ANNEXURE - I

SYLLABUS

PART – I

ENGINEERING MATHEMATICS (Common to all Candidates)

i) **Determinants and Matrices**: Solving system of equations – Rank of the Matrix – Eigenvalues and eigenvectors – Reduction of quadratic form to canonical form.


iii) **Vector Calculus**: Double and triple integrations and their applications – Gradient, Divergence, Curl and Laplacian – Green’s, Gauss divergence and Stroke’s theorem.


PART – II

BASIC ENGINEERING & SCIENCES (Common to all Candidates)


PART – III

1. CIVIL ENGINEERING

i) Structural Engineering:


Steel Structures: Steel Sections – Connections – Design of Tension and Compression Members – Beams, Column Bases – Plate Girders and Trusses.


iii) Transportation Engineering : Highway Planning: Road Classification, Geometric Design of Highways, Construction of Earth, WBM, Bituminous and concrete roads, Design of flexible and rigid pavements. Drainage of roads, maintenance of roads. Railways, Airways, Docks and Harbour Planning: Railway alignment, components of permanent way, geometric design Airport planning, components of airport, site
selection, planning for terminal building, runways. Harbour planning, components of harbour, inland water transport.

Traffic Engineering: Traffic characteristics, Traffic surveys, Traffic Signals, Road markings and signs.


v) Environmental Engineering: Water and Waste water Engineering: Water requirements; water demand, quality standards; Development of water supply source, conveyance system; basic unit processes and operations for water treatment; water distribution; sewage characteristics; sewage treatment, primary and secondary treatment of sewage, sludge disposal, sewage disposal.

Air Pollution and Control: Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits.

Noise Pollution and Control: Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

equationlevel netsastronomical survey-practical astronomy-photogrammetry-EDM-hydrographic survey


2. MECHANICAL ENGINEERING


3. ELECTRICAL & ELECTRONICS ENGINEERING

i) Electrical Circuits and Fields: KCL, KVL, Nodal & Mesh analysis, transient response of D.C and A.C networks; sinusoidal steady-state analysis; resonance in electrical circuits; concepts of ideal voltage and current sources, network theorems, driving point admittance and transfer functions of two port network, three phase circuits; Fourier series and its application; Gauss theorem, electric field intensity and potential due to point, line, plane and spherical charge distribution, dielectric, capacitance calculations for simple configurations; Ampere’s and Biot-Savart’s law, inductance calculations for simple configurations.

ii) Electrical machines: Single phase transformer-equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformer-connections; auto transformer; principles of energy conversion, windings of rotating machines: D.C generators and motors-characteristics, starting and speed control, armature reaction and commutation; three phase induction motors-performance characteristics, starting and speed control; single-phase induction motors; synchronous generators- performance, regulation; synchronous motors-starting characteristics, applications, synchronous condensers; fractional horse power motors; permanent magnet and stepper motors.

iii) Power Systems: Electric power generation – thermal, hydro, nuclear; transmission line parameters; steady-state performance of overhead transmission lines and cables and surge propagation; distribution system, insulators, bundle conductors, corona and radio interferences effects; per-unit quantities; bus admittance and impedance matrices; load flow; voltage control and power factor correction; economic operation; symmetrical components, analysis of symmetrical and unsymmetrical faults; principle of over current, differential and distance protections; concepts and solid state relays and digital
protection; circuit breakers; principles of system stability-swing curves and equal area criterion

iv) Control systems : Principles of feedback; transfer function; block diagram; steadystate errors; stability- Routh and Nyquist criteria; Bode plots; compensation; root loci; elementary state variable formulation; state transition matrix and response for Linear time Invariant systems.

v) Power Electronics and Drives : Semiconductor power devices-diodes, transistors, thyristors, triacs, GTO, MOSFETs and IGBTs-static characteristic and principles of operation; triggering circuits; phase control rectifiers; bridge converters-fully controlled and half controlled; principles of choppers and inverters, basic concepts of adjustable speed dc and ac drives.


Microcontrollers: 8 bit microcontroller – 8051 architecture, bus configuration, Instruction sets, programming & applications.


4. ELECTRONICS AND COMMUNICATION ENGINEERING

i). Circuit Analysis: DC Circuit analysis, Thevenin’s and Norton’s equivalent circuits, Sinusoidal steady state analysis, Transient and resonance in RLC circuits.

Electronic Devices: Diodes, Bipolar Junction Transistors, FET, MOSFET, UJT, Thyristor.

Electronic Circuits: Small signal amplifiers using BJT and FET devices, Large signal amplifiers, Power supplies, Feed back amplifiers, Oscillators, Pulse shaping circuits.

Digital Electronics: Logic gates, Combinational circuits, Sequential circuits.

Linear Integrated Circuits: Operational amplifiers and its applications, PLL, Voltage regulators, A/D and D/A converters.

Measurements and Instrumentation: Transducers, Digital Instruments, Display and Recording systems. Microprocessor and its applications: Microprocessors-8085 and 8086 architectures and interfaces, Micro-controller and applications.


EM waves and waveguides: Guided waves, Rectangular and cylindrical waveguides.


Microwave Engineering: Microwave tubes, semiconductor devices, Passive components, Microwave measurements.

Digital Communication: Base band signaling, Band pass signaling, Error control coding, Spread spectrum techniques.


Optical Communication: Optical Fibers, optical transmitters and receivers.


Digital Signal Processing: IIR and FIR filters, Realisation and implementation, Quantisation effects.

Control Systems: Transfer function, Time and frequency response analysis, Stability analysis, state variable analysis

5. PRODUCTION and MANUFACTURING


6. **INDUSTRIAL ENGINEERING**


ii) **Work System Design and Ergonomics**: Productivity – concepts and measurements; method study, micro-motion study, principles of motion economy; work

iii) Operation Research: Linear programming – problem formulation, simplex method, duality and sensitivity analysis; transportation and assignment models; network flow models; Project management – PERT and CPM, Dynamic Programming, Decision Analysis, Game Theory, Waiting Line Models, Markov Processes, Inventory – functions, costs, classifications, deterministic inventory models, quantity discount; perpetual and periodic inventory control systems, Introduction to simulation and applications


7. COMPUTER SCIENCE & ENGINEERING AND INFORMATION TECHNOLOGY


v) **Distributed Systems**: Communication and Distributed Environment, Distributed Operating Systems, Distributed Shared Memory, Protocols, Fault Tolerance and Distributed File Systems, Distributed Object Based Systems.

vi) **Programming And Data Structures**: Problem Solving Techniques, Trees, Hashing and Priority Queues, Sorting, Graph, Heap Search.


viii) **Microprocessors And Microcontrollers - Computer Architecture And Organisation**: Digital Fundamentals, Combinational Circuits, Synchronous and Asynchronous Sequential Circuits, Instruction Set Architecture (RISC, CISC, ALU Design), Instruction Level Parallelism, Processing Unit and Pipelining, Memory Organisation.

ix) **Digital Signal Processing**: FFT, Filter Design.

x) **Computer Networks**: Data Communication Systems, Applications.

xi) **Database Management Systems**: Relational Model, Database Design, Implementation Techniques, Distributed Databases, Object Oriented Databases, Object Relational Databases, Data Mining and Data Warehousing.


xiii) **Artificial Intelligence**: Intelligent Agents, Search Strategies, Knowledge Representation, Learning, Applications.


8. **INSTRUMENTATION ENGINEERING**

i) **Measurements**: Units & Standards, Calibration methods, Systematic and random errors in measurement, propagation of errors, static & dynamic characteristics of Transducers. PMMC, MI and dynamometer type instruments. Bridges for measurement of R, L and C. Measurement of voltage, current and power in single and three phase circuits, time, phase and frequency measurements, digital voltmeter, digital multi-meter. Oscilloscope, shielding and grounding.

ii) **Analog Electronics**: Characteristics and applications of diode, Zener diode, BJT and MOSFET. Small signal analysis of transistor circuits, feedback amplifiers, Characteristics of operational amplifiers and applications of opamps: difference amplifier, adder, subtractor, integrator, differentiator, instrumentation amplifier, precision rectifier and active filters. Oscillators, signal generators, voltage controlled oscillators and phase locked loop.

iii) **Digital Electronics**: Combinational logic circuits, minimization of Boolean functions. IC families: TTL and CMOS. Arithmetic circuits, comparators, Schmitt trigger, multivibrators, sequential circuits, flip-flops, shift registers, timers and counters, sample-and-hold circuit, multiplexer, analog-to-digital (successive approximation, integrating, flash and sigma-delta) and digital-to-analog converters (weighted R and R-2R ladder), Characteristics of ADC and DAC (resolution, quantization, significant bits, conversion/settling time). Basics of number systems, 8-bit microprocessor and microcontroller: applications, memory and input-output interfacing, basics of data acquisition systems.

iv) **Industrial Instrumentation & Analytical Instrumentation**: Transducers for industrial instrumentation: displacement (linear and angular), velocity, acceleration, force, torque, vibration, shock, pressure (including low pressure), flow (differential pressure, variable area, electromagnetic, ultrasonic, turbine and open channel flow meters) temperature (thermocouple, bolometer, RTD (3/4 wire), thermistor, pyrometer and semiconductor); liquid level and viscosity measurement. Smart Transmitters (HART/Foundation Fieldbus enabled Transmitters). pH and conductivity meters, Chromatography, NMR & X-ray Spectroscopy.