Jharkhand University of Technology, Ranchi

B. Tech. First Year

Branch: Mech, Civil, Metal, Chem, Prod, Mining, Fashion Technology

Revised
Semester: II

Session: 2023-2024

BSP01 Engineering Physics

Course Outcomes:

Students should be able to

1. Apply the concepts of Quantum mechanics to one dimensional motion of electrons
2. Classify solids on the basis of Band theory and to calculate carrier concentrations
3. Evaluate the electrical conductivity and identify the type of semiconductor
4. Implement the fundamentals of LASER for different applications

Unit 1

Quantum Mechanics: Matter waves, Properties of matter waves, Physical significance of wave function. Schrödinger's time dependent and time independent equations, Operators, Eigen values and Eigen functions, Expectation values, Applications of Schrödinger's equation; Motion of a free particle, Electron in an infinite deep potential well (rigid box), Electron in a finite deep potential well (non-rigid box)

Unit 2

Solid State Physics: Lattice parameters, Miller indices, inter planer distance of lattice plane, density of crystals (linear, planar and volume), Sommerfield's free electron theory, Density of states (3D), Fermi-Dirac probability function, Nearly free electron theory (E-k curve), classification of solids on the basis of band theory

Unit 3

Semiconductor Physics: Electron and hole concentrations in semiconductors, intrinsic density, intrinsic and Extrinsic conductivity, Position of Fermi level in intrinsic and extrinsic semiconductors, Law of mass action, Temperature variation of carrier concentration in extrinsic semiconductors, Electrical conduction in extrinsic semiconductor, Hall Effect

Unit 4

Laser Physics: Introduction to laser, Spontaneous and stimulated emission of radiations, Thermal equilibrium, Condition for Light amplification, Population inversion, Pumping (Three level and four level pumping), Optical resonator, Laser beam characteristics, Ruby laser, Nd-YAG Laser, He-Ne Laser, Semiconductor Laser, Engineering applications of Laser (Fiber optics, Laser material interaction)

Learning resources:

1. Introduction to quantum mechanics / David J. Griffiths
2. A text book of Engineering physics, Avadhanulu and Kshirsagar, S. Chand Pub.
3. Concepts of Modern Physics, Arthur Beiser; Tata McGraw – Hill Edition.
4. Introduction to Solid State Physics, Charles Kittel, Wiley.
5. Solid State Physics, S. O. Pillai, New Age International Publishers.
6. Solid state electronic devices, Ben G. Streetman, Sanjay Banerjee Pearson Prentice- Hall.
7. LASERS Theory and Applications, K. Thyagarajan, A. K. Ghatak; Macmillan India Ltd.
8. Mechanical Vibrations Theory and Applications, Francis S. Tse, Ivan E Morse, Rolland T. Hinkle

BSPP1: Engineering Physics Laboratory

Course Outcomes:

Students should be able to

1. Calculate energy gap, carrier concentration and mobility of the given material.
2. Verify quantum mechanical phenomena.
3. Estimate the size of the object using Laser diffraction.
4. Determine the magnetic susceptibility and dielectric constant of the material

List of Experiments:

1. Frank-Hertz Experiment
2. Planck's Constant
3. To determine the wavelengths of light of a given source using diffraction grating
4. Band gap of a semiconductor by four probe method
5. Hall effect in Semiconductor
6. Magnetoresistance measurement of semiconductor
7. To determine the reverse saturation current and material constant of PN Junction
8. To determine the dielectric constant of material
9. Study of Biot-Savart's law
10. Measurement of magnetic susceptibility by Quinke's method

Course Objectives:

1. To provide an experimental foundation for the theoretical concepts introduced
2. To achieve hands-on experimental skills and the study of practical applications will bring more confidence.

BSM02 Engineering Mathematics II

Course Outcomes:

Students should be able to

5. **Design, Classify** and **Develop** the linear differential equation of first order for the real life problems
6. **Evaluate** the analytical solution of two-dimensional heat flow problem and wave problems using variable separable method.
7. **Analyze** periodic phenomenon of forces, electric currents, voltage, wave motion, sound waves in the form of trigonometric function using Fourier series.
8. **Introduce** and **apply** the distribution function in statistical analysis.

Unit 1

Ordinary Differential Equations:

First order Ordinary Differential Equations: Homogeneous, Linear, Exact ; Higher order linear equations with constant coefficients, Euler-Cauchy equations, Non homogeneous higher order linear differential equations with constant coefficients (method of undetermined coefficients and method of variation of parameters), Applications to Initial and boundary value problems: Orthogonal Trajectories, Statement and Application of Newton's Law of Cooling, Growth and Decay, Kirchhoff's Law, Simple Electrical Circuits, Heat Flow, Rectilinear Motion, Simple Harmonic Motion.

S: First order Ordinary Differential Equations - Variable Separable, Homogeneous, Linear

Unit 2

Partial Differential Equations:

Fourier Series, Dirichlet's condition, Half range series, Formulation of Partial differential equation, Solution of First order partial differential equations, Quasi-linear differential equations, Second order differential equations and canonical form. Initial and Boundary value problem, Method of separation of variable, Dirichlet's problem, Poisson's Equation, Vibrations of a String, One dimensional heat equation, Two- dimensional heat equation (Laplace Equation) under steady state conditions.

S: two-dimensional heat equation (Laplace Equation) under steady state conditions

Unit 3

Probability:

Random variables, Probability distributions, Expectation and variance, Moment Generating Function, Binomial distribution, Poisson distribution, Normal distribution and Exponential distribution.

S: Basic concept of Probability, Conditional Probability, Exponential distribution

Textbooks:

1. Erwin Kreyszig , "Advanced Engineering Mathematics", Wiley eastern Ltd ,10th edition

Reference Book:

3. Maurice D. Weir, Joel Hass, Frank R. Giordano, "Thomas' Calculus ",14th edition Pearson Education.
4. P.N. Wartikar and J.N. Wartikar ,"Applied Mathematics", Vidhyarthi Griha Prakashan Pune ,Vol.1 (Reprint July 2014)
3. Ross S.M., "Introduction to probability and statistics for Engineers and Scientists", Elsevier Academic press, 8th Edition, 2014
5. Ram, B., Engineering Mathematics, Dorling Kindersley (India), Pearson Education.

BSB02 Biology for Engineers

Course Outcomes:

Students should be able to

3. Understand the overlapping areas between biology and engineering
4. Observe the principles of biological organization with lessons of increasing efficiency of engineered technologies
3. Analyze the analogies between biological and engineering processes
4. Explore the basic biological principles as guiding elements for engineering structures and processes
5. Appreciate the technological optimization of living systems

Unit 1

Crosstalk between Biology and Engineering:

a) Biologically inspired technologies: Case studies of designs in nature and inspired technologies, Biomemetics: Nature inspired material and mechanisms, Self-cleaning surfaces; Self-healing Bioconcrete, Biomining, Algorithms in nature,

b) Contribution of engineering in biological domain: Contribution of Microscope, Imaging techniques, Bio-medical Instruments, Mechanisms (Ergonomics)

Unit 2

Organization of Living Machines:

Biomolecules and manufacturing of Biopolymers:

- Carbohydrates (structure-based function and engineering applications)
- Lipids (structure-based function and engineering applications)
- Proteins (structure-based function and engineering applications)
- Nucleic Acids (structure-based function and engineering applications)

Organization of life forms: Cell to organism

Bioenergetics- Energy dynamics in biological system- principles of energy conservation and optimization

Unit 3

Analogy of biological organ/system and engineering Device/Mechanism:

Organ & system: Brain & CPU, Eye & Camera, Kidney & Filtration system, Lungs & purification system, Heart & Pumping system Process: Photosynthesis & solar cells, Xylem & plumbing, Thermoregulation in human body & heat transfer in machine, Defense mechanism in organism, signaling processing in biology and electronics

Unit 4

Concepts in Bioengineering:

Biomechanics: Mechanical properties of tissues, Prosthesis and rehabilitation

Bioprinting: 3D printing of biological tissues and organ engineering and transplanting

Biomaterials: Types, properties and applications

Tissue Engineering: Principle, Components, Methods of Scafold synthesis, properties and applications.

Unit 5

Application areas of Bioengineering:

Databases & Biocomputing: Acquisition, storage, processing and transmission of biological data and its applications like PCR

Bioinstrumentation: Diagnostic and Therapeutic devices

Bioimaging: Principle, types and examples

Biosensors: Principle, types and examples

Computational biology and application of Artificial Intelligence in bio-medical field

Suggested learning resources:

1. Lodish H, Berk A, Zipursky SL, et al. (2000)“ Molecular Cell Biology” W. H. Freeman
2. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2000),“Lehninger principles of biochemistry” New York: Worth Publishers
3. Lewin B. (2000) “Genes VII” Oxford University Press
4. Rao CNR, et.al. , “Chemistry of Nanomaterials: Synthesis, Properties and Applications”
5. Eggins BR. (1006) , “Biosensors: An Introduction”, John Wiley & Sons Publishers

6. Palsson B.O. and Bhatia S.N. (2009) “Tissue Engineering” Pearson

ESPP1 Programming for Problem Solving

Course Outcomes:

Students should be able to

1. Represent real life data using data types and variables provided by programming language.
2. Write flow chart, using standard notation, for given problems.
3. Solve a given problem using expressions, conditional statements, arrays and loops.
4. Design a modular solution using functions, by breaking down the problem into parts, using programming language.
5. Demonstrate the ability to process files of various types.

Unit1

Understanding a problem:

Framing a problem in simple terms – mathematical, graphical, other abstractions. Number systems. Syntax errors and runtime errors. Manual solutions to real life problems. Algorithms, Properties/characteristics of Algorithms, Flowchart and Pseudo code, Algorithmic representation of the solutions

Basic steps in program execution: Editing, compiling/interpreting/running programs, OS view and programmer's view.

Unit 2

Introduction to problem solving using computers:

Basic Problems: Basic Data types (Numerical, String). Variables. Expressions. Statements. I/O statements for keyboard handling. Decision Making Statements (if-Statements, if-else Statements, Nested if Statements, Multi-way if-elif-else Statements), Conditional statements, Exchange values of two variables. Finding maximum of three numbers.

Unit 3

Iterative Problems without arrays: Introduction to iterative constructions in language. Find Sum, average of a given set of numbers. Loop design techniques: While loop - body, iterative step, loop condition. Emphasis on while loop against for loop. Factorial. Sine function computation. Fibonacci sequence generation. Some problems to read data from files.

Array techniques: Arrays as homogenous collection of elements. Array properties. Reversing elements of an array.Finding maximum. Finding second maximum. Algorithms for substring search.

Search problems: linear search. linear search in sorted array. Binary search.

Unit 4

Modular Solutions

Functions: Introduction to functions. Importance of design of functions. Rewriting earlier solutions using functions. Taking care of all possible values of arguments, Parameters, return values, signature, local and global scope, Modular code, Reusability.

Unit 5

Recursion:

Basic rules of recursion: recursive formulation, terminating case, handle all cases, recursion leading to terminating case. Factorial: iterative vs. recursive.

Recursive formulation for: multiplication, gcd, towers of Hanoi, binary search. Recursion vs. iteration in general.When to use recursion.

Unit 6

Sorting: Insertion, Bubble, selection sorts

Textbooks:

1. R. G. Dromey, "How to solve it by Computer", Pearson Education, ISBN 0-13-433995-9
2. Maureen Sprankle, "Problem Solving and Programming Concepts", Pearson Education, ISBN-978-81-317-0711-1

Reference Books:

1. Stephen G. Krantz, “Problem Solving Techniques” , Universities Press.
2. Kernighan and Ritchie, “The ‘C’ programming language”, Prentice Hall
3. Reema Thareja, “Python Programming: Using Problem Solving Approach”, Oxford University Press; First edition, 978-0199480173

ESCP1 Programming for Problem Solving Laboratory

The course involves writing code for solved, unsolved and practice programming problems given in the lab manual.

List of suggested experiments

1. Write a program to enter two numbers and perform all arithmetic operations.
2. Program to find area of a triangle using Heron’s Formula
3. Take two integers as input and divide the first by the second. Prevent division by zero.
4. Write a program to print `n' terms of an Arithmetic series, with the first term `a' and a constant difference `d'. Take `a,d,n' from user.
5. Take a real value `x' from the user and find the value of tan (x), log (x), square root of x
6. Write a program to display all the prime numbers between 1 and 100
7. Write a program to take as input, 10 integers and put them in an array and display their values. Then, find the sum of all elements in the array and the position of the largest element. (Hint: use the logic of the algorithm to find maximum)
8. Declare a 3x3 matrix. Initialize it to zero using nested loops. Then fill some user- given values into it. Print the matrix in proper format to make sure the inputs are correctly taken.
9. Write your own function to find the minimum element of an array of integers. (Input to the function is integer array, output is the position number of the minimum element)
10. Declare an array of 10 integers. Declare a pointer and point it to the base of the array. Print all the elements of the array using this pointer and not using the original name of the array.
11. Write a program to sort a given set of structures on a given key-pair, using bubble sort.
12. Write a recursive function to raise a number to a given power.

ES ME2 Materials Engineering

Course objectives:

1. To increasing demand of the available materials, coupled with new applications and requirements has brought about many changes in the style of their uses.
2. To develop the basic knowledge of metals, polymers composites and ceramics other than conventional metals and alloys to apply them to advance engineering applications.

Course Outcomes:

At the end of this course, the students would be able to:

1. Select different materials other than conventional metals and alloys for specific engineering applications.
2. To solve the materials problems associated with the weight reduction through the appropriate choice of metals, polymers, ceramics and composites.
3. Selection criterion for polymers and composites for various engineering applications.

Unit 1

Introduction: Crystalline and Non crystalline solids. Classification of Engineering materials and their selections, bonding in Solids: Ionic, Covalent and Metallic bonding.

Unit 2

Crystal Structure: Space lattices, Bravais lattices, Crystal system, Unit Cell, Metallic crystal structures: SC, BCC,FCC,HCP structures, Miller notations of planes and directions, Imperfections in crystals: Point defects, Line, surface defects, Dislocations: Edge and Screw dislocation, Burgers vectors.

Unit 3

Metallic Materials: Metals and alloys, ferrous materials- introduction to Iron -carbon Diagram, Steel and their Heat treatment, properties and applications. Different types of heat treatment processes. Non-ferrous alloys:Copper based alloys, Al based alloys, other important nonferrous alloys, properties and applications.

Unit 4

Polymers: Basic concepts of Polymer Science, polymer classifications, Crystallinity of polymers, Copolymers, Thermoplastic and Thermosetting polymers, Elastomers, Properties and Applications.

Unit 5

Ceramics-Basic concepts of ceramics science, traditional and new ceramics, Oxide and Non-Oxide ceramics, Ceramics for high temperature applications, Glass, applications of ceramics, and glass. Composite materials-Definition, general characteristics, Particles reinforced and fiber reinforced composite materials, MMC, CMC, PMC, properties and applications.

Text Books:

1. Elements of Material Science by Van Vlack
2. Material Science by O.P. Khanna
3. Material Science and Engineering by V. Raghavan
4. Material Science by R.S.Khurmi and R.S. Sedha

Reference Books:

1. Material Science and Engineering by William D. Callister Course

ESCM2 Civil Engineering Materials

Course Objectives:

- To use mathematic and engineering in calculating the mechanical properties of structural materials.
- To understand the concept of building construction and collaboration principles & processes and also on structural functions and the role of materials in building construction.
- To use the techniques, skills and modern engineering tools necessary for engineering.

Unit	Content
1.	**Introduction to Civil Engineering Materials, Types of civil engineering materials used in civil engineering structures** **Lime:** classification and uses of lime, properties of lime, setting action of fat lime and hydraulic lime, Storing of lime **Cement:** Introduction, raw materials, flow diagram of manufacturing of cement Types of cement, properties of cement Portland cement: chemical composition of raw material, bogue compounds, hydration of cement, role of water in hydration, testing of cements, **Bricks and Masonry Blocks:**Introduction to bricks, Manufacturing of bricks, classification and specification of bricks, properties and field and laboratory tests to evaluate quality, **Brick Masonry:** Types of bonds, construction of wall **Fly ash**: properties and use in manufacturing of bricks and cement.
2.	**Mortar:** Functions of Mortar, Preparation of cement mortar, lime mortar, lime cement mortar and their uses. **Concrete:** Definition and grading of concrete, Workability of concrete, Water - Cement Ratio, mix proportions, mechanical and durability properties of concrete, factors affecting properties of concrete, tests on concrete, Special concrete: lightweight concrete, high density concrete, vacuum concrete, shotcrete, steel fibre reinforced concrete, polymer concrete, Ferro cement, high performance concrete, self-compacting concrete. **Admixtures** – mineral & chemical admixtures – uses.
3.	**Building stone:** classifications, properties and structural requirements; **Aggregate:** Classification, Physical and mechanical properties, alkali-aggregate reaction, thermal properties of aggregate **Timber and Timber Products:** Introduction to wood macrostructure, sap wood and heart wood, defects and decay of timber, seasoning and preservation of timber, fire resisting treatment, introduction to wood products- veneers, plywood, fibre board, particle board, block board, batten boards.
4.	**Metals:** Ferrous metals: Composition, properties and uses of cast iron, mild steel, HYSD steel, high tension steel as per BIS. Commercial forms of ferrous, metals. Aluminium & Stainless Steel
5.	**Glass:** types and uses, **Gypsum:** source, properties, uses; **Plastic:** Thermosetting and thermoplastics and their uses as materials in building, **Paint:** types, distemper, varnish, **Adhesive:** Types, **Bitumen:** types, properties and tests. Geo-textiles, Ceramics, and Refractories, Rubber and asbestos, Graphene, Carbon composites and other engineering materials including properties and uses of these.

Text Books / Reference Books:

1. Rangwala, Engineering Materials
2. Sharma S.K., Civil Engineering Construction Materials
3. Arora S.P., Civil Engineering Materials

ESCM3 Fashion Technology Materials

Course Outcomes:

Students should be able to

1. To understand calculation of Mechanical properties of textile fibers.
2. To understand the concept of yarn and fabric construction.
3. To understand the concept of construction of garments needed and woven.
4. To use technical skills and modern fashion technology design tools.
5. To understand the concept of fashion free forecast and fashion.

Unit 1
Fundamental Concepts

Introduction to polymers, Classification of polymers, Different polymerization techniques, with special reference to textile& clothing material, molecular weight and degree of polymerization, polydispersity and molecular weight, size of polymer, properties of fiber forming polymers, Concept of thermoplastic and thermoset material. Concept of rubbery state and rubber elasticity. Transition from glassy to rubbery state. Melting of polymers. Concept of fiber and Classification of fibres. Essential and Desirable properties of a textile grade fibre . Identification of Textile fibers by Physical and Chemical methods.

Unit 2

Natural Fiber

Sources of Natural fiber, like vegetable, protein and minerals, Brief idea on extraction of natural fibers from their sources like cotton, jute, flax, hemp, wool, silk etc. Physical and chemical structure of different natural fibers like cotton, jute, flax, hemp, wool, silk etc. Physical and chemical properties of natural fibers, cotton, jute, flax, hemp, wool, silk etc. Application of the fibers like cotton wool, silk, jute etc. Brief idea on other natural fibers like banana, ramie, pineapple, bamboo etc.

Unit 3

Man-Made Fiber

Basic production systems of man-made fiber, brief idea on Melt, Wet and Dry Spinning. Out line of the manufacturing of regenerated fibers like viscose rayon , Cupramonium rayon, acetate rayon soya milk fibers. Introduction to synthetic fibres, Out line of the manufacturing process of filament and Staple fiber with special reference to polyester, polyamide, polypropylene and acrylicfiber. Brief idea on Post spinning processes like, Drawing, heat setting and texturising of synthetic fibers. Properties and applications of Glass, carbon, aramid, tencel, modal, polyurethane, micro and nano fibers.

Learning Resources:

1. Manufactured Fiber Technology, by Kothari andGupta.
2. Textile Fibre- V.A.Shenai
3. Fibre Science and Technology byS.P.Mishra.
5. Textbook of Polymer Science by F.W.Billmeyer.
6. Production of Mand-made Fibres –A.Vaidya
7. Sustainability in the Textile and Apparel Industries by SS Muthu
8. Hand Book of Garments Manufacturing Technology by Eiri Staff

PCMM2 Basic Metallurgical Engineering

Course Outcomes:
Student will be able to
1. Understand about the Materials and its properties.
2. Understand the iron making and steel making process.
3. Understand the Iron-carbon diagram and its application.
4. Understand the basics of characterization of materials.

Unit 1
Materials and its classifications, Advance Materials, Moderns Materials need, Minerals and ores of metals and non metals, objectives of mineral processing, Laws of crushing and grinding, Introduction to coal and coke.

Unit 2
Introduction to Iron making - An overview of blast furnace, Introduction to Steel making-An overview of basic oxygen furnace (BOF-LD), solidification, nucleation, Homogeneous and heterogeneous nucleation, concepts of surface and volumetric energy, growth of solid- smooth interface growth and dendrite growth.

Unit 3
Basic concepts of phase diagram(binary) and Gibb's phase rule , Iron -carbon diagram and its importance in Metallurgical Engineering, lever rule and its application, Heat Treatment Processes- Annealing, normalizing, hardening and tempering.

Unit 4
Characterization of materials: Basics of Metallography, Mechanical Properties of Materials-hardness, brittleness, resilience,toughness,ductility, malleability etc., hardness testing- Brinell, Rockwell and Vicker's hardness test; Tensile and Compressive test.

References:
1. Materials Science and Engineering, By V Raghavan
2.Physical Metallurgy Principles, R. Abbaschian, R. E. Reed-Hill, Cengage Learning, 2009
3. Iron Making by R.H.tupkary
4. Steel Making by R.H.tupkary
5. Mechanical Metallurgy by George E Dieter
6. Materials Science and Engineering,William D. Callister

PCML2 :Basic Metallurgical Engineering-Lab

List of Experiments

1. To determine the reduction ratio of minerals after crushing the minerals in Blake Jaw Crusher.
2. To determine the average size of minerals particles by sieve analysis.
3. To study the Metallurgical Microscope and its application.
4. To prepare the Mild Steel sample for Metallographic examination.
5. To determine the ASTM grain size number for given 100X microstructure.
6. To perform Annealing of plain carbon steel sample.
7. To measure the Hardness of a sample.
8. To perform Tensile Test of a sample.

References:

1. Mineral Processing Technology by B.A.Wills
2. Metallography: Principles and Practice by George F.Vander Voort
3. Heat Treatment: Principle and technique by T V Rajan and C P Sharma
4. Mechanical Metallurgy by George E Dieter.

PCME2 Basic Mechanical Engineering

Course Outcomes:

Student will be able to

1. Understand the properties, testing and inspection of engineering materials.
2. Understand the manufacturing of metals & alloys.
3. Understand the working of steam generators and steam engines.
4. Understand the importance and uses of IC Engines, working of IC Engines.
5. Comprehend the working and use of various power plants.

Unit 1

Metallic and non-metallic properties such as: - Mechanical, physical, and chemical properties - Mechanical properties:- strength, hardness, toughness, brittleness, creep, fatigue, stiffness, ductility, malleability, elasticity and plasticity.-Physical properties: - density, viscosity, color, finish, porosity, specific gravity, fusibility.
Thermal properties such as specific heat, thermal conductivity, thermal resistance, and thermal diffusivity-Magnetic properties- Electrical Properties such as Resistance, Resistivity, conductance and conductivity, capacitance-Chemical properties: - Corrosion resistance, acidity and alkalinity. Ferrous and non-ferrous metals

Unit 2

Steam and its uses-classifications- wet steam, dry steam, Super-heated steam.
Steam boilers- Classification - fire tube and water tube with simple sketches-Explain with sketches La-Mont boiler & Cochran boiler- comparison between water tube & fire tube boiler- Boiler mountings - functions with sketches of Stop valve-Safety valve-Water level indicator-Pressure gauge- Fusible plug, Boiler accessories - function with sketches of-Feed pump-Economizer-Super heater-Air preheater, Energy conservation for steam.
Steam engine-simple classification-Brief explanation (with line sketch) of working of double acting steam engine.

Unit 3

The Importance and uses of Engines-Definition, Classification-I C & E C Engines- two stroke engines - four stroke engines - various parts and functions of I C engines.-Working of two stroke petrol engine and diesel engine with line sketches - working of four stroke petrol and diesel engines with line sketches - Comparison between two stroke and four stroke engines -S I and C I engines.

Unit 4

Classification of power plants- Working of power plant with line sketches-Steam power plant-Hydro- electric power plant - Diesel power plant -Nuclear power plant- merits and demerits. Non-conventional energy power plants – solar- wind-tidal- geo thermal, with line sketches- merits & demerits of various non-conventional power plants.

References:

1. Workshop technology vol1, By S K Hajra choudhary
2. Thermal Engineering ,By RS Khurmi
3. Power plant Engg ,By Nagpal
4. Production technology ,By PC Sharma
5. Manufacturing processes & Engg materials By Serope Kalpakjian & Steven R Schmid.
6. Heat Engines Vol 1, By Pandya &Shah

PCMP2: Basic Mechanical Engineering Lab

1. Study of fire tube boiler.
2. Study of water tube boiler.
3. Study of the boiler mountings and accessories.
4. Study of Steam Engines.
5. Study of 2-stroke petrol and diesel engine.
6. Study of 4-stroke petrol and diesel engine.
7. Impact test.
8. Hardness Test.
9. Study of thermal power plant layout.
10. Study of Hydel power plant layout.

PCBP2 Basic Production & Industrial Engineering

Course Outcomes:
Student will be able to
1. Understand the properties to engineering materials.
2. Learn the basics of manufacturing science and processes.
3. Understand the basics of machining technology.
4. Learn the importance and uses of advanced manufacturing processes.
5. Comprehend the fundamentals of Industrial and management concepts.

Module-I

Engineering Materials: Metallic and non-metallic materials. Mechanical properties: strength, hardness, toughness, brittleness, creep, fatigue, stiffness, ductility, malleability, elasticity and plasticity. Physical properties: density, viscosity, porosity, specific gravity, fusibility. Thermal properties: specific heat, thermal conductivity, thermal resistance, and thermal diffusivity. Magnetic properties, Electrical Properties: Resistance, Resistivity, conductance and conductivity, capacitance. Chemical properties: Corrosion resistance, acidity and alkalinity. Manufacturability, castability, machinability, weldability, ferrous and Non-ferrous metals, Alloying and its effects.

Module -II

Classification and principles of manufacturing processes: Manufacturing definition and its history, broad classification of manufacturing processes and their basic principles; casting and moulding, metal forming, material removal process, welding and joining, powder metallurgy and additive manufacturing. Manufacturing process flow in an industry with case studies; Application of manufacturing process in various industries;

Module -III

Machining and Machine tools: Basics of machine tools, classification and kinematics of machine tool drives, classification cutting tools, tool materials, General purpose machine tools and applications: Lathe, Milling, Shaper, Planner, Drilling, Grinding, Punching. Special purpose machine tools and applications: capstan and turret lathe, gear hobbing machine, Computer control in machine tool, CNC.

Module -IV

Advanced and Digital Manufacturing: Advanced manufacturing processes; Precision and micro-to-nano manufacturing; Reverse engineering and rapid prototyping; Additive manufacturing processes; IoT and Industrial IoT; Introduction to Industry 4.0 and beyond.

Module -V

Introduction to Industrial Engineering: Production Planning, Scheduling, Inventory Management System, Lean Manufacturing Concept, Facility Layout & Design, Logistics and Supply Chain Management, Equipment Maintenance, Industrial Safety.

Text Book:

1. S.K. Hajra Choudhary, Workshop Technology, Vol-I & Vol-II, Media Promoter & publishers Pvt. Ltd.
2. P.C. Sharma, A Textbook of Production Technology (Manufacturing Processes), S. Chand & Co.
3. A.B. Chattopadhyay, Machining and Machine tools, Wiley Publication
4. P.N. Rao, Manufacturing Technology, Vol-I &II, TMH Pvt. Ltd
5. O.P. Khanna - Industrial Engineering and Management, Dhanpat Rai Publications
6. B. Kumar, Industrial Engineering and Management, Dhanpat Rai Publications
7. S. C. Sharma and T. R. Banga, Industrial Engineering and Management, Cengage Learning

Reference books:

1. W.A.J. Chapman, Workshop Technology, Part-I &II, Taylor & Francis Publication
2. Martand T. Telsang, Industrial Engineering and Production Management, S. Chand Publication

PCPP2: Basic of Production and Industrial Engineering Lab

Course Outcomes:

Student will be able to

1. Select various engineering materials based on the properties and desired applications.
2. Understand the basics of various manufacturing processes
3. Explain different machine tools and its selection for engineering applications.
4. Summarize advanced manufacturing system and robotics.
5. Interpret the different components of industrial engineering.

List of Experiments

1. Study and demonstration of lattice structures of materials
2. Mechanical properties of materials
3. Study of fundamentals and demonstration of foundry equipment and tools
4. Study of arc welding process and its parameters
5. Simulation of arc welding using VR Simulator
6. Demonstration of sheet metal forming using hydraulic press
7. Study and demonstration of 3D Printing
8. Study and demonstration of CNC turning and CNC milling
9. Study and demonstration of robots in manufacturing.
10. Simulation of industrial systems

PCCH1 Basic Chemical Engineering

Course Outcome:

At the end of the course students are able to

1. Understand Basic principles in Chemical Engineering
2. Solve the basic conservation principles
3. Evaluate the basic problems in momentum, heat and mass transfer
4. Understand the order, molecularity and rate expression in chemical kinetics

Unit 1

Definition of chemical engineering, basic concepts in chemical engineering: unit operations, basic laws, units and dimensions, dimensionless numbers and their importance

Fundamentals of Materials and Energy Balance: Conservation of Mass and Energy

Unit 2

Flow of fluids:

Fluid properties, pressure and its measurement, basic concepts of kinetics and dynamics of fluid flow

Unit 3

Heat Transfer:

Fundamental concepts of Conduction, Convection and Radiation.

Mass Transfer:

Diffusion-diffusion in different phases, role of concentration difference in diffusion, resistance to diffusion, diffusion in liquids. Inter-phase mass transfer, mass transfer coefficients, relation between mass transfer coefficients and overall mass transfer coefficients.

Unit 4

Chemical kinetics: introduction, order, molecularity, determination of the rate equation, effect of temperature on reaction rate, reactors (description with diagrams)

Text Book:

1. Introduction to Chemical Engineering, S. K. Ghosal, S. K. Sanyal & S. Datta, Tata-McGraw-Hill.

Reference Books:

1. Introduction to Chemical Engineering, Walter L. Badger & Julius T. Banchero, Tata-McGraw-Hill, New Delhi.
2. Unit Operations of Chemical Engineering, Warren L.Mc Cabe, Julian C.Smith, Peter Harriot, 7th edition, McGraw Hill, New Delhi.
3. Mass Transfer Operations, Robert E. Treybal, 3rd edition, McGraw Hill, New Delhi.
4. Introduction to Chemical Engineering, Smith J. M., McGraw Hill, New Delhi.

PCCP2: Basic Chemical Engineering Lab

List of Experiments

1. Calibration of Mercury Glass Thermometer
2. Estimation of Critical Velocity using Sedimentation
3. Estimation of concertation of NaOH using Acid Base Titration
4. Estimation of turbidity using Nephelometer
5. Diffusion of Acetone in air
6. Study of Chemical Equipment symbols in industry
7. Layout of Unit Operation Lab
8. Study of Cannot Cycle
9. Synthesis of Aspirin

PCMN2 Basic Mining Engineering

Course Outcome:

At the end of the course students are able to

1. To understand the career objectives in the field of mining engineering.
2. To be acquainted with minerals and mine.
3. To be aware of different stages in the life of a mine.
4. To understand the basics of mining methods.

Unit 1
Scope of Mining Engineering as a career, basic terminologies: Significance of mining sector, current scenario of mining sector in India and overseas, mining terminology: Mining engineering, mine, mining, mineral, rock, reserve, resource, ore, gangue, waste, mining methods, mine & miners safety.

Unit 2
Different stages in the life of a mine: Prospecting, exploration, development, exploitation and reclamation.

Unit 3
Opening of mineral deposits: Types of mine opening, selection, location, shape and size of different types of opening, drivage methods and cycle of operation.

Unit 4:
Overview of underground mining: Different Coal Mining Methods, their applicability and limitations, Different Metal Mining Methods, their applicability and limitations.

Unit 5:
Overview of surface mining: Types of surface mine, Unit Operation, Applicability and Limitation, Advantages and Disadvantages.

Text/Reference Books:

1. Introductory Mining Engineering-, Howard L. Hartman, Jan M. Mutmansky/ Wiley India (P) Ltd
2. Elements of Mining Technology Vol.-I - D.J. Deshmukh /Denett & Company
3. Principles and Practices of Modern Coal Mining - R. D. Singh
4. Surface Mining Technology : Samir Kumar Das

PCNP2: Basic Mining Engineering Lab

S. No.	Name of Experiment
1	Study of boring and various methods of boring.
2	Study of explosives and its types.
3	Study of blasting accessories.
4	Study of priming, charging, stemming and shot firing.
5	Study of solid blasting practices in underground mines.
6	Study of blasting patterns in underground and surface mines.
7	Study of different types of mine entry.
8	Study of temporary lining of shaft during sinking.
9	Study of concrete lining of shaft.
10	Study of special methods of shaft sinking.

PCBE2 Basic Civil Engineering

Unit	Content
1.	What is Civil Engineering/Infrastructure, History of Civil Engineering, Overview of ancient & modern civil engineering marvels, Scope of work involved in various branches of Civil Engineering
2.	Important Civil Engineering structure; Types of trusses, Method of analysis of simple truss, Component of building- superstructures and substructures, Types of foundation, Types of bridges, Elements of bridges, factors affecting suitable site for bridge construction, Types of IRC loading, IS and IRC codes.
3.	Role and significance of fluid mechanics, hydraulics and hydrology in Civil Engineering, Introduction to various water resource structures: dams, reservoirs, spillways, weirs, barrage, canals etc., Introduction to various facilities for river basin development, flood control, water supply, groundwater remediation, and other activities related to water resources like river interlinking, dam break analysis, basics of optimization.
4.	Introduction to surveying; Linear and Angular measurements; Compass surveying; Plane table surveying; Level & levelling; Modern tools of surveying; GIS and its application, Application of surveying in context of construction of civil infrastructure.
5.	**Introduction** of different modes of transportation and its developments. **Highway Engineering**: Classification of highways, Function of IRC, MORTH, CRRI, and NHAI. Highway construction materials & its properties, IS codes. **Railway Engineering**: Introduction and classification of railways in India, Different components of rail. **Airport Engineering**: Introduction and classification of airports in India, Different components of airport. Current Projects of Highway, Railway and Airport in India.
6.	Soil formation and composition, Index and engineering properties, Identification and classification of soils, Concepts of permeability and seepage of water through soils, Compaction and consolidation of soils, Shear parameters, Retaining walls
7.	Purpose of Estimation, Resource management, Material management, Various construction equipment and machinery, Construction management, Safety management, Introduction to legal, arbitration and tendering process.

PCBP2: Basic Civil Engineering Lab

List of Experiments

S.No.	Contents (tests)
01	To determine the water absorption percentage of burnt clay building bricks
02	To determine the compressive strength of burnt clay building bricks
03.	To determine the specific gravity of cement, coarse and fine aggregates
04.	To determine standard consistency of cement
05.	To determine the initial and final setting time of cement
06.	To determine the soundness test of given cement
07.	To determine fineness of cement
08.	To determine the fineness modulus of fine aggregates
09.	To determine the bulk density of coarse and fine aggregates
10.	To determine the gradation, particle size distribution of coarse and fine aggregates
11.	To determine the percentage water absorption of coarse and fine aggregates
12.	To determine the bulking of fine aggregate
13.	To determine the compressive strength of mortar

PCFT2 Basic Fashion Technology

Course Outcomes:

Students should be able to

1. Understand field of fashion technology.
2. Acquainted with fiber and fashion material.
3. Aware of different stages of the fashion cycle.
4. To understand the basic concepts of textile and garment.

Unit 1

Fashion language, Elements of fashion, Terminology of fashion. Fashion trends, Elements of an Art and Principles of Design, Basic concept of Line, Direction, Shape, Size, Texture, Value, Colour: Repetition, Alternation, Harmony, Gradation, Contrast, Dominance and subordination, Unity, Balance: Study of different types of motifs: - Natural, Decorative, Geometric and Abstract Motif.

Unit 2

Different stage of fashion art and science, development in fashion sector and different fashion industry, basic concept of fiber, yarn, fabric and garment manufacturing processes.

Unit 3

Introduction to different types of natural and synthetic dye, different types of fiber and their properties.

Unit 4

Overview of Fabric production in different methodologies their applicability and limitation. Manufacturing of fully fashion garment.

Unit 5

Sustainable Design

Ecological Sensitivity and Design Sustainability and Sustainable designs-Introduction to sustainability-Sustainable fashion. Forms of Sustainable, Fashion. Sustainable Fashion Cycle, Sustainable Fashion Practice, Sourcing and direct applications - Sustainable interior designs, Sustainable marketing.

Reference Books:

1. Bernard P. Corbman**, "**Textiles: Fiber to Fabric (Asia School Family Studies Fashion)" McGraw Hill Education; 6th edition
2. Prasanta Sarkar, "Garment Manufacturing: Processes Practices and Technology" Mudranik Technologies
3. Dr. Deepali Rastogi Dr. Chanchal Dr. Sheetal Chopra Dr. Chitra Arora, "Textile Science A Practical Manual" Elite Publishing
4. S.P. Mishra, "A Textbook Of Fibre Science And Technology" new age publishers; First Edition
5. J.N. Chakraborty, "Fundamentals and Practices in Colouration of Textiles" Woodhead Publishing India PVT. LTD.

PCFL2 Basic Fashion Technology
Laboratory Course

The course involves writing code for solved, unsolved and practice about fashion technology given in lab manual.

List of suggested experiments

1. To study of various types of fibers
2. To study of hand operated/manual pedestal swing machine
3. To study of automatic sewing machine
4. To study of different type of prince and design
5. To study of practicing making and patterning
6. Identification of natural fibers
7. To study of cotton silk wool polyester jute and linen
8. To study of polyester nylon and acrylic fiber
9. To develop Colour mixture according to light theory of Colour with primary, secondary and intermediate Colour.
10. To develop Colour modification using change in hue, change in value (tints and shades) and coloured grey.

HSM01 Indian Knowledge System

Unit 1		
Basics of Ancient Indian Knowledge and Diverse Fields from Health (Yoga), Agriculture, Performing Arts etc.	:	Yoga - Patanjali and Panini, Yoga Sutras & Mahabhashya, Yoga from Ancient Rishis, Munies, Sages and Seers, Different types of Yogas, Asanas & Pranayamas, Vagbhata Samhita for Health Benefits. Agriculture - Ancient Agricultural Trends, Practices & means of Transportation in Agriculture. Performing Arts – Different types of Ancient Arts, i.e; Murtikala, Embossing in Jewellery, Different School of Arts in Ancient India : Mathura, Gandhara and Amravati School, Pottery & Utensil making from Mud.
Unit 2		
Ancient Indian Knowledge in Various Science Streams like Physics, Chemistry, Biology, Forestry, Mathematics etc.	:	Gravitational Laws, Concept of Pendulum, Ancient knowledge of Space & Astronomy related to Outer Space and different Celestial Bodies, i.e; Planetary System, Stars and their Movement. Chemistry – Ancient Knowledge of Rasayanas, Preservative Methods using Oil and Salt etc. Biology & Forestry – Rich Cultural Heritage of Ayurveda, Different types of Medicinal uses of Plants, Fauna, Flora. Study of Animal and Plant Fossils, Interaction/ Inter-relation of Mankind and Nature on Mutually Beneficial Basis. Traditional methods for conservation of Forests, Trees and Preventing Soil Erosion. Mathematics – Present Day Decimal System traces its History to Ancient India, Giving the concept of Zero as a number to the World, Negative Numbers, basic Arithmetic and Algebraic concept, Knowledge of Advance Trigonometry in Ancient India.
Unit 3		
Ancient Indian Knowledge in Civil Engineering, Metallurgy, Mechanical Sciences, Textile Technology etc	:	Civil Engineering Concept and Familiarity with Sthapaty Kala, the Art of Construction in Ancient India, Civil Engineering Knowledge in Architecture in Making a Well Planned City by the Harappan Civilization Remains Undisputed. World Heritage Sites of Ajanta, Ellora, Khajuraho, Sanchi, Mahabalipuram are the Testaments of Excellent Civil Engineering Craftsmanship and Architecture, Well Developed Architecture During Cholas, Pal Dynasty is Evident in Various Ancient Temples in Present India. Concept of Canals and Wells for Irrigation & Human Needs in Ancient India is Well Documented Metallurgy – Concept Well Mentioned in Vedic Age Texts Using the Term Ayas for Metals, Minting/ Metal Casting Of Gold, Silver, Bronze, Copper for Utensils and Jewellery During Ancient India. Mechanical Sciences – Agriculture and Military Equipments like Hammer, Tongs, Idea of Basic Mechanical Concept for Transportation Using Bullock-Carts, Handpulled Carts Using Wheels, Chariots, Boats Using Patwar (Rudder) During Vedic Age ss Well Known, Use of Ploughing Tools Made of Metals and Wood etc. Textile Technology – Archaeological Evidence of Cotton Textile at Mohenjo Daro in the Indus Valley, Use of Charkhas and Traditional Yarns like Khadi, Silk Fabric from Silk Worm and export of quality Silk to West and European Countries is well established.
Unit 4		
Ancient Indian Knowledge in Electrical, Electronics, Computational Studies, Instrumentation etc.	:	Ancient India Knowledge in Generation of Electricity from Water, Silk and Clouds, Agastya Samhita Speaks about Electroplating, Basic knowledge of Computations and Instrumentation during Vedic Period, Musical Instruments like Seven-Holed Flute and other Stringed Instruments like Ravanahatha, Cymbals, Dhol (Drum) found by Archaeologists from Indus Valley Civilization Sites.

CCA02

Sports/NSS/NCC/YOGA/Painting/Music/Classical dance

INT02

Summer Internship