SYLLABUS FOR THE SUBJECT OF PRINCIPLE OF ENGINEERING
PAPER- I
Fundamentals of Engineering

Total Marks: 100

1   Applied Physics:

Classical mechanics: Density, Dimension, Gravity, Motion, Position, Velocity, Acceleration, Mass, Momentum, Force, Energy, Angular momentum, Torque, Conservation law, Wave, Work, Power.

Quantum mechanics: Matrix Mechanics, Planck's constant, Quanta, Quantization, Quantum harmonic oscillator, Quantum number, Spin, Wave-function, Wave mechanics, Wave-particle duality, Zero-point energy, Pauli Exclusion Principle, Heisenberg Uncertainty Principle.

Theory of relativity: General principle of relativity, Gravity, Inertial frame of reference, Invariance, Length contraction, Principle of Relativity, Reference frame, Rest energy, Rest mass, Speed of light, Stress-energy tensor, Time dilation.

Optical Physics: Aberrations, Diffraction, Dispersion, Optical Resolution, Polarization, Ray (optics), Reflection, Refraction, Scattering, Wave, Lenses, Mirrors, Optical instruments, Prisms

Particle Physics: Fundamental force (gravitational, electromagnetic, weak, strong), Elementary particle, Spin, Antimatter, Quantum gravity, Vacuum energy

Solid State Physics: Amorphous solid, Crystal Structure, Free electron model, Energy band gap, conduction band, electron hole, excitation, valence band, Superconductivity, crystal optics.

RECOMMENDED BOOKS:

1.   *Sears and Zemansky's University Physics by Hugh D. Young, Roger A. Freedman, T.R. Sandin and A. Lewis Ford*
2.   *Basic Physics by Karl F. Kuhn*

2.   Applied Chemistry:

Electro-Chemistry: Electrolysis, Electrolytic conductance, Migration of ions, Galvanic Cells, reversible and Irreversible cells, Standard electrode potentials, Buffer solutions.

Solutions: Ideal and non–ideal solutions, Roult's and Henry's Laws, Solubility curves, Heat of solutions.

Liquids and their properties: Vapor pressure, vapor pressure and boiling point, surface tension, viscosity, Refractive index and its measurement, Polarimetery, Intermolecular and intermolecular forces amongst liquid molecules.

Solid State: Crystalline structure, different properties of crystals, X-rays and crystal structures, production of X-rays, Heat capacities of solids.

Gases: Boyle's Law, Charles's Law, Gas constant, Dalton's Law of Partial Pressure, Graham's Law of Diffusion, Kinetic theory of Bases, Heat Capacity of Gases.

3. **Applied Electricity & Electronics:**

Electricity & Magnetism; Electrical potential, Resistance, Laws of resistance, Conductance, Conductivity, Impedance, Ohm law, Resistance in series and in parallel, practical resistors, work, power, Energy, Joule's law of electric field intensity, Gauss's Theorem, Capacitor, Capacitance, Capacitors in parallel and series. Force on a conductor in a magnetic field, electrical and magnetic circuits, leakage flux, Relation between magnetism and electricity, Induced emf, induced current and directions, Faraday's laws of electromagnetic inductions, Lenz's law, dynamically induced emf, Self inductance, mutual inductance and inductance in series/parallel, magnetic hysteresis, Energy stored in magnetic field, Generation of alternating currents and voltages.

Electrical Machines:

DC Motors: Shunt, Series and Compound Motors, Speed and Torque Relations. Transformers: Principle, Construction, Voltage transformation ratio, Step-up/step-down transformers, Copper & Iron Losses, Transformer connections; delta and star.

AC Motors: Induction motor, Synchronous motor, Performance, Efficiency. Single phase and three phase Motors.

Generators: Principle, Construction, Different components of generators. AC Generators, DC Generators.

Electronics:

N-type material, P-type material, diodes, junctions, P-N junction, forward bias, reverse bias.

Transistors: types, calculations of voltages and currents in simple transistor circuits.

Amplifier & Oscillators: Working and classification of amplifiers, Class A and Class B Amplifiers, Feedback Amplifiers, Types of Feedback, RC Oscillators.

Integrated circuits: OP Amps, timers, flip flop, converters, filters.

Telecommunications: EM theory, antennas, antenna gain, free space loss, fading. Modulations (AM, FM, PM, PWM, Delta, FSK, ASK, PSK), Error correction, Demodulation, Detectors, Transmitter, Receivers.

DSP and Controls; filters, stability, Z-transform, Nyquist criteria, S domain, transfer functions.

Introduction to Computing; History and evolution of computers, central processing unit, data storage, input/out put devices, multimedia, operating systems, programming languages, networking, the internet, system analyses and design, management information system, electronic commerce, security and privacy issues, ethical issues and the computing profession,

Power Systems: power network analysis, Polyphase circuits, Transients, Transmission Lines, Losses.

RECOMMENDED BOOKS:

1. *Electrical Technology by B.L. Tharaja*
2. *Electronic Devices and Circuits by Bogart.*
3. *DC Machines by P.C. Sen*
4. *Semiconductors by Manzar Saeed*
5. *Modern Digital and Analog Communication by B.P.Lathi*
6. *Introductory Electronic Devices and Circuits by Paynter*
7. *Network analysis, by Van Belkernberg.*
8. *Wireless Communication by Willium Stallings.*
9. *Computers, tools for an information age, 8th ed. H.L. Captron, Addison Wesley, 2003*

4. **Mechanical Engineering Fundamentals**

Mechanics and Strength of Materials: Concept of Stress and Strain, bending, torsion, geometric properties of areas, principal stresses, Tensile testing, Stress-Strain curve, Difference between Engineering and True stress & Strain, Shear Stress & Strain, Concept of elastic and plastic deformation, Yield & ultimate Tensile strengths, Elongation, Toughness and Resilience, Ductility and Malleability, Hardness Testing, Brinell and Rock well Hardness test, bending moment,
Fluid Mechanics; Properties and basics of fluid mechanics, loss of head, power transformation by fluids, pumps, turbines. Fluid static's, Fluid dynamics, Types of flow: Turbulent and Laminar, Reynold's number.

Thermodynamics and Heat Transfer. (Basics of thermodynamics, properties of fluids and steam, steam turbines, power plants. First and second Laws of Thermodynamics, Enthalpy, Entropy, Heat Capacity, Carnot cycle, Gibbs free energy, Equilibrium, PV – diagrams, Refrigeration and Air conditioning, principle and models of heat transfer, Evaporators, Condensers, Heat engines, Engines (2 and 4 strokes).

Manufacturing: Different manufacturing processes like Casting, Forging, Machining, Rolling, Extrusion, Wire-drawing, welding, Turning(lathe), Milling, Shaping, Gear cutting, Drilling, Fitting.

RECOMMENDED BOOKS:

1. *Schaum Outline Series; Strength of Materials by Williym A. Nash 3ʳᵈ Ed 1994, McGraw Hill Edition.*
2. *Fluid Mechanics by Lewitt*
3. *Fluid Mechanics by Daugherity*
4. *Engineering Mechanics (Statics) by J.L. Merriems.*
5. *Engineering Mechanics (synamics)by J.L. Merriems*
6. *Strength of Materials by Singer for Mechanics of Materials*
7. *Testing of metals by Fazal Karim*
8. *Manufacturing Processes for Engineering Materials by Kalpakgjian*

5. **Materials Engineering:**

Introduction to Materials; Types of Materials. Structure of an atom, Metallic bonding, Crystal Structures and geometry,
Metallic Materials: Mechanical properties of Metals and alloys, Ferrous and non-ferrous metals & alloys, Applications of Different metals and alloys in industry

Polymeric and Ceramic Materials: Polymerization, General purpose and Engineering thermo-plastics, thermosetting plastics, Rubbers.

Traditional and engineering ceramics, Processing of ceramics, Electrical properties of ceramics, Mechanical properties of ceramics, Thermal properties of ceramics, Glasses.

RECOMMENDED BOOKS:

1. *Principles of Materials Science and Engineering by William F. Smith*
2 *Introduction to Physical Metallurgy by Sydney H. Avner*

6.   Civil Engineering Fundamentals:

Structures; stress, strain, shearing force and bending moment concepts, beams, columns, footing. Simply supported and Cantilever beams, Pulleys and gears.

Transportation Engineering: Introduction, highway administration, scheme preparation, traffic appraisal, environmental appraisal, highway geometry, drainage, lighting, signing, communications and safety, roads and traffic in urban areas, highway maintenance, low cost roads in developing countries.

Environmental Engineering: Environmental impacts on water resources projects, transportation engineering projects, waste water treatment and management, water supply and distribution.

Fundamentals of Hydraulic Engineering: Properties of fluid mechanics, pressure measuring devices, flow measuring devices, losses in pipelines, open channels, barrages and dams.

RECOMMENDED BOOK:

1. *Properties of Concrete by A.M. Neville.*
2. *Plain and reinforced concrete by Nilson.*
3. *Strength of material by Andrew Pytel and Singer.*
4. *Transportation Engineering, Planning and design by Paul Wright.*
5. *Civil Engineer's Reference Book by LS Blake 4th Ed.*
6. *Surveying and Leveling by T.P Kanetaker.*
7. *Public Health Engineering by STEEL.*
8.   *Fluid mechanics with engineering applications, 10th Ed by Finnemore/Franzini.*

SYLLABUS OUTLINES-ENGINEERING MANAGEMENT

PRINCIPLEK OF ENGINEERING
PAPER II

Paper II will comprise EIGHT questions including One Compulsory MCQ type question containing 20 parts of one mark each (1/2 marks will be deducted for each wrong answer). Candidates will be required to attempt total FIVE questions including the compulsory question. Each question will carry 20 marks.

1. **Engineering Economics:** cost analysis, purchasing power parity, supply and demand, macro economics, monopoly and oligopoly.
2. **Costing, Accounting and Budgeting:** Net p resent value, Net future value, cash flows, auditing, income statement, balance sheet, taxation, financial risk management, cost analysis.
3. **Testability and Test Planning:** Black box testing, White box testing, test plans, test executions, regression testing, destructible and non destructible testing, test reports.
4. **Project Management:** time lines, milestones, resources allocation, dependency, Gant Charts,
5. **inventory Management:** FIFO models, LIFI models, Identification Schemes, Inventory management systems.
6. **Quality Management Systems:** QA modles. Deming, Juran Crosby, Quality circles, management responsibility, quality planning, purchasing, design process and design validation, quality audit, corrective and preventive measures.
7. **Time analysis and Manufacturing Management:** Managerial issues, manufacturing systems, process optimization, mathematical modeling, time management, resource allocation, raw material, production analysis.
8. **Problem analysis and Decision tree:** decision support system, decision tree, design of experiments.
9. Production and operation management
10. Management tools

RECOMMENDED BOOKS:
1. *Handbook of Engineering Management by Dennis Lock.*
2. *Total Quality Management by Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield, Mary Gesterfield-Sacre*
3. *Manufactruing Processes and systems by Ostwalds*
4. *Handbook of Reliability Engineering and Management by W. Grant Ireson, Clyde F. Coombs, Richard Y. Moss.*