

ANNEXURE B

SYLLABUS FOR PHD ENTRANCE TEST PART-1 (COMMON FOR ALL)

Research Methodology

Foundations of Research: Research: concept, characteristics, and objectives; Types of research: basic vs. applied, quantitative vs. qualitative, interdisciplinary, mixed-methods; Research ethics: plagiarism, data fabrication/falsification, copyright.

Research Problem and Research Design: Identifying and formulating a research problem; Review of literature and gap analysis; Objectives, hypotheses, and research questions; Research design: exploratory, descriptive, diagnostic, experimental, longitudinal, cross-sectional

Measurement, Sampling, and Data Collection: Measurement scales: nominal, ordinal, interval, ratio; Validity and reliability of instruments; Sampling: probability and non-probability; Sample size determination Data collection methods: surveys, case studies, interviews, focus groups, experiments, simulations, sensor-based data; Use of questionnaires, schedules, and observation

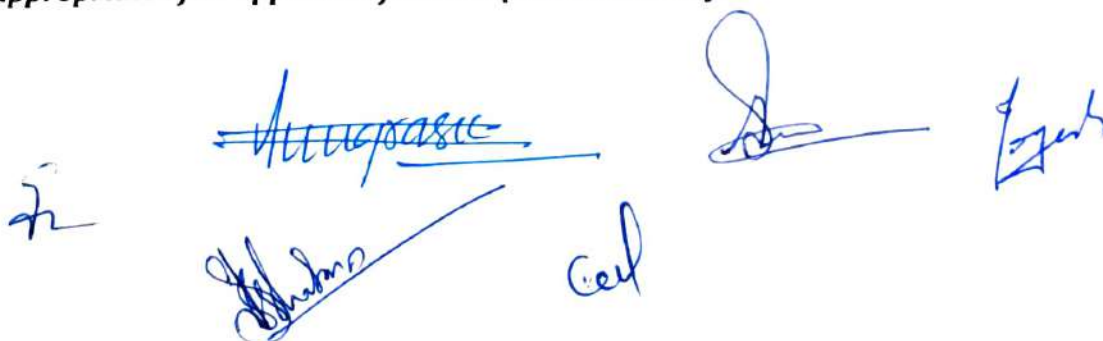
Data Analysis: Descriptive statistics: mean, median, mode, standard deviation, variance, Correlation and regression analysis; Hypothesis testing: null vs. alternative, levels of significance, p-value; **Basics of Parametric tests:** t-test, ANOVA, Z-test; **Basics of Non-parametric tests:** chi-square, Mann-Whitney U, Kruskal-Wallis; **Basics of Qualitative Approaches:** grounded theory, ethnography, phenomenology, narrative, case study

ICT and Research Reporting : Structure of a research proposal and thesis/dissertation; Referencing styles: APA, MLA, IEEE, Application of ICT in research

Aptitude, Reasoning & Data Interpretation : Understanding the Structure of Argument. Evaluating and distinguishing Deductive and Inductive Reasoning. Analytical Reasoning. Verbal Analogies, Word Analogy Applied Analogy. Verbal Classification Numerical computation & estimation numerical reasoning and data interpretation.

The syllabus for specific subjects of the PhD entrance exam will be shared further

Note: The University may change terms/conditions of this document as deemed appropriate after approval of the competent authority.

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Syllabus for Entrance Test

Part - 2 (Domain Specific)

Skill Faculty of Engineering and Technology

Skill Department of Automotive

Studies Automotive fundamentals

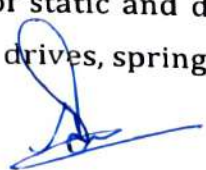
Power Cycles, Engine Control, Ignition System. Drive Train. Transmission. Brakes. Steering System. Battery. Starting System. Automotive Instrumentation and Communication, Vehicle Motion Control. Automotive Diagnostics, Expert Systems, Industrial automation, Mechatronics systems. Alternative Vehicles.

Mechanical engineering science

Fluid (Pneumatic and hydraulic) properties, flow of incompressible fluids, fluid statics, volume analysis of mass, momentum and energy. continuity equation. Thermodynamic system and processes, behaviour of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes. Modes of heat transfer, conduction, convection and radiation, electrical analogy, steady and unsteady heat transfer, thermal boundary layer, heat exchanger performance. LMTD and NTU methods. Power engineering: compressors. Refrigeration and air-conditioning: Turbomachinery: velocity diagrams, impulse and reaction turbines

Design and materials fundamentals

Principal stresses and strains, stress-strain relations, uniaxial loading. thermal stresses, shear force and bending moment, torsion of circular shafts, structure and properties of engineering materials, Ferrous and non-ferrous materials, Heat treatments, TTT curve, polymers and composites, smart materials, material testing with UTM, hardness and impact strength. Dynamic analysis of linkages, cams, gears and gear trains, flywheels and governor, gyroscope. Design of static and dynamic loading, failure theories, design of joints, transmission drives, springs and bearings, basic criteria of selection of



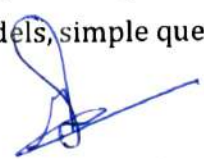
material, factor of safety. Tribology of materials, dry sliding and erosion wear.

Manufacturing Science

Fundamentals of manufacturing processes, Casting, forming and joining processes, metal working, Hot and cold working: forging, rolling, extrusion, drawing, sheet metal, machine tools, tool geometry and materials, economies of machining, non-traditional machining processes, micro machining, work holding devices, jigs and fixtures, dies and punches. Powder Metallurgy, metal powders, compaction and sintering, powder forging. CIM, CAD/CAM. CMP. cellular manufacturing. NC. CNC, DNC. Robotics. FMS, Manufacturing technologies strategies and selection, metrology and inspection.

Industrial management

Production Planning and Control. Forecasting models, aggregate production planning. scheduling, materials requirement planning. Inventory Control, Operations Research. Linear programming, simplex, transportation and assignment model, network flow models, simple queuing models, PERT and CPM.



Skill Department of Computer Science Engineering

(CS/IT) Discrete Structure

Sets, functions, relations, counting; generating functions, recurrence relations and their solutions; algorithmic complexity, growth of functions and asymptotic notations. Programming,

Data Structures and Algorithms

Data types, control structures, functions/modules, object-oriented programming concepts: sub-typing, inheritance, classes and subclasses, etc. Basic data structures like stacks, linked list. queues, trees, binary search tree, AVL and B+ trees; sorting, searching, order statistics, graph algorithms, greedy algorithms and dynamic programming

Computer System Architecture

Boolean algebra and computer arithmetic, flipflops, design of combinational



and sequential circuits, instruction formats, addressing modes, interfacing peripheral devices, types of memory and their organization, interrupts and exceptions.

Operating Systems

Basic functionalities, multiprogramming; multiprocessing, multithreading, timesharing, real-time operating system; processor management, process synchronization, memory management, device management, File management, security and protection; case study: Linux.

Software Engineering

Software process models, requirement analysis, software specification, software testing, software project management techniques, quality assurance.

DBMS and File Structures

File organization techniques, database approach, data models, DBMS architecture; data independence, E-R model, relational data models, SQL, normalization and functional dependencies.

Computer Networks

ISO-OSI and TCP/IP models, basic concepts like transmission media, signal encoding, modulation techniques, multiplexing, error detection and correction; overview of LAN/MAN/WAN; data link, MAC, network, transport and application layer protocol features; network security.

Artificial Intelligence and Machine Learning

Uninformed and informed search techniques; Knowledge and Reasoning; Supervised, unsupervised and Reinforced machine learning methods, Parametric and non-parametric methods, Overfitting/under fitting & Regularization, Curse of Dimensionality. Mixture Models. Basics of image processing, enhancement, features, matching.

Optimization: Linear Programming

Mathematical Model, Graphical Solution, Simplex and Dual Simplex Method, Sensitive Analysis; Integer Programming, Transportation and Assignment Models, PERT-CPM: Diagram Representation, Critical Path Calculations,

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Resource Levelling, Cost Consideration in Project Scheduling.

Computer Graphics & Image Processing

Video-Display Devices Raster-Scan and Random-Scan Systems; Graphics Monitors, Input Devices, Points and Lines; Line Drawing Algorithms, Mid-Point Circle and Ellipse Algorithms; Scan Line Polygon Fill Algorithm, Boundary-Fill and Flood-Fill, 2-D and 3-D Geometrical Transforms

Elements of digital image processing, Image model, Sampling and quantization. Discrete Fourier Transform, Discrete Cosine Transform, Haar Transform, Enhancement by point processing, Spatial filtering, Dilation and Erosion



Skill Department of Industry 4.0

Networks: Network graphs: matrices associated with graphs; incidence, fundamental cut set and Fundamental circuit matrices. Solution methods: nodal and mesh analysis. Network theorems: superposition. Thevenin and Norton's maximum power transfer. Wye-Delta transformation. Steady state sinusoidal analysis using phasors. Linear constant coefficient differential equations: time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State equations for networks.

Electronic Devices: Energy bands in silicon, intrinsic and extrinsic silicon. Carrier transport in silicon: diffusion current, drift current, mobility, and resistivity. Generation and recombination of carriers. p-n junction diode, Zener diode, tunnel diode, BJT, JFET, MOS capacitor, MOSFET, LED. p-n and avalanche photo diode, Basics of LASERS. Device technology: integrated circuits fabrication process oxidation, diffusion, ion implantation, photolithography, n-tub, p-tub and twin-tub CMOS process.

Analog Circuits: Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor and FET amplifiers. Amplifiers: single-and



multi-stage, differential and operational, feedback, and power. Frequency response of amplifiers. Simple op-amp circuits. Filters. Sinusoidal oscillators: criterion for oscillation: single-transistor and op-amp configurations. Function generators and wave-shaping circuits. 555 Timers. Power supplies.

Digital circuits: Boolean algebra, minimization of Boolean functions; logic gates, digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shift-registers. Sample and hold circuits, ADC DACS Semiconductor memories, Microprocessor (8085): architecture, programming, memory and I/O interfacing.

Signals and Systems: Definitions and properties of Laplace transform, continuous-time and discrete-time Fourier series, continuous-time and discrete-time Fourier Transform, DFT and FFT, z-transform. Sampling theorem. Linear Time-Invariant (LTI) Systems, definitions and properties, causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay. Signal transmission through LTI systems.

Control Systems: Basic control system components; block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems; transient and steady state analysis of LTI control systems and frequency response. Tools and techniques for LTI control system analysis: root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. Control system compensators: elements of lead and lag compensation, elements of Proportional-Integral-Derivative (PID) control. State variable representation and solution of state equation of LTI control systems.

Communications: Random signals and noise: probability, random variables, probability density function, autocorrelation, power spectral density. Analog communication systems: amplitude and angle modulation and demodulation systems, spectral analysis of these operations, superheterodyne receivers; elements of hardware, realizations of analog communication systems; signal-



to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions. Fundamentals of information theory and channel capacity theorem. Digital communication systems: pulse code modulation (PCM), differential pulse code modulation (DPCM), digital modulation schemes: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK), matched filter receivers, bandwidth consideration and probability of error calculations for these schemes. Basics of TDMA, FDMA and CDMA and GSM.

Electromagnetics: Elements of vector calculus: divergence and curl; Gauss' and Stokes' theorems, Maxwell's equations: differential and integral forms. Wave equation, Poynting vector. Plane waves: propagation through various media; reflection and refraction; phase and group velocity, skin depth. Transmission lines: characteristic impedance; impedance transformation; Smith chart; impedance matching; S parameters, pulse excitation.

Waveguides: modes in rectangular waveguides: boundary conditions, cut-off frequencies: dispersion relations. Basics of propagation in dielectric waveguide and optical fibers. Basics of Antennas: Dipole antennas, radiation pattern; antenna gain.



Skill Department of Green Technology

For Candidates having graduation/post-graduation in mechanical engineering/production engineering/industrial engineering, the Syllabus of Ph.D. Entrance Test is as follows: -

Thermodynamics: Thermodynamic systems and processes; properties of pure substances, behaviour 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.

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.

Compressors and Heat Engines: 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; multistage refrigeration systems, vapour absorption refrigeration systems, properties of moist air, psychrometric chart, basic psychrometric processes.

Hydraulic Machines: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines.

Solar Thermal: Solar radiation, Flat Plate Collectors; Concentrating Collectors; Solar Air Heating System Solar Drying, Solar Cooker; Solar Pond, Solar Distillation, Solar Detoxification. Solar Cooling System, Central Receiver Systems, Parabolic Trough Systems, Solar Furnaces.

Non-conventional energy sources: wind energy, wind turbines, wind energy storage, geothermal energy, ocean energy.

For Candidates having graduation/post-graduation in Electrical Engineering, the Syllabus of Ph.D.

Entrance Test is as follows: -

Basic Electrical and Circuit Analysis: AC and DC Circuit Analysis, series and parallel resonance, nodal analysis, mesh analysis, time domain and frequency domain analysis of simple RLC circuits, power factor, star and delta connected loads, thevenin theorem, Norton theorem, superposition theorem, maximum power transfer theorem, reciprocity theorem.

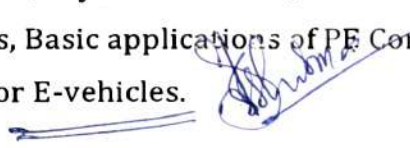
Electrical Machines: Transformers, D.C Machines: DC motor and DC generator, Induction Machines: Single phase and Three phase Induction

Motor, Synchronous Machines: Synchronous motor and Synchronous generator, industrial Applications of electrical machines.

Control Systems: introduction to control systems, Mathematical Models of Physical Systems, Representation of Control Components, Time domain analysis and design specification of linear systems: Concepts of Stability and Routh Hurwitz Criterion, Root Locus Technique, Frequency Response Analysis and Stability Studies in Frequency Domain, Design and Compensation Technique, Introduction to State Variable Approach.

Power Systems: Per Unit system, Distribution systems, electrical design of overhead lines, mechanical design of overhead lines, insulators, insulated cables, transmission and performance, corona, inductive interference; short circuit analysis, protective relays, protective relaying schemes - protection of feeders & transmission lines, transformers and alternators, circuit interruption devices.

Power Electronics and Drives: Familiarization with semiconductor devices including Diode, Thyristor, BJT, MOSFET, IGBT, GTO, TRIAC, DIAC, Operation and analysis of: Uncontrolled and Controlled Rectifier, DC-DC Converters, Inverters, Cycloconverters, AC voltage Regulators, Different switching topologies, Basic applications of PE Converters in Home appliances & Industry, Drives for E-vehicles.



Skill Faculty of Management Studies and research

Skill Department of Tourism & Hospitality

Front Office: Evaluation and growth of hotel industry, products and services of hospitality industry, organizational structural, classification of hotels, star rating, organization of front office department, coordination of front office and other departments, room tariffs, reservations, registration, guest services, guest cycle, upselling and discounts, front office accounting, budgeting, yield management, forecasting, revenue management, crisis management, situation handling, complaint handling, hospitality marketing and research

Accommodation: Housekeeping organization, organizational structural, types of rooms, coordination of housekeeping department and other departments, control desk, duty roaster, work schedule, briefing and debriefing, lost & found, pest control, guest room cleaning services, cleaning public areas, cleaning science and principals, linen room, laundry system, stains and stain removal process, linen measurements, amenities and supplies, inventory control, par stock, budget, interior and exterior designing, modern trends in housekeeping and hotels, situation handling, complaint handling

Food & Beverage Service: Types of catering establishments, food and beverage service areas in a hotel and restaurant, service equipment and its use, care and maintenance, service organization, service personnel attitude and attributions, interdepartmental relationship, French classical menu, service methods, bar and bar operations, beverage temperatures, alcoholic and non-alcoholic beverages, menu management, Food and beverage control

Food Production: Culinary history, basic terminologies related to kitchen and bakery, kitchen equipment and hygiene, methods of cooking, fundamentals of food production, basic cuts, menu planning and development, food commodities, cold kitchen, starters, Sandwiches, historical background of baking, basic pastries, yeast dough products, cake making, International and Indian Cuisine – Major Ingredients, Dishes and broad overview, Cuisine of Haryana – Major delicacies & role of ingredients, HACCP Certification

Tourism and Airlines: Understanding concept of environment and relation between environment, tourism & hospitality, tourism concepts, tourism resources, type of tourism, tourism mix, tour & travel operations: role, scope & challenges, travel agency operations: tasks, functions & challenges, airline services: role, scope & challenges, guide & escorting services: tasks, functions & challenges, tourism & guest psychology, tourist decision making, sociological impacts of tourism, sports, hospitality & tourism, cargo handling, airport operations, aviation safety and security, customer service, aviation law and regulations, crisis management

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**Skill Department of Banking and Finance and Skill Department of
Management Studies**

(Syllabus is common for Both Departments)

MANAGEMENT

MANAGEMENT PROCESS AND ORGANIZATIONAL BEHAVIOR

Evolution of management thought: Systems and contingency approach for understanding organizations; Managerial processes, functions, skills and roles in an organization; Social Responsibility of Business; Understanding and Managing individual behaviour; Personality; Perceptions; Attitudes; Learning; Decision-making; Management by Objectives; Understanding and managing group processes—interpersonal and group dynamics; Applications of Emotional Intelligence in organizations. Leadership and influence process; Work Motivation. Understanding and Managing organizational system—Organizational design and structure, Work stress, Organizational Change and development; Conflict Management; Stress Management.

MANAGERIAL ECONOMICS

Nature and scope of Managerial Economics. Importance of Managerial decision-making; Marginal analysis; Objective of a firm, Demand function, Elasticity of demand and its significance in Managerial decision-making; Consumer equilibrium—utility and indifference curve approach; Price, income and substitution effects; Fundamentals of demand estimation and forecasting; Short-run and long-run production functions

BUSINESS ENVIRONMENT

Nature, components and determinants of business environment, dynamics of business environment, key indicators; Risk in business environment, Assessing business environment

— country risk and political risk.

Logesh

Current state of business environment in India Economic reforms — Liberalization, privatization, globalization, industrial policy and industrialization trends, public enterprise reforms and disinvestment programmes; competitive environment; financial environment

BUSINESS COMMUNICATION

Importance and nature of business communication, Effective communication skills; Process of communication Oral and Non-Verbal communication, Barriers and gateways in communication and Do's and Don'ts of business writing, Commercial letters; Writing business and academic reports; Public speaking, listening and Negotiations; conducting and attending interview and meetings. Emotional Intelligence

ACCOUNTING FOR MANAGERS

Management Accounting: Nature, scope and tools of Management Accounting; Management Accounting vs. Financial accounting; Financial analysis, Ratio analysis, Funds-Flow Statement, Cash-flow Statement

Budgeting: Types of budgets and their preparation, Performance budgeting and Zero-base budgeting. *Overview of latest developments in Accounting:* Transfer Pricing, Responsibility, accounting, Inflation accounting, Divisional performance analysis, Human Resources Accounting

MARKETING MANAGEMENT

Nature, scope and concept of marketing, Corporate orientations towards the marketplace; The Marketing environment and Environment scanning; Marketing information system and Marketing research; Understanding consumer and Industrial markets; Market segmentation, Targeting and positioning; Product decisions —product mix, product life cycle, new product development, branding and packaging decisions; Pricing methods and strategies; Promotion decisions— promotion mix, advertising, sales promotion, publicity and personal selling; Place Decisions; Distribution Channels, Physical Distribution, Selection of distribution channel; *consumer buying behavior; International Marketing Management;* Ethics in Marketing; Contemporary issues in marketing - Globalization, Consumerism, Green



Marketing, Direct Marketing, Network Marketing, Event Marketing.

HUMAN RESOURCE MANAGEMENT

Concepts and Perspectives on Human Resource Management; Human Resources Management in a changing environment; Corporate objectives and Human Resource Planning; Career and succession planning; job analysis; Methods of manpower search; Attracting, Selecting and retaining human resources; Induction and socialization; Manpower training and development; Performance appraisal and potential evaluation; Job evaluation and compensation; Employee welfare; Industrial relations & trade unions; Dispute resolution & grievance management, Employee empowerment.

PRODUCTION AND OPERATIONS MANAGEMENT

Nature and Scope of Production and Operations Management; *Operations Strategy*; Operations Strategy, Competitive Capabilities and Core Competencies, Facility Location; Types of Manufacturing Systems and Layouts; Layout Planning and Analysis; Material Handling; *Total Quality Management*; *Project Management*; *Supply Chain Management*; *Value Engineering*; *Just-In-Time*

E-COMMERCE

Introduction to Electronic Commerce: Framework, applications; network infrastructure (including internet). Internet commercialization Electronic payment system, inter-organizational commerce & intra—organisational commerce, Security, advertising & marketing on the internet, introduction to e CRM, consumer search & resource discovery, computer based education & training, digital copyrights.

BUSINESS POLICY AND STRATEGIC MANAGEMENT

An Introduction to business policy — Nature, Objective and importance of business policy; An overview of strategic management; Strategic decision making; Process of strategic decision making.



Types of planning systems - corporate planning, strategic planning and long range planning;

Strategy Formulation, Company's mission, purpose and objectives; Corporate strategy - concept, significance and objectives; types of strategies; Environmental and organizational appraisal (Internal & external) techniques of business environment analysis. Strategic alternatives and choice; Business ethics and corporate strategy
Concept of value chain and competitive advantage.

ENTREPRENEURSHIP DEVELOPMENT

Significance of Entrepreneur in Economic Development; Economic, Social and psychological need for entrepreneurship; Characteristics, qualities and pre - requisites of entrepreneur; The function of the entrepreneur in economic development of a Country; Methods and procedures to start and expand one's own business; Life cycle of new business and relationship with large enterprises; Achievement motivation; Environmental Factors affecting success of a new business; Reasons for the failure and visible problems for business.

FINANCIAL MANAGEMENT

Corporate Financial Objectives and Functions, Introduction to financial management, Objectives of financial management; Time value of money, sources of finance, Financial Analysis; Comparative Balance Sheet, Common Size Statement Analysis, Trend and Ratio Analysis; Capital Budgeting and its methods, Risk analysis: Cost of capital; Concept and importance,

Capital Structure Theories and Applications, Corporate Investment Decisions: Estimation of Cash Flows and Analysis Techniques, Cash Flow Projection and Evaluation Techniques; Valuation of the Firm; Working Capital Planning, Monitoring and Control of Working Capital, Working Capital Financing Managing the Components of Working Capital, Dividend and Valuation, Irrelevance and Relevance of Dividends, Determinants of Dividends Policy and Dividend Policy of Companies



BANKING & FINANCE

Financial Markets: Role in Financial Development, Government Economic Philosophy and Financial Market, Structure of Financial Market in India, Critical Evaluation of the Development and Future Trends, Financial Market Systems and Regulations in India; Money Market, Capital Market and Their Components, Primary Market Intermediaries, Secondary Market System, Regulations and Regulatory Agencies (Primarily SEBI), Role of FIs, MFs and Investment Bankers; Risk and Risk Management Process Associated with Insurance, Objectives of Risk Management; Role of Risk Pooling and Insurance, Institutions for Insurance and Reinsurance - Economic Rationale and requirements, Insurance Laws and Regulation, Insurance Pricing, Corporate Risk Management and Insurance; Role of Financial Institutions in Financial Development, Banking and Non Banking Financial Institutions, Investment Banking

Skill Faculty of Applied Sciences and Humanities

Department of Psychology & Behavioral Science (PSYCHOLOGY)

GENERAL PSYCHOLOGY

Perception: Perceptual processing, Role of attention in perception, Perceptual organization, Perceptual sets, Perceptual constancies, Depth perception, Illusions.

Learning: Principles and applications of Classical conditioning, Operant conditioning, and Observational learning; Cognitive influences on learning;

Memory & Forgetting: Sensory memory, STM, LTM, working memory, Meta-memory: Semantic & Episodic Memory procedural memory Models of Semantic knowledge, The Atkinson and Shiffrin model, Forgetting- Due to decay, due to interference, forgetting and retrieval inhibition. Theories of forgetting, Mnemonics

Intelligence: Nature and Theories of intelligence- Gardner, Sternberg, Das and Naglieri, measurement of intelligence, the cognitive and neural basis of intelligence, heredity, environment and intelligence.

Motivation: Meaning and Definition of Motivation, Need, Drive and Incentives. Theories of motivation- Drive theory, Arousal theory, Expectancy theory, Maslow's need hierarchy theory. Forms of human needs and motivation- hunger, need for achievement, need for affiliation, need for power.

Emotion: Nature and Definition of Emotion, Brief description of Cannon-Bard, James-Lange and Schachter-Singer theories of emotion; Expression of emotion.

Systems and Theories in Psychology: Introduction- Systems and theories: An overview of history and schools of psychology. Early schools of Psychology: Structuralism (Tichner), Functionalism (William James), Behaviorism (Watson), Gestalt psychology (Wertheimer,

Koffka and Kohler)

Personality theories: Trait (Biological) and Type Theories: Allport, Cattell, Eysenck, Sheldon and Friedman, Alternative Five Factor Model. The Freudian Theory; The Neo Analytic Theory; Karen Horney; Erik Erikson; Harry Stock Sullivan; Skinners Radical Behaviours, Social Learning Theory; Social cognitive Theory; Bandura, Abraham Maslow's and Carl Rogers' Theory, Kelly and Rollo May.

COGNITIVE PSYCHOLOGY

Historical Background: Psychophysical approach, Information processing approach, Ecological Approach, Contemporary Cognitive Psychology.

Attention and Perception: Theories of Attention and current developments: Broadbent's filter theory, Triesman's attenuation theory, automatic and controlled processing, switching attention.

Perceptual learning and development, Perception of shape, space and movement, Implicit perception and sensory integration theory, Cognitive - Attention Theory: Information Processor, Cognitive Timer

Learning and Language Disorder: General Phenomenon of Learning: Learning vs Maturation, Native Response Tendencies, Verbal learning: Stimulus material, Trigram Methods-Serial Learning, Paired Associate Learning, Discrimination Learning: Nature, Theories- Algebraic Summation Theory, Relational Theory, Learning disorders: Transposition Effect Reading Disorder/Developmental Dyslexia, Disorder of written expression / Dysphasia / Aphasia, Math Disability / Dyscalculia, Auditory Processing Disorder, Speech and Language pathology, Specific language Impairment

Thinking and Language Formation: Concept formation and categorization, Judgment and Decision-making, Reasoning & Problem solving: Stages - Preparation, Production, Judgment and Incubation, Structure of language, its acquisition and Formation, Language and Thinking: Linguistic Determinism, language and Cognition

SOCIAL PSYCHOLOGY

Attitude and Attitude Change: Attitude - Behaviour Link: Influence of attitude on behavior: responsible factors - aspects of the situation, aspects of the attitude, Attitude Change: Approach to attitude change- Persuasion approach, cognitive approach, Attitudes resist change: reactance, forewarning, selective avoidance, active defense biased assimilation and attitude polarization

Pro-social Behaviour: Concept of Pro-social Behaviour, Latance Darley's five step model, situational factors: Attraction, Attributions and Pro-social Models, Theories of Prosocial Behaviour: Empathy - Altruism Theory, Egoistic Theory, Genetic Selfishness

Social Issues: Mass violence, Terrorism, Mob behavior, Natural Disaster, Environmental stresses and social behavior, Social psychological perspectives on health and illness, Psychological effects of unemployment Social and ethnic minorities and law

Applied Social Psychology: Applied Social Psychology in India: Challenges and possibilities need for indigenization, Applied Social Psychology and developing countries; Emerging themes, Multidisciplinary approach to the study of social change; Policy oriented research; need for reorienting Social Psychology, Methods of Applied Social Psychology: Laboratory experiment, Field experiment, Field study.

PSYCHOPATHOLOGY

Classification and Theoretical Models: Systems of Classification, basic features; DSM-IV TR, ICD-10, similarities and differences, Major Theoretical Models of Psychopathology: The medical model, Psychoanalytic model, Behaviouristic model, Humanistic-existential models, Interpersonal approach, Systems approach

Diagnosis and Prognosis: Problems and methods of diagnosis: physiological examination, observation, case-history, interview method, psycho-diagnostic tests, measures of bodily functions, computer assisted diagnosis.

Mood and Anxiety Disorder: Bipolar disorders: Manic, Depressive, Mixed, Depressive disorder: Major depression and dysthymia, Suicide, Anxiety Disorders: Generalized anxiety disorder, phobia, panic disorder, post traumatic stress disorder and obsessive compulsive disorder

Major Clinical Disorders: Schizophrenia, Other psychotic disorders: Bipolar, Delusional, psychotic depression, Conversion disorder, Somatization disorder, Hypochondriasis, Body dysmorphic disorder, Pain disorder, Developmental disorder: PDD, Rett Disorder, Asperger Disorder, Behavioral Disorder: Conduct Disorder, Hyperactivity Disorder, ADHD, Genetic Disorders: Down Syndrome

PSYCHOTHERAPY

Psychoanalytic Therapies: Freud's Psycho-analytic Therapy, Adlerian Psychotherapy, Brief Dynamic Therapies

Humanistic Therapies: Client-Centered Therapy, Existential Therapy and Gestalt Therapy

Behavioral and Cognitive Behavior Therapy: Behavioral therapy, Cognitive Behavior therapy, Rational Emotive Behavior Therapy (Ellis)

Other Important Therapies: Family, Marital and Interpersonal Therapy, Therapies with Children and Adolescents, Group Therapy, Psychotherapy in the Indian context, Spirituality and psychotherapy, Yoga and Meditation

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CLINICAL & COUNSELING PSYCHOLOGY

Development of clinical Psychology as a profession: Consultation, administration. Subspecialties of clinical Psychology: Clinical health Psychology, Forensic Psychology, Geropsychology, Clinical Neuropsychology, and child clinical psychology.

Diagnosis and assessment: Nature and purpose of Clinical diagnosis & assessment, Stages in the Assessment Process, Clinical Assessment Techniques: observation, interview, case-study, Psychological tests. Counseling Process: Settings for counseling, Steps in counseling, Therapeutic relationship:

Counseling Approach: Psychodynamic Approach: Psychoanalytic, Adlerian, Humanistic Approach: Existential, Client-centered, Gestalt, Behavioural Approach: Operant-Conditioning, Classical-Conditioning, Cognitive Approach: Cognitive Therapy, Rational emotive therapy, Other Approaches: Narrative Therapy, Expressive Therapy, and Biofeedback.

Current Issues in Counseling: Ethical Issues: Professional Codes, our divided loyalties, Areas of ethnical difficulty, recent trends Legal Issues: Advice for the passionately committed counseling student, Mental Health Counseling, Counseling diverse population.

Humane

Skill Faculty of Applied Sciences and Humanities

Department of Science & Computation (MATHEMATICAS)

Analysis: Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum.

Sequences and series, convergence, $\limsup$, $\liminf$. Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem. Sequences and series of functions, uniform convergence. Riemann sums and Riemann integral, Improper Integrals. Monotonic functions, types of discontinuity, functions of bounded variation, Lebesgue measure, Lebesgue integral.

Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation, inverse and implicit function theorems.

Metric spaces, compactness, connectedness. Normed linear Spaces. Spaces of continuous functions as examples.

Linear Algebra: Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations. Algebra of matrices, rank and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms. Inner product spaces, orthonormal basis. Quadratic forms, reduction and classification of quadratic forms

Complex Analysis: Algebra of complex numbers, the complex plane, polynomials, power series, transcendental functions such as exponential, trigonometric and

hyperbolic functions.

Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem. Taylor series, Laurent series, calculus of residues. Conformal mappings, Mobius transformations.

Algebra: Permutations, combinations, pigeon-hole principle, inclusion-exclusion principle, derangements. Fundamental theorem of arithmetic, divisibility in $\mathbb{Z}$, congruences, Chinese Remainder Theorem, Euler's ϕ -function, primitive roots.

Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems.

Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain. Polynomial rings and irreducibility criteria. Fields, finite fields, field extensions, Galois Theory.

Topology: basis, dense sets, subspace and product topology, separation axioms, connectedness and compactness.

Ordinary Differential Equations (ODEs): Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs. General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function.

Partial Differential Equations (PDEs): Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs. Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations.

Numerical Analysis: Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Lagrange, Hermite and spline interpolation, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and Runge-Kutta methods.

Calculus of Variations: Variation of a functional, Euler-Lagrange equation, Necessary and sufficient conditions for extrema. Variational methods for boundary value problems in ordinary and partial differential equations.

Linear Integral Equations: Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels. Characteristic numbers and eigenfunctions, resolvent kernel.

Classical Mechanics: Generalized coordinates, Lagrange's equations, Hamilton's canonical equations, Hamilton's principle and principle of least action, Two-dimensional motion of rigid bodies, Euler's dynamical equations for the motion of a rigid body about an axis, theory of small oscillations.

Statistics: Descriptive statistics, exploratory data analysis, Sample space, discrete probability, independent events, Bayes theorem. Random variables and distribution functions (univariate and multivariate); expectation and moments. Independent random variables, marginal and conditional distributions. Characteristic functions. Probability inequalities (Tchebyshef, Markov, Jensen). Modes of convergence, weak and strong laws

of large numbers, Central Limit theorems (i.i.d. case).

Markov chains with finite and countable state space, classification of states, limiting behaviour of n -step transition probabilities, stationary distribution, Poisson and birth-and-death processes.

Standard discrete and continuous univariate distributions. sampling distributions, standard errors and asymptotic distributions, distribution of order statistics and range.

Methods of estimation, properties of estimators, confidence intervals. Tests of hypotheses: most powerful and uniformly most powerful tests, likelihood ratio tests. Analysis of discrete data and chi-square test of goodness of fit. Large sample tests.

Simple nonparametric tests for one and two sample problems, rank correlation and test for independence. Elementary Bayesian inference.

Gauss-Markov models, estimability of parameters, best linear unbiased estimators, confidence intervals, tests for linear hypotheses. Analysis of variance and covariance. Fixed, random and mixed effects models. Simple and multiple linear regression. Elementary regression diagnostics. Logistic regression.

Multivariate normal distribution, Wishart distribution and their properties. Distribution of quadratic forms. Inference for parameters, partial and multiple correlation coefficients and related tests. Data reduction techniques: Principle component analysis, Discriminant analysis, Cluster analysis, Canonical correlation.

Simple random sampling, stratified sampling and systematic sampling. Probability proportional to size sampling. Ratio and regression methods.

Completely randomized designs, randomized block designs and Latin-square designs. Connectedness and orthogonality of block designs, BIBD. $2K$ factorial experiments: confounding and construction.

Hazard function and failure rates, censoring and life testing, series and parallel systems.

Linear programming problem, simplex methods, duality. Elementary queuing and inventory models. Steady-state solutions of Markovian queuing models: $M/M/1$, $M/M/1$ with limited waiting space, $M/M/C$, $M/M/C$ with limited waiting space, $M/G/1$.

Skill Faculty of Applied Sciences and Humanities

Department of Language and Culture (English)

There shall be 50 Multiple Choice Questions of one mark each from the following areas:

1. British literature from Chaucer to Contemporary Times
2. English in India: History, Evolution and Futures
3. American and Other Non-British Literatures in English
4. Literary Criticism
5. Literary and Critical Theory of the 20th Century
6. Cultural Studies
7. Language: Basic concepts, theories and pedagogy. English in Use.
8. Research Methods and Materials in English

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