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 @ ½ mark for each.

4. Duration of Test: 1 hour 30 minutes.
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, Thévenin’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.
Microprocessors & 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, IPv4, IPv6 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, eular tour, Hamiltonian graph. Travelling Salesman problem.

Database Design:

E-R. diagram, Data flow diagram, Data models: Relational & Hiearchi 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 = 286

Proposed Total Marks = Min. 90, Max. 144
• 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,
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 Dielectric 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, Encapsulatin Reverse Tunneling, MIP v6.

Monolithic Microwave Integrated Circuits

Rader & Navigation.

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:

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, multipliers 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:
- First analysis, measurement of current, voltage, power, energy, power-factor, resistor,
Electronic measuring instruments: multimeter, CRD, digital voltmeter, frequency counter, Q-meter.

Transducers: Thermocouple, thermometer, RTD, LVDT, strain-gauge, piezo-electric crystal, use transducers in measurements of non-electrical quantities.

Data acquisition systems.

Control System:

Elements of control systems, block-diagram representation, open-loop & closed-loop systems, principles and applications of feedback.

LTI systems: time-domain and transform-domain analysis.

Stability: Routh-Hurwitz criterion, root loci, Nyquist's criterion, Bode plots.

Design of lead-lag compensators.

Proportional, PI, PID controllers.

State-variable representation and analysis of control systems.

Principles of discrete-control systems.

Microprocessors and Microcontrollers:

Microprocessor architecture, Address/Data and Control lines, Timing Diagram, Internal ROM, Interrupt mechanism (Hardware/software), Memory interfacing, I/O interfacing, Programmable Per device, Microcontrollers and Embedded Processors - its architecture.

Electrical Machines:

Principles of electromechanical energy conversion: Torque and emf in rotating machines.

DC machines: characteristics and performance analysis, starting and speed control of motors.

Transformers: principles of operation, analysis, regulation, efficiency, 3-phase transformers.

3-phase induction machines and synchronous machines: characteristics, performance analysis, speed control and braking.

Special machines: Stepper motors, brushless DC motors, permanent magnet motors, synchronous induction motors, AC series motors.

Power Electronics & Electric Drives:

Semi-conductor power devices: diode, transistor, thyristor, triac, GTO and Power MOSFET characteristic and principles of operation.

Diode rectifiers, phase control rectifiers, triggering circuits.

Bridge converters: fully-controlled and half-controlled.

Principles of choppers and inverters.

Basic concepts of speed control of dc and ac motor drives.

Linear power supplies and SMPS.

Power Systems and Protection:

Construction and parameters of overhead lines and underground cables, T and T mod 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.

Concept of power system stability: rotor angle stability and voltage stability, swing equation, criterion.

Line compensation, static VAR system, basic concepts of HVDC transmission and Transmission System (FACTS).

Power system protection: principles of overcurrent, differential and distance protection, f lines, transformers, busbars and generators.
Circuit breaker: principles of current interruption and arc quenching, restricting voltage, making capacity and breaking capacity, different types of circuit breakers.

Introduction to energy control centre: SCADA and RTUs.

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

Analog & Digital Communication:
- Signals and Spectra: properties of Signals and Noise.
- Analog modulation Techniques: AM, FM and PM.
- Pulse Amplitude modulation and digital communication: PAM, Delta, ASK, FSK, 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, Delectric Heating - principles & application.
- Radiometric and Photometric quantities, Laws of Illumination, Photometry.
- Lamps: incandescent, discharge and solid-state types, their efficacies, features and applications.
- Luminaire - its functions.

General indoor lighting design by Lumen method.

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 mass wasting; 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.
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


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. Lame's equation, theories of failure.

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


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-SS 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.

contd...p.3
10. DYNAMICS OF MACHINES (CONT'D.)

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.


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 nozzles.

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):


(c) Design of Reinforced Concrete and Masonry Structures:


contd...p/2
Fluid mechanics and Hydraulics

Fluid properties and definitions, flow kinematics, contiuou
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, defin-
tion of ideal fluid.

III. Soil Mechanics and Foundation Engineering:

(1) Properties of soils, classifications and interrela-
tionship; definitions of terms used, soil testing in labora-

cory 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; compressi-
bility and 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, soil piles
provision 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 preven-
tion, design of retaining walls, wells, sheet piles and
caissons, reinforced earth technique and its use.

IV. Surveying:

Classification of surveys, scales, accuracy; Measurement of
distance by direct and indirect methods, optical and

electronic devices, measurement of directions, prismatic
compass, local tractions; Theodolites-types, measurement
of elevations, triconometric levelling, contours, establish-
ment of control by triangulations and traversing, measurement
and adjustment of observation, computation of coordinates;

Errors and their corrections, 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 gradients; 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, classifica-
tion and specification - Provisions in I.S. code. Props-
erties 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.
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 programmes.

(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 ENG.

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 by-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.

Contd...p/4
II. ENVIRONMENTAL ENGINEERING

(1) Water Supply Engineering -

Water uses; Quality requirements; potable water quality. Water sources of water, ground water hydraulic, 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; Design principles of screen, grit-removal, sedimentation, Bio-filters, 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 system 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

Lecture in Survey Engg.

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

9. Modern Physics:
   Bohr’s theory
   Millikan’s experiment
   X-rays, Monocrysal, Bragg reflection
   Radioactivity, alpha, beta, gamma rays.

30.4.16
Group - A

Organic Chemistry

1. Bonding in organic molecules:
   - α and β bonds, bond distance, bond angle, and bond energy.
   - Dipole moment of organic molecules.
   - Inductive, resonance, and hyperconjugative effect.
   - Hydrogen bond.
   - Tautomerism.
   - Aromaticity, Hückel'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 diastereomerism.
   - Optical purity, racemization, resolution.
   - Examples of enantiotopic and diastereotopic ligands and faces.
   - Conformations of alkanes (upto 4 carbon).
   - Cyclohexanes and dimethylcyclohexanes.
   - 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 carbenes, carbanions, free radicals, carbenes, and benzynes.

5. a) Substitution reaction—S_N,S replacing N or C.
   - Electrophilic and nucleophilic substitution of aromatic compounds.
   - Elimination reaction—E_1, E_2, E_1aE, and Syn—elimination.
   - Addition reaction—electrophilic addition to C=C and C=C, nucleophilic addition to C=O, conjugated olefins and carbynyls.
   - Rearrangement reaction:
     - Piracol-pinacolone, Hofmann, Beckmann, Claisen, Baeyer-Villiger, Favorovskii.

6. Chemistry and mechanism of:
   - Aldol condensation.
   - Claisen condensation.
   - Perkin reaction.
   - Knoevenagel reaction.
   - Wittig reaction.
   - Michael reaction.
   - Al Ester reaction.
   - Aciylen condensation.
   - Friedel-Crafts reaction.
   - Von Richter reaction.

7. Synthetic uses of reagents:
   - OsO_4, HIO_4, Pb(OAc)_4, SeO_2, LiAIH_4, NaBH_4, B_2H_6,
   - NBS, PCC, Na or Li in 1q-NH,
   - Alkyl lithium, Lithium dialkylecuprate,
   - Lithium disopropylamidate,
   - Aluminium isopropoxide.

8. IUPAC nomenclature.
   - Synthesis and reactions of alkanes, alkenes, alkynes, alkyl halides, ethers, alkanols, alkanones, alkanolic 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 probe related to spectroscopy and organic reactions.

Contd... P/2
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 approximations, sigma and pi bonds, multiple bonding, MO diagrams of simple homonuclear and heteronuclear diatomic molecules like BeH₂, CO₂, BF₃, 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 chemical 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). C 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 contrib spin only moments of 3dᵣ ions.

   Theoretical aspects of d-d spectra (elementary idea) selection rules for spectral transitions.

7. Organic metallic compounds:
   Definition and classification, Metal-Carbon bonded complexes of transition metals – their preparation, properties, stability. Application of 18 electron rule to carbonyl, nitrosyl and cyanides of transition metals.

8. The Chemical elements and its compounds:
   (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 propensity of important class of compounds such as oxides, oxyacids, halides and formation of complex compounds with r metal to the following groups of (i) Li, Na, K (ii) Be, Mg, Ca, Sr and Ba (iii) B, Al, Ga, In, Ti (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 equilbrium, 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.
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, Schrödinger's wave equation (time independent), Interpretation of function particle in one-dimensional box, quantum numbers, hydrogen atom wave functions, separation of radial and angular parts, 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 phenomena, Maxwell's distribution of speeds, features of kinetic energy distribution, mean speed, root mean square's most probable speed, principle of equipartition of energy, specific heats of gases, intermolecular collisions, collision mean free-path, viscosity of gases and mean free-path.

3. The Liquid State:

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, Eins 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 enthalpy 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 time criteria for spontaneity and equilibrium, physical concept of entropy, entropy and probability.
   c) Application thermochemistry, laws and their applications, Kirchhoff's relation, Maxwell relation,  

6. Reaction Equilibrium:
   a) Homogeneous equilibrium, relationship \( K_p, K_c, K_v \). Van't Hoff's reaction isotherms (deduction using the potential). Temperature dependence of equilibrium constant, La-Chatelier's principle, response of equilibria different conditions.
   b) Ionic equilibrium, solubility product, dissociation constant of weak acids, ionic product of water, pK<sub>a</sub> 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 electrolyte 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 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 reaction decomposition, CH<sub>3</sub>CHO-decomposition, H<sub>2</sub> + Br<sub>2</sub> reaction, photosensitized reaction, Fluorescence and phosphorescence.

10. Surface Phenomena and Catalysis:
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 ≥ GM ≥ 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 problem.

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 & 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 - constant Co-efficient.

Geometry:

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.
- Bases 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
(a) Internet Protocols - TCP/IP, UOP, 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**
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**


- **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 overhead 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 & NRI's

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 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: Demurr 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

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 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 LTCG, exemptions u/s 54 and 54F, taxability of STCG and LTCG.
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 Items ; 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 Kuzents 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.
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
Material Technology

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

Mechanical properties - stress, strain, strength, hardness, malleability, ductility, 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. Each type 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.


Fluid flow

Incompressible and compressible fluids, 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, Kármán's vortex. 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, Moody-Wentworth relation, eddy flow.

Flow past immersed bodies - Drag, drag coefficients, drag coefficients of typical shapes, Leveque equation, terminal settling velocity, free and hindered settling, Stokes' law, Newton's law, criteria 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- or multistage 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**


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.


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 axially steady state conduction.

Convection 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.


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, Stefan-Boltzmann'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 thin evaporators, evaporator capacity, evaporator economy. Multiple effect evaporators, methods of feeding, capacity and economy of multiple effect evaporators, multiple effect calculations.

Mass Transfer


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 concurrent 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 relations, 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
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 dryers, tower dryers, rotary dryers, spray dryers. 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.


Leaching & extraction - General principles of leaching & extraction. Working principle of moving bed leaching equipments, Böhm extractor, Hildebrandt extractor. General principles of extraction, working principle of extraction equipments: mixer-settlers, spray and packed extraction towers, aphidic tower extractors. Percentage extraction calculation for single stage and multistage countercurrent 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, permeability 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 equation, 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.


Vapor/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 for modified Raoult's law, VLE from K-value correlations, flash calculations. Activity coefficient and its estimation from VLE data: van Laar equation, Margules equation, Gibbs Duhem's equation.

Chemical kinetics

Basic 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.


Solid catalyzed 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

Chemical industries - Manufacture of Sodium Chloride, Soda Ash, Sodium bicarbonate, Chlorine and Caustic Soda.

Petroleum 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.

Linear close loop systems - Controllers and final control elements, 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 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

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


Energy Technology


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 - strategies for sustainable development - 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.


Water pollution: Origins and 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


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

Treatement Techniques: Removal of Sulphur Compounds in all Petroleum Fractions to improve performance, Destruction of Sulphur Compounds and Catalytic Desulfurization, Solvent Treatment Processes, Dewaxing, Clay Treatment and Hydrogenation.
Definition: overview of petrochemical, importance and growth potential of petrochemical in India, Economics and feedstock selection for petrochemical.

Gaseous products: Production of C2 and C3 Compounds Ethylene, Acetylene, Propylene, Isobutylene and Isobutane. Ammonia

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


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 Off-site. Safety aspects of maintenance in chemical plant

Effective steps to implement safety procedures: Periodic advice and checking to follow safety procedures and rules - Safety 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: Outline of methodology. Consequences analysis - Dow (Index) Fire and Explosion Index System of Risk Analysis, Safety Audit.