



SHRI VISHWAKARMA SKILL UNIVERSITY
(Enacted by Act of 25 of 2016, State of Haryana)

Syllabus for Phd Entrance Test

Part-I(Common for All)

S.No.	Broad Areas	Syllabus
1	Research Methodology	Annexure:1

Syllabus for Part-II

S.No.	Broad Areas/Department/Skill Faculty	Syllabus
1	Department of Automative Studies	Annexure A
2	Skill Department of CS/IT	Annexure B
3	Skill Department of Industry 4.0	Annexure C
4	Skill Department of Green Technology	Annexure D
5	Behavioural Psychological and Emotional issues in Industry,	Annexure E
6	Skill Pedagogy, Skill Policy, Skill Planning, Skills required for progression in NSQF Level , Skill based Education System in Ancient India	Annexure F
7	English	Annexure G
8	Mathematics	Annexure H
9	Management Science, Marketing Research, Finance, Entrepreneurship and Economics Analytics	Annexure I

* The Candidate should submit the choice of Broad area/Department for considering the Part-II for entrance test on the following link before 28.10.2020

<https://forms.gle/xVMhHAzukciy84yg6>

The selected Area/Department shall be final for entrance test and no change will be considered.



COMMON FOR ALL

PhD SYLLABUS

PART- I

Research Methodology

Basic statistics: Sources and type of data: quantitative and qualitative data; diagrammatic and graphical representation of data. Mean, median, mode, geometric mean, harmonic mean and other measures of central tendency, measure of dispersion, mean deviation, quartile deviation, standard deviation, variance, coefficient of variation, skewness, kurtosis, moments, correlation and regression, elementary probability theory, Baye's theorem, Poisson, Normal and Binomial distributions.

Research Methodology: Nature and Scope of Research Methodology, Problem Formulation and Statement, Research Objectives; Research Process; Research Designs - Exploratory, Descriptive and Experimental; Hypothesis formulation and testing of hypothesis. Sampling and Sampling Design Methods, Data Collection methods, tools and techniques — Observational and Survey Methods; Questionnaire and Interviews. Data analysis techniques

Aptitude: 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.



Skill Faculty of Engineering and Technology

Syllabus for Ph.D. Entrance Examination (Part-II)

Department of Automotive Studies

Section A

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, control-volume analysis of mass, momentum and energy, continuity equation. Thermodynamic system and processes, behavior 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.

Section B

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 governors, 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.



SHRI VISHWAKARMA SKILL UNIVERSITY

(A State Skill University, setup by an Act of Legislature in 2016)

Section C

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, economics 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, CAPP, 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.



ANNEXURE B

Skill Faculty of Engineering and Technology

Syllabus for Ph.D. Entrance Examination (Part-II)

Skill Department of CS/IT

Discrete Structures:

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, 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 FloodFill, 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 Faculty of Engineering and Technology

Syllabus for Ph.D. Entrance Examination (Part-II)

Skill Department of Industry 4.0

Section A

Signal Conditioning and Control:

Sensor Characteristics and Physical effects, Active and Passive sensors, Static and dynamic characteristics of sensors, Laplace, Fourier and z-transforms, DFT and FFT, IIR and FIR filters. Mathematical modelling and representation of systems, Transient and Steady-state analysis, Stability analysis, compensators, controllers, State space representation

Analog & Digital Electronics:

Small signal analysis of diodes, BJTs and MOSFETs, clamper, clipper, rectifier, amplifier, Number systems, Boolean algebra, logic gates, Combinatorial and Sequential circuits.

Automation and Mechatronics:

Asimov's laws and classification of robotics, dynamic stabilization of robots, Power sources and sensors, hydraulic, pneumatic and electric drives variable speed arrangements, micro machines in robotics manipulators, actuators and grippers, control circuits for industrial automation, Safety in industrial automation material handling and identification technologies, Design of mechatronics-based systems, PLC and SCADA

Section- B

Energy 4.0 and Automotive Electronics

Network analysis, transformers, AC & DC machines, Power generation, transmission and distribution systems and analysis, power system integrated with renewable energy, voltage and frequency control in integrated systems using power electronics converters, smart grid. Automotive Fundamentals, Air and Fuel Systems, Automotive Instrumentation and Communication, Vehicle Motion Control, Automotive Diagnostics, Expert and embedded Systems, Introduction to Alternative Vehicles and its architecture

Internet of Things



M2M to IoT, Reference Model and IoT Architecture, IoT Smart Applications, Cloud Service Management and IoT, Data Analytics for IoT, soft computing-based techniques for manufacturing and energy systems.

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/underfitting & Regularization, Curse of Dimensionality, Mixture Models

Section-C

Manufacturing Technologies:

Machine tools, tool geometry and materials, Mechanics of machining, economics of machining, non-traditional machining processes, micro machining, work holding devices, jigs and fixtures. Computer Integrated Manufacturing, CAD/CAM, CAPP, cellular manufacturing, NC, CNC, DNC, FMS, and CIM, Manufacturing technologies–strategies and selection.

Mechanical Engineering Science:

Fluid (Pneumatic and hydraulic) properties, flow of incompressible fluids, fluid statics, control-volume analysis of mass, momentum and energy, continuity equation. Thermodynamic system and processes, behavior 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.



ANNEXURE D

Skill Faculty of Engineering and Technology

Syllabus for Ph.D. Entrance Examination (Part-II)

Skill Department of Green Technology

Energy & Environment:

Basic Introduction to Energy, Energy storage systems, Energy Management, Energy Audit, Economic Analysis, Environment, Ecosystem, Environmental Pollution. Renewable Energy sources, wind energy, solar pv and thermal systems, biomass energy, other energy sources.

Modelling and Simulation:

Fundamentals and techniques for designing and using simulation, modelling, and optimization algorithms with applications in system performance modelling, business infrastructure modelling, and distributed and parallel computing. An introduction to advanced complex systems models.

Solar Energy Engineering and Applications:

Solar radiation: Solar thermal conversion: , solar thermal energy systems: Development of solar thermal collectors; Solar cooling and refrigeration; Concentrating solar collector: optical design of concentrators, solar water heaters, solar dryers; Solar thermal power generation and economics; Solar Energy Mission photovoltaic: Principle of photovoltaic conversion; Solar cell basics and materials; Different solar cell technologies: Crystalline silicon solar cell, Thin Film solar cell, Tandem solar cell; Photovoltaic system: Component and configurations; off grid and grid connected PV systems, PV system design and economics Solar Photo-catalysis: Solar photo-catalysis mechanism, kinetics and application

Environmental Management:

Fundamental and emerging topics related to air and water, pollution, water use and management, aquatic ecosystems, energy and climate, change, biodiversity, toxic substances in the environment, solid waste, management, and regulatory strategies for risk assessment and environmental, management are examined. A local aquatic field trip is planned on a weekend in the fall with alternatives provided for distance students.

Green Nanotechnology:

Green Manufacturing Trends, Sustainable Green Manufacturing, Waste Management, Industrial Ecology, Nanomaterials for "Green" Systems

Green Building Concepts:



Valuing Nature: the case(s) for Green Building, Cost Factors, Urban Form and Natural Systems, Transportation, Parking and The Car, Design Strategies and Processes,

Construction Process & Commissioning, Site Design Factors, Water Systems: Storm water and Water Use, Daylighting for Energy Savings and Enhanced Productivity, Indoor Air Quality, Energy Efficiency & Renewable Production, Environmental Aspects of Materials Selection, Valuing Green & Metrics,

Application of Nanomaterial:

Ferroelectric materials, coating, molecular electronics and Nano electronics, biological and environmental, membrane based application, polymer based application.

Solar Photovoltaic Technology:

Fossil fuel energy usage and global warming; role of renewable energy in sustainable development; renewable energy sources; global potential for solar electrical energy systems. Solar radiation, extra-terrestrial and terrestrial solar spectrum; clear sky direct-beam radiation; total clear sky insolation on a collecting surface; radiation on the collector in tracking systems; calculation of average monthly insolation from measured data. PV cells and modules

Photovoltaic cell and its simple model; i-v and p-v characteristics; PV modules and arrays; effect of shading, use of bypass and blocking diodes; influence of temperature; types of solar cells and their performance; schemes for maximum power point tracking; solar PV concentrators. PV inverters

Grid-connected single-phase PV inverter schemes and control; power processing schemes based on single string, multi-string and ac module technologies; types of grid interface; power electronic converters used in single phase PV systems and their operation; transformer less inverters, centralized grid-connected three-phase inverters for large PV installations. Schemes with battery energy storage

Green Energy and Economics:

Principles of Economics, Energy Taxonomy, Economics of Non-renewable Resource Extraction, Measuring Resource Scarcity, Policy Issues.



Faculty of Applied Sciences and Humanities

PhD Syllabus Part-II

(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 to 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

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 ethical difficulty, recent trends Legal Issues: Advice for the passionately committed counseling student, Mental Health Counseling, Counseling diverse population.



Faculty of Applied Sciences and Humanities

PhD Syllabus Part-II

Broad Areas: Skill Pedagogy, Skill Policy, Skill Planning, Skills required for progression in NSQF Level, Skill based Education System in Ancient India

1. Introduction

Frameworks of skill-based learning/teaching; Role of a trainer in skilling environment, pedagogy/andragogy curriculum development and effective delivery; workshops, entrepreneurship and placement, soft skills classroom and seminar management. The aptitude of the candidate to steer industry engagement, using various educational tools, case study methods, skill assessment method, developing curricula for various levels, exposure of online tools, teaching & training and research exposure.

2. Model of Learning

The six views of learning to promote skilling (The Behaviorist view, The Cognitive view, The Developmental view, The Humanist view, The Cybernetic view, The Constructivist view.

3. Knowledge Skill

A Classification Schema for Skilled Performance (Dimension 1: The Domains of Performance, Dimension 2: The Reproductive/Productive Scale, Distinction between Factual knowledge and conceptual knowledge, The Structuring of Knowledge in the Mind)

4. Quantitative Statistics

Data gathering, Hypothesis testing, Result Presentation and application tools of Basic Statistical Analysis and variance (Measures of Central Tendency, Measures of Variability, Correlation)

5. Instruction Design/Lesson Planning

Broad Levels of decision Making with instruction designing on skilling (Course level, Lesson level, Instructional event level, Learning step level), The Control of Instructing, Prescriptive and Student Controlled systems, IT Enabled Intelligent Systems like LMS etc. Organizing Course Materials: - Lecture notes, View graphs, Free run videos, Web based lecture notes, Interactive CBT, MOOCs.



6. Knowledge and Skill:

Knowledge management, Comparison of Expositive & Experiential strategies, teaching methodologies for the teaching of knowledge & skills, ICT based teaching-learning process, selecting strategies for delivering and implementation of chosen strategy, Identifying critical skills and research temperament.

7. Evaluation Design

Methods of Evaluation, Computer aided evaluation, Courseware organisation cis a vis evaluation and course/quality audit. Measuring Quality and Productivity in Educational Organization, Accreditation, Costing of Educational Services, perspective Quality Circle and participatory Quality Improvement, Total Quality Management – basic principles.



Faculty of Applied Sciences and Humanities

PhD Syllabus :Part-II

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



Faculty of Applied Sciences and Humanities

PhD Syllabus: Part-II

MATHEMATICS

Section 1 Calculus:

Functions of two or more variables, continuity, directional derivatives, partial derivatives, total derivative, maxima and minima, saddle point, method of Lagrange's multipliers; Double and Triple integrals and their applications to area, volume and surface area; Vector Calculus: gradient, divergence and curl, Line integrals and Surface integrals, Green's theorem, Stokes' theorem, and Gauss divergence theorem.

Section 2 Linear Algebra:

Finite dimensional vector spaces over real or complex fields; Linear transformations and their matrix representations, rank and nullity; systems of linear equations, characteristic polynomial, eigenvalues and eigenvectors, diagonalization, minimal polynomial, Cayley-Hamilton Theorem, Finite dimensional inner product spaces, Gram-Schmidt orthonormalization process, symmetric, skew-symmetric, Hermitian, Skew-Hermitian, normal, orthogonal and unitary matrices; diagonalization by a unitary matrix, Jordan canonical form; bilinear and quadratic forms.

Section 3 Real Analysis:

Metric spaces, connectedness, compactness, completeness; Sequences and series of functions, uniform convergence, Ascoli-Arzelà theorem; Weierstrass approximation theorem; contraction mapping principle, Power series; Differentiation of functions of several variables, Inverse and Implicit function theorems; Lebesgue measure on the real line, measurable functions; Lebesgue integral, Fatou's lemma, monotone convergence theorem, dominated convergence theorem.

Section 4 Complex Analysis:

Functions of a complex variable: continuity, differentiability, analytic functions, harmonic functions; Complex integration: Cauchy's integral theorem and formula; Liouville's theorem, maximum modulus principle, Morera's theorem; zeros and singularities; Power series, radius of convergence, Taylor's series and Laurent's series; Residue theorem and applications for evaluating real integrals; Rouché's theorem, Argument principle, Schwarz lemma; Conformal mappings, Möbius transformations.



Section 5 Ordinary Differential equations:

First order ordinary differential equations, existence and uniqueness theorems for initial value problems, linear ordinary differential equations of higher order with constant coefficients; Second order linear ordinary differential equations with variable coefficients; Cauchy-Euler equation, method of Laplace transforms for solving ordinary differential equations, series solutions (Power series, Frobenius method); Legendre and Bessel functions and their orthogonal properties; Systems of linear first order ordinary differential equations, Sturm's oscillation and separation theorems, Sturm-Liouville eigenvalue problems, Planar autonomous systems of ordinary differential equations: Stability of stationary points for linear systems with constant coefficients, Linearized stability, Lyapunov functions.

Section 6 Algebra:

Groups, subgroups, normal subgroups, quotient groups, homomorphisms, automorphisms; cyclic groups, permutation groups, Group action, Sylow's theorems and their applications; Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domains, Principle ideal domains, Euclidean domains, polynomial rings, Eisenstein's irreducibility criterion; Fields, finite fields, field extensions, algebraic extensions, algebraically closed fields.

Section 7 Functional Analysis:

Normed linear spaces, Banach spaces, Hahn-Banach theorem, open mapping and closed graph theorems, principle of uniform boundedness; Inner-product spaces, Hilbert spaces, orthonormal bases, projection theorem, Riesz representation theorem, spectral theorem for compact self-adjoint operators.

Section 8 Numerical Analysis:

Systems of linear equations: Direct methods (Gaussian elimination, LU decomposition, Cholesky factorization), Iterative methods (Gauss-Seidel and Jacobi) and their convergence for diagonally dominant coefficient matrices; Numerical solutions of nonlinear equations: bisection method, secant method, Newton-Raphson method, fixed point iteration; Interpolation: Lagrange and Newton forms of interpolating polynomial, Error in polynomial interpolation of a function; Numerical differentiation and error, Numerical integration: Trapezoidal and Simpson rules, Newton-Cotes integration formulas, composite rules, mathematical errors involved in numerical integration formulae; Numerical solution of initial value problems for ordinary differential equations: Methods of Euler, Runge-Kutta method of order 2.

Section 9 Partial Differential Equations:



Method of characteristics for first order linear and quasilinear partial differential equations; Second order partial differential equations in two independent variables: classification and canonical forms, method of separation of variables for Laplace equation in Cartesian and polar coordinates, heat and wave equations in one space variable; Wave equation: Cauchy problem and d'Alembert formula, domains of dependence and influence, non-homogeneous wave equation; Heat equation: Cauchy problem; Laplace and Fourier transform methods.

Section 10 Topology:

Basic concepts of topology, bases, subbases, subspace topology, order topology, product topology, quotient topology, metric topology, connectedness, compactness, countability and separation axioms, Urysohn's Lemma.

Section 11 Linear Programming:

Linear programming models, convex sets, extreme points; Basic feasible solution, graphical method, simplex method, two phase methods, revised simplex method ; Infeasible and unbounded linear programming models, alternate optima; Duality theory, weak duality and strong duality; Balanced and unbalanced transportation problems, Initial basic feasible solution of balanced transportation problems (least cost method, north-west corner rule, Vogel's approximation method); Optimal solution, modified distribution method; Solving assignment problems, Hungarian method.



FACULTY OF MANAGEMENT STUDIES AND RESEARCH

PhD SYLLABUS: PART-II

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.



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



SHRI VISHWAKARMA SKILL UNIVERSITY

(A State Skill University, setup by an Act of Legislature in 2016)

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 FIIs, 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