



Ph.D. Entrance Test Syllabus for Ph.D. in Engineering and Technology, and Management

The SUMPET (Ph.D. Entrance test) for Ph.D. in Engineering and Technology, and Management 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 and Technology, and Management.

RESEARCH METHODOLOGY: PAPER-I COMMON TO ALL CANDIDATES

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.

COMPUTER SCIENCE & ENGINEERING / COMPUTER APPLICATION: PAPER-II

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, Undecidability, 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.

CIVIL ENGINEERING: PAPER-II

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.

MECHANICAL ENGINEERING: PAPER-II

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, flow through pipes, Hydraulic machines.

ELECTRICAL ENGINEERING: PAPER-II

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 modelling 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 Routh-Hurwitz 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.

MANAGEMENT: PAPER-II

1. ORGANIZATIONAL BEHAVIOR AND ETHICS

The concept and significance of organizational behavior- Skills and roles in an organization- classical, Neo- classical and modern theories of organizational structure-Organizational design- Understanding and Managing individual behavior personality-Perception-Values- Attitudes- Learning-Motivation, Understanding and managing group behavior, 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).