**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/stepdown

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 nonferrous

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.*