution Generalized correlations for the fugacity coefficient, Lewis Randall rule, excess properties.

Vapour/liquid equilibrium - Criteria for equilibrium between phases, chemical potential and fugacity, phase rule, Duhem's theorem, Pxy and Txy diagrams for homogeneous systems. Simple models for VLE: Raoult's law, Dew point and bubble point calculations with Raoult's law for binary mixtures, VLE by modified Raoult's law, VLE from K-value correlations, flash calculations. Activity coefficient and its estimation from VLE data: van Laar equation, Margulus equation, Gibbs Duhem's equation.

Chemical kinetics

Basic of reactor design - Kinetics of homogeneous reactions: concentration-dependent term of a rate equation, temperature-dependent term of a rate equation, predictability of reaction rate from theory. Interpretation of batch reactor data: constant-volume batch reactor, varying-volume batch reactor, temperature and reaction rate, search for a rate equation.

Ideal reactor - Introduction to reactor design. Ideal reactors for a single reaction: ideal batch reactors, steady-state mixed flow reactors, steady-state plug flow reactors.

Non-ideal reactor - Basics of non-ideal flow: E-age distribution of fluid-RTD, conversion in non-ideal flow reactors. Dispersion model: axial dispersion, chemical reaction and dispersion. Tanks-in-series model: pulse response experiments and the RTD, chemical conversion.

Solid catalysed reactions - Rate equation for surface kinetics, pore-diffusion resistance combined with surface kinetics, performance equations for reactors containing porous catalyst particles, experimental methods for finding rates. Determination of surface area, void volume and solid density, pore-volume distribution, catalyst preparation, promoters and inhibitors, catalyst deactivation.

Chemical Process Technology

Chlor-alkali industries- Manufacture of Sodium Chloride, Soda Ash, Sodium bi carbonate, Chlorine and Caustic Soda.

Acid industries - Manufacture of Sulphuric Acid, hydrochloric and phosphoric acid and their uses.

Fertilizers - Synthetic Ammonia, Nitric Acid, Urea, Diammonium Phosphate, Nitrogenous Fertilizers.

Phosphorous industries: Phosphate rock, manufacturer of phosphorous, Phosphoric Acid, Super phosphate and Triple super phosphate

Others- Paper & pulp, sugar, soap and detergents, edible and essential oils.

Process Control & Instrumentation

Basic concept - Laplace transform of simple functions, transforms of derivatives, solution of differential equations, inversion by partial fractions: partial fractions. Response of first-order systems, physical examples of first-order systems, response of first-order systems in series, higher order systems: Second-order and transportation lag.

Linear close loop systems - Controllers and final control element, principles of pneumatic and electronic controllers, closed-loop transfer functions-servo and regulator problems, transient response of closed-loop control systems and their stability.

Stability - characteristic equation, Routh-Hurwitz criterion, Root-Locus analysis: Introduction to frequency response of closed-loop systems, control system design by frequency, Bode diagram stability criterion, Nyquist diagram, Tuning of controller settings.

Control systems - Cascade control for: jacketed CSTR, heat exchanger, distillation column and process furnace.

Measuring devices - Principles of measurements and classification of process control instruments, measurements of temperature, pressure, flow rate, viscosity, pH, concentration, thermal conductivity and humidity of gases.

Process Engineering Economics

Time value of money, Equivalence, Equations for economic studies and Equivalence, Depreciation, Depletion.

Balance sheet and cost accounting - Capital requirements for process plants - balance sheet charts - earnings, process and returns - economic production, break-even analysis charts - cost accounting - pre construction cost estimation - allocation of cost.

Energy Technology

Fuel technology - Solid fuels - Coal origin, analysis and properties, efficient utilisation, storage and applications. Liquid fuels - Petroleum - Production and consumption, refining, properties and petroleum products, Gaseous fuels - natural gas, producer gas, water gas, gasification of coal; gases from biomass.

Combustion - Distinct features of combustion of solid, liquid and gaseous fuels - determination of gross and net calorific values - combustion of solid fuels including pulverized fuels, stoking and ash removal - fluidized bed combustion of solid fuels - combustion of liquid fuels - burners and nozzles - combustion of gaseous fuels - types of combustion: surface combustion, submerged combustion and preheating combustion.

Renewable Energy - World energy status, Current energy scenario in India, Environmental aspects of energy utilization, Classification of Energy resources, Advantages and Disadvantages of Non-Conventional source of energy, Renewable energy resources - potentials - achievements - application.

Solar energy - Basic concepts, Solar thermal systems - Flat plate and concentrating collectors, Solar passive space - Solar heating and cooling techniques - Solar desalination - Solar Pond - Solar cooker - Solar dryers - Solar furnaces - Solar pumping.

Wind energy - Introduction-Background-Availability- wind power plants , Power from the wind, Wind energy conversion systems, site characteristics, Wind energy Applications - New developments - Safety and environmental aspects.

Biomass energy biomass - usable forms- composition- fuel properties - applications, Biomass resources, Biomass conversion technologies - direct combustion - pyrolysis - gasification - anaerobic digestion, Bioethanol and Biodiesel Production - Recent developments.

Industrial Pollution

Industrial activity and environment, industrialization and sustainable development indicators of sustainability-sustainability strategies-Barriers to sustainability- Pollution prevention in achieving sustainability.

Policies and regulations - Prevention vs control of industrial pollution-Environment policies and Regulations to encourage pollution prevention

Definition of pollutant, types of pollution; Air, Water, Land, noise- adverse effects of pollutants ecosystem and human health - need for effluent treatment and toxicity, control. Water standards for potable, agricultural and left-off streams- air standards for cities, industrial areas, resorts.

Air pollution and control methods - Particulate emission control- gravitational settling chambers- cyclone separators, fabric filters, electrostatic precipitators, wet scrubbers, absorbers. Control of sulphur dioxide, oxides of nitrogen, carbon monoxide and hydrocarbons. Noise pollution measurements and its control.

Waste water origin, types of water pollutants and their effects, waste water sampling and analysis, determination of organic and inorganic matters, physical characteristics, bacteriological measurements, Treatment Primary, secondary and tertiary treatments - advanced waste water treatments: recovery of metals from process effluents .

Petroleum Refinery Engineering

Origin occurrence of petroleum, Formation and Evaluation of Crude Oil. Testing of Petroleum Products. Petroleum refining processes, general processing, topping and vacuum distillations. Thermal cracking in vapor, liquid and mixed phase. Overview of Refinery Products

Catalytic cracking, Catalytic reforming. Conversion of petroleum gases into motor fuel with special reference to alkylation, polymerization, hydrogenation and dehydrogenation.

Treatment Techniques - Removal of Sulphur Compounds in all Petroleum Fractions to improve performance. Destruction of Sulphur Compounds and Catalytic Desulphurization, Solvent Treatment Processes, Dewaxing, Clay Treatment and Hydrofining.

Petrochemicals

Definition, overview of petrochemical, importance and growth potential of petrochemical in India, Economics and feedstock selection for petrochemical.

Gaseous - production of C2 and C3 Compounds-Ethylene, Acetylene, Propylene, Isobutylene and Butadiene. Ammonia

Intermediate chemicals: Acrylonitrile, ethylene oxide, propylene oxide, ethyl chloride, vinyl acetate and vinyl chloride. Higher olefins: Benzene, toluene, xylene, phenol and Styrene

Polymerization process - Plastics-Ethenic and polycondensation polymers, Elastomers- synthetic rubber, Polymeric Oils-Silicones, Synthetic fibers- Cellulosic, polyamides and polyesters.

Safety & Hazards

Importance of safety consciousness in Indian Chemical Industries - Safety in transportation, storage and handling of hazardous chemicals, Chemical process hazards and their control - First degree and second degree hazards

Emergency preparation: On-site and Offsite. Safety aspects of maintenance in chemical plant. Effective steps to implement safety procedures-Periodic Advice and checking to follow safety procedures and rules- Safe guarding of Machines - Ergonomics -Proper selection and replacement of handling equipment -Safe handling and operation of materials and machineries, Fire triangle. Classification of fires, Common causes of industrial fires, Fire protection systems- prevention

Risk Assessment - Hazard identification techniques with examples such as FMEA, CMA, Fault Tree Analysis, Preliminary Hazard Analysis (PHA), Hazard and operability (HAZOP) study, Quantitative risk analysis- Out line of methodology, Consequences analysis -Dow (Index) Fire and Explosion Index System of Risk Analysis, Safety Audit.

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