Course Name: **PHYSICS - II**

Course Code: **PY 201** **Credits:** **4** **L T P:** **4 0 0**

Pre-requisite: **PY 101**

Lecture-wise breakup **(No. of Lectures)**

1. QUANTUM MECHANICS & ATOMS

Quantum theory of light, X-rays – production, spectrum & diffraction (Bragg's law), photoelectric effect, Compton effect, pair production, photons & gravity, black holes, de-Broglie hypothesis, particle diffraction, uncertainty principle and applications **(7)**

Postulates of quantum mechanics, Schrodinger theory, time-dependent and time-independent Schrodinger equation, wave function, Born interpretation and normalization, expectation values **(3)**

Particle in a box (infinite potential well), finite potential step and barrier problems, tunneling, linear harmonic oscillator (one-dimensional) **(4)**

Hydrogen atom, radiative transitions and selection rules, electron spin, Stern-Gerlach experiment, Spin-orbit coupling, exclusion principle, symmetric and antisymmetric wavefunctions **(6)**

ADDITIONAL TOPICS FOR HONOURS STUDENTS: α-decay, Zeeman effect, Correspondence Principle, Angular Momentum in Quantum Mechanics

2. NUCLEAR PHYSICS

Natural radioactivity, successive radioactive transformations, radioactive equilibrium, radioactive series, radiometric dating **(3)**

Nuclear force and its characteristics, Elementary description of shell model, explanation of magic numbers, liquid drop model and semi-empirical binding energy formula **(3)**

Nuclear fission, fission products, mass and energy distribution of fission products, neutron emission and energy distribution of neutrons emitted in fission, theory of fission process, nuclear reactors – classification, neutron cycle in thermal reactors and four-factor formula for neutron reproduction, nuclear fusion – controlled thermonuclear reactions. **(5)**

ADDITIONAL TOPICS FOR HONOURS STUDENTS: Artificial radioactivity and its applications, β-decay (energy spectrum & discovery of neutrino), Fusion Reactions in stars

3. STATISTICAL PHYSICS

Maxwell-Boltzmann statistics, molecular energies in an ideal gas, Bose-Einstein and Fermi-Dirac statistics, black body radiation, Rayleigh-Jeans and Planck's radiation laws, free electrons in a metal, electron-energy distribution, Fermi energy, electronic specific heat, conduction in metals, thermionic emission **(9)**

ADDITIONAL TOPICS FOR HONOURS STUDENTS: Specific heat of solids, Bose-Einstein condensation

4. SOLIDS AND SEMICONDUCTOR PHYSICS

Band theory of solids, Kronig-Penney Model (qualitative), conductors, insulators and semiconductors, p-type and n-type semiconductors, statistics of electrons and holes, Hall effect (for single as well as both type of charge carriers) **(5)**

ADDITIONAL TOPICS FOR HONOURS STUDENTS: p-n junction, rectifier, LED, tunnel diode

5. SUPER CONDUCTIVITY

Occurrence, destruction of super conductivity, Meissner effect, type I and type II Super-conductors; heat capacity, isotope effect, thermodynamical considerations, London equations & penetration depth, coherence length, BCS theory (elementary description), applications of superconductors. **(5)**

ADDITIONAL TOPICS FOR HONOURS STUDENTS: High temperature superconductivity, Josephson junctions

TEXT BOOK: Concepts of Modern Physics, by Arthur Beiser (McGraw-Hill)

REFERENCE BOOKS:

1. Nuclear Physics, by I. Kaplan (Addison-Wesley)
2. Solid State Physics, by C. Kittel (Wiley Eastern)
3. Solid State Physics, by S.O. Pillai (New Age International)
4. Introduction to Modern Physics, by Richtmyer, Kennard & Cooper (McGraw Hill)
5. Introduction to Modern Physics, by Mani & Mehta (East West Press)

Modern Physics, by Bernstein, Fishbane & Gasiorowicz (Pearson Education)

Course Name: PHYSICS LAB

Course Code: PY 202 Credits: 2 L T P: 0 0 3

Pre-requisite: None

Lecture-wise breakup (No. of Lectures)

TWELVE EXERCISES OUT OF THE FOLLOWING:

1. Familiarization with various measuring instruments – Vernier calipers, screw gauge, spherometer, spectrometer etc. **(3)**

2. To find the wavelength of sodium light using Fresnel's biprism. **(3)**

3. (i) To determine the wavelength of He-Ne laser using transmission grating.
(ii) To determine the slit width using the diffraction pattern. **(3)**

4. To determine the wave length of sodium light by Newton's rings method. **(3)**

5. To determine the wave length of sodium light using a diffraction grating. **(3)**

6. To find the specific rotation of sugar solution using a Bi-quartz Polarimeter. **(3)**

7. To find the energy band gap of the given semiconductor by four probe method. **(3)**

8. To find the angle of prism and the angle of minimum deviation with the help of a spectrometer, and hence to determine the refractive index of the material of the prism. **(3)**

9. To design a method to draw equipotential lines with various geometries of electrodes kept at different potentials. **(3)**

10. To study the Hall effect of a given semiconductor. **(3)**

11. To determine the dielectric constant of the given materials. **(3)**

12. To study the photoelectric effect. **(3)**

13. To study the B-H curve of the ferromagnetic materials. **(3)**

14. To design a hollow prism and used it find the refractive index of a given liquid. **(3)**

TEXT BOOKS:

1. Practical Physics, by Gupta & Kumar (Pragati Prakashan)
2. B.Sc. Practical Physics, by C.L.Arora (S. Chand)

Course Name: MATHEMATICS III

Course Code: MA201 Credits :4 LTP :4 0 0

Pre Req :

Lecture wise breakup **No. of Lectures**

1. COMPLEX VARIABLES **(25)**

Demoivre's theorem with applications, Functions of a complex variable, Separation into real and imaginary parts, Limit, Continuity and Differentiability, Analytic functions, Cauchy–Riemann equations, Laplace's equation, Harmonic functions, Integration in the complex plane, Cauchy's theorem, Cauchy's integral formula, Morera's theorem,

Liouville's theorem, Taylor's series, Laurent's series, Zeros, Singular points, Residues, Residue theorem , Evaluation of real integrals.

2. PARTIAL DIFFERENTIAL EQUATIONS (21)

Formation and solution of first order partial differential equations, .Linear equations of higher order with constant coefficients, Classification and solution of second order partial differential equations, Applications to Engineering problems**.**

3. FOURIER SERIES (10)

Periodic functions, Trigonometric series, Fourier Series, Euler's formulae, Conditions for existence of Fourier series, Even and odd functions, Half range expansions, Complex Fourier series, Applications of Fourier series, Parseval's identity, Harmonic analysis.

TEXT BOOK:

1. Advanced Engineering Mathematics, Kreyszig, John Wiley and Sons.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics, Wylie and Barrett, Mc Graw Hill.
2. Complex Variables with Applications, Brown and Churchill, McGraw Hill.
3. Elements of Partial differential equations, Sneddon, Mc Graw Hill.

MA 201H Mathematics – III with honours

In addition to the contents of MA 201 the additional topics:

Conformal Mappings – Mapping, Conformal mapping, Transformation by exponential, Trigonometric, Hyperbolic, Power & logarithmic functions, Bilinear transformations.

Course Name: MANUFACTURING PROCESS-II
Course Code : PE 204
Credit : 4

L T P : 4 0 0

Pre-Req. : PE 201

Lecture wise breakup No. of Lectures

INTRODUCTION: (4)
Classification of M/c Processes, Kinds of Motions in M/c tools, Tool materials & Cutting fluids.

LATHE & LATHE OPERATIONS: (10)
Classification of lathes & Capstan turrets, Geometry of a single Pt tool, Speed, Feed & Depth of Cut, Turning, facing, taper turning, parting, chamfering & threading. Types & classification of Shapers, Planers, Specifications, QRM, Speed, Feed & Machining time calculations. Job holding devices & applications of these M/cs.

DRILLING MACHINES : (8)

Classifications, Nomenclature of a Drill, Drilling operations such as boring, reaming, tapping.., Speed, feed & M/c time calculations.

MILLING M/C : (8)

Classifications, Specs, Indexing devices, Up Milling & Down Milling, Milling Attachments, Cutter geometry, Speed, feed & M/c time calculations.

GRINDING MACHINES: (6)

Classifications & Applications. Surface, Internal & Centre-less grinding, Wheel Selection, Standards, M/c times. Dressing& truing of Grinding wheels.

BROACHING M/C: (5)

Classifications & Applications. Broaching Tools, parameters, machining times calculations

THORY OF METAL CUTTING (5)

Types of Chips, Mechanics of Chip Formation, Relevance of Shear Angle, Merchant Circle, Forces in Turning, Drilling & Milling, Mechanisms of tool failures, Tool life, Mach inability.

NON CONVENTIONAL MACHINING PROCESSES: (5)

Abrasive jet M/c. Ultrasonic Machining, Electro-Chemical M/c Electric Discharge m/c, Electron beam M/c, Laser Beam M/c, Plasma Arc Machining Electro-Chemical Grinding, Chemical M/c,

HIGH VELOCITY METAL FORMING: (5)

Electro-hydraulic Forming, Mechanical High Velocity Forming, Magnetic pulse Forming & Explosive forming

GEAR MANUFACTURING PROCESSES: (5)

Introduction & Methods used. Production of Spur, Bevel & Worm gears. Casting, Powder Metallurgy, Molding & Rolling Gear Hobbing & Gear Shaping Processes Bevel Gear Generator & Gear Finishing Operations. Gear Shaving, Gear Burnishing & Gear Grinding Operations.

BOOKS:

Production Technology by PC Sharma

REFERENCES:

1. Fundamentals of Metal Cutting & Machine Tools by B L Juneja & G S Sekhon
2. Modern Machining by P C Pandey & H S Shan
3. Production Engineering by P C Pandey & C K Singh

PE 204H: MANUFACTURING PROCESS - II

In addition to the contents of PE 204 the additional topics are:

1. Cutting tools
2. Dynamometers

Course Name : MACHINE DRAWING
Course Code : PE-205
Credit : 4

L T P : 4 0 0

Pre-Req : TA 102 (Engineering Graphics)

Lecture wise breakup No. of Lectures

BASICS OF MACHINE DRAWING: (30)

Review of ISI Standard SP 46: Review of orthographic projection. Dimensioning. Introduction to limits, fit and tolerances and surface roughness. Representation of screw threads. Representation of machining, symbols and welding symbols, types of rivets, bolts, nut and other fasteners and Conventions.

ASSEMBLY DRAWINGS AND LAYOUTS: (26)

Assembly drawing from detailed working drawing of various elements and detailed working from assembly drawings of the following machine parts: Journal Bearing, Lathe Tool Post, Shaper Tool Post, Bench Vice, Lathe Tail Stock, and Gear Train

BOOKS:

1. Engineering Drawing by Parkinson

REFERENCES:

1. Machine Drawing by N D Bhatt
2. Machine Drawing by P S Gill

Course Name : MANUFACTURING PROCESS-III
Course Code : PE-206
Credits : 4
L T P : 4 0 0

Pre-Req. : --

Lecture wise breakup No. of Lectures

METALLURGY : (10)

Solidification of metals, Nucleus formation, Crystal growth & Imperfections. Principles of Phase transformations, Phase rule & Equilibrium diagrams, Recovery & recrystallization

HEAT TREATMENT (28)

Iron Carbon Equilibrium Diagram, Principles & Applications of: annealing, Normalizing, Hardening. Tempering, Surface hardening of Steels: Principles of Induction & Oxyacetylene flame hardening. Procedure for Carburising, Nitriding & Cyanising, Harden ability: Measures, methods of determining harden-ability. Jominey end quench test Basic principles involved in heat treatment of plain carbon steels & alloy steels,

WELDING (18)

Classification of welding processes, physics of arc, arc blow, welding symbol, types of V-I characteristics, different types of power sources**,** Classification and selection of welding electrodes, welding fluxes, Principle, advantages disadvantages and applications of gas ,welding, SMAW,MIG,TIG, SAW, Electro-slag, Plasma, EBW and LBW process. Weld-ability of carbon steel, stainless-steel , cast Iron, and aluminum, welding defects, brazing, soldering and spraying.

BOOKS

1. Physical Metallurgy by Avnar ,
2. Welding Technology by RS Parmar, Khanna Publisher

REFERENCES:

1. Physical Metallurgy by Lakthin
2. AWS handbooks

PE-206H: MANUFACTURING PROCESS - III

In addition to PE-206 the following topics shall be included:

1. Destructive Testing
2. Non-destructive testing
3. Latest Developments in Welding

Course Name : DESIGN OF MACHINE ELEMENTS
Course Code : PE-207
Credits : 4

Design Points : 2

L T P : 4 0 0

Pre-Req : TA 102 (Engineering Graphics)

Lecture wise breakup **No. of Lectures**

FUNDAMENTALS OF DESIGN (14)

Scope and Meaning of design with special reference to machine design. Concept of tearing, bearing, shearing, crushing, bending etc. Selection of materials, Behavior of materials. Fabrication characteristics of materials. Stress concentration, factor of safety under different loading conditions, stress concentration factors. Design stress for variables and repeated loads. Endurance limit, Fits and tolerance and finish.

SHAFTS AND KEYS , DESIGN OF RIGID AND FLEXIBLE COUPLINGS (06)

FASTNERS (14)

Cotters and cotters joints, pin fasteners, knuckle joints, Welded joints and rivet connection, eccentrically loaded

DESIGN OF BELT DRIVE (6)

Flat Belt

DESIGN OF GEAR DRIVE (8)

Factors influencing the choice of a gear. Design details of spur and helical gear.

DESIGN OF SPRINGS (6)

Design of helical spiral and leaf springs.

DESIGN OF A SLIDING AND ROLLING TYPE OF BEARINGS

Design of journal blocks, Details of bearing housing

BOOKS:

1. Machine Design by P C Sharma and D K Aggarwal

REFERENCES:

1. Machine Design by Heartman & Malieev.
2. Manual of Machine Design by Castle
3. Mechanical Engineering Design by Shigley J E , McGraw Hill

PE 207H: DESIGN OF MACHINE ELEMENTS

In addition to the contents of PE 207 the students shall be carrying out project work demonstrating the application of the concepts learned during the course related to real life projects / systems.

1. Design of shaft/ coupling for multiple applications.
2. Selection of bearing for given application.
3. Design of spring for given application.
4. Design of gear drive for given application.
5. Design a wall bracket by using rivets and welds joints.

Course Name : DEPARTMENT LAB- I
Course Code : PE-208
Credits : 2

Design Points : 2
L T P : 0 0 3
Pre-Req. : ---

1) To perform tensile test on ductile and brittle materials with universal testing machine and to determine Young's Modulus of elasticity, Limit of proportionality, Yield point / 0.2 percent proof stress, Ultimate tensile stress, Percentage elongation, Percentage of reduction in area.
2) a) To perform compression test and calculate the strength of material in compression.
   b) To perform shear test and calculate shear strength for various materials.
3) To perform the torsion test on brittle and ductile material and determine the Torsion shear strength and modulus of rigidity of the materials.
4) To determine the hardness of given samples on the Rockwell hardness testing machine.
5) To perform impact test on various materials.
6) Perform fatigue test on various materials.
7) Motion analysis of slider crank mechanism.
8) Study of various inversions of kinematic chains.
9) Determine the moment of inertia of flywheel.
10) Balance experimentally as far as possible the known unbalance force due to rotating weight by introducing two balancing weight in two different planes.
    a) Balancing planes on either side or unbalanced force.
    b) Balancing planes on the same side of unbalanced force.
11) Determine the characteristic curve of the following governors.
    a) Watt Governor
    b) Porter Governor

c) Proell Governor