SUMPET (Ph.D. ENTRANCE TEST) SYLLABUS FOR Ph.D.

IN

ENGINEERING & TECHNOLOGY/ MANAGEMENT /EDUCATION

The SUMPET (Ph.D. Entrance test) for Ph.D. consists of two parts:

*Part I: Research Methodology (50 marks) and

Part II: Subject Specific (Related to the branch for 50 marks)

Total Marks for Ph.D. Entrance Test: 100 Marks

*The Syllabus for Research Methodology is common to all branches of Engineering & Technology/Management/Education

1. RESEARCH METHODOLOGY: AN INTRODUCTION

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods Versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India

2. DEFINING THE RESEARCH PROBLEM

What is a Research Problem? Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem

3. RESEARCH DESIGN

Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs

4. PUBLICATIONS, PLAGIARISM, INTELLECTUAL PROPERTY RIGHTS

Quality of research work and papers –indexing, impact factor, H Index, citation index Meaning and principles of plagiarism, methods of plagiarism check, plagiarism checking software, Principles of intellectual property rights, patents, copyrights, trademarks and their importance.

5. INTERPRETATION AND REPORT WRITING

Meaning of Interpretation, Why Interpretation? Technique of Interpretation, Precautions in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Part-II: COMPUTER SCIENCE & ENGINEERING / COMPUTER APPLICATION:

1. COMPUTER ARCHITECTURE & ORGANIZATION
Combinational Circuit: adder, subtractor, decoder, MUX etc. Sequential Circuit: Flip-flops, Registers, Counters, Machine Instructions and Addressing Modes, ALU & Data path, Memory interface, I/O Interface, Instruction pipeline, Cache, Main and secondary storage.

2. COMPUTER NETWORKS
ISO/OSI stack, LAN technologies, Flow and error control techniques, IPV4, IPV6, TCP/UDP, Routing algorithms, Congestion control, Application layer protocols, Basic concepts of Switches, Bridges, Gateway & Routers, Basic concepts of Network security: Public and private key cryptography, Firewall, Digital signature etc.

3. OPERATING SYSTEM
Process, Thread, Inter process Communication, CPU Scheduling, Concurrency control, synchronization, Deadlock, Memory management and Virtual Memory, File system, I/O System Protection and Security.

4. DATA STRUCTURES
Overview of Programming in C/C++, Recursion, Parameter Passing, Scope, Binding, Array , Stacks, Queues, Link list, Searching & Sorting Techniques ,Lists and their Applications, Trees: Binary Tree, Properties & Representation, ADT Binary Tree, Binary search Trees, AVL Trees & Applications, Graphs: Representations & Properties, Directed and Undirected graphs, Graph search methods, Path finding Algorithms, Asymptotic notations ,Greedy, Dynamic Approach, Branch and Bound techniques.

5. THEORY OF COMPUTATION AND COMPILER DESIGN
Regular Language and Finite Automata, Context free Grammar, Context sensitive Grammar, push down automata, Turing Machine, Undecidabilty, Lexical Analyzer, Parsing Syntax, Direct translation, Runtime environment, Immediate and Target code generation, Code optimization.

6. DATABASE MANAGEMENT SYSTEM
Basic concept, ER model, Relationship Model, Relational algebra, Tuple Calculus, Data Base design, Integrity constraint, Normal Forms, Query languages (SQL), File structure, Concurrency Control and Transactions.

7. SOFTWARE ENGINEERING AND WEB DEVELOPMENT
Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project, design, coding testing, implementation, maintenance. HTML, XML, Scripting and Basic Concept of Client and server side programming.

8. PROBABILITY THEORY AND DISCRETE MATHEMATICS
Conditional Probability, Mean, Median, Mode and Standard Deviation, Exponential, Sets, Relations, Functions, Group, Partial Order, Boolean algebra, Propositional and Predicate Logic.

9. ADVANCE COMPUTING
Artificial intelligence, Heuristic and blind search, Knowledge base system, Fuzzy logic, fuzzy membership function, Neural network, ANN, Learning rules. Single layer and multilayer neural network, Back Propagation network, Genetic algorithm, Fundamentals, basic concepts, working principle, encoding and fitness function.

Part-II: CIVIL ENGINEERING

1. STRENGTH OF MATERIALS

Shear force and bending moment, Simple Stresses and strains, Shear stresses in beams, Principal stresses and strains, Direct and bending stresses, Columns and struts, Thin cylinders.

2. FLUID MECHANICS

Fluid statics, pressure measurement, buoyancy & floatation, fluid kinematics, fluid dynamics, flow measurement, orifices, mouth pieces, notches, weirs, flow through pipes, dimensional analysis and models, laminar flow, turbulent flow in pipes, boundary layer theory, flow through channels, rapidly varied flow.

3. THEORY OF STRUCTURES

Fixed Beams, Continuous Beams, Moving Loads and Influence lines, Analysis of Trusses

4. CONCRETE TECHNOLOGY

Cement, Aggregates, Water, Admixtures, Fresh Concrete, Properties of Hardened Concrete, Concrete Mix Design, Durability of Concrete

5. GEOTECHNICAL ENGINEERING

Structure of soil, The Three Phase System, Index Properties of soils, Classification of Soils, Soil Water and Effective stress principal, Permeability of soils, Compressibility, Compaction, Shear strength, Exploration and in situ soil measurements.

6. WATER RESOURCES ENGINEERING

Hydrology, Precipitation, Infiltration, Evaporation and evapotranspiration, Run-off, Hydrographs, Floods, Ground water hydrology, Irrigation.

7. ENVIORMENTAL ENGINEERING

Introduction to Water Supply, Quality of Water, Sources of Water, Raw Water Conveyance, Treatment of Water, Distribution of Water., Sewage and Sewerage, Sewer Design, Sewer Appurtenances, Sewer Pumping, Waste Water Characteristics, Sewage Treatment, Effluent Disposal.

Part-II: MECHANICAL ENGINEERING

1. ENGINEERING MECHANICS

Free body diagrams and equilibrium; kinematics and dynamics of particles and of rigid bodies in plane motion

2. MECHANICS OF SOLIDS

Stress and strain, force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; springs; thin walled sections; Euler's theory of columns; strain energy methods; thermal stresses; mechanical properties; material testing.

3. VIBRATIONS

Free and forced vibration of single degree of freedom systems; effect of damping; vibration isolation; resonance; critical speeds of shafts.

4. DESIGN

Design for static and dynamic loading; failure theories; principles of the design of machine elements such as shafts, spur gears, rolling and sliding contact bearings, brakes, clutches and various joints.

5. PRODUCTION ENGINEERING

Unconventional Machining Processes, Computer controlled machines, CAD/CAM, CNC, Mechanics of Metal Cutting, Tool wear and Machinability, Economics of Metal cutting, Metal Forming, Casting Processes, Powder Metallurgy, Joining Processes, Finishing operations and super finishing processes, Measurement.

6. THERMAL ENGINEERING

Basic Laws of Thermodynamics, Availability, Irreversibility, Concept of Energy, Thermodynamic cycles related to energy conversion. Air Standard cycles, Normal and Abnormal Combustion in S.I. engines and C.I. Engines., Engine performance, Alternative Fuels for I.C. Engines.

7. FLUID MECHANICS AND MACHINES

Fluid properties, Bernoulli's equation, low through pipes, Hydraulic machines.

Part-II: ELECTRICAL ENGINEERING

1. ELECTRIC CIRCUITS
Network elements: ideal voltage and current sources, dependent sources, R, L, C, M elements; Network solution methods: KCL, KVL, Node and Mesh analysis; Network Theorems: Thevenin's, Norton's, Superposition and Maximum Power Transfer theorem; Transient response of dc and ac networks, sinusoidal steady-state analysis, resonance, two port networks, balanced three phase circuits, star-delta transformation, complex power and power factor in ac circuits.

2. ELECTROMAGNETIC FIELDS
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.

3. SIGNALS AND SYSTEMS
Representation of continuous and discrete time signals, shifting and scaling properties, linear time invariant and causal systems, Fourier series representation of continuous and discrete time periodic signals, sampling theorem, Applications of Fourier Transform for continuous and discrete time signals, Laplace Transform and Z transform. R.M.S. value, average value calculation for any general periodic waveform

4. ELECTRICAL MACHINES
Single phase transformer: equivalent circuit, phase diagram, open circuit and short circuit tests, regulation and efficiency; Three-phase transformers: connections, vector groups, parallel operation; Auto-transformer, Electromechanical energy conversion principles; DC machines: types, operation modes, characteristics, speed control; three-phase induction motors: operation, performance, tests, control; single-phase motors; losses, efficiency.

5. POWER SYSTEMS
Fundamentals of power generation, transmission models, load dispatch, compensation, fault analysis, protection systems, load flow methods, stability concepts, power factor correction, voltage/frequency control, and circuit breakers.

6. CONTROL SYSTEMS
Mathematical modeling and representation of systems, Feedback principle, transfer function, Block diagrams and Signal flow graphs, Transient and Steady- state analysis of linear time invariant systems, Stability analysis using RouthHurwitz and Nyquist criteria, Bode plots, Root loci, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model, Solution of state equations of LTI systems

7. ELECTRICAL AND ELECTRONIC MEASUREMENTS
Bridges and Potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, Digital voltmeters and multi-meters, Phase, Time and Frequency measurement; Oscilloscopes, Error analysis.

Part-II: MANAGEMENT

1. ORGANIZATIONAL BEHAVIOR AND ETHICS

The concept and significance of organizational behaviour- Skills and roles in an organization-classical, Neo- classical and modern theories of organizational structure-Organizational design-Understanding and Managing individual behaviour personality-Perception-Values- Attitudes-Learning-Motivation, Understanding and managing group behaviour, process-Inter-personal and group dynamics-communication- leadership-managing change-managing conflicts, Organizational development. Ethics and management system; ethical issues and analysis in management; Value based organizations; Personal framework for ethical choices; Ethical pressure on individual in organizations; Gender issues; Ecological consciousness; Environmental ethics; Social responsibilities of business; Corporate governance and ethics.

2. HUMAN RESOURCE MANAGEMENT

Concepts and perspectives in HRM; HRM in changing environment, Human resource planning-Objectives, process and techniques, Job analysis- job description, Selecting human resources, Induction, training and development, Exit policy and implications, Performance appraisal and evaluation, Potential assessment, Job evaluation, Wage determination, Industrial relations and Trade unions, Dispute resolution and grievance management, Labour welfare and social security measures.

3. FINANCIAL MANAGEMENT

Financial management- nature and scope, Valuation concepts and valuation of securities, Capital budgeting decisions- risk analysis, Capital structure and cost of capital, Dividend policy-determinant, Long-term and short-term financing instruments, Mergers and Acquisitions.

4. MARKETING MANAGEMENT

Marketing Environment and Environment scanning; Marketing information systems and marketing research; understanding consumer and industrial markets; demand measurement and forecasting; market segmentation - targeting and positioning; product decisions, product mix, product life cycle; new product development; branding and packaging; pricing methods and strategies. Promotion mix; advertising; Personal selling; channel management; vertical marketing systems; Evaluation and control of marketing effort; Marketing of services; Customer relation management, Uses of internet as a marketing medium- other related issues like branding, market development, advertising and retailing on the net.

5. PRODUCTION MANAGEMENT

Role and scope of production management; Factory location; Layout planning and analysis; Production Planning and control - production process analysis; Demand forecasting for operations; Determinations of product mix; Production scheduling; Work measurement ; Time and motion study; Statistical Quality Control; Role and scope of operations research; linear programming; sensitivity analysis; duality; transportation model; inventory control; Queuing Theory; decision theory; Markov Analysis; PERT/CPM.

6. ENTREPRENEURSHIP

Concepts- types, characteristics; motivation; competencies and development; innovation and entrepreneurship; small business - concepts government policy for promotion of small and tiny enterprises; process of business opportunity identification; detailed business plan preparation; managing small enterprises; planning for growth; sickness in small enterprises; rehabilitation of sick enterprises; Entrepreneurship (organizational entrepreneurship).

Part-II: EDUCATION

1. Educational Psychology

Concept: Meaning, Nature, Scope, and Function of Psychology, Heredity and Environment, Growth and Development at Different Stages, Theories – Thondike Theory of Learning, Piaget and Bruner's Cognitive Development, Maslow's Theory of Motivation, Erikson, Bandura and Vygotsky's Theories of Social Development, Kohlberg, Piajet's Theories Of Moral Development, Pavlov's Classical And Skinner's Operant Conditioning; Learning By Insight, Factors Affecting Learning - Transfer of Learning, Memory, Forgetting and Imagination, Interest, Intelligence, Aptitude, Attitude, Creativity, Personality, Adjustment And Mental Health - Process of Adjustment. Conflicts and Defence Mechanism, Mental Hygiene and Mental Health

2. Philosophical & Sociological Foundations

Indian Schools of Philosophy: Sankhya, Vedanta, Buddhism, Jainism, Islamic traditions with special reference to the concept of knowledge, reality and values and their educational implications. Contributions of Vivekananda, Tagore, Gandhi, and Aurobindo, JK Krishnamurthy to educational thinking. Western Schools of Philosophy: Idealism, Realism, Naturalism, Pragmatism, Existentialism, with special reference to the concepts of knowledge, reality and values their educational implications for aims, curriculum and methods of education. Sociology of Education: Concept, Nature, and Scope; Relationship between Education and Society; Concept of Social Organization, Social Groups, Social Stratification, and Relation to Education - Social Mobility and Social Change; Major factors in the process of Social Change. Agencies of Education for Socialization: Family, School, Community and State - Religion- Meaning and characteristics and relation to education; Culture- Meaning and Nature; Role of Education in cultural context; Education and cultural change. Equality of educational opportunities; Education of deprived groups-SC, ST, Disabled, Gender, Minority groups, Social, Cultural and Economic - Directive principles of constitution, Articles related to education, RTE-2009, Education for national integration and international understanding

3. Educational Leadership & Management

Introduction to Management-Concept, Characteristics, Functions of Management. Theories of Management – Peter Drucker, Fayol, Taylor. Resource Management – Human Resource Management, Records and Registers, Financial Management, Material Resource Management Leadership in Educational Administration: Meaning and Nature of Leadership Theories of Leadership Styles of Leadership Measurements of Leadership, Decision Making. Quality in Education – TQM, Supervision and Inspection, PTA, School Climate, Challenges In Management.

4. Guidance and Counselling

Concept, Need and Importance of Guidance and Counselling. Difference Between Guidance & Counselling, Types of Counselling, Steps of Counselling, Organizing Guidance Services At Different Levels Of Education, Occupational Information, Tools and Techniques of Guidance-Standardized Tests (Personality Inventories, Aptitude, Intelligence, Interest Inventories), Non-Standardized Tests (Rating Scale, Interview, Questionnaire, Case Study, Anecdotal Records) Counselling For Special Education- Hearing Impaired, Visual Impaired, Slow Learners, Learning Disability, Physically Handicapped, Cerebral Palsy, ADHD, Autism, Mentally Challenged, Gifted. Inclusive Education – Concept, History, Need, Challenges, Infrastructure Requirement, Teachers Role, Strategies for Inclusive Classroom.

5. Educational Evaluation

Evaluation – Concept, Need and Importance, Types, Principles, Blooms Taxonomy, Tools of Measurement - Subjective and Objective Tools, Essay Test, Objective Test, Scales, Questionnaires, Schedules, Inventories, Performance Tests. Characteristics of a Good Measuring Instrument: Validity Reliability Norms Usability, Etc. Test Standardization. Norm-Referenced and Criterion-Referenced Tests. Scaling Standard Scores. Measures of Central Tendency, Measures of Variability, Normal Probability Curve. New Trends in Evaluation – CBCS, Outcome Based Education, Grading System, Use Of Computer In Evaluation.

6. Teacher Education and Higher education

Basics of Teacher Education: Meaning, Concept, Scope, Historical Development, Elementary, Secondary and Teacher Education at Higher Level, Privatization, Globalization and Autonomy in Teacher Education, Problems in Teacher Education, Use of ICT in Education. Professional Development: Professional Code of Ethics for Teacher Educators, Performance Appraisal, Trends in Research in Teacher Education, Innovative Practices in Teacher Education. Concept of Higher Education: Concept and Purposes and History of Higher Education in India, Agencies and Their Functions in Higher Education: UGC, DST, ICSSR, ICMR, IISER, ICAR, AICTE, NCTE, RCI, NAAC. Issues and Problems in Higher Education Higher Education Management - Types of Universities- Central, State and Private, University Management and Autonomy, Constitutional Provision and Legislation for Universities.