HLL Lifecare Limited
(A Government of India Enterprise)

एचएलएल लाइफ़केयर लिमिटेड
स्वस्थ पीढ़ियों के लिए नवान्वेषण

CORRIGENDUM NO.03 Dated 26.06.2026

RECRUITMENT OF MANAGEMENT TRAINEES

ADVERTISEMENT NO: HLL/HR/020/2026 dated 18.02.2026

The following amendment has been incorporated in the above mentioned Recruitment of Management Trainees.

1. Exam Pattern

Part	Description	Marks	Time allotment
Part I & Part II	General Arithmetic, English Comprehension, Logical Reasoning, General Knowledge, and Aptitude, Domain / Discipline Knowledge	100	120 minutes

All relevant clauses of the advertisement published for the selection of Management Trainees shall be read in conjunction with the above change, and the documents to be submitted by the candidates shall strictly comply with the same. All other clauses of the original advertisement shall remain unchanged.

Note *: The date of the examination will be notified subsequently on the HLL official website, www.lifecarehll.com, and the application portal, https://hllmt.cbtexam.in/. Candidates are advised to visit these websites regularly for updates.*

Sd/-
Senior Manager (HR)

HLL MANAGEMENT TRAINEE –SYLLABUS

- **Part I – General Section: 50 Marks** *(Common for all candidates)*
- **Part II – Domain section: 50 Marks**
- **Total Marks: 100 Marks**
- **Duration of Exam: 120 Minutes**

PART I – GENERAL SECTION

PART II – DOMAIN SECTION

- DOMAIN KNOWLEDGE (BIOMEDICAL)
- DOMAIN KNOWLEDGE (CHEMICAL)
- DOMAIN KNOWLEDGE (CIVIL)
- DOMAIN KNOWLEDGE (COMPUTER SCIENCE & IT)
- DOMAIN KNOWLEDGE (ELECTRICAL & ELECTRONICS)
- DOMAIN KNOWLEDGE (INSTRUMENTATION)
- DOMAIN KNOWLEDGE (MECHANICAL)
- DOMAIN KNOWLEDGE (MECHATRONICS)
- DOMAIN KNOWLEDGE (DATA ANALYTICS)
- DOMAIN KNOWLEDGE (PHARMA)
- DOMAIN KNOWLEDGE (HUMAN RESOURCES)
- DOMAIN KNOWLEDGE (HOSPITAL MANAGEMENT)
- DOMAIN KNOWLEDGE (SOCIAL WORK)
- DOMAIN KNOWLEDGE (MARKETING)

PART I – GENERAL SECTION

MAX. MARKS – 50 ONLY

1. General Arithmetic

Number System, Simplification, LCM & HCF, Ratio and Proportion, Percentage, Average, Profit and Loss, Simple Interest and Compound Interest, Time and Work, Time and Distance, Partnership, Mixture and Allegation, Basic Numeracy (Class X Level), Data Interpretation (Charts, Graphs, Tables), Data Sufficiency, Orders of Magnitude, Numerical Ability.

2. English Comprehension

Reading Comprehension, Vocabulary, Grammar, Usage, Synonyms, Antonyms, Sentence Improvement, Error Detection, Fill in the Blanks, Cloze Test, Para Jumbles, One Word Substitution, Idioms and Phrases, Active and Passive Voice, Direct and Indirect Speech.

3. Logical Reasoning

Analytical Ability, Verbal and Non-Verbal Reasoning, Coding-Decoding, Analogy, Classification, Series, Blood Relations, Direction Sense, Statement and Conclusion, Statement and Assumption, Syllogism, Decision Making, Problem Solving, Interpersonal Skills, Communication Skills, Logical Sequencing, Puzzle Solving.

4. General Knowledge

Current Events of National and International Importance, Economic and Social Development - Sustainable Development, Poverty, Inclusion, Demographics, Social Sector Initiatives, General issues on Environmental ecology, Bio-diversity and Climate Change

5. Aptitude

General Mental Ability, Logical and Analytical Ability, Decision Making, Problem Solving, Interpersonal Skills, Communication Skills, Critical Thinking, Basic Numeracy, Data Interpretation, Data Sufficiency, Analytical Reasoning, Ability to Interpret Information, Mental Ability and Aptitude for Administrative Decision Making.

6. Common Topics

Public Health & Healthcare Landscape in India, About HLL Lifecare Limited, Business Acumen related topics, Artificial Intelligence.

PART II – DOMAIN SECTION

DOMAIN KNOWLEDGE (BIOMEDICAL)

MAX. MARKS – 50 ONLY

BE/B.Tech – BIOMEDICAL ENGINEERING

1. Engineering Mathematics:

Linear Algebra: Matrix algebra, systems of linear equations, eigenvalues and eigenvectors. Calculus: Mean value theorems, theorems of integral calculus, partial derivatives, maxima and minima, multiple integrals, Fourier series, vector identities, line, surface and volume integrals, Stokes, Gauss and Green's theorems. Differential equations: First order linear and nonlinear differential equations, higher order linear differential equations with constant coefficients, method of separation of variables, Cauchy's and Euler's equations, initial and boundary value problems, and solution of partial differential equations. Analysis of complex variables: Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent's series, residue theorem. Probability and Statistics: Sampling theorems, conditional probability, mean, median, mode and standard deviation, random variables, discrete and continuous distributions: normal, Poisson and binomial distributions. Tests of Significance, statistical power analysis, and sample size estimation. Linear Regression and correlation analysis; Numerical Methods: Matrix inversion, numerical solutions of nonlinear algebraic equations, iterative methods for solving differential equations, numerical integration.

2. Electrical Circuits: Voltage and current sources - independent, dependent, ideal and practical; v-i relationships of resistor, inductor and capacitor; transient analysis of RLC circuits with dc excitation; Kirchoff’s laws, superposition, Thevenin, Norton, maximum power transfer and reciprocity theorems; Peak, average and rms values of ac quantities; apparent, active and reactive powers; phasor analysis, impedance and admittance; series and parallel resonance, realization of basic filters with R, L and C elements, Bode plot.

3. Signals and Systems: Continuous and Discrete Signal and Systems - Periodic, a periodic and impulse signals; Sampling theorem; Laplace and Fourier transforms; impulse response of systems; transfer function, frequency response of first and second order linear time invariant systems, convolution, correlation. Discrete time systems - impulse response, frequency response, DFT, Z - transform; basics of IIR and FIR filter.

4. Analog and Digital Electronics: Basic characteristics and applications of diode, BJT and MOSFET; Characteristics and applications of operational amplifiers - difference amplifier, adder, subtractor, integrator, differentiator, instrumentation amplifier, buffer, filters and waveform generators. Number systems, Boolean algebra;

combinational logic circuits - arithmetic circuits, comparators, Schmitt trigger, encoder/decoder, MUX/DEMUX, multi-vibrators; Sequential circuits - latches and flip flops, state diagrams, shift registers and counters; Principles of ADC and DAC; Microprocessor- architecture, interfacing memory and input- output devices.

5. Measurements and Control Systems: SI units, systematic and random errors in measurement, expression of uncertainty - accuracy and precision index, propagation of errors; PMMC, MI and dynamometer type instruments; DC potentiometer; bridges for measurement of R, L and C, Q-meter. Basics of control system - transfer function.

6. Sensors and Bioinstrumentation: Sensors - resistive, capacitive, inductive, piezoelectric, Hall effect, electro chemical, optical; Sensor signal conditioning circuits; application of LASER in sensing and therapy. Origin of bio potentials and their measurement techniques - ECG, EEG, EMG, ERG, EOG, GSR, PCG, Principles of measuring blood pressure, body temperature, volume and flow in arteries, veins and tissues, respiratory measurements and cardiac output measurement. Operating principle of medical equipment-sphygmomanometer, ventilator, cardiac pacemaker, defibrillator, pulse oximeter, hemodialyzer Electrical Isolation (optical and electrical) and Safety of Biomedical Instruments

7. Human Anatomy and Physiology: Basics of cell, types of tissues and organ systems; Homeostasis; Basics of organ systems - reproductive. musculoskeletal, respiratory, circulatory, excretory, endocrine, nervous, gastro intestinal and reproductive.

8. Medical Imaging Systems: Basic physics, Instrumentation and image formation techniques in medical imaging modalities such as X-Ray, Computed Tomography, Single Photon Emission Computed Tomography, Positron Emission Tomography, Magnetic Resonance Imaging, Ultrasound.

9. Biomechanics: Kinematics of muscles and joints - free-body diagrams and equilibrium, forces and stresses in joints, biomechanical analysis of joints, Gait analysis; Hard Tissues - Definition of Stress and Strain, Deformation Mechanics, structure and mechanical properties of bone - cortical and cancellous bones; Soft Tissues - Structure, functions, material properties, visco elastic properties, Maxwell & Voight models; Biofluid mechanics - Flow properties of blood in the intact human cardiovascular system.

10. Biomaterials: Basic properties of biomaterials - Metallic, Ceramic, Polymeric and Composite; Fundamental characteristics of implants - biocompatibility, bioactivity, biodegradability; Basics of drug delivery; Basics of tissue engineering. Biomaterial characterization techniques - Rheology, Atomic Force Microscopy, Electron Microscopy, Transmission Electron Microscopy Fourier Transform Infrared Spectroscopy

DOMAIN KNOWLEDGE (CHEMICAL)

MAX. MARKS – 50 ONLY

BE/B.Tech – CHEMICAL ENGINEERING

Section 1: Engineering Mathematics Linear Algebra: Matrix algebra, Systems of linear equations, Eigenvalues and eigenvectors. Calculus: Functions of single variable, Limit, continuity and differentiability, Taylor series, Mean value theorems, Evaluation of definite and improper integrals, Partial derivatives, Total derivative, Maxima and minima, Gradient, Divergence and Curl, Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems. Differential Equations: First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplace transforms, Solutions of one-dimensional heat and wave equations and Laplace equation. Complex Variables: Complex number, polar form of complex number, triangle inequality. Probability and Statistics: Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions, Linear regression analysis. Numerical Methods: Numerical solutions of linear and non-linear algebraic equations. Integration by trapezoidal and Simpson's rule. Single and multi-step methods for numerical solution of differential equations.

Section 2: Process Calculations and Thermodynamics Steady and unsteady state mass and energy balances including multiphase, multi- component, reacting and non-reacting systems. Use of tie components; recycle, bypass and purge calculations; Gibb's phase rule and degree of freedom analysis. First and Second laws of thermodynamics. Applications of first law to close and open systems. Second law and Entropy. Thermodynamic properties of pure substances: Equation of State and residual properties, properties of mixtures: partial molar properties, fugacity, excess properties and activity coefficients; phase equilibria: predicting VLE of systems; chemical reaction equilibrium.

Section 3: Fluid Mechanics and Mechanical Operations Fluid statics, surface tension, Newtonian and non-Newtonian fluids, transport properties, shell-balances including differential form of Bernoulli equation and energy balance, equation of continuity, equation of motion, equation of mechanical energy, Macroscopic friction factors, dimensional analysis and similitude, flow through pipeline systems, velocity profiles, flow meters, pumps and compressors, elementary boundary layer theory, flow past immersed bodies including packed and fluidized beds, Turbulent flow: fluctuating velocity, universal velocity profile and pressure drop. Particle size and shape, particle size distribution, size reduction and classification of solid particles; free and hindered settling; centrifuge and cyclones; thickening and classification, filtration, agitation and mixing; conveying of solids.

Section 4: Heat Transfer Equation of energy, steady and unsteady heat conduction, convection and radiation thermal boundary layer and heat transfer coefficients, boiling, condensation and evaporation; types of heat exchangers and evaporators and their process calculations; design of double pipe, shell and tube heat exchangers, and single and multiple effect evaporators.

Section 5: Mass Transfer Fick's laws, molecular diffusion in fluids, mass transfer coefficients, film, penetration and surface renewal theories; momentum, heat and mass transfer analogies; stage-wise and continuous contacting and stage efficiencies; HTU & NTU concepts; design and operation of equipment for distillation, absorption, leaching, liquid-liquid extraction, drying, humidification, dehumidification and adsorption, membrane separations (micro-filtration, ultra-filtration, nano-filtration and reverse osmosis)

Section 6: Chemical Reaction Engineering Theories of reaction rates; kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors, kinetics of enzyme reactions (Michaelis Menten and Monod models), non-ideal reactors; residence time distribution, single parameter model; non-isothermal reactors; kinetics of heterogeneous catalytic reactions; diffusion effects in catalysis; rate and performance equations for catalyst deactivation.

Section 7: Instrumentation and Process Control Measurement of process variables; sensors and transducers; P&ID equipment symbols; process modeling and linearization, transfer functions and dynamic responses of various systems, systems with inverse response, process reaction curve, controller modes (P, PI, and PID); control valves; transducer dynamics; analysis of closed loop systems including stability, frequency response, controller tuning, cascade and feed forward control.

Section 8: Plant Design and Economics Principles of process economics and cost estimation including depreciation and total annualized cost, cost indices, rate of return, payback period, discounted cash flow, optimization in process design and sizing of chemical engineering equipments such as heat exchangers and multistage contactors.

Section 9: Chemical Technology Inorganic chemical industries (sulfuric acid, phosphoric acid, chlor-alkali industry), fertilizers (Ammonia, Urea, SSP and TSP); natural products industries (Pulp and Paper, Sugar, Oil, and Fats); petroleum refining and petrochemicals; polymerization industries (polyethylene, polypropylene, PVC and polyester synthetic fibers)

DOMAIN KNOWLEDGE (CIVIL)

MARKS – 50 ONLY

BE/B.Tech – CIVIL ENGINEERING

Section 1: Engineering Mathematics Linear Algebra: Matrix algebra; Systems of linear equations; eigenvalues and eigenvectors. Calculus: Functions of single variable; Limit, continuity and differentiability; Mean value theorems, local maxima and minima; Taylor series; Evaluation of definite and indefinite integrals, application of definite integral to obtain area and volume; Partial derivatives; Total derivative; Gradient, Divergence and Curl, Vector identities; Directional derivatives; Line, Surface and Volume integrals. Ordinary Differential Equation (ODE): First order (linear and non-linear) equations; higher order linear equations with constant coefficients; Euler-Cauchy equations; initial and boundary value problems. Partial Differential Equation (PDE): Fourier series; Separation of variables; solutions of one- dimensional diffusion equation; first and second order one-dimensional wave equation and two-dimensional Laplace equation. Probability and Statistics: Sampling theorems; Conditional probability; Descriptive statistics – Mean, median, mode and standard deviation; Random Variables – Discrete and Continuous, Poisson and Normal Distribution; Linear regression. Numerical Methods: Error analysis. Numerical solutions of linear and non-linear algebraic equations; Newton's and Lagrange polynomials; numerical differentiation; Integration by trapezoidal and Simpson's rule; Single and multi-step methods for first order differential equations.

Section 2: Structural Engineering Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and its applications; Centre of mass; Free Vibrations of undamped SDOF system. Solid Mechanics: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, Transformation of stress; buckling of column, combined and direct bending stresses. Structural Analysis: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis. Construction Materials and Management: Construction Materials: Structural Steel Composition, material properties and behaviour; Concrete - Constituents, mix design, short-term and long-term properties. Construction Management: Types of construction projects; Project planning and network analysis - PERT and CPM; Cost estimation. Concrete Structures: Working stress and Limit state design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete beams. Steel Structures: Working stress and Limit state design concepts; Design of tension and compression members, beams and beam- columns,

column bases; Connections - simple and eccentric, beam-column connections, plate girders and trusses; Concept of plastic analysis - beams and frames.

Section 3: Geotechnical Engineering Soil Mechanics: Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Seepage through soils – two - dimensional flow, flow nets, uplift pressure, piping, capillarity, seepage force; Principle of effective stress and quicksand condition; Compaction of soils; One- dimensional consolidation, time rate of consolidation; Shear Strength, Mohr's circle, effective and total shear strength parameters, Stress-Strain characteristics of clays and sand; Stress paths. Foundation Engineering: Sub-surface investigations - Drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes – Finite and infinite slopes, Bishop's method; Stress distribution in soils – Boussinesq's theory; Pressure bulbs, Shallow foundations – Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations – dynamic and static formulae, Axial load capacity of piles in sands and clays, pile load test, pile under lateral loading, pile group efficiency, negative skin friction.

Section 4: Water Resources Engineering Fluid Mechanics: Properties of fluids, fluid statics; Continuity, momentum and energy equations and their applications; Potential flow, Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth; Concept of lift and drag. Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, gradually varied flow and water surface profiles. Hydrology: Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's Law. Irrigation: Types of irrigation systems and methods; Crop water requirements - Duty, delta, evapo-transpiration; Gravity Dams and Spillways; Lined and unlined canals, Design of weirs on permeable foundation; cross drainage structures

Section 5: Environmental Engineering Water and Waste Water Quality and Treatment: Basics of water quality standards – Physical, chemical and biological parameters; Water quality index; Unit processes and operations; Water requirement; Water distribution system; Drinking water treatment. Sewerage system design, quantity of domestic wastewater, primary and secondary treatment. Effluent discharge standards; Sludge disposal; Reuse of treated sewage for different applications. Air Pollution: Types of pollutants, their sources and impacts, air pollution control, air quality standards, Air quality Index and limits. Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

Section 6: Transportation Engineering Transportation Infrastructure: Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments. Geometric design of railway Track – Speed and Cant. Concept of airport runway length, calculations and corrections; taxiway and exit taxiway design. Highway Pavements: Highway materials - desirable properties and tests; Desirable properties of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible and rigid pavement using IRC codes. Traffic Engineering: Traffic studies on flow and speed, peak hour factor, accident study, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Traffic signs; Signal design by Webster's method; Types of intersections; Highway capacity. Section 7: Geomatics Engineering Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Horizontal and vertical curves. Photogrammetry and Remote Sensing - Scale, flying height; Basics of remote sensing and GIS.

DOMAIN KNOWLEDGE (COMPUTER SCIENCE & IT)

MAX. MARKS – 50 ONLY

BE/B.Tech – COMPUTER SCIENCE and INFORMATION TECHNOLOGY ENGINEERING

Section 1: Engineering Mathematics Discrete Mathematics: Propositional and first order logic. Sets, relations, functions, partial orders and lattices. Monoids, Groups. Graphs: connectivity, matching, colouring. Combinatorics: counting, recurrence relations, generating functions. Linear Algebra: Matrices, determinants, system of linear equations, eigenvalues and eigenvectors, LU decomposition. Calculus: Limits, continuity and differentiability, Maxima and minima, Mean value theorem, Integration. Probability and Statistics: Random variables, Uniform, normal, exponential, Poisson and binomial distributions. Mean, median, mode and standard deviation. Conditional probability and Bayes theorem.

Section 2: Digital Logic Boolean algebra. Combinational and sequential circuits. Minimization. Number representations and computer arithmetic (fixed and floating point).

Section 3: Computer Organization and Architecture Machine instructions and addressing modes. ALU, data-path and control unit. Instruction pipelining, pipeline hazards. Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).

Section 4: Programming and Data Structures Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

Section 5: Algorithms Searching, sorting, hashing. Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph traversals, minimum spanning trees, shortest paths.

Section 6: Theory of Computation Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and context-free languages, pumping lemma. Turing machines and undecidability.

Section 7: Compiler Design Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation. Local optimization, Data flow analyses: constant propagation, liveness analysis, common sub expression elimination.

Section 8: Operating System System calls, processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU and I/O scheduling. Memory management and virtual memory. File systems.

Section 9: Databases ER-model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.

Section 10: Computer Networks Concept of layering: OSI and TCP/IP Protocol Stacks; Basics of packet, circuit and virtual circuit- switching; Data link layer: framing, error detection, Medium Access Control, Ethernet bridging; Routing protocols: shortest path, flooding, distance vector and link state routing; Fragmentation and IP addressing, IPv4, CIDR notation, Basics of IP support protocols (ARP, DHCP, ICMP), Network Address Translation (NAT); Transport layer: flow control and congestion control, UDP, TCP, sockets; Application layer protocols: DNS, SMTP, HTTP, FTP, Email

DOMAIN KNOWLEDGE (ELECTRICAL & ELECTRONICS)

MAX. MARKS – 50 ONLY

BE/B.Tech – ELECTRICAL & ELECTRONICS ENGINEERING

1. Engineering Mathematics

Linear Algebra, Matrix Algebra, Systems of Linear Equations, Rank of Matrix, Eigen Values and Eigen Vectors, Vector Spaces, Calculus, Partial Differentiation, Maxima and Minima, Multiple Integrals, Vector Calculus, Differential Equations, Partial Differential Equations, Fourier Series, Laplace Transform, Z-Transform, Complex Variables, Taylor and Laurent Series, Probability Theory, Random Variables, Probability Distributions, Correlation and Regression Analysis, Mean, Median, Mode, Standard Deviation, Numerical Methods and Statistical Analysis.

2. Electrical Circuits, Electromagnetic Fields and Signals & Systems

Circuit Elements (R, L, C), Network Analysis, KCL, KVL, Node and Mesh Analysis, Network Theorems, Star-Delta Transformation, Transient and Steady-State Analysis, Resonance, Three-Phase Circuits, Two-Port Networks, Complex Power and Power Factor, Electric and Magnetic Fields, Coulomb's Law, Gauss's Law, Ampere's Law, Faraday's Law, Maxwell's Equations, Transmission Lines, Wave Propagation, Waveguides, Optical Fibres, Antennas, Continuous and Discrete Time Signals, Linear Time Invariant Systems, Convolution, Fourier Series, Fourier Transform, Laplace Transform, Z-Transform, Sampling Theorem, Frequency Response, Poles and Zeros.

3. Electrical Machines and Power Systems

Single and Three Phase Transformers, Auto Transformers, DC Machines, Induction Motors, Synchronous Machines, Single Phase Motors, Electromechanical Energy Conversion, Characteristics and Performance of Electrical Machines, Testing of Electrical Machines, Losses and Efficiency, Power Generation, Transmission and Distribution Systems, Transmission Line Parameters, Distribution Systems, Per Unit System, Load Flow Studies, Economic Load Dispatch, Voltage and Frequency Control, Power Factor Improvement, Symmetrical Components, Fault Analysis, Protective Relays, Circuit Breakers, Insulators and Power System Stability.

4. Electronic Devices and Analog Electronics

Semiconductor Physics, Intrinsic and Extrinsic Semiconductors, PN Junction Diode, Zener Diode, BJT, MOSFET, LED, Photodiode, Solar Cell, Carrier Transport Mechanisms, Diode Circuits, Rectifiers, Clippers, Clampers, BJT and MOSFET Amplifiers, Differential Amplifiers, Current Mirrors, Operational Amplifiers, Instrumentation Amplifiers, Integrators, Differentiators, Active Filters, Oscillators, Schmitt Triggers, Signal Conditioning Circuits and Analog Electronic Applications.

5. Digital Electronics, Microprocessors and Computer Organization

Binary Number System, Number Representation, Boolean Algebra, Logic Gates, Karnaugh Maps, Combinational Circuits, Sequential Circuits, Flip-Flops, Counters, Shift Registers, Multiplexers, Demultiplexers, Encoders, Decoders, ADC, DAC, Semiconductor Memories, ROM, RAM, SRAM, DRAM, Computer Organization, Arithmetic Logic Unit, Instruction Set, Addressing Modes, Data Path, Control Unit, Pipelining, Microprocessor and Microcontroller Fundamentals.

6. Control Systems, Instrumentation and Power Electronics

Mathematical Modelling of Systems, Transfer Functions, Block Diagrams, Signal Flow Graphs, Feedback Control Systems, Time Domain Analysis, Frequency Domain Analysis, Stability Criteria, Root Locus, Bode Plot, Nyquist Plot, State Space Analysis, PID Controllers, Bridges and Potentiometers, Electrical Measurements, Instrument Transformers, Digital Measuring Instruments, Oscilloscopes, Error Analysis, Thyristors, SCR, MOSFET, IGBT, Controlled and Uncontrolled Rectifiers, DC-DC Converters, AC-DC Converters, DC-AC Inverters, PWM Techniques and Industrial Power Electronic Applications.

7. Communication Systems and Digital Signal Processing

Random Processes, Noise Analysis, Analog Communication Systems, Amplitude Modulation, Frequency Modulation, Phase Modulation, Superheterodyne Receivers, Information Theory, Entropy, Channel Capacity, Pulse Code Modulation, Digital Modulation Techniques (ASK, FSK, PSK, QAM), Error Detection and Correction Codes, Hamming Codes, CRC, Matched Filters, Signal-to-Noise Ratio, Bit Error Rate, Digital Signal Processing Fundamentals and Signal Analysis Techniques.

8. General Electrical and Electronics Engineering

Engineering Materials, Electrical Safety Practices, Energy Conservation Techniques, Renewable Energy Systems, Industrial Electrical Installations, Industrial Automation Basics, Sensors and Transducers, Measurement and Instrumentation Fundamentals, PLC and SCADA Basics, Electrical Standards and Codes, Electrical Estimation, Wiring Systems, Earthing, Protection Systems, Recent Advances in Electrical and Electronics Engineering, Emerging Technologies, Industrial Applications and Engineering Ethics.

DOMAIN KNOWLEDGE (INSTRUMENTATION)

MAX. MARKS – 50 ONLY

BE/B.Tech – INSTRUMENTATION / APPLIED ELECTRONICS / ELECTRONICS & COMMUNICATION ENGINEERING

Section 1: Engineering Mathematics Linear Algebra: Matrix algebra, systems of linear equations, consistency and rank, Eigenvalue and Eigenvectors. Calculus: Mean value theorems, theorems of integral calculus, partial derivatives, maxima and minima, multiple integrals, Fourier series, vector identities, line, surface and volume integrals, Stokes, Gauss and Green's theorems. Differential Equations: First order equation (linear and nonlinear), second order linear differential equations with constant coefficients, method of variation of parameters, Cauchy's and Euler's equations, initial and boundary value problems, solution of partial differential equations: variable separable method. Analysis of Complex Variables: Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent's series, residue theorem, solution of integrals. Probability and Statistics: Sampling theorems, conditional probability, mean, median, mode, standard deviation and variance; random variables: discrete and continuous distributions: normal, Poisson and binomial distributions. Numerical Methods: Matrix inversion, solutions of non-linear algebraic equations, iterative methods for solving differential equations, numerical integration, regression and correlation analysis.

Section 2: Electricity and Magnetism Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss's Law, Divergence, Electric field and potential due to point, line, plane and spherical charge distributions, Effect of dielectric medium, Capacitance of simple configurations, Biot-Savart's law, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Magnetomotive force, Reluctance, Magnetic circuits, Self and Mutual inductance of simple configurations.

Section 3: Electrical Circuits and Machines Voltage and Current Sources: Independent, dependent, ideal and practical; v-i relationships of resistor, inductor, mutual inductance and capacitor; transient analysis of RLC circuits with dc excitation. Kirchoff's laws, mesh and nodal analysis, superposition, Thevenin, Norton, maximum power transfer and reciprocity theorems. Peak-, average- and rms values of AC quantities; apparent-, active- and reactive powers; phasor analysis, impedance and admittance; series and parallel resonance, locus diagrams, realization of basic filters with R, L and C elements. transient analysis of RLC circuits with ac excitation. One-port and two-port networks, driving point impedance and admittance, open-, and short circuit parameters. Single Phase Transformer: Equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three phase induction

motors: principle of operation, types, performance, torque-speed characteristics, no-load and blocked rotor tests, equivalent circuit, starting and speed control; Types of losses and efficiency calculations of electric machines.

Section 4: Signals and Systems Periodic, aperiodic and impulse signals; Laplace, Fourier and z-transforms; transfer function, frequency response of first and second order linear time invariant systems, impulse response of systems; convolution, correlation. Discrete time system: impulse response, frequency response, pulse transfer function; DFT and FFT; basics of IIR and FIR filters.

Section 5: Control Systems Feedback principles, signal flow graphs, transient response, steady-state-errors, Bode plot, phase and gain margins, Routh and Nyquist criteria, root loci, design of lead, lag and lead lag compensators, state-space representation of systems; time-delay systems; mechanical, hydraulic and pneumatic system components, synchro pair, servo and stepper motors, servo valves; on-off, P, PI, PID, cascade, feed forward, and ratio controllers, tuning of PID controllers and sizing of control valves.

Section 6: Analog Electronics Characteristics and applications of diode, Zener diode, BJT and MOSFET; small signal analysis of transistor circuits, feedback amplifiers. Characteristics of ideal and practical operational amplifiers; applications of opamps: adder, subtractor, integrator, differentiator, difference amplifier, instrumentation amplifier, precision rectifier, active filters, oscillators, signal generators, voltage controlled oscillators and phase locked loop, sources and effects of noise and interference in electronic circuits.

Section 7: Digital Electronics Combinational logic circuits, minimization of Boolean functions. IC families: TTL and CMOS. Arithmetic circuits, comparators, Schmitt trigger, multi-vibrators, sequential circuits, flipflops, shift registers, timers and counters; sample-and-hold circuit, multiplexer, analog to-digital (successive approximation, integrating, flash and sigma-delta) and digital-to analog converters (weighted R, R-2R ladder and current steering logic). Characteristics of ADC and DAC (resolution, quantization, significant bits, conversion/settling time); basics of number systems, Embedded Systems: Microprocessor and microcontroller applications, memory and input-output interfacing; basics of data acquisition systems, basics of distributed control systems (DCS) and programmable logic controllers (PLC).

Section 8: Measurements SI units, standards (R, L, C, voltage, current and frequency), systematic and random errors in measurement, expression of uncertainty - accuracy and precision, propagation of errors, linear and weighted regression. Bridges: Wheatstone, Kelvin, Megohm, Maxwell, Anderson, Schering and Wien for measurement of R, L, C and frequency, Q-meter. Measurement of voltage, current and power in single and three phase circuits; ac and dc current probes; true rms meters, voltage and current scaling, instrument transformers, timer/counter, time, phase and frequency measurements, digital voltmeter, digital multimeter; oscilloscope, shielding and grounding.

Section 9: Sensors and Industrial Instrumentation Resistive-, capacitive-, inductive-, piezoelectric-, Hall effect sensors and associated signal conditioning circuits; transducers for industrial instrumentation: displacement (linear and angular), velocity, acceleration, force, torque, vibration, shock, pressure (including low pressure), flow (variable head, variable area, electromagnetic, ultrasonic, turbine and open channel flow meters) temperature (thermocouple, bolometer, RTD (3/4 wire), thermistor, pyrometer and semiconductor); liquid level, pH, conductivity and viscosity measurement. 4- 20 mA two-wire transmitter.

Section 10: Communication and Optical Instrumentation Amplitude- and frequency modulation and demodulation; Shannon's sampling theorem, pulse code modulation; frequency and time division multiplexing, amplitude-, phase-, frequency-, quadrature amplitude, pulse shift keying for digital modulation; optical sources and detectors: LED, laser, photo-diode, light dependent resistor, square law detectors and their characteristics; interferometer: applications in metrology; basics of fiber optic sensing. UV-VIS Spectrophotometers, Mass spectrometer.

DOMAIN KNOWLEDGE (MECHANICAL)

MAX. MARKS – 50 ONLY

BE/B.Tech – MECHANICAL ENGINEERING

Section 1: Engineering Mathematics Linear Algebra: Matrix algebra, systems of linear equations, eigen values and eigen vectors. Calculus: Functions of single variable, limit, continuity and differentiability, mean value theorems, indeterminate forms; evaluation of definite and improper integrals; double and triple integrals; partial derivatives, total derivative, Taylor series (in one and two variables), maxima and minima, Fourier series; gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, applications of Gauss, Stokes and Green's theorems. Differential Equations: First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; Euler-Cauchy equation; initial and boundary value problems; Laplace transforms; solutions of heat, wave and Laplace's equations. Complex Variables: Analytic functions; Cauchy-Riemann equations; Cauchy's integral theorem and integral formula; Taylor and Laurent series. Probability and Statistics: Definitions of probability, sampling theorems, conditional probability; mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions. Numerical Methods: Numerical solutions of linear and non-linear algebraic equations; integration by trapezoidal and Simpson's rules; single and multi-step methods for differential equations.

Section 2: Applied Mechanics and Design Engineering Mechanics: Free-body diagrams and equilibrium; friction and its applications including rolling friction, belt-pulley, brakes, clutches, screw jack, wedge, vehicles, etc.; trusses and frames; virtual work; kinematics and dynamics of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations; Lagrange's equation. Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; concept of shear centre; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength. Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope. Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts. Machine Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

Section 3: Fluid Mechanics and Thermal Sciences Fluid Mechanics: Fluid properties; fluid statics, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings; basics of compressible fluid flow. Heat Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan- Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis Thermodynamics: Thermodynamic systems and processes; properties of pure substances, behavior of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations. Applications: Power Engineering: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. I.C. Engines: Air-standard Otto, Diesel and dual cycles. Refrigeration and air-conditioning: Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes. Turbomachinery: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines; steam and gas turbines.

Section 4: Materials, Manufacturing and Industrial Engineering Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials. Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding. Machining and Machine Tool Operations: Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming. Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly; concepts of coordinate-measuring machine (CMM). Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools; additive manufacturing. Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials

requirement planning; lean manufacturing. Inventory Control: Deterministic models; safety stock inventory control systems. Operations Research: Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

DOMAIN KNOWLEDGE (MECHATRONICS)

MAX. MARKS – 50 ONLY

BE/B.Tech – MECHATRONICS ENGINEERING

1. Mathematical Foundations & Computational Methods

Engineering Mathematics—Linear algebra (matrices, eigenvalues), vector calculus, complex variables, Laplace and Fourier transforms; Differential equations; Numerical methods—solution of nonlinear equations, interpolation, numerical integration; Probability and statistics—random variables, stochastic processes, Markov chains, and queuing models.

2. Mechanical Systems & Engineering Fundamentals

Engineering Mechanics—statics, dynamics, free-body diagrams, work and energy principles; Strength of materials basics; Kinematics of machinery; Fluid mechanics fundamentals; Material science—properties and applications of metals, polymers, and composites relevant to mechatronic systems.

3. Electrical & Electronics Engineering

Basic electrical circuits—AC/DC analysis, network theorems; Analog and digital electronics—diodes, transistors, amplifiers, logic gates; Combinational and sequential circuits; Power electronics—rectifiers, converters, inverters, and motor drives; Basics of microcontrollers and interfacing.

4. Control Systems & Instrumentation

Control system modeling—transfer functions and block diagrams; Time and frequency response; Stability analysis (Routh, Nyquist, Bode); PID control and tuning; State-space analysis; Sensors and transducers (temperature, pressure, displacement); Actuators—hydraulic, pneumatic, and electric; Measurement and instrumentation systems.

5. Robotics & Automation Systems

Robot kinematics and dynamics (Denavit–Hartenberg parameters); Trajectory planning and control; Industrial robotics applications; Automation systems—PLC programming, SCADA, and Distributed Control Systems (DCS); Flexible manufacturing systems and industrial automation concepts.

6. Computing, Programming & Embedded Systems

Programming fundamentals using C/C++ and Python; Data structures and algorithms; Embedded systems—microcontroller architecture (8051/ARM), interfacing, and real-time operating systems (RTOS); Internet of Things (IoT) architecture and communication protocols; Introduction to Robot Operating System (ROS).

7. Artificial Intelligence & Smart Systems

Machine learning basics—supervised and unsupervised learning; Neural networks and deep learning fundamentals; Computer vision and object detection; Decision-making algorithms; Applications of AI in robotics, automation, and smart manufacturing systems.

8. Mechatronics Integration, Industry Applications & Professional Skills

System integration of mechanical, electrical, and control components; Design of mechatronic systems; Industrial case studies in automation and robotics; Sustainable engineering and green technologies; Project management, risk analysis, technical communication, and professional ethics.

DOMAIN KNOWLEDGE (DATA ANALYTICS)

MAX. MARKS – 50 ONLY

DATA ANALYTICS

1. Management Foundation for Analytics

Principles of Management—Planning, Organizing, Staffing, Directing, and Controlling; Organizational Behavior—motivation, leadership, team dynamics; Managerial Economics—demand-supply analysis, elasticity, market structures; Business Environment—macro and micro environmental factors; Role of analytics in managerial decision-making.

2. Functional Business Knowledge

Marketing Analytics—customer segmentation, demand forecasting; Financial Analytics—cost analysis, budgeting, financial ratios; HR Analytics—performance metrics, workforce analytics; Strategic Management—competitive strategies, business intelligence in decision-making.

3. Accounting & Financial Analytics

Fundamentals of Financial Accounting—balance sheet, profit & loss account, cash flow statements; Cost Accounting—cost classification, break-even analysis; Financial Analysis—ratio analysis, budgeting techniques; application of analytics tools in financial decision-making and forecasting.

4. Mathematical & Statistical Foundations

Probability theory—random variables and probability distributions (Binomial, Poisson, and Normal); Descriptive Statistics—mean, median, variance; Inferential Statistics—sampling, hypothesis testing, confidence intervals; Regression & Correlation; Time Series basics; Stochastic models; Optimization techniques including linear programming and basic operations research concepts.

5. Data Management, Database Systems & Infrastructure

Relational data model; Entity-Relationship (ER) modeling; SQL—queries, joins, subqueries; Functional dependencies and normalization (up to BCNF); Transaction management—ACID properties; Concurrency control and recovery mechanisms; Indexing techniques.

Data Warehousing—ETL processes, OLAP systems; Data Cleaning & Preparation; Data Integration; Data Governance; Introduction to Data Mining techniques and data organization frameworks.

Web technologies; Client-server architecture; APIs and backend integration; Database connectivity concepts.

6. Programming & Analytical Tools

Programming fundamentals in Python and R—data structures, functions, libraries; Data manipulation using Pandas/R tools; Basics of scripting and automation; Use of tools such as SAS, Excel (advanced functions, Pivot Tables, Data Visualization using Charts and Graphs, and data analysis features).

7. Advanced Analytics & Machine Learning

Supervised Learning—regression, classification; Unsupervised Learning—clustering, association rules; Model evaluation techniques; Predictive analytics; Introduction to Artificial Intelligence and Deep Learning; Natural Language Processing basics; Ethical considerations in AI and data usage.

8. Business Intelligence & Data Visualization

Concepts of Business Intelligence systems and their applications in supply chain management and business decision-making;

Dashboard for Key Performance Indicators; Data visualization principles; Tools such as Power BI, Tableau, and Excel dashboards.

9. Big Data & Emerging Technologies

Big Data ecosystem—Hadoop, Spark frameworks; Distributed data processing; Text analytics and sentiment analysis; Real-time analytics; Emerging trends in data science including AI-driven analytics in health care.

10. Fundamentals of Software Engineering

Models: Waterfall, Spiral, Agile (Scrum, Kanban), and DevOps. Requirements Engineering: Gathering, feasibility studies, and Software Requirement Specification (SRS) documentation.

Estimation Techniques: Function Point (FP) analysis, Lines of Code (LOC), and COCOMO models. Risk Management: Identification, projection, and mitigation planning (RMMM). Quality Assurance: ISO standards, CMMI levels, and metrics tracking.

Enterprise Resource Planning (ERP) and Management Information Systems (MIS) concepts. Cloud Computing: Foundational knowledge of AWS, Microsoft Azure, or Google Cloud.

PHARMA DOMAIN

DOMAIN KNOWLEDGE (PHARMA)

MAX. MARKS – 50 ONLY

1. Pharmaceutical Chemistry & Medicinal Chemistry

Fundamentals of Inorganic and Organic Chemistry relevant to pharmaceuticals; Medicinal Chemistry of major therapeutic classes including CNS, CVS, and Anti-infective agents; Structure–activity relationships (SAR); basic analytical techniques such as titrimetry, chromatography (HPLC, GC), and spectroscopy (UV-Visible).

2. Pharmaceutics & Drug Delivery Systems

Principles of dosage form design including tablets, capsules, liquids, and parenteral; Physical Pharmaceutics—solubility, dissolution, rheology; Biopharmaceutics and Pharmacokinetics (ADME concepts); Introduction to Novel Drug Delivery Systems (NDDS) such as liposomes, nanoparticles, and controlled release formulations.

3. Pharmacology & Toxicology

Pharmacodynamics and Pharmacokinetics of drugs acting on major systems (Autonomic, Central Nervous, Cardiovascular); Mechanism of action, therapeutic uses, adverse drug reactions (ADRs), drug interactions; Basics of Toxicology including poisoning, antidotes, and bioassays.

4. Pharmacognosy & Herbal Drug Technology

Study and classification of crude drugs of natural origin; Isolation and identification of phytoconstituents such as alkaloids, glycosides, and terpenoids; Standardization, quality control, and evaluation of herbal formulations and traditional medicines.

5. Pharmaceutical Analysis & Quality Control

Principles of drug analysis, validation of analytical methods, quality control testing of pharmaceuticals, impurity profiling, and stability testing; application of instrumental techniques in drug standardization.

6. Pharmaceutical Management & Marketing

Principles of management in pharmaceutical industry; Product life cycle management, pricing strategies, sales force management, market research, supply chain and logistics; Digital marketing and branding in pharma sector.

7. Regulatory Affairs & Pharmaceutical Jurisprudence

Drugs and Cosmetics Act, 1940 and Rules, 1945; Pharmacy Act; NDPS Act; Intellectual Property Rights (IPR) and patenting; Regulatory requirements for drug

approval including IND, NDA, ANDA; Good Manufacturing Practices (GMP) and Schedule M compliance.

8. Biostatistics & Clinical Research

Statistical methods in pharmacy—measures of central tendency, hypothesis testing (t-test, ANOVA); Clinical trial phases (I–IV), study design, data interpretation; Ethical guidelines (ICH-GCP) and regulatory aspects of clinical research.

9. Pharmacy Practice, Public Health & Hospital Management

Hospital pharmacy management, drug store operations, patient counseling, Therapeutic Drug Monitoring (TDM), ADR reporting systems; Role of pharmacist in community health, national health programs, preventive healthcare, and nutrition-related disorders.

HR DOMAIN

DOMAIN KNOWLEDGE (HUMAN RESOURCES)

MAX. MARKS – 50 ONLY

1. Principles of Management & Organizational Behavior

Evolution of Management Thought; contributions of Taylor, Fayol, Mayo, Mary Parker Follett, and C.I. Barnard; Behavioral, Systems, Quantitative and Contingency Approaches; Functions of Management—Planning, Organizing, Staffing, Directing, Controlling, Coordinating and Communication. Individual Behavior—Personality, Perception, Learning, Attitude, Motivation and Morale. Group Dynamics—Leadership, Power, Authority and Interpersonal Behavior. Organizational Dynamics—Change, Development, Climate, Effectiveness, Stress Management, Job Satisfaction, Fatigue and Monotony.

2. Human Resource Management (HRM)

Conceptual framework, Line and Staff functions, HRM in changing business environment. Human Resource Planning, Job Analysis, Recruitment, Selection, Placement and Induction. Performance Management, Competency Development, Career and Succession Planning, Potential Appraisal. HR Systems—HRIS, HR Analytics and HR Audit. Contemporary HR practices including Employee Engagement, Diversity & Inclusion and emerging HR challenges.

3. Human Resource Development (HRD) & Strategy

HRD concepts, assumptions, mechanisms, Action-Research Model, HRD Culture and Climate. Training Need Assessment, Learning Theories, Training Models and Evaluation. Strategic HRM, Leadership Development, Knowledge Management and HR Scorecard. International HRM, Cross-cultural Management and Global Workforce Diversity.

4. Industrial Relations (IR)

Concept, Scope, Evolution, Approaches, Actors and Models, Conflict and cooperation, Bi-partitism, Tri-partitism, Collective Bargaining, Workers' Participation in Management, Grievance Handling and Disciplinary Action, Code of Conduct, Industrial Relations in changing scenario, Employers' organizations.

5.Trade Unions

Concepts, Evolution, Problems of trade unions in India, Recognition, Emerging role of trade unions in India.

6. Industrial Disputes

Factors, Forms, Trends, Prevention and Settlement, Role of State and Central Labour Administration, Strikes and Lockouts.

7. Labour Legislation (Acts & Rules)

Labour Codes: Code on Wages (2019), Industrial Relations Code (2020), Social Security Code (2020), and Occupational Safety, Health and Working Conditions (OSHWC) Code (2020).

Special Statutes: POSH Act (2013), RTI Act (2005), RPwD Act (2016), and CSR provisions under the Companies Act.

8. Compensation, Welfare & Labour Market

Compensation Management—Wage theories, Job Evaluation, Wage Differentials, Incentives, Rewards and Employee Benefits. Labour Welfare—Concept, statutory and non-statutory welfare measures. Occupational Health, Industrial Safety, Hygiene and Accident Prevention. Labour Economics, Features, Demand and Supply of Labour, Nature and Composition of Indian Labour Force, Unemployment and Underemployment, Types of Labour Market, Characteristics of Indian Labour Market, New Dynamics of Labour Market in India, Economic Systems and Labor Market, Problems of Labour in India.

9. Social Security

Concept and Scope, Social Assistance and Social assurance.

10. New Trends in HRM

Changing environment of HRM and contemporary challenges, Emerging HRM Concepts. HR as Business Partner, Emerging technology in HR, Digitalization in HR, HR Analytics, Sustainability, Business Ethics and Corporate Governance, Mental Health and Wellbeing at Work, Employee Engagement, Strategic Adaptive Learning and Career Resilience, Entrepreneurship and HR for Startups and the Gig Economy, HRM and IR in Service Organizations, Diversity, Equity, Inclusion and Belongingness, HR Consulting, Managing Millennials and Multigenerational Workforce, Strategic HR

11. Industrial Psychology

Occupational Psychology: Study of behavior in work situation and applications of Psychological principles to problems of selection, Placement, Counselling and training. Human engineering Social environment: Group dynamics in Industry, counselling, job motivations, job satisfaction. Special study of problem of fatigue, boredom and accidents. Consumer behavior, study of consumer preference, effects of advertising, Industrial morale: The nature and scope of engineering psychology, its application to industry. Work Methods: Efficiency at work, the concept of efficiency, the work curve, its characteristics, the work methods; hours of work, nature of work, fatigue

and boredom, rest pauses. The personal factors; age abilities, interest, job satisfaction, the working environment, noise, illumination, atmospheric conditions, increasing efficiency at work; improving the work methods, Time and motion study, its contribution and failure resistance to time and motion studies, need for allowances in time and motion study. Work and Equipment Design: Criteria in evaluation of job-related factor, job design, human factors, Engineering information, input processes, mediation processes, action processes, methods design, work space and its arrangement, human factors in job design. Accident and Safety: The human and economic costs of accidents, accident record and statistics, the causes of accidents situational and individual factors related to accident reduction

HOSPITAL MANAGEMENT DOMAIN

DOMAIN KNOWLEDGE (HOSPITAL MANAGEMENT)

MAX. MARKS – 50 ONLY

1. Principles of Management & Organizational Behavior

Management functions—Planning, Organizing, Staffing, Directing, and Controlling. Organizational Behavior—Individual and group behavior, motivation, leadership, communication, and organizational culture.

2. Healthcare Systems & Public Health

Structure of healthcare delivery in India and globally, health policies, public health systems, epidemiology basics, and community health programs.

3. Health Economics & Financial Management

Demand and supply of healthcare services, cost analysis, budgeting, financial statements, capital and working capital management, and healthcare financing.

4. Human Resource Management in Healthcare

Manpower planning, recruitment, training & development, performance appraisal, labour laws, and employee relations in healthcare institutions.

5. Hospital Planning & Infrastructure Management

Hospital planning, facility layout, departmental design, biomedical equipment planning, and maintenance management.

6. Hospital Operations & Support Services

Management of clinical and non-clinical services including OPD, IPD, emergency, ICU, radiology, laboratory, pharmacy, dietary, housekeeping, and waste management.

7. Quality Management & Accreditation

Total Quality Management (TQM), patient safety, quality assurance, clinical audits, and accreditation standards such as NABH, NABL, and JCI.

8. Health Information Systems & Digital Health

Hospital Information Systems (HIS), Electronic Health Records (EHR), MIS, telemedicine, and emerging digital health technologies.

9. Medical Ethics, Legal Framework & Insurance

Medical ethics, patient rights, medical negligence, healthcare laws, health insurance systems, TPA roles, and risk management.

10. Healthcare Marketing, Strategy & Emerging Trends

Healthcare marketing, patient relationship management, strategic management, supply chain basics, medical tourism, healthcare entrepreneurship, and emerging trends such as AI and innovation in healthcare.

SOCIAL WORK DOMAIN

DOMAIN KNOWLEDGE (SOCIAL WORK)

MAX. MARKS – 50 ONLY

1. Foundations, Ideologies & Professional Ethics

Evolution of Social Work profession in India and globally; Philosophy, values, principles, and ethics of social work; Social Work as a profession; Social structures in rural, urban, and tribal contexts; The history of Social Work education Ethical standards, professional conduct, and handling ethical dilemmas in practice.

2. Human Behavior, Psychology & Mental Health

Bio-psycho-social model of human behavior; Human growth and development across the lifespan; Theories of personality; Concepts of mental health, normality and abnormality; Positive mental health, stress, resilience, trauma, and crisis response, mental health policies, rights-based approaches, life skills, and changing trends in mental health care.

3. Primary Social Work Methods

Social Case Work and Social Group Work; Interviewing techniques, psychosocial assessment, diagnosis, and intervention; Counseling methods, therapeutic approaches, crisis intervention, and case management in clinical settings; Community Organization, Community: definition and types, community organisation as a social work process, phases and models of community organisation.

4. Social Work Methods (Macro & Administration)

Social Action; principles, methods, strategies and skills for social action, Major social action movements in India. Social Welfare Administration; Planning, management, and functioning of NGOs and voluntary organizations; Fayol's five functions of management, Program implementation and social transformation strategies.

5. Social Work Research & Data Analysis

Research methodology—qualitative and quantitative approaches; research designs, Sampling techniques; Data collection tools; Statistical applications in social work; Data analysis using basic software/tools; Report writing and documentation.

6. Legal Framework, Social Policy & Labour Welfare

Social policies and welfare legislations; Human rights and social justice; rights-based legislations (Right to Education (RTE), Right to Information (RTI), Forest Rights Act, Food Security Act), Child protection and gender justice laws (Juvenile justice, POCSO, domestic violence, dowry prohibition, POSH), Labour Codes of India (2020 reforms),

Corporate social responsibility (CSR) and labor ethics. Constitution and social welfare provisions; Labour laws including industrial relations, wages, and safety; Social security and welfare administration.

7. Medical & Psychiatric Social Work Practice

Healthcare social work in hospital settings; Role of medical social worker in multidisciplinary teams; Psychopathology (ICD/DSM classifications); Community mental health; Models of mental health—bio-psycho-social, recovery and strengths perspective; Psychosocial interventions in oncology, HIV/AIDS, palliative care, and rehabilitation; Fundamentals of counseling, Contemporary mental health concerns

8. Disaster, Trauma Management & Field Practice

Disasters- Concepts, and definitions, classifications and differential impacts of disasters, disaster management cycle—mitigation, preparedness, response, and recovery; Trauma-informed care; Psychological first aid; Crisis intervention; Vulnerability assessment; Field practicum, rural/tribal camps, internships, professional supervision, documentation, and life skills development.

MARKETING DOMAIN

DOMAIN KNOWLEDGE (MARKETING)

MAX. MARKS – 50 ONLY

1. Marketing Foundations

Marketing Principles—Evolution of marketing concepts, core concepts, functions of marketing, and Marketing Mix. Strategic Marketing—Segmentation, Targeting, Positioning (STP), BCG Matrix, Ansoff Matrix, SWOT Analysis, Porter's Five Forces, and Competitive Advantage. Basic Economics—Demand and Supply, Market Equilibrium, Elasticity of Demand, and Demand Forecasting.

2. Product & Brand Strategy

Product Management—Product concepts, Product line and mix, Product Life Cycle (PLC), packaging, labeling, and product differentiation. Brand Management—Brand positioning, Brand equity, Brand loyalty, Brand extension, and rebranding strategies. Innovation and New Product Development—Idea generation, product testing, commercialization, and product launch strategies.

3. Consumer Behaviour & Market Insights

Consumer Behaviour Models, Perception, Learning, Attitudes, Motivation, Personality, and Buying Behaviour. Social & Cultural Influences—Reference groups, family, social class, culture, subculture, opinion leadership, values, and lifestyle (psychographics). Consumer Decision-Making Process, Innovation Diffusion Theory, Customer Satisfaction, and Customer Experience Management.

4. Pricing Strategy & Revenue Management

Pricing Objectives and Pricing Methods—Cost-based pricing, competition-based pricing, value-based pricing, penetration pricing, skimming pricing, psychological pricing, and dynamic pricing. Break-even analysis, pricing strategies for services, tender pricing, and public sector pricing concepts.

5. Marketing Research & Analytics

Marketing Research Process, Problem Identification, Research Design, Primary and Secondary Data Collection, Questionnaire Design, Sampling Techniques, Survey Methods, Data Interpretation, Consumer Insights, Marketing Metrics, KPIs, ROI Analysis, and Introduction to Marketing Analytics.

6. Integrated Marketing Communications (IMC)

Promotion Mix—Advertising, Public Relations, Sales Promotion, Personal Selling, and Direct Marketing. Media Planning—Media selection, scheduling, budgeting, and effectiveness measurement. Corporate Communication, Brand Communication, Event

Marketing, Sponsorship, and Publicity Management.

7. Sales & Distribution Management

Sales Force Management—Sales organization, recruitment, training, motivation, compensation, territory management, and performance evaluation. Distribution Channels—Channel design, channel conflict management, wholesaling, retailing, logistics, physical distribution, dealer/distributor management, retail trends in India, and supply chain coordination.

8. Digital & Contemporary Marketing

Digital Marketing concepts, Digital transformation, Search Engine Optimization (SEO), Search Engine Marketing (SEM), Social Media Marketing, Content Marketing, Email Marketing, Influencer Marketing, Mobile Marketing, E-commerce Marketing, Omnichannel Marketing, Marketing Automation, AI in Marketing, CRM tools, and Marketing Analytics.

9. Industrial, Rural & Service Marketing

Industrial Marketing—Industrial buying behaviour, organizational buying process, institutional sales, and B2B marketing. Rural Marketing—Rural consumer behaviour, rural distribution, and rural communication strategies. Service Marketing—Characteristics of services, 7Ps of services, Service Blueprinting, Service Quality gaps, Capacity Management, and Customer Relationship Management (CRM).

10. Healthcare, Pharma & Social Marketing

Healthcare Marketing concepts, Public Health Communication, Social Marketing, Government Procurement Systems, Tender-based Marketing, Institutional Marketing, Pharma Marketing basics, Behaviour Change Communication (BCC), and CSR-oriented campaigns.

11. International Marketing

International Marketing Environment, Export Marketing, Global Branding, International Market Entry Strategies, Cross-Cultural Marketing, International Trade Basics, and Global Supply Chain Concepts.

12. Relationship Marketing & CRM

Customer acquisition, retention, loyalty programs, customer lifetime value, relationship management, database marketing, complaint handling, after-sales service, and customer engagement strategies.

13. Marketing Ethics & Sustainability

Ethical issues in Marketing related to Product, Pricing, Promotion, and Distribution. Consumer Protection Laws, Sustainable Marketing, Green Marketing, Environmental concerns, Responsible Advertising, and Not-for-Profit Marketing.

14. Competitive Analysis & Strategic Marketing

Industry Analysis, Competitor Analysis, Benchmarking, Market Positioning, Strategic alliances, Market entry strategies, Strategic Business Units (SBUs), Growth strategies, and Competitive Strategy frameworks.

15. Case Studies & Application-Based Marketing

Marketing case analysis, Product launch strategies, Branding decisions, Consumer insight interpretation, Campaign effectiveness evaluation, Business scenarios, Analytical reasoning in marketing situations, and Practical applications of marketing concepts.