

# **Department of Computer Science**

National Institute of Technology

## **Broad Syllabus Topics for PhD Entrance Exam**

1. Operating Systems
2. Data Structures
3. Algorithms
4. Computer Networks
5. Network and Computer Security
6. Theory of Computation
7. DBMS
8. Computer Architecture
9. C/C++ Programming
10. Engineering Mathematics and General Aptitude.

**Department of Chemistry,  
National Institute of Technology, Srinagar.**

**Syllabus for M. Phil. /Ph.D. Entrance test-2018**

**Inorganic Chemistry:**

1. Chemical periodicity
2. Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR Theory).
3. Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents.
4. Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds.
5. Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms.
6. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.
7. Organometallic compounds: synthesis, bonding and structure, and reactivity. Organometallics in homogeneous catalysis.
8. Analytical chemistry: separation, spectroscopic, electro- and thermoanalytical methods.
9. Nuclear chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.
10. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogen fixation, metal complexes in medicine.

**Organic Chemistry:**

1. Stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction.
2. Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions.
3. Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes.

ELECTRONICS & COMMUNICATION ENGINEERING DEPARTMENT

NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR



SYLLABUS FOR PH. D ENTRANCE TEST (2018 SESSION) FOR E C E DEPARTMENT

**ELECTRIC CIRCUITS & 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'S AND NORTON'S MAXIMUM POWER TRANSFER, 3 PHASE AND WYE-DELTA TRANSFORMATION. TRANSIENT AND STEADY STATE ANALYSIS OF AC AND DC CIRCUITS. 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. FILTERS.

**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.

**ELECTRONIC DEVICES & CIRCUITS:** 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-I-N AND AVALANCHE PHOTO DIODE, BASICS OF LASER. DEVICE TECHNOLOGY: INTEGRATED CIRCUITS FABRICATION PROCESS, OXIDATION, DIFFUSION, ION IMPLANTATION, PHOTOLITHOGRAPHY, N-TUB, P-TUB AND TWIN-TUB CMOS PROCESS. SMALL SIGNAL EQUIVALENT CIRCUITS OF DIODES, BJTs AND MOSFETs. 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. SINUSOIDAL OSCILLATORS; CRITERION FOR OSCILLATION.

**DIGITAL CIRCUITS:** BOOLEAN ALGEBRA, MINIMIZATION OF BOOLEAN FUNCTIONS; LOGIC GATES; 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, ADCs, DACs. MICROPROCESSOR (8085): ARCHITECTURE, PROGRAMMING, MEMORY AND I/O INTERFACING.

**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, SUPER-HETERODYNE 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.

### **ANTENNAS & WIRELESS COMMUNICATIONS**

TRANSMISSION LINES- DISTORTION LESS & DISSIPATION LESS LINES, OPEN AND SHORT CIRCUIT LINES AND LINES OF DIFFERENT LENGTHS. BASIC ANTENNA PARAMETERS, ANTENNA ARRAYS, PARABOLIC REFLECTOR, FOLDED DIPOLE.

CELLULAR CONCEPTS, FREQUENCY REUSE, CO CHANNEL INTERFERENCE, CELL SPLITTING. RADIO PROPAGATION CHARACTERISTICS; MODELS FOR PATH LOSS, SHADOWING AND MULTIPATH FADING. DIVERSITY TECHNIQUES AND RAKE DEMODULATOR. WAVE PROPAGATION THROUGH VARIOUS MEDIA.

### **COMPUTER NETWORKS**

REVIEW OF DATA COMMUNICATION TECHNIQUES. DATA TRANSMISSION, LINE CODING, ERROR CONTROL CODING. SWITCHING. LAN TOPOLOGIES AND PROTOCOLS. MAC PROTOCOLS, ROUTING AND CONGESTION CONTROL. QUALITY OF SERVICE. NETWORK SECURITY: SERVICES, ATTACKS AND MECHANISMS. CRYPTOGRAPHY: SECRET AND PUBLIC KEY. HASH FUNCTIONS, DIGITAL SIGNATURES

**COMPUTER ORGANIZATION AND ARCHITECTURE:**COMPUTER CYCLE CONTROL, CPU ORGANIZATION, MEMORY ORGANIZATION, I/O ORGANIZATION, PIPELINING

PROGRAMMING AND DATA STRUCTURES: PROGRAMMING IN C; FUNCTIONS, RECURSION, PARAMETER PASSING, BINDING; ABSTRACT DATA TYPES, ARRAYS, STACKS, QUEUES, LINKED LISTS, TREES, BINARY SEARCH TREES, BINARY HEAPS.

### **BASIC MATHEMATICS & GENERAL APTITUDE**

IT IS ALSO INFORMED THAT

WRITTEN TEST SHALL BE BASED ON MULTIPLE CHOICE QUESTIONS (MCQ)

FOR ANY QUERIES PLEASE CONTACT:

OFFICE ECE DEPARTMENT

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**Department of Electrical Engineering  
National Institute of Technology Srinagar**

**SYLLABUS FOR Ph. D ENTRANCE EXAMINATION 2018**

1. Electric Machines – Transformers, D.C Machines, Induction Machines, Synchronous Machines.
2. Control Systems – Classical & Modern Control.
3. Circuit Analysis – AC & DC
4. Power Systems – Transmission distribution, fault analysis & Stability, Renewable Energy Systems.
5. Electric Measurements & Instrumentation
6. Power Electronics
7. Microprocessor & Microcontrollers
8. General Aptitude
9. Engineering Mathematics

**(Dr. S. A. Lone)  
Prof. & Head**

DEPARTMENT OF INFORMATION TECHNOLOGY

NIT SRINAGAR

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## **Broad Syllabus Topics for PhD Entrance Examination**

1. C & Data Structures
2. Software Engineering
3. DBMS
4. Operating System
5. Microprocessors
6. Data communication
7. Big data and Cloud Computing
8. Computer Networks
9. Wireless Mobile Communication
10. Artificial Intelligence
11. Computer Graphics and Image Processing
12. Embedded Systems
13. Information Security
14. General Aptitude and Engineering Mathematics.

# National Institute of Technology

## Department of CIVIL Engineering

### Syllabus for Ph.D. admission–Session: Autumn-2018

#### (Geotechnical Engineering)

#### **A. Core Areas (50% Weightage)**

**Soil Mechanics**; Soil and its formation, processes and agencies involved in formation, types of soils, three phase soil model, index properties and classification of soils. Flow through soils, Laplace equation for steady flow. Effective stress concept and pore pressure, Compaction of soils and its field application; stress distribution under loaded plates; Clay Mineralogy, Basic structural units, Isomorphic substitution, base exchange capacity, inter atomic and inter molecular bonds, different clay minerals; Engineering properties of clay minerals, permeability, swelling & shrinkage and stress – strain characteristics of soil and consolidation theory; review of conventional shear stress factors affecting shear strength of soils – pore pressure in soils – pore pressure measurements in triaxial test and field measurements – total and effective shear stress parameters, stress path, total stress path and effective stress path – Mohr's shear parameters – shear strength, thixotropy and liquefaction of soils.; Compressibility of Soils: Concept of Stress, Principal Stress and Strain, Stress – Strain relations, plane Stress, Plane Strain, Mohr's diagram.; Settlement and consolidations: ultimate Settlements (Consolidation Test), Time rate of Consolidation, Effect of Layers and changes in parameters on the rate of consolidations.;

**Shallow and Deep Foundations**; Soil Investigations: Factors affecting site investigation, Planning sub soil exploration programme, Methods of soil exploration, Spacing and depth of borings, Location of borrow areas, bore log.; Types of Shallow Foundations: Strip pad, Combined, Raft Foundations; Bearing Capacity: Terzaghi's factors, Accuracy of Terzaghi's factors, Effect of footing shape, Net bearing capacity, General formulae, Soil layers of finite depths, Non uniform soils, Strength increasing with depth, Footings on slopes, Layered soils.; Settlement: Limits of settlement, Settlement computation, theory of elasticity, 1-D Conditions, 3-D problems.; Rate of settlement, Settlement of footings on sand, determination of BC based on settlement and bearing criteria.; Raft Foundations: Strip raft, Circular raft, rectangular raft, foundation – soil materialization – Beams & Plates on EI Found.; Foundation – Soil Structure Interaction: Idealized soil behavior – Foundation behavior, Interface behavior, Analytical techniques, Scope of soil – Foundation interaction analysis.; Beams on Elastic Foundations: Winkler and Modified Winkler Models ;Theory of sub grade reaction, Applications of solution of beams on elastic foundations for footings and rafts, Finite Difference Method.;

**Deep Foundations**: Criteria for Design, types of Piles, Pile Load Capacity, Group Effects ; Design charts and equations for single pile, pile group settlement, pile load testing, Butter Piles, Negative Skin friction, Settlements and deformation prediction, Lock – Socketed Piles.; Well Foundations: Shapes of wells and component parts, Depth of well foundation and bearing capacity, Forces acting on a well foundation, Analysis of well foundation, well curb, cutting edge, staining and bottom plug, Well sinking.;

**Earth Pressure and Retaining Structures**; Earth Pressure Theories and Retaining Walls: conventional retaining wall, Gravity and Cantilever walls, sheet pile walls (Cantilever & Anchored)...; Strutted excavations: Stability of slopes to open excavations, Support of excavations, Structural Design of Supports to excavation, Overall stability, inward yielding and settlement of ground surrounding excavation.; Reinforced Earth Walls: Concepts – Designs

### **B- Allied Areas-----(25% Weightage):**

**Surveying**; principles of surveying, types of surveying; Leveling and trigonometrical leveling; Theodolite surveying; Tacheometry, Geodetic surveying, areas and volume, curves,

**Structural Engineering**: Analysis of stress and strain, flexural and torsional load analysis, determinate and indeterminate structures, bending and shear stresses, compound stresses, slopes and deflections, columns.

**Fluid mechanics and Hydraulics**: Basic fluid flow concepts, fluid statics, fluid kinematics and dynamics, pressurized flow, water hammer, laminar and turbulent flow; open channel hydraulics, irrigation engineering; water quality and waste treatment.

### **C. General Aptitude & Mathematics -----(25% Weightage)**

#### **i) General Aptitude**

#### **ii) Mathematics**

The calculus of the Finite Difference : Differences, Differences Formulae, Difference table, Operator E, Properties of the operator E and  $\Delta$ , Leibnitz rule – Interpolation with equal intervals, unequal intervals, Central difference interpretation formulae.; Numerical Differentiation and Integration and Inverse Interpolation; Numerical solution of ordinary difference equations of the first and second order; Simultaneous linear algebraic equations – methods of solution using the inverse of the matrix, method of successive elimination.; Iterative method – Gauss-Seidel method, Relaxation methods;



# National Institute of Technology

## Department of CIVIL Engineering

### Syllabus for Ph.D. admission–Session: Autumn-2018

#### (Water Resources Engineering)

#### **A. Core Areas (50% Weightage)**

**Fluid Mechanics and Hydraulics:** Properties of fluids, principal of conservation of mass, momentum, energy and corresponding equations, potential flow, applications of momentum and Bernoulli's equation, laminar and turbulent flow, flow in pipes, pipe networks. Concept of boundary layer and its growth. Uniform flow, vertical flow and gradually varied flow in channels, specific energy concept, hydraulic jump. Forces on immersed bodies flow measurements in channels, tanks and pipes. Dimensional analysis and hydraulic modeling Kinematics of flow, velocity triangles and specific speed of pumps and turbines.

**Hydrology:-** Hydrologic cycle, rainfall, evaporation, infiltration, stage discharge relationships, unit hydrographs, flood estimation, reservoir capacity, reservoir and channel routing. Well hydraulics.

**Irrigation :** Duty , delta, estimation of evapo- transpiration. Crop water requirements. Design of: lined and unlined canals, water ways, head works, gravity dams and spillways. Design of weirs on permeable foundation. Types of irrigation system, irrigation methods. Water logging and drainage, sodic soils.

**Water Quality:** Quality standards, basic unit processes an operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water. Sewage and sewerage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, sludge disposal, effluent discharge standards, Domestic wastewater treatment, quantity of characteristics of domestic waste water , primary and secondary treatment. Unit operations and unit processes of domestic waste water sludge disposal.

**Air pollution;** Types of pollutants, their sources and impact, air pollution meteorology, air pollution control, air quality standards and limits.

**Municipal solid wastage:** Characteristics, generation , collection and transportation of solid wastes, engineered systems of solid waste management (reuse/recycle, energy recovery, treatment and disposal.

#### **B- Allied Areas-----(25% Weightage):**

**Surveying;** principles of surveying, types of surveying; Leveling and trigonometrical leveling; Theodolite surveying; Tacheometry, Geodetic surveying, areas and volume, curves,

**Structural Engineering:** Analysis of stress and strain, flexural and torsional load analysis, determinate and indeterminate structures, bending and shear stresses, compound stresses, slopes and deflections, columns.

**Soil Mechanics:** Origin of soils, soil classification, three-phase system, fundamental definitions, permeability and seepage effective stress principle, consolidation, compaction, shear strength

### **C. General Aptitude & Mathematics -----(25% Weightage)**

#### **i) General Aptitude**

#### **ii) Mathematics**

The calculus of the Finite Difference : Differences, Differences Formulae, Difference table, Operator E, Properties of the operator E and  $\Delta$ , Leibnitz rule – Interpolation with equal intervals, unequal intervals, Central difference interpretation formulae.; Numerical Differentiation and Integration and Inverse Interpolation; Numerical solution of ordinary difference equations of the first and second order; Simultaneous linear algebraic equations – methods of solution using the inverse of the matrix, method of successive elimination.; Iterative method – gauss Siedel method, Relaxation methods;

# National Institute of Technology

## Department of CIVIL Engineering

### Syllabus for Ph.D. admission–Session: Autumn-2018

#### (Engineering Geosciences and Rock Engineering)

#### **A. Core Areas (50% Weightage)**

(Earthquake Engineering)

1. Engineering Seismology (Earthquake Engineering) Engineering Seismology, Seismology and Seismic Exploration (Definitions). Introduction to Seismic Hazard and Earthquake Phenomenon. Global seismicity - Analysis of earthquake focal mechanisms. Seismotectonics and Seismic Zoning of India. Microzonation. Mechanism of Faulting. Earthquake Prediction. Site Response to Earthquakes: Local geology and soil conditions. Site investigations and soil tests. Dynamic design criteria for a given site. Earthquake Monitoring and Seismic Instrumentation. The Seismograph – Principles of Seismometer. Location of the epicenter of an earthquake. Earthquake size and intensity. Energy released in an earthquake. Earthquake: Risk and Preparedness. Earthquake: Social Consequences; Codes and Public Policy.

2. Engineering Geology:

Physical Geology; geology and its relevance to civil engineering, geological work of wind, rivers, glaciers and seas. Petrology; formation of rocks, types/field classification, weathering of rocks, origin of soils. Structural Geology; folds, faults, joints, unconformities. Engineering Geology; geological considerations in tunnels, dams, bridges, building sites; landslides; Earthquakes; basic definitions, types and causes, distribution in the world, seismic zones.

3. Materials:

Stones; their engineering properties; bricks, classification and strength requirements; tiles and their uses. Timber; properties, defects, seasoning, decay and prevention. Lime; types, properties and tests.

4. Rock Mechanics:

Introduction to rock mechanics and rock engineering. Terminology, Rock Classification Systems. Physical and Mechanical Properties of Rocks. Laboratory Testing. Rock masses: strength, deformability, failure criteria. Foundations and slope stability: foundations on discontinuous rock, slope instability basic mechanisms. Rock reinforcement and rock support: underlying principles, similarities and differences. Rock Bolting.

## 5. Tunnelling Technology:

Introduction to tunnelling: Fundamental definitions, tunnelling art and engineering, historical development, Classification of tunnels. Geological aspects of tunnelling: Geological investigation, evaluation and appreciation, importance of geological knowledge, aim of geological investigation, principal elements of exploration programme, Influence of geological conditions on design and construction of tunnels. Methods of Tunnelling in soft and hard rock. Lining of tunnels. Tunnel supports.

### **B- Allied Areas-----(25% Weightage):**

**Surveying**; principles of surveying, types of surveying; Leveling and trigonometrical leveling; Theodolite surveying; Tacheometry, Geodetic surveying, areas and volume, curves,

**Soil Mechanics**: Origin of soils, soil classification, three-phase system, fundamental definitions, permeability and seepage effective stress principle, consolidation , compaction, shear strength

**Water Resources Engg.**: Hydrologic cycle, rainfall, evaporation, infiltration, stage discharge relationships, unit hydrographs, flood estimation, reservoir capacity, reservoir and channel routing. Well hydraulics.

### **C. General Aptitude & Mathematics -----(25% Weightage)**

#### **i) General Aptitude**

#### **ii) Mathematics**

The calculus of the Finite Difference : Differences, Differences Formulae, Difference table, Operator E, Properties of the operator E and  $\Delta$ , Leibnitz rule – Interpolation with equal intervals, unequal intervals, Central difference interpretation formulae.; Numerical Differentiation and Integration and Inverse Interpolation; Numerical solution of ordinary difference equations of the first and second order; Simultaneous linear algebraic equations – methods of solution using the inverse of the matrix, method of successive elimination.; Iterative method – gauss Siedel method, Relaxation methods;

**Mechanical Engineering Department**  
**National Institute of Technology Srinagar**  
Syllabus outline for PhD Entrance Exam, Autumn 2018

**Thermodynamics**

Zeroth law, First law & Second law of thermodynamics, air & vapor power cycles, nozzles, boilers, steam turbines, compressors, refrigeration and air-conditioning, internal combustion engines, gas turbines

**Theory of Machines**

Kinematics & kinetics of particles, lower pairs & higher pairs, mechanisms and DOF, inversions, velocity and acceleration analysis, instantaneous centre, governors, flywheels, gears & cams, torsional vibrations, various types of damping, forced harmonic vibration

**Mechanics of Materials**

Free body diagrams, section forces in beams, analysis of stress and strain, pressure vessels, mechanical properties of solids, symmetric & unsymmetrical beam bending, theories of elastic failure, columns, torsion of circular shafts, strain energy due to normal and shear stresses, Castigliano's theorem, complementary energy theorem, slopes and deflections, theories of failure, stresses in hollow and solid discs, stresses in rotating disc of constant thickness, closed coiled helical springs, leaf springs, conical springs,

**Fluid Mechanics & Hydraulic Machinery**

Fluid at rest, manometers, hydrostatic pressure thrusts, buoyancy, flotation, stability, scalar and velocity fields, flow field and description of fluid motion, Continuity equation, Momentum equation, energy equation, Euler's equation, Bernoulli equation, Navier-stokes equation, boundary layer equations, momentum-integral equation of boundary layer, Turbulent flow, Work output and efficiency, water turbines, pumps, dimensional analysis

**Heat Transfer**

Fourier's law of heat conduction, three dimensional heat conduction equation in Cartesian, cylindrical and spherical coordinates, heat conduction with heat generation, fins, unsteady heat conduction with negligible internal temperature gradients, free and forced convection, thermal radiation, boiling heat transfer

**Machine Design**

Introduction to design, objectives of design, design process, concept of factor of safety in design, design of riveted joints, welded joints, screw jack, design of brakes, gear design, bearing design, Various types of loading in mechanical systems, stress concentration, endurance limit, SN curves and fatigue, manufacturing consideration in design, standardization of design of friction elements, design of internal combustion engine components, introduction to fracture mechanics based design

**Manufacturing Technology**

Introduction to basic manufacturing processes and engineering materials, casting technologies, introduction to metal cutting, machine processes and machine tools, metal forming, hot working and cold working, forging, extrusion, press-work operations, explosive forming, electromagnetic forming, fabrication of composites, welding, resistance welding, ultrasonic welding, laser beam welding, defects in welding

**Material science**

Classification of materials, modern and advanced materials, primary and secondary bonds and energy related concepts, structure of metals and ceramics, concept of unit cell and lattice arrangements, ceramic crystals and density computations, crystal systems, polycrystalline materials, and single crystalline material, atomic densities (linear and planar), x-ray diffraction, diffusion mechanism, deformation and strengthening mechanisms, phase diagrams

**Industrial Engineering**

Productivity, work study, facility layout & location, material management & its techniques, SQC, techniques of operation research

**Automatic Control**

Open and closed loop systems, servo-mechanisms, block diagram and transfer functions, system response, first and second order systems, response to step and pulse, ramp and sinusoidal inputs, modes of control, stability of control systems, Routh's criteria, frequency response analysis, Bode and Nyquist stability criteria

**Instrumentation**

Generalized measurement system, standards, calibration, uncertainty, errors, Hydraulic and pneumatic load cells, instruments for high, mid and low pressure measurement, flow measuring devices, temperature sensing techniques

**Mathematics**

Laplace transforms, numerical methods, statistics and probability, complex variables, ordinary and partial differential equations, complex variables