Text Books List

Mathematics-II
✓ Mathamatics 1
A.Sarkar, Naba Prakashani
✓ Engineering Mathamatics
A.Sarkar, Naba Prakashani

Applied Physics –II
✓ Applied Physics 1
D.Choudhury, Bhagabati Publication
✓ Basic Physics
D.Choudhury, Bhagabati Publication

Introduction to IT Systems
✓ Introduction to IT System,P. Mondal, Bhagabati Publication.
✓ Computer Applications, P.K. De & A. Basu, Lakshmi Prakashani

WrokShop
✓ Workshop Practice, Swarn Singh, Katson Books

Applied Chemistry
✓ Basic Chemistry
Kaberi Bhattacharya, Lakhi Prakashani
✓ Applied Chemistry
Kaberi Bhattacharya, Lakhi Prakashani
✓ Engineering Drawing
N.D. Bhatt, Charotar Publication

Communication Skills in English
✓ Life & Office Skills, British Council

***

Ramakrishna Mission Shilpamandira

**An AICTE Approved
Self-Financed Polytechnic**

Belur Math, Howrah

Syllabus Booklet

Semester – I (Part-I)

All Discipline (CE, EE, ETCE & ME)

**Based on the Latest Syllabus published by the
West Bengal State Council of Technical & Vocational Education and Skill
Development**

Mathematics - I

Unit-1: Algebra
Logarithm:
- Definition of natural and common logarithm.
- General Properties of logarithm and simple problems

Complex Numbers:
- Definition of Complex numbers
- Real and Imaginary parts of a complex number
- Equality of two complex numbers
- Conjugate of a complex number
- Modulus and Argument of a complex number and simple problems
- Polar and Cartesian forms of a complex number and their relation
- Algebraic operations (Addition, Subtraction, multiplication, Division) of complex numbers
- De Moivre's Theorem (without proof) and simple problems
- Cube roots of unity and their properties with problems

Quadratic Equations:
- Definition of Quadratic Equations
- Finding roots of a quadratic equation
- Conjugate roots& simple problems
- Nature of the roots using discriminant & problems
- Roots & coefficients: Relationship & problems
- Formation of quadratic equations if roots are given

Binomial Theorem:
- Definition of factorial of a number
- Permutation ^nP_r & combination ^nC_r
- Binomial Theorem for any index
- Simple problems on positive index
- General & Middle Term; problems
- Expansion of $(1+x)^{-1}$, $(1-x)^{-1}$, $(|x| <1)$, exponential & logarithmic series.

Unit-2: Vector Algebra
- Definition of vector; types of vectors
- Concept of a position vector and Ratio formula & simple problems
- Rectangular resolution of a vector
- Equality, addition, subtraction of vectors and multiplication of a vector by a scalar
- Scalar (dot) Product ; problems
- Vector (cross) product ; problems
- Application of dot product - work done by a force, projection of a vector upon another
- Application of cross product -- finding area of a triangle and parallelogram, moment of a force

Unit-3: Trigonometry
- Concept of trigonometrical angles
- Measurement of angles in degree, radian and grade & their relation only
- Trigonometrical ratios of angles, associated angles, Standard Trigonometric ratios, problems
- Compound angles formula, multiple Sub-multiple angles & problems
- Solutions of Trigonometrical Equations, Problems (0 to 2π)
- Inverse Circular Function & problems
- Properties of triangle, basic formulae and some problems

Unit-4: Function, Limit & Continuity, Derivative
Function:
- Definition of variables & constants
- Definition of function with examples, domain and range of a function
- Function Type (even/odd, increasing, / decreasing, inverse, periodic)
- Some problems
- Graph of trigonometric functions, sin x, cos x, tan x only

Communication Skills in English

Unit 1: Communication
- Basics of Communication: Introduction, meaning and definition, process of communication etc.
- Types of communication: formal and informal, verbal, non-verbal and written. Barriers to effective communication.
- 7 Cs for effective communication (considerate, concrete, concise, clear, complete, correct, courteous).
- Technical Communication.

Unit 2: Soft Skills for Professional Excellence
- Introduction: Soft & Hard Skills.
- Time Management.
- Motivation
- Stress Management.
- Emotional Intelligence.
- Self-awareness.
- Problem solving skills
- Decision Making
- Interpersonal Skills

Unit 3: Reading Comprehension
- Comprehension of a written text
- Note Taking.

Unit 4: Professional Writing
- Writing Reports
- Writing Emails
- Writing Memo
- Job Application Letters
- CV/Resume

Unit 5: Vocabulary and Grammar
- Remedial Grammar and Exercises
- Parts of speech, active and passive voice, tenses etc.

Communication Skills in English-Lab

Introducing yourself and others:
- Talking about yourself
- Describing people

Speaking about your free time:
- Talking about your free time
- Giving reasons for things you like
- Discussing daily routines

Giving instructions and advice:
- Giving and following instructions
- Giving route directions
- Advising about places/ tourist spots etc.

Out and about:
Talking about:
- Going shopping
- Eating in a restaurant
- Films and Television
- Holidays
- Social Events

Speaking and listening:
- College Life
- Talking about the World, Weather, Environment, etc.

Enhancing employability and Professional skills:
- Job Interviews
- Group discussions
- Professional Presentations

Forging Shop

Introduction:

- ✓ Purpose of Smithy/Forging Works
- ✓ Different types of Hearths used for Smithy/Forging works
- ✓ Specification, usage, care and maintenance of various tools and equipment used in the shop.
- ✓ Types of raw materials used in Smithy/Forging shop & their required temperature for it.
- ✓ Types of fuel used in hearth and the maximum temperature obtained.
- ✓ Uses of Fire Bricks & Clays in Smithy/Forging Work Shop.
- ✓ Types of heat treatment processes involved in Smithy / Forging shop and its effect on forged items.
- ✓ Hot forge & cold forge utility.
- ✓ Safety measures & equipment for Smithy/Forging Shop

Practical:

- ✓ Practice / Demonstration of firing of hearth/Furnace, Cleaning of Clinkers and Temperature Control of Fire.
- ✓ Demonstration on basic Forging operations: Upsetting, Drawing down, Setting down, Necking, Cutting, Bending, Fullering, Swaging, Punching and Drifting etc.
- ✓ Demonstration on making of
  - Cube, hexagonal cube, hexagonal bar from round bar.
  - Hexagonal /octagonal flat chisel including tempering of edges.

Job Preparation–Student group Jobs
- ✓ Job 1, 2: Cold/hot flat chisel, Tongs
- ✓ Job 3: utility tools: Chain-links, door ring, hexagonal bolt / square shank boring tool, fan hook (long S-type) etc.
- ✓ Job- 4, 5: Door hinge, 'L' hook

Electrical Shop

- ✓ Basic concept of voltage and current.
- ✓ Basic laws of electrical engineering (Ohm's law, KVL, KCL etc)
- ✓ Basic elements of electrical circuit (Sources ,Resistors, capacitors, inductors etc)
- ✓ Concept of electrical power, energy.
- ✓ Different voltage and current levels.
- ✓ Structure of electrical power system.
- ✓ Different types of wiring, switches and fuse.
- ✓ Wiring of a room, fluorescent lamp, two way switches (stair case) & calling bell.
- ✓ Earthing: requirement & types
- ✓ Single phase service connection
- ✓ Tools used in electrical workshop,
- ✓ Different electrical meters.
- ✓ Different types of wire joints.
- ✓ Electrical shock ,general safety & precaution

Electronics Shop

- ✓ Active & Passive component.
- ✓ Basic components (Specifications, types, rating, uses)
- ✓ Resistors, Capacitors, Inductors, Coils, Transformers, Relays, Diode, Transistors.
- ✓ Discussion on Multimeter and use.
- ✓ Testing & identification of basic components using Digital Multimeter.
- ✓ Bread board, Vero board, PCB.
- ✓ Soldering and de-soldering practice.
- ✓ Safety measure to be followed in Electronic Shop.

Limit & Continuity:

- ✓ Definition of limit (with left hand limit & right hand limit),
- ✓ Fundamental Theorem on limit,
- ✓ Standard limits and simple problems
- ✓ Continuity of functions, elementary test for continuity (finite limit)

Derivative:

- ✓ Definition of derivatives with some problems
- ✓ Derivatives of standard functions with some problems
- ✓ Rules of differentiation of sum, difference, product and quotient of functions with some problems Derivatives of composite functions (Chain Rule) examples
- ✓ Derivatives of inverse circular functions, implicit functions and logarithmic differentiation examples
- ✓ Derivative of parametric functions, derivative of a function with respect to another function with examples
- ✓ Second order derivatives; problems
- ✓ Application of derivatives –Physical & Geometrical interpretation of derivative
- ✓ Checking increasing- decreasing functions
- ✓ Finding velocity & acceleration
- ✓ Maxima-Minima of function of single variable with simple problems

Applied physics-I

Unit 1: Physical world, Units and Measurements

- ✓ Physical quantities
  a) Fundamental and derived
  b) Units & systems of units (CGS,SI)
- ✓ Dimensions and dimensional formula of physical quantities
  a) Principle of homogeneity of dimensions
  b) Dimensional equations and their applications
  c) Limitations of dimensional analysis.
- ✓ Measurements:
  a) Measuring instruments
  b) Least count
  c) Types of Measurement
  d) Errors in Measurements (systematic and random)
  e) Mean value, absolute error, relative error, error propagation, error estimation
  f) Significant figures, Numericals.

Unit 2: Force and Motion

- ✓ Force
  a) Momentum
  b) Conservation of linear momentum and its applications
  c) Impulse of force, Impulsive force
  d) Newton laws of motion and its applications
- ✓ Circular motion
  a) Angular displacement
  b) Angular velocity
  c) Angular acceleration
  d) Frequency, Time period
  e) Concept of Centripetal and centrifugal forces.
  f) Banking of roads and bending of cyclist
  g) Numerical problems

Unit 3: Work, Power and Energy

- ✓ Work
  a) Concept and units
  b) Positive, Negative and zero work
  c) Numerical problems
- ✓ Power
  a) Concept and its units
  b) Power and work relationship
  c) Calculation of power
  d) Numerical problems

- ✓ Energy
  - a) Concept and its units
  - b) Kinetic energy & potential energy
  - c) Work energy theorem
  - d) Conservation of mechanical energy
  - e) Transformation of energy
  - f) Numerical problems
- ✓ Friction
  - a) Concept and types of friction
  - b) Laws of limiting static friction
  - c) Coefficient of friction
  - d) Angle of friction, Angle of repose
  - e) Work done by a moving object on rough inclined plane.
  - f) Reducing friction and its engineering applications
  - g) Numerical problems

Unit 4: Rotational Motion
- ✓ Translational and rotational motion with examples
  - a) Definition of torque and angular momentum and their relation
  - b) Conservation of angular momentum and its applications.
  - c) Moment of inertia and its physical significance
  - d) Radius of gyration for rigid body
  - e) Theorems of parallel and perpendicular axes
  - f) Moment of inertia of rod, disc, ring and sphere
  - g) Numerical problems.

Unit 5: Properties of Matter
- ✓ Elasticity:
  - a) Definition of stress and strain
  - b) Hooke's law, Moduli of elasticity
  - c) Significance of stress-strain curve.
  - d) Numerical problems
- ✓ Surface tension:
  - a) Concept and units
  - b) Cohesive and adhesive forces
  - c) Surface energy, Angle of contact

  - d) Capillary rise
  - e) Jurin's law
  - f) Applications of surface tension
  - g) Effect of temperature and impurity on surface tension
  - h) Numerical problems
- ✓ Hydrodynamics:
  - a) Specific gravity, Pressure of fluid
  - b) Pascal's law
  - c) Buoyancy and Buoyant force
  - d) Archimedes principle
  - e) Fluid motion: stream line & turbulent flow
  - f) Reynold's number
  - g) Equation of continuity
  - h) Bernoulli's Theorem and its applications
  - i) Viscosity; Coefficient of viscosity
  - j) Terminal velocity
  - k) Stoke's law
  - l) Numerical problems

Unit 6: Heat and Thermometry
- ✓ Concept of heat and temperature
  - a) Basic concepts of measurements of heat and temperature
  - b) Modes of heats transfer (conduction, convection and radiation with examples)
  - c) Co-efficient of thermal conductivity
  - d) Numerical problems.
- ✓ Expansion of solids, liquids,& gases
  - a) Coefficient of linear, surface and cubical expansions of solids
  - b) Relation among coefficient of linear, surface and cubical expansions of solids
  - c) Specific heats of a substance
  - d) Specific heats Cp & Cv of a gas and their relationship.

Washer, Locking arrangement and their conventional representations.

Unit 7: AutoCAD
- ✓ Basic 2D Commands & Simple 2D Drawings.

Carpentry Shop

Introduction:
- ✓ Raw materials used in carpentry shop: wood & alternative materials.
- ✓ Hand & M/c Tools: Specification, usage, care & maintenance of various tools, equipment and machineries used in the Carpentry shop.
- ✓ Types of wood.
- ✓ Hard & soft wood: Difference.
- ✓ Timber: characteristics, usage, defects
- ✓ Difference between wood & timber.
- ✓ Seasoning of wood.
- ✓ Different types of joints such as cross half-lap joint, through ten on and mortise joint, dove tail joints, etc.
- ✓ Auxiliary materials for Carpentry.
- ✓ Safety measures in carpentry shop.
- ✓ Study on and practice of the following machines: a) Wood turning lathe b) Surface planer c) Circular saw d)Band saw e) Drilling machine.

Practical jobs:
- ✓ Demonstration of use of different tools, equipment and machineries.
- ✓ Demonstration of different wood working processes, like plaining, marking, chiseling, grooving, turning of wood etc.
- ✓ Job Preparation -Individual Works
  1) Cross half lap joint
  2) Tee-dove tail joint
  3) Through mortise & tenon joint
- ✓ Production of utility articles (Group work)
  4) Making Handles of chisels

Fitting Work Shop

Introduction:
- ✓ Demonstration of different tools and equipment used in fitting shop.
- ✓ Study of measuring instrument such as micrometer, vernier calipers, bevel protractors.
- ✓ Care and maintenance of the above mentioned tools and equipment.
- ✓ Study of drilling machines and power tools used in fitting shop.
- ✓ Safety measure in Fitting shop.

Practical job:
- ✓ Demonstration of different fitting job operations like chipping, filing, drilling, tapping, sawing, cutting etc.

Job Preparation -Individual Works:
- ✓ One simple fitting job involving practice of chipping, filing, marking, drilling, tapping, cutting etc.
- ✓ Job no 1: "T" Fitting

Welding Shop
- ✓ Purpose of welding, advantages & disadvantage so fit over other joining processes.
- ✓ Types of welding processes (in brief)
- ✓ Specification, usage, care & maintenance of various welding machines, tools & equipment.
- ✓ Selection of welding methods and electrodes.
- ✓ Safety measures & equipment required for working in welding shop

Sheet Metal Shop
- ✓ Briefing on different types of sheet metal: Stainless Steel, Copper, Brass, Corrugated Sheet Metal, Galvanized Sheet Metals etc., and their uses.
- ✓ Demonstration of different types of Tools & machines and their use in sheet metal work.

Applied Chemistry Lab

- Identification of Basic Radicals by Dry and wet Test
- Identification of Acid Basic Radicals by Dry and wet Test
- Preparation of standard oxalic acid and standard potassium dichromate solution.
- To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution and phenolphthalein as indicator.
- Standardization of potassium permanganate solution using standard oxalic acid
- Standardization of sodium thiosulphate using standard potassium dichromate solution by Iodometry.
- Iodometric estimation of copper in copper sulfate sample.
- Iodometric estimation of iron in iron oxide sample.
- Volumetric estimation of total acid number (TAN) of given oil.
- Volumetric estimation of -
  a) Total hardness of water sample using standard EDTA solution.
  b) Alkalinity of water sample using 0.01N sulphuric acid.
- Determine the conductivity of given water sample.
- Verify first law of electrolysis: copper sulfate using copper electrode.
- To apply thin layer chromatography for separation of mixture of inorganic/organic compounds.
- Qualitative detection of Arsenic in a given sample of water (~5 ppm solution of sodium arsenite)

- Determination of dissolved oxygen in a sample of water.
- Determination of pH value of unknown solution.

Engineering Graphics

Unit 1 & 2: 1st Plate: Lettering, Scale & Geometrical Construction:
- LETTERING- Letters and numerals (single stroke, vertical, capital).
- SCALES- 2 problems on plain scale and on diagonal scale.
- GEOMETRICAL CONSTRUCTION- Curve passing through five no. of points, regular polygons, ellipse, parabola, hyperbola & cycloid.

Unit 3: 2nd Plate
Orthographic Projection of Lines & Solids:
- Projection of Line- Two problems on straight line, inclined with one plane and parallel to other.
- Projection of Solid- Four problems on pyramid, prism, cylinder, cone; axis inclined to one plane and parallel to other.

Unit 4: 3rd Plate
Conversion of Pictorial Views Into Orthographic Views:
- Isometric View Into Orthographic Projection - Three problems on isometric view into orthographic projection of simple 3D objects.

Unit 5: 4th Plate
Isometric Projection & View:
- Orthographic Views Into Isometric View, and Projections - Problems on regular solids.
- Construction of Isometric Scale.

Unit 6: 5th Plate: Freehand Sketches:
- Thread Terminology & Profiles, Nuts, Bolts, Studs, Set Screws,

Applied Physics - I Lab

- Determination of volume of a hollow Cylinder by using slide callipers.
- Area of cross section of a thin wire using a screw gauge.
- To determine radius of curvature of a convex and a concave mirror surface by using a spherometer.
- Determination of Specific Gravity of a heavy Insoluble Solid By Hydrostatic Balance.
- To determine the relative density of sand by using a specific gravity bottle.
- Viscosity of a liquid by Stoke's law
- To verify Boyle's law.
- Measurement of volume of using Travelling microscope
- Determination of the surface tension of water by capillary rise method.
- Determination of the Young's modulus of steel by searle's method.
- Density of a solid rod using common balance, and slide calliper's, Screw gauge (for diameter of the rod).
- Young's modulus (Y) of the material of a beam by the method of flexture.

Introduction to IT Systems

Number system & Codes
- Binary, octal, hexadecimal and decimal number systems
- Binary addition and subtraction
- Signed and Unsigned binary numbers
- 1's and 2's complement format.

Boolean Algebra:
- Basic logic circuits: Logic gates (AND, OR, NOT, NAND, NOR, Ex-OR, ExNOR with truth tables), Universal Gates,
- De-Morgan's theorem

Computer Hardware:
- CPU, Memory, Display, Keyboard, Mouse, HDD, SSD, & other Peripheral Devices.
- Printer & their classification
- Various port of a mother board
- Classification of Computer
- Organization of a Computer System
- Computer generation, Classification of software & their usage.

Algorithm & Flowcharts:
- Algorithm& Flowcharts : Definition, Characteristics, Advantages and disadvantages, Symbols of flowchart
- Examples of Algorithm & Flowchart of Various programs.

HTML5, JavaScript
HTML 5:
- Introduction HTML
- HTML, Head, Body, Style, Script
- Break, body, center, div, form, heading level (1 to 6), image, font, order list, under list, paragraph, table, data cell etc.
- Formatting Tags : Link, bold, italic, underline, strong, emphasized text, small, del, subscript, superscript, etc.
- Input, label, text, select, textarea, button, option, checkbox, radio, hidden filed, date, file, color etc.

Java Script:
- Introduction, Features & Application, Advantage, JavaScript Syntax
- Embedding Script in HTML File: Internal & External
- Comments lines, Character set, Identifier, Keywords, Variable, Data type,
- Operators: Arithmetic, Logical, Comparison, Assignment, bitwise
- Input / Output Statement
- Conditional Statement: If, If-Else, Switch
- Loops: For, While, Do/while examples.

Intro. to IT Systems Lab

- Components of computer system: Input & Output Devices; Memory handling; Storage devices.
- Identification of Hardware components, ports / interfaces, cables, etc.

HTML5, JavaScript
- Webpage design with HTML, CSS & JavaScript

MS Word :
- Formatting Word Document
- Mail merge, Shapes, Table
- Create : Bio-data & Cover Page etc.

MS Excel:
- Apply Custom Formats and Layouts
- Format Cells, Sorting, Filter
- Apply Borders, Design Borders
- Custom Formatting

Simple & Advanced formulas:
- Simple Text, Mathematical functions
- Conditional & Logical Functions
- Lookup, vlookup, hlookup,
- Index, Match, Scenarios, Goal seek

Charts :
- Bar Charts, Pie Chart, Donut chart,
- Histograms, Line Graph, Trend,
- Pivot tables

MS-Power Point
- Power Point Slide Template.
- Create Animation, transition
- Add: movie, sound, tables, chart etc
- Changing slide colour scheme.
- Slide navigator: Create, Save, Print.

Applied Chemistry

Unit 1: Atomic Structure:
- Rutherford model of atom
- Bohr's theory (expression of energy and radius to be omitted), and hydrogen spectrum explanation based on Bohr's model of atom

- Heisenberg uncertainty principle
- Quantum numbers - orbital concept. Shapes of s, p and d orbitals, Pauli's exclusion principle
- Hund's rule of maximum multiplicity Aufbau rule, electronic configuration

Type of chemical bonding:
- Ionic, covalent, metallic and hydrogen bonds.
- Example of each type. Hybridization, sp3, sp2, sp
- Example: BeCl2, BF3, CH4, NH3, H2O; structure of diamond, graphite.
- Solution – idea of solute, solvent and solution, methods to express the concentration of solution-
- Molarity, ppm, mass percentage, volume percentage & mole fraction.

Unit 2: Water
- Graphical presentation of water distribution on Earth (pie or bar diagram)
- Classification of soft and hard water based on soap test, salts causing water hardness
- Unit of hardness, numericals
- Cause of poor lathering of soap
- Problems caused by use of hard water in boiler (corrosion, scale, sludge, foaming, priming, etc),
- Quantitative measurement of water hardness by ETDA method,
- Total dissolved solids (TDS)
- alkalinity estimation.
  a) Water softening techniques - soda lime, zeolite, ion exchange
  b) Municipal water treatment - sedimentation, coagulation, filtration, sterilization.
- Water for human consumption
- Indian standard specification of drinking water (understand data & standards).

Unit 3: Engineering Materials
Natural occurrence of metals:
- Minerals, ores of iron, aluminium, copper, gangue (matrix), flux, slag

Metallurgy:
- Brief account of general principles of metallurgy
- Extraction of iron from haematite ore using blast furnace, aluminium from bauxite along with reactions,
- Reactions during copper extraction

Alloys:
- Definition, purposes of alloying, ferrous alloys and non-ferrous with examples, properties & applications.
- General chemical composition, composition based applications: Port land cement and hardening, Glasses Refractory and Composite materials.

Polymers :
- Monomer, homo and co polymers, degree of polymerization, simple reactions involved in preparation
- Application of thermoplastics and thermosetting plastics (PVC, PS, PTFE, nylon-6, nylon-66, Bakelite)
- Rubber and vulcanization of rubber.

Unit 4: Fuels and Lubricants
Fuels:
- Fuel and fuel Combustion
- Classification of fuels, calorific values (HCV & LCV), calculation of HCV & LCV using Dulong's formula
- Proximate analysis & ultimate analysis of coal solid fuel
- petrol & diesel - fuel rating (octane, cetane numbers)
- Chemical composition, calorific values and applications of LPG, CNG, water gas, coal gas, producer gas and biogas

Lubrication :
- Function and characteristic properties of good lubricant
- Classification with examples
- Lubrication mechanism :
- Hydrodynamic, boundary lubrication
- Physical properties (viscosity, viscosity index, oiliness, flash & fire point, cloud & pour point)
- Chemical properties (coke number, total acid number saponification value) of lubricants.

Unit 5: Electro Chemistry
- Electronic concept of oxidation
- Reduction and redox reactions

Definition of terms:
- Electrolytes, Non-electrolytes with suitable examples
- Faradays laws of electrolysis and simple numerical problems.
- Elementary concept of pH and buffer. Industrial Application of Electrolysis–Electrometallurgy, Electroplating, Electrolytic refining
- Application of redox reactions in electrochemical cells – Primary cells - dry cell,
- Secondary cell - commercially used lead storage battery, fuel, Solar cells.

Corrosion of Metals:
- Definition, Types of corrosion (chemical, electrochemical)
- H2 liberation, O2 absorption mechanism of Electrochemical corrosion, factors affecting rate of corrosion

Corrosion preventive measures:
- Internal: Purification, alloying and heat treatment
- External: a) metal (anodic, cathodic) coatings, b) organic inhibitors.

Sheet Metal Shop

Job involving soldering, riveting etc:
- ✓ Taper tray, Pipe joint by locked grooved joint, Cabinet, Square hopper, Mug, Materials Estimation
- ✓ Bill of Materials.

Forging Shop

- ✓ Cold / Hot flat chisel, Door ring
- ✓ Fan hook (Long S-type), Ring Tongs

Life & Office Skills

Self analysis and Management:
- ✓ Self-analysis(SWOT analysis)
- ✓ SMART GOAL &Time management

Listening Skill & Body language:
- ✓ Benefits of good communication
- ✓ Communication barriers to avoid.
- ✓ Listening skills, Body Language.

Conversation & Presentation Skills:
- ✓ Building an effective communication to interact with audience.
- ✓ Methods of planning a presentation.

GD, Interview and CV:
- ✓ Techniques of "Group Discussion"
- ✓ Techniques of "Personal Interview".
- ✓ Preparation of CV.

Project:
- ✓ Facing a mock interview session arranged in the campus.

Text Books List

Mathematics-II
- ✓ Engineering Mathematics-II, A. Sarkar, Naba Publication
- ✓ Mathematics – II BK Pal, UN Dhur.

Applied Physics –II
- ✓ Applied Physics – II, D.Choudhuri, Bhagabati Publication
- ✓ Text books of Physics for Class XI & XII (Part I & II); N.C.E.R.T., Delhi.

Introduction to IT Systems
- ✓ Introduction to IT System,P. Mondal, Bhagabati Publication.
- ✓ Computer Applications, P.K. De & A. Basu, Lakshmi Prakashani

FEEE
- ✓ Fundamentals of Electrical & Electronics Engineering, P Das &TK Nag, Bhagabati.
- ✓ Electrical Technology Vol – I , J.B. Gupta, S.K. Kataria & Sons

Environmental Science
- ✓ Environmental Engineering, Dr. Aloka Devi, Bhagabati Publication
- ✓ Applied Chemistry, Kaberi Bhattacharya, Lakshmi Prakashani

Engineering Mechanics
- ✓ A Text Book of Engineering Mechanics, AR Basu, Dhanpat Rai.
- ✓ Engineering Mechanics, DS Kumar, SK Kataria & Sons
- ✓ Applied Mechanics, RS Khurmi, S. Chand & Co

Internship - I
- ✓ Workshop Practice, Swarn Singh, Katson Books
- ✓ Engineering Graphics, N.D. Bhat, Charotar Publishing House;
- ✓ A Textbook of Engineering Drawing, R. K. Dhawan, S. Chand & Co
- ✓ Life & Office Skills, British Council

***

Ramakrishna Mission Shilpamandira

**An AICTE Approved
Self-Financed Polytechnic**

Belur Math, Howrah

Syllabus Booklet

Semester – II

**Based on the Latest Syllabus published by the
West Bengal State Council of Technical & Vocational Education and Skill Development**

Mathematics - II

Unit-1: Determinants
- ✓ Definition of determinants of order 2 & 3
- ✓ Minors and cofactors
- ✓ Determinants: Properties & problems
- ✓ Chios Method for 4th order
- ✓ Cramer's Rule for simultaneous linear equations (up to 3 unknowns).

Matrix:
- ✓ Definition of Matrix and its order.
- ✓ Types of Matrices (rectangular, square, row, column, upper & lower triangular, diagonal, scalar, identity, null)
- ✓ Singular & non-singular matrices with simple problems
- ✓ Equality of matrices & Simple prob.
- ✓ Algebraic of matrices Addition, & subtraction
- ✓ Matrix Multiplication(2x2); problems
- ✓ Transpose of a matrix; problems
- ✓ Orthogonal matrix; problems
- ✓ Symmetric & skew symmetric matrices with simple problems
- ✓ Adjoint & inverse of matrix (order 3)

Unit-2:Co-ordinate Geometry (2D)
Coordinate System:
- ✓ Cartesian & Polar Coordinate system & their relations.
- ✓ Distance between two points
- ✓ Internal & external division of a line segment & simple problems.
- ✓ Triangle Area; Collinearity condition

Straight Line:
- ✓ Definition; Gradient (slope)
- ✓ Equations of straight line in various standard forms & simple problems
- ✓ Angle between two straight lines
- ✓ Conditions of parallelism and perpendicularity & simple problems
- ✓ Perpendicular distance from a point to a line, between 2 parallel lines

Circle:
- ✓ Definition, Equation of a circle

- ✓ Centre-radius form, diameter form, Standard form and their equation
- ✓ Simple problems

Conic Section Parabola:
- ✓ Definition & Types, equation,
- ✓ Vertex, axis, eccentricity, focus, directrix, latus rectum & problem

Ellipse:
- ✓ Definition & types, Equation,
- ✓ Vertex, axis, eccentricity, focus, directrix, latus rectum & problem.

Trigonometry & Calculus (Revision):
- ✓ Trigonometry: Concepts & Formulas
- ✓ Derivative : Concepts & Formulas

Unit-3 : Integral Calculus
Indefiniteintegral:
- ✓ Integration as inverse process of differentiation; Rules for integrations (sum, difference, scalar multiple)
- ✓ Integration of standard functions
- ✓ Integration by substitution
- ✓ Integration by parts & partial fraction

DefiniteIntegral:
- ✓ Definite integral Properties, problems
- ✓ Applications: i) area of bounded region ii) Volume &Surface Area of solid generated by revolving about an axis

Unit-4: Ordinary Differential Eq^n
1st Order Differential Equation:
- ✓ Definition of ordinary differential equation, order & degree.
- ✓ Formation of differential equation.
- ✓ Solution of Differential equation of First order and first degree by -
- ✓ Separation of Variables
- ✓ Homogeneous, Exact, & Linear differential equations
- ✓ Bernoulli's differential equation

2nd order differential equation:
- ✓ Solution of 2nd order Differential equations with constant coefficients
- ✓ Complementary Functions (CF)
- ✓ Particular Integral & Problems.

- ✓ Voltage and Current relationship in Star and Delta connections;
- ✓ Voltage &current through resistance, inductance & capacitance: sinusoidal excitation (phasor representation)
- ✓ A.C in resistor, inductor & capacitor
- ✓ A.C in R-L series, R-C series, R-L-C series and parallel circuits;
- ✓ A. C. Power& power triangle.

Unit 6 : Transformer & Machines:
- ✓ Construction and principle of different type of transformers;
- ✓ EMF equation &transformation ratio of transformers; Auto transformers;
- ✓ Construction, Working, Basic Equations & Characteristic of Motors

FEEE Lab
- ✓ Multimeter, Resistor Colour Code, Capacitance measurement
- ✓ R load: Voltage, current, &power.
- ✓ R-L load: Voltage, current, &power.
- ✓ R-C load: Voltage, current, &power.
- ✓ R-L-C load: Voltage, current, power
- ✓ Transformer (1-φ):Turns Ratio
- ✓ Transformer: Efficiency under load.
- ✓ Electric Pump : Starter Connection
- ✓ Kirchhoff's Current & Voltage laws
- ✓ Ammeter etc. Internal resistance
- ✓ Truth tables of different logic gates
- ✓ Diode, BJT testing by multimeter; Forward V-I characteristics.
- ✓ De Morgan's Laws
- ✓ Op-Amp: amplifier, adder, subtractor

Internship – I
Internship will consist of training in:
1. Technical Skills:
   - Engineering Graphics
   - Workshops: Carpentry, Fitting, Welding, Sheet Metal, & Forging
2. Life & Office Skills

Engineering Graphics
Section of solid:
- ✓ Cube, Pentagonal Pyramid, Cylinder, Cone
Development of surfaces:
- ✓ Square Prism, Cylinder, Square Pyramid, Cone
Missing views, Isometric & Sectional views:
- ✓ Orthographic: Missing, Isometric views
- ✓ Sectional Views of Machine Components (half & full)
- ✓ Civil Engg. drawing

Carpentry Shop
Introduction:
- ✓ Wood working Machines: (Wood turning lathe, Circular saw machine, Drilling machine, Thickness planer)
- ✓ Demonstration of above Machines
Practical jobs:
1) Through Mortish & Tenon joint
2) Dove tail Tee- half lap joint
3) Handle of Chisel (Group Job)

Project: Wooden Tray (Group Tasks)
- ✓ Wooden Tray: Materials Estimation
- ✓ Bill of Materials.

Fitting Work Shop
Introduction:
- ✓ Limits, Fits and Tolerance.
- ✓ Screw Threads
Practical job:
- ✓ 'T' Fitting & Step Fitting

Welding Shop
- ✓ Lap joint on M.S plate, Flat position
- ✓ Butt joint on M.S plate, position Flat
- ✓ Hard soldering; brazing /gas welding
- ✓ Spot welding on M.S sheet
Mini project:
- ✓ Window Grill &Materials Estimation
- ✓ Bill of Materials.

Unit 4– Local Administration
- District Administration
- Municipal Corporation
- Zila Panchayat

Unit 5– Election Commission
- Role and Functioning
- Chief Election Commissioner
- State Election Commissioner

Environmental Chemistry Lab

1. Identification of acid and basic radicals by dry and wet tests.
2. Identification of unknown salts.
3. Hardness of water ($NaCO_3$ method)
4. Iron content in Mohr's salt using $KMnO_4$ and $K_2Cr_2O_7$ separately.
5. Determination of Iron in Iron ore Solution by $KMnO_4$.
6. Neutralization of weak acid and weak base by conductivity meter.
7. Total chlorine residuals (Iodometric).
8. Saponification value of an oil.
9. Preparation of Bakelite.
10. Preparation of Potash alum.
11. Electroplating.
12. Copper in Cu2+ solution (hypo).
13. Strength of HCl by titration against NaOH Solution using pH meter.

Fundamentals of Electrical & Electronics Engineering

Unit 1: Electronic Components & Signals:
- Passive & Active Components:
  - Resistance, Capacitor, Inductor
  - Diode, BJT, FET, MOS, CMOS
  - Applications.
- Energy level diagrams of insulator, conductor & semiconductor.
- Intrinsic & Extrinsic semiconductor, Doping concentration
- Formation of P-Type and N-Type semiconductor and their properties.
- P-N junction Diode & its properties.

- Signals: DC/AC, Voltage/Current, Periodic/Non-periodic signals
- Average, RMS, Peak value
- Different types of signal waveforms
- Sources: Ideal/Non-ideal, Voltage, & Current, Independent, & Dependent.
- Charge, current, voltage, resistance, inductance, Capacitance, power, energy and their units.
- Resistances in series and parallel
- Kirchhoff's Current & Voltage laws
- Simple problems on D.C. Circuits

Unit2 : Overview of Analog Circuits:
- PNP & NPN transistor, Configurations
- Input / Output Characteristics
- Operational Amplifiers: Ideal & Practical, Open & closed loop
- Amplifier, Adder, Differentiator Integrator.

Unit 3: Overview of Digital Electronics:
- Boolean Algebra, Operations
- Karnaugh Map (K-Map) ≤4 variables
- Gates: Functional Block Approach
- Flip Flops (Storage Elements)
- Counters: Ripple, Up/down, Decade.
- Digital IC Gates (TTL Type).

Unit 4 : Electric & Magnetic Circuits:
- EMF, Current, Potential Difference, Power, Energy;
- MMF, magnetic force, permeability, hysteresis loop, reluctance, leakage factor, BH curve;
- Electromagnetic induction, Faraday's laws, Lenz's law; Dynamically, & Statically Induced EMF
- Self & mutual inductance Equations
- Electric & Magnetic Circuit Analogy

Unit 5 : A.C. Circuits:
- Cycle, Frequency, Time Period, Amplitude, Angular velocity, RMS, Average value, Form & Peak Factors
- Impedance, phase angle, power factor
- Sinusoidal quantities in exponential, complex, and polar forms (Phasor)

Unit-5 : Partial Differentiation :
- Definition & meaning of partial derivative.
- Evaluation of partial derivatives.
- Homogeneous functions:
- Euler's theorem on Homogeneous functions for 2 variables & Problems.

Unit-6: Statistics & Probability
Statistics:
- Introduction & definition of Statistics
- Random & continuous variables
- Frequency distribution: Definition.
- Measure of Central Tendency (mean, median, mode) & Simple problems
- Dispersion Measure (SD) problems
- Mean & SD of Composite group

Probability:
- Def. of random experiment, sample space, event, occurrence of events
- Events: Exhaustive, Equally likely, Impossible, Mutually exclusive, etc
- Probability definition (classical & axioms), problems
- Total theory of probability, compound theorem probability, Conditional probability, & problem.

Applied physics II

Unit -1: Wave Motion & Applications
Simple Harmonic Motion (SHM):
- Definition and expression for displacement, velocity, acceleration, time period, frequency
- Study of vibrations of cantilever & determination of its time period
- Free, damped and forced vibrations with examples, Numerical problems

Wave motion:
- Transverse and longitudinal waves
- Definitions of wave velocity, frequency, wave length relationship
- Equation of a plane progressive wave
- Principle of superposition of waves

and beat formation, Numericals
Acoustics of buildings:
- Reverberation of sound
Ultrasonic Waves :
- Introduction and properties
- Engineering & medical applications of ultrasonics

Unit – 2: Optics
Basic optical laws:
- Reflection, refraction, refractive index
- Images; image formation by thin lens
- Lens & lens maker's formula
- Power of lens, Magnification
- Total internal reflection
- Critical angle and conditions for total internal reflection
- Numerical problems

Optical Instruments:
- Simple, compound microscope
- Astronomical telescope, Numericals
- Interference and diffraction of light

Unit – 3: Electrostatics
Electric field:
- Coulombs law, unit of charge
- Electric lines of force & properties
- Electric flux, Gauss law
- Application of Gauss law: Electric field due to a charged sphere / plate
- Electric potential & potential diff.
- Numerical problems

Capacitor & Capacitance:
- Capacitor and its working
- Types of capacitors
- Capacitance and its units
- Capacitance of a parallel plate capacitor
- Capacitors in Series / parallel
- Dielectric and its effect on capacitance
- Dielectric break down
- Numerical problems

Unit – 4: Current Electricity
Electric Current:
- Direct and alternating current
- Ohm's law, Resistance and its units

- ✓ Specific resistance
- ✓ Conductance, Specific conductance
- ✓ Series & parallel resistances circuits
- ✓ Factors affecting resistance of a wire
- ✓ Carbon resistance & colour coding
- ✓ Kirchhoff's law, Wheatstone bridge
- ✓ Carrey Foster Bridge &applications
- ✓ Concept of potential difference & Electro motive force (EMF)
- ✓ Numerical problems

Heating effect of current:
- ✓ Electric Work, Electric Power
- ✓ Electric energy and its units
- ✓ Joule's law for Heating effect of electric current, Numerical problems

Thermoelectricity:
- ✓ Thermocouple, Seebeck effect
- ✓ Thermo E.M.F, Neutral temperature and Inversion temperature
- ✓ Peltier effect, Numerical Problems

Unit -5: Electromagnetism
Magnetic effect of electric current:
- ✓ Magnetic field and its origin
- ✓ Lorentz force, Biot- Savart law
- ✓ Application to Straight Conductor & circular loop
- ✓ Concept of magnetic dipole
- ✓ Force on current carrying conductor
- ✓ Torque on rectangular coil placed in magnetic field
- ✓ Numerical problems

Electromagnetic induction:
- ✓ Magnetic Flux, Flux density
- ✓ Faraday's Laws
- ✓ Moving coil galvanometer
- ✓ Conversion of a galvanometer into ammeter and voltmeter
- ✓ Magnetic material Types; dia, para and ferromagnetic; their properties
- ✓ Numerical problems

Unit-6: Semiconductor Physics:
- ✓ Energy bands in solids
- ✓ Types of materials (insulator, semi-conductor, conductor)
- ✓ Intrinsic and extrinsic semiconductors
- ✓ p-n junction, junction diode and V-I characteristics
- ✓ Diode as rectifier: half &full wave
- ✓ Transistor
- ✓ Transistor as an amplifier CE mode
- ✓ Photocells, Solar cells
- ✓ LED:Principle, &Applications

Unit-7: Modern Physics
Atomic structure:
- ✓ Bohr's atom model; Energy levels;
- ✓ Ionization and Excitation potentials

X-rays:
- ✓ Production of X-rays :Coolidge tube
- ✓ Continuous and characteristic-X-rays
- ✓ Soft and hard X-rays
- ✓ Properties of X-rays
- ✓ Uses or application of X-rays
- ✓ Numerical problems

Laser:
- ✓ Spontaneous and stimulated emission
- ✓ Basic components of Laser
- ✓ He-Ne laser characteristics
- ✓ Holography & Applications of lasers

Fiber Optics:
- ✓ Introduction to optical fibers
- ✓ Mechanism of light propagation through Optical fiber, Applications

Nanoscience and nanotechnology

> **Applied Physics - II Lab**

1. Verify laws of resistances in series by P.O.box.
2. Verify laws of refraction (snell's law) using a glass slab.
3. Focal length and magnifying power of a convex lens by u-v method.
4. Ohm's law (Graphical Method)
5. Resistance of a galvanometer (half deflection method).
6. Galvanometer to ammeter/voltmeter.

Air Pollution:
- ✓ Sources (Natural and man-made)
- ✓ Particulate pollutants: PM10, PM2.5
- ✓ Environmental Effects, Control: Bag filter, Electrostatic precipitator, Cyclone separator, Scrubber

Gaseous Pollutants:
- ✓ Environmental Effects & Control: Absorption, Adsorption, Catalytic converter
- ✓ National Ambient Air Quality Standard
- ✓ Global warming, Green House effect
- ✓ Ozone layer depletion, Acid rain

Noise Pollution:
- ✓ Sources, Units & Measuring devices
- ✓ Effects & Prevention, & Limits

Unit-3 :Water and Soil Pollution
Water Pollution:
- ✓ Water Sources& Pollutants
- ✓ Turbidity, pH, Total dissolved solid
- ✓ Total suspended solid, Total solids
- ✓ Fe, Arsenic and Fluoride
- ✓ Definition of DO, BOD, COD
- ✓ BIS water quality standard
- ✓ Flow diagram of drinking watertreatment

Acid, Base, Salt
- ✓ Solubility product, Common-ion-effect

Chemical equilibrium:
- ✓ Equilibrium; Irreversible, Reversible, Exothermic, Endothermic Reactions.
- ✓ Catalyst, Catalysis, Promoter, Catalysis poison, Auto catalyst.
- ✓ Le Chatelier's principle.

Waste water Treatment:
- ✓ Primary Treatment: Coagulation, flocculation, sedimentation
- ✓ Secondary Treatment, Activated Sludge, Trickle filter, Bio-reactor
- ✓ Tertiary Treatment: Membrane Separation Technology, Reverse osmosis
- ✓ General standards for Discharge of Environmental Pollutants

Soil Pollution:
- ✓ Excessive use of fertilizer
- ✓ Pesticides And Insecticides
- ✓ Preventive Measures

Unit-4 : Renewable sources of Energy
Solar Energy:
- ✓ Basics of solar energy
- ✓ Solar water heater
- ✓ Solar drier and Solar stills.

Biomass:
- ✓ Biomass as energy source.
- ✓ Flow Chart of Biogas production
- ✓ Storage and utilization of biogas

Other Energy Sources:
- ✓ Basic Concept & Application of:
  - — Tidal energy, Geothermal energy
  - — Hydrogen, Ocean Energy Resources

Unit-5 : Solid Waste Management:
- ✓ Sources, & Characteristics:
  - — Municipal Solid Waste
  - — Bio-medical waste, and E- waste
- ✓ Industrial Metallic & Nonmetallic waste: lubricants, plastic, rubber
- ✓ Effects & Management 4R (Reduce, Reuse, Recycle & Recover)
- ✓ Composting, Sanitary landfill, Incineration, Open Dumping.

Indian Constitution
Unit 1–The Constitution: Introduction
- ✓ The History of the Making of the Indian Constitution.
- ✓ Preamble and the Basic Structure, and its interpretation
- ✓ Fundamental Rights and Duties and their interpretation
- ✓ State Policy Principles

Unit 2– Union Government
- ✓ Structure of the Indian Union
- ✓ President – Role and Power
- ✓ Prime Minister, Council of Ministers
- ✓ Lok Sabha and Rajya Sabha

Unit 3– State Government
- ✓ Governor – Role and Power
- ✓ Chief Minister, Council of Ministers
- ✓ State Secretariat

- ✓ Centre of Gravity of Simple Solids: Cube, Cuboid, Cylinder, Sphere.
- ✓ Centre of Gravity of composite solids. Basics only.

Unit–VI : Simple Lifting Machines:
- ✓ Definition of Lifting Machine, Applications and Advantages.
- ✓ Machine: Load, Effort, Mechanical Advantage, Velocity Ratio, Efficiency
- ✓ Law of machine, Ideal Machine.
- ✓ Friction in Machine, Maximum Mechanical Advantage & Efficiency,
- ✓ Reversible & non-reversible machines; conditions for reversibility
- ✓ Velocity ratios of (i) Simple, & Differential Axle & Wheel (ii) Worm & worm wheel (iii) Single purchase & Double Purchase Crab Winch (v) Simple Screw Jack (vi) Simple Pulley Block., Simple numericals.

Unit VII: Motion in a Plane
Rectilinear Motion:
- ✓ Displacement-Time & Velocity-Time diagrams, Motion equations.
- ✓ Newton's 2nd Law of linear motion
- ✓ Momentum & its Conservation
- ✓ Simple numerical problems.

Curvilinear Motion:
- ✓ Angular displacement/velocity, Linear/Angular velocity Relation.
- ✓ Angular acceleration, Linear & angular acceleration Relationship.
- ✓ Centripetal and centrifugal force
- ✓ Numerical problems

Work, Power, Energy:
- ✓ Concept & math expression (& SI units) of Work, Power &Energy.

Engineering Mechanics Lab
1. Single purchase crab winch: Find MA, VR, η, law of machine.
2. Double purchase crab winch: Find MA, VR, η, law of machine.

3. Worm and worm wheel: Find MA, VR, η, law of machine.
4. Differential Axle and Wheel: Find MA, VR, η, law of machine.
5. Simple Screw Jack: Find MA, VR, η, law of machine.
6. Horizontal plane: Coefficient of friction for motion.
7. Inclined plane: Coefficient of friction for motion.
8. Resultant of concurrent force system (Analytical /Graphical Method).
9. Polygon Law of forces: Resultant of concurrent forces(Experimental)
10. Resultant of Parallel force system: (Analytical / Graphical Method).
11. Verify Lami's theorem (graphical)
12. Centroid of Plane Lamina
13. Jib crane: Forces in the members.

Environmental Science & Indian Constitution

Environmental Science
Unit-1 : Industrial Chemistry:
Corrosion, Metallurgy,
Organic Chemistry:
- ✓ Preparation & properties of Methane, Ethylene, & Acetylene.
- ✓ Functional Groups, Isomer, Homologous series,
- ✓ Polymers: Thermoset & thermoplastic materials:
- ✓ Petroleum & Petro-chemicals
Radioactivity:
Radioactivity and Radioactive elements, Natural Radioactivity, properties of α, β, γ – rays, Radioactive decay, difference between radioactive change and chemical change, half-life period. Nuclear reactions – Fission & Fussion reaction.
Unit-2 : Air and Noise Pollution:
- ✓ Definition of pollution pollutant

7. V-I characteristics of semiconductor diode (Ge, Si); & its Knee voltage.
8. Laws of resistances in parallel (using Ammeter and Voltmeter).
9. Specific resistance of a wire (with Meter Bridge)
10. Acceleration due to gravity (g) (by pendulum).
11. Frequency of unknown tuning fork (Sonometer method)
12. Velocity of sound (Resonance Air Column Method).
13. Frequency of unknown tuning fork (Resonance Air Column Method).
14. Lines of force due to a bar magnet; Finding of neutral points
15. Zener diode as voltage regulator.
16. Specific heat of a solid (Method of Mixtures).
17. Verify the laws of reflection of light.

Introduction to IT Systems

Unit -1: Basic Internet skills:
- ✓ Understanding Browser & Examples
- ✓ Definition of Search Engine & efficient use
- ✓ Search Engine working principles
- ✓ ISP (Internet Service Provider)
- ✓ Email Address & Structure
- ✓ Email working principles & their protocols
- ✓ Digital India portals, Vision, initiatives and college portals.

Number system & Codes
- ✓ Binary, octal, hexadecimal and decimal number systems
- ✓ Inter conversion, BCD numbers
- ✓ Gray code, Excess–3 code
- ✓ ASCII, Unicode, EBCDIC codes.
- ✓ Binary addition and subtraction
- ✓ Signed and Unsigned binary numbers
- ✓ 1's and 2's complement format.

Boolean Algebra:
- ✓ Basic logic circuits: Logic gates (AND, OR, NOT, NAND, NOR, Ex-OR, ExNOR and their truth tables), Universal Gates,
- ✓ Laws of Boolean algebra,
- ✓ De-Morgan's theorem,

Computer Hardware:
- ✓ CPU, Memory, Display, Keyboard, Mouse, HDD, SSD, & other Peripheral Devices.
- ✓ Printer & their classification
- ✓ Various port of a mother board
- ✓ Classification of Computer
- ✓ Organization of a Computer System
- ✓ Computer generation, Classification of software & their usage.

Unit -2: Operating Systems
Overview of Operating Systems:
- ✓ What is an OS, Brief history.
Background and Basics:
- ✓ Computer System review
- ✓ Types of OS, Computer Architecture
- ✓ Classification : Batch, Multi-programmed batch, Timesharing
- ✓ Computer System Structures
- ✓ Operating System Structures

Unit -3: Algorithm & Flowcharts
- ✓ Algorithm & Flowcharts : Definition, Characteristics, Advantages and disadvantages
- ✓ Symbols of flowchart
- ✓ Examples of Algorithm & Flowchart of Various programs.

Unit -4: HTML5, CSS, JavaScript
HTML 5:
- ✓ IntroductionHTML,
- ✓ HTML, Head, Body, Style, Script
- ✓ Break, body, center, div, form, heading level (1 to 6), image, font, order list, under list, paragraph, table, data cell etc.

- Formatting Tags : Link, bold, italic, underline, strong, emphasized text, small, del, subscript, superscript, etc.
- Input, label, text, select, textarea, button, option, checkbox, radio, hidden filed, date, file, color etc.

Cascading Style Sheets(CSS):
- CSS Introduction & Advantage
- HTML vs CSS; CSS Styling type : Inline, Internal, External
- CSS formatting (Styling): Text, Font, Background, List, Table, etc
- CSS Box Model : Border, Margin, Padding, Content Area, CSS Outline
- CSS syntax : Id & Class; Display
- CSS layout – Positioning: static, relative, fixed, absolute, Floating, Clear, Align, CSS Navigation Bar
- CSS Image Gallery, Image Opacity

JavaScript:
- Introduction, Features & Application, Advantage, JavaScript Syntax
- Embedding Script in HTML File: Internal & External
- Comments lines, Character set, Identifier, Keywords, Variable, Data type,
- Operators: Arithmetic, Logical, Comparison, Assignment, bitwise
- Input / Output Statement
- Conditional Statement: If, If-Else, Switch
- Looping Statement: For, While, Do/while & their examples.

Unit-5: Network Utilities & Devices :
- Computer Network & their components
- Network Classification
- Network topology, IP address
- Introduction to Computer Security
- Ethics & Safety measures
- Cyber Stalking, Fraud, and Abuse
- Denial of Service Attacks (Scanning – WireShark)
- Computer virus, Malware (Hacking)

Intro. to IT Systems Lab

Unit 1, 2, 3, 4:
- Browser features & Settings, Search engines, writing search queries,
- e-governance / Digital India portals
- Operating system fundamentals
- Components of computer system: Input & Output Devices; Memory handling; Storage devices.
- Wikipedia pages on Internet: Identification of Hardware components, ports / interfaces, cables, etc.

Unit 5 & 6:
- Install Linux and Windows operating system on identified lab machines.
- Overview of various peripherals (printer, scanner, etc.) to computer;

Unit 7:
- Webpage design with HTML,CSS & JavaScript

Unit 8 : MS Office
MS Word :
- Formatting Word Document
- Mail merge, Shapes, Table
- Create : Bio-data & Cover Page etc.

MS Excel:
- Apply Custom Formats and Layouts
- Format Cells, Sorting, Filter
- Apply Borders, Design Borders
- Custom Formatting

Simple & Advanced formulas:
- Simple Text, Mathematical functions
- Conditional & Logical Functions

Reference formulas like:
- Lookup, vlookup, hlookup,
- Index, Match, Scenarios, Goal seek

Charts :
- Bar Charts, Pie Chart, Donut chart,
- Histograms, Line Graph, Trend,Pivot tables

Unit 9:MS-Power Point:
- Power Point Slide Template.
- Create Animation, transition
- Add: movie, sound, tables, chart etc

- Changing slide colour scheme.
- Slide navigator: Create, Save, Print.

Unit 10:Using Internet:
- Create Email
- Online Google Office Tools: (Docs, Sheets, Slides, Forms):
- Save/Shareon Google Drive (Cloud)

Engineering Mechanics

Unit–I : Basics of Mechanics:
- Concept of Engineering Mechanics– Statics & Dynamics;
- Space, time, mass, particle,
- Flexible body and rigid body.
- Scalar Quality and Vector Quality;
- Addition & Subtraction of Vectors
- Basic units, Derived Units, SI units.

Force:
- Definition, Units, Representation (Vector, & Bow's notation)
- Characteristics and Effects of a Force
- Principle of transmissibility of force.
- Force systems and its classification
- Co-planar Force System.

Coplanar Concurrent Force System
Composition of Forces:
- Parallelogram Law, Triangle Law and Polygon Law of Forces.
- Resultant by Analytical & Graphical methods.Vector diagram.
- Resolution of Forces: Orthogonal components of a force.
- Simple problems on composition & resolution of forces

Unit–II : Moments & Couples
Moment:
- Moment of a force about a point
- Physical significance of Moment
- system of parallel & inclined forces – Varignon's Theorem, Problems

Couples:
- Definition of moment of a couple
- Physical significance of Couples

- Equivalent couples– Resultant of any number of coplanar couples
- Replacement of a force about a point by an equal like parallel force & a couple. Simple problems.

Unit–III: Condition of Equilibrium
Coplanar Concurrent Force System:
- Lami's Theorem. Triangle Law & Polygon Law of equilibrium
- Concept of Free Body diagram.
- Equilibrium of Co-planar system of non-concurrent forces:
- Conditions of equilibrium of non-concurrent parallel forces (Like & Unlike)
- Simple problems (excluding statically in-determinant Type).
- Types of beams, and loads
- Supports:Simple, hinged, roller, fixed
- Simply Supported Beam: Reaction; with or without overhang; Point Load & Uniformly Distributed load.
- Simple Problems

Unit–IV : Friction:
- Friction: Relevance in Engineering
- Types & Laws of friction.
- Limiting Friction, Friction Coefficient
- Angle of friction, Cone of Friction, Angle of Repose.
- Relation between Coefficient of Friction and Angle of Friction.
- Equilibrium on inclined plane subject to forces parallel & inclined to plane.
- Simple Problems

Unit–V:Centroid, Centre of Gravity:
- Concept & definition.
- Centroid of Uniform Plane Lamina: Triangular, Rectangular, Circular, Semi-circular &, quadrant of Circle.
- Centroid of Composite sections (i) T, I, & Z-sections, (ii) angle-sections, (iii) Channel-sections, (iv) cut-out sections, (vii) Built-up sections
- Simple Problems

Ramakrishna Mission Shilpamandira

**An AICTE Approved
Self-Financed Polytechnic**

Belur Math, Howrah

Syllabus Booklet

Electronics & Tele-Communication Engineering [ETCE]

Semester –III (Part-II)

Based on the Latest Syllabus published by the
West Bengal State Council of Technical & Vocational Education and Skill Development

Principles of Electronic Communication

Group – A

Unit-1: Basics of Electronic communication
- ✓ Electromagnetic spectrum, basic electronic communication system
- ✓ Noise, signal to noise ratio
- ✓ Idea of simplex, half & full duplex
- ✓ Fourier series & Fourier transform

Unit-2: Analog modulation techniques
- ✓ Concept of modulation and its need.
- ✓ Amplitude Modulation(AM): AM wave Mathematical representation, Modulation Index, percentage of modulation, Bandwidth and side bands, AM wave in time domain and frequency domain, Concept of DSB, SSB and VSB, Power requirement in AM wave
- ✓ Frequency Modulation(FM): FM wave Mathematical representation, Frequency deviation, Modulation Index, Representation of FM wave in time domain and frequency domain, Bandwidth requirement, NB and WB frequency modulation
- ✓ Phase Modulation: Mathematical representation, Modulation Index
- ✓ Comparison of AM, FM and PM

Group – B

Unit-3: Transmitter and Receiver
- ✓ AM wave Generation: Collector modulated class C amplifier, Balanced Modulator, Filter method for SSB generation, AM broadcast transmitter Block diagram
- ✓ AM Receiver: Block diagram & working principle of AM super heterodyne receiver, IF amplifier & its choice IF, Mixer & converter, Alignment & tracking, Receiver characteristics & testing, sensitivity, selectivity & fidelity
- ✓ Demodulation of AM – Envelop detector, AGC & delayed AGC circuit & its operation
- ✓ Generation of FM wave – Direct (Varactor diode modulator) and Indirect (Armstrong) method, Block diagram & operation of FM broadcast transmitter
- ✓ Receiver of FM – Block diagram & operation, Pre-emphasis & De-emphasis, AFC, PLL
- ✓ FM Demodulation: Foster-Seeley discriminator, ratio detector, limiter

Unit-4: Wave propagation
- ✓ Electromagnetic Wave & its properties:, Plane & spherical wave fronts, Reflection, Refraction, Polarization, Diffraction, radiation, absorption, attenuation, interference
- ✓ Ground wave, VLF propagation
- ✓ Sky wave propagation: Ionospheric layers, virtual height, critical frequency, MUF, skip distance
- ✓ Space wave propagation: Line of sight, multipath, Radio horizon, & Duct (microwave) propagation
- ✓ Tropospheric scatter propagation

Unit-5: Telephony
- ✓ Telephone hand set Block diagram & operation, Transmitter, Receiver, side tone, anti-side tone circuit & operation, ringer, switch hook, tone dialing, DTMF, Hybrid circuit and its operation, local loop
- ✓ Block diagram of Electronic exchange, Space division switching, Time division switching
- ✓ Numbering plan of telephone network- National and International scheme of numbering plan

Looping statements –
- ✓ while, for, do-while.
- ✓ Special control statements – goto, break, continue, exit.

Arrays –
- ✓ Introduction of one-dimensional arrays, Declaration and initialization of Array, Accessing of array elements and other allowed operations, Definition of header file, Use of header files, Different header files, Functions from ctype.h, string.h, Simple program with a one dimensional array.

Functions –
- ✓ Concept of function, Using functions, Call-by-value Vs Call by-reference, Simple programs.

Pointer-
- ✓ Concept of pointer, Simple Progs

List of Programs:-
- ✓ Check whether a number is even or odd
- ✓ Programs to find the sum of n natural numbers
- ✓ Largest and smallest number among five numbers
- ✓ Factorial of a number
- ✓ Fibonacci sequence
- ✓ GCD and LCM of two numbers
- ✓ Count number of digits in an integer
- ✓ Demonstrate recursion
- ✓ Demonstrate use of pointers
- ✓ Sort 10 elements in ascending or descending order
- ✓ Summation of three numbers using function
- ✓ Maximum between two numbers using function

Text Books List

Principles of Electronic Communication
- ✓ Communication Systems: Analog and Digital by Sanjay Sharma, S.K. Kataria & Sons
- ✓ Communication Electronics: Principles & Applications by Louis Frenzel, Tata McGraw-Hill
- ✓ Analog Communication by V. Chandra Sekar, Oxford University Press

Electronic Devices and Circuits
- ✓ Electronics Devices & Circuits by JB Gupta, Kataria & Sons
- ✓ Principles of Electronics by VK Mehta, Rohit Mehta, S Chand
- ✓ Electronic Principle by Sahadev, Dhanpat Rai & Sons.
- ✓ Electronic Fundamentals and Applications by Chattopadhyay & Rakhshit, New Age International

Digital Electronics
- ✓ Fundamental Digital Circuits by A. Anand Kumar, PHI
- ✓ Digital Circuits and Design by S. Salivahnan & A. Arivazhgan, Vikash Publishing House

Electric Circuits & Network Lab
- ✓ Introduction to network, Filters and Transmission Lines by A. K. Chakraborty, Dhanpat Rai & Sons
- ✓ Network Analysis & Synthesis by Ravish R. Singh, McGraw-Hill

Computer Programming Language
- ✓ A first course in programming with C by T. Jeyapoovan, Vikash Publishing House
- ✓ Programming in 'C' by Balgurusamy, Tata Mc-Graw Hill.

***

Group – C

Unit-6: Analog Pulse Modulation
- ✓ Introduction; comparison with continuous wave modulation; advantages, Sampling Theorem, Nyquist rate, natural & flat top sampling
- ✓ Definition, principle of generation & reception of PAM (Pulse Amplitude Modulation), PWM (Pulse Width Modulation) and PPM (Pulse Position Modulation) with block diagram and applications

Unit-7: Digital Communication Systems and Coding Methods
- ✓ Idea of Digital Communication – Advantages of digital communication over analog communication, Elements of digital communication system with block diagram – source, channel, transmitter and receiver
- ✓ Channel characteristic – Bit rate, Baud rate, channel capacity, Synchronous & Asynchronous data
- ✓ Information Theory – Relationship between data speed and channel capacity, Hartley's Law, Hartley – Shannon Theorem
- ✓ Error correction – Causes of error and its effect, error detection and correction using Parity Check, Cyclic Redundancy Check (CRC)
- ✓ Idea of Inter Symbol Interference (ISI); EYE diagram interpretation
- ✓ Line coding format – RZ, NRZ, AMI and Manchester code

Principles of Electronic Communication Lab
- ✓ Study AM generation & waveforms
- ✓ Study Envelop detector for AM demodulation; observe the effect.

- ✓ To study generation of FM signal using varactor and reactance modulator and the waveforms
- ✓ To study detection of FM signal using Foster Seeley method.
- ✓ Study frequency spectrum of AM and FM using spectrum analyzer
- ✓ To study super heterodyne AM receiver and measurement receiver parameters as i)Sensitivity, ii) selectivityand iii) Fidelity
- ✓ To study modulation and demodulation of i) PAM, ii) PWM, iii) PPM signals
- ✓ To study the analog signal sampling and reconstruction for different sampling frequency
- ✓ To study the different blocks of a telephone receiver
- ✓ Mini projects on: AM radio receiver, FM radio receiver, AM transmitter, FM transmitter

Electronic Devices & Circuits

Group – A
Unit-1: Diodes & their Applications
- ✓ Half Wave and Full Wave Rectifiers(with Centre Tapped Transformer and Bridge) : Average & R.M.S. voltage, efficiency, ripple factor, Percentage voltage regulation & TUF
- ✓ Function of filter circuits, Capacitor & Inductive filter – PI filter – Calculation of ripple factor and average output voltage
- ✓ Diode wave shaping circuits – clipper and clamper circuits
- ✓ Zener diode, Zener breakdown & Avalanche Breakdown.
- ✓ Varactor diode & Schottky diode.

Unit-2: Bipolar Junction Transistor and its biasing
- ✓ Transistor configurations (CB, CE & CC), input and output characteristics. α, β, and γ factors
- ✓ Comparison of CB, CE, and CC configurations
- ✓ Concept of Q-point, ac and dc load lines
- ✓ Stabilization and stability factor
- ✓ Biasing: Base bias — Collector feedback bias — Emitter feedback bias — Potentialdivider bias.

Group – B
Unit-3: Small Signal Transistor Amplifiers
- ✓ Hybrid model and h-parameters of CB, CE & CC mode transistor amplifiers – Calculation of voltage gain, current gain, power gain, input and output impedance in terms of h-parameters
- ✓ High frequency model of BJT
- ✓ Types of Coupling in Amplifier: RC coupled, Direct coupled & Transformer-coupled amplifiers; their relative advantages and disadvantages.
- ✓ Effect of cascading on Gain & Bandwidth and Frequency response

Unit-4: JFET, MOSFET AND UJT
- ✓ Field Effect Transistors: FET – Working Principle, Classification
- ✓ N-Channel/ P-Channel MOSFETs – characteristics, enhancement and depletion mode, MOSFET as a Switch
- ✓ MOSFET Small Signal model
- ✓ Small signal FET equivalent circuits – Common Source and Common Drain amplifier–FET application as VVR, Constant Current Source etc.

- ✓ Uni-Junction Transistor – equivalent circuit, operation and application.

Group – C
Unit-5: Power Amplifier
- ✓ Characteristics of Class A, Class B, Class C and Class AB amplifier
- ✓ Transformer Coupled Audio Power Amplifier- Impedance Matching and Maximum Power Output.
- ✓ Push-Pull Amplifiers: Advantages of Push-Pull amplifier, Power considerations&Distortion in class B Push-Pull Amplifier.

Unit-6: Feedback Amplifier and concept of oscillation
- ✓ Basic idea of positive and negative feedback
- ✓ Basic Feedback Amplifier Topologies: Voltage Series, Voltage Shunt, Current Series, Current Shunt
- ✓ Effect of negative feedback on gain, gain stability, distortion, noise, bandwidth, phase shift, input and output impedances
- ✓ Performance of emitter follower circuit – Calculation of gain and input & output impedances
- ✓ Barkhausen criteria and operation of Tuned Collector Oscillator.

Electronic Devices & Circuits Lab

- ✓ To study the rectifier with and without capacitor filter for : —
    - a) Half-wave rectifier,
    - b) Full-wave rectifier,
- ✓ To observe the waveform at the input and output of clipping circuits in different clipping configuration.
- ✓ To study the operation of positive and negative clamper circuit.

- ✓ To measure the attenuation constant and phase shift constant for matched termination.
- ✓ Mini project: Filter
- ✓ Introduce Proteus & Multisim circuit maker software.

Computer Programming Language

Group – A
Unit-1: Computer Fundamentals
- ✓ Introduction of computers, Classification of computers, Anatomy of a computer, Memory hierarchy, Introduction to OS, Operational overview of a CPU.
- ✓ Generation and classification of programming languages, Compiling, Interpreting, Loading, Linking of a program, Developing program, Software development.
- ✓ Flow chart and algorithm development.

Unit-2: Basics of C
- ✓ Overview of C, Structure of a C program, Comments, Program statements, C tokens, Keywords, Identifiers, Data types, Variables, Constants, Operators, Expressions and precedence.
- ✓ Non-formatted and formatted input and output functions.

Unit-3: Control Statements
- ✓ Selection statements – if, if-else, nested if, nested if-else, comma operator, conditional operator, switch.
- ✓ Iterative statements – while, for, do-while.
- ✓ Special control statements – goto, break, continue, return, exit.

Group – B
Unit-4: Arrays and Pointers
- ✓ Introduction of one-dimensional

arrays, Declaration and initialization of Array, Accessing of array elements and other allowed operations, Definition of header file, Use of header files, Different header files, Functions from ctype.h, string.h, Simple program with a one dimensional array.
- ✓ Understanding pointers, declaring and accessing pointer, '&' and '*' operators, Pointer expressions, Pointer assignments, Pointer arithmetic.

Unit-5: Functions
- ✓ Concept of function, Using functions, Call-by-value Vs Callby-reference, Passing arrays to functions, Recursion, Simple programs.

Unit-6: Basic Concepts of Object Oriented Programming
- ✓ Introduction to Object Oriented Programming, Concepts of Objects and Classes.

Computer Programming Language Lab

Familiarization with programming environment (Editor, Compiler, etc.)
Basics of C :
- ✓ Structure of a C program, Comments, Program statements, C tokens, Keywords, Identifiers, Data types, Variables, Constants, Operators, Expressions & precedence.
- ✓ Non-formatted and formatted input and output functions.

Selection statements
- ✓ if, if-else, nested if, nested if-else, comma operator, conditional operator, switch.

- ✓ Active filter - Basic idea, advantages and disadvantages of basic filters, application of filter circuits.

Unit-5: Attenuators and Equalizers
- ✓ Basic idea of attenuators, difference between attenuator and filter, symmetrical T and π attenuator – field of application of attenuators.
- ✓ Concept of equalizer – purpose of equalizer and its classification – Difference between series & shunt equalizer and their field of applications

Unit-6: Transmission Lines
- ✓ Types of transmission lines: Parallel wire and coaxial cable
- ✓ Primary and secondary constants of transmission lines
- ✓ Characteristic impedance – Reflection co-efficient – Standing wave ratio and their relationship
- ✓ Simple matching methods, single and double stub match for transmission lines
- ✓ Losses in transmission lines
- ✓ Distortion in transmission line – Causes of distortion and condition for distortion less transmission – Practical feasibility for distortion less transmission

Group – C
Unit-7: Laplace Transform
- ✓ Laplace Transform; properties
- ✓ Analysis of electrical circuits using Laplace transform for standard inputs (unit step, ramp)
- ✓ Initial and Final Conditions for network elements
- ✓ Forced & free response, time constants
- ✓ Steady state and transient state response

- ✓ Solution of 1st and 2nd order differential equations for series and parallel RL, RC, RLC circuits
- ✓ Inverse Laplace Transform

Unit-8: Fourier Series
- ✓ Discrete spectra and symmetry of waveforms for Exponential and Trigonometric Fourier Series
- ✓ Steady state response of a network to non-sinusoidal periodic inputs, power factors, effective values.
- ✓ Fourier Transform and continuous spectra

Electric Circuits & Network Lab

- ✓ To verify node and mesh analysis using independent and controlled sources
- ✓ To verify Thevenin's and Norton's theorems
- ✓ To verify Superposition theorem.
- ✓ To verify Maximum Power Transfer theorem and Reciprocity Theorem
- ✓ To verify characteristics of Series resonant Circuit
- ✓ To verify characteristics of Parallel resonant Circuit
- ✓ To measure the characteristic impedance of symmetrical T and π networks
- ✓ To measure the cut –off frequencies of the following: —
   (a) constant k-type low pass filter;
   (b) constant k-type high pass filter;
- ✓ To measure T and π type attenuator
- ✓ Observe standing wave pattern for a finite length transmission line:
   (a) open termination,
   (b) shorted termination and
   (c) matched termination,

- ✓ To study the VI characteristics of a forward and reverse biased Zener diode.
- ✓ To study the input and output characteristics and to determine the h-parameters of a BJT for: —
   (a) C-E configuration,
   (b) C-B configuration,
   (c) C-C configuration
- ✓ To determine frequency response characteristics of RC coupled amplifier circuit and calculation of bandwidth, midband gain, input impedance and output impedance for:
   (a) Single-stage amplifier,
   (b) Double-stage amplifier
- ✓ To study Drain Characteristics and Transfer Characteristics of a Field Effect Transistor (FET)
- ✓ To study Drain Characteristics and Transfer Characteristics of a MOSFET.
- ✓ To study the V-I characteristics of UJT (show the cut-off, saturation and negative resistance region)
- ✓ To study the operation of a Class B Push-Pull Amplifier
- ✓ To determine the frequency characteristics of a negative feedback amplifier and compare with that of an amplifier without feedback.

Digital Electronics

Group – A
Unit-1: Number systems and codes
- ✓ Difference between Analog and Digital Logic system, Positive and Negative Logic system, Introduction to different number systems – Binary, Octal, Decimal,

Hexadecimal and Conversion from one number system to another.
- ✓ Gray code (unit distance code), BCD (weighted code), Excess3(self-complementary) code, ASCII, EBCDIC Code, conversion between Gray and Binary codes

Unit-2: Logic gates, Boolean Algebra & Simplification of logic
- ✓ Symbolic representation , truth table and expressions of different logic gates: BUFFER– (NOT, OR, AND) – (NAND,NOR)– (XOR, X-NOR)
- ✓ Rules and laws of Boolean Algebra, Difference between boolean and ordinary variables, Basic logic circuits, De-Morgan's theorem
- ✓ Max. term and Min term – Canonical form of equation – Simplification of Boolean expressions
- ✓ Karnaugh Map technique (upto 4 variables) – Don't care condition – Prime implicants– Canonical forms – Quine-McClusky method
- ✓ Realization of Boolean expression with different logic gates

Unit-3: Combinational Logic Circuits
- ✓ Arithmetic Circuits – Addition, Subtraction, 1's 2's Complement and 9's complement method of addition, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallal and Series Adders.
- ✓ Realization of NAND and NOR as a universal Logic Gate, Realization of AND-OR is equivalent to NAND-NAND and OR-AND is equivalent to NOR-NOR
- ✓ Code converters, Operation, Truth Table & Circuit diagram of 2: 4, 3: 8 & 4: 16 Decoders.

- Cascading of Decoders, Realization of different Boolean functions by using Decoders, BCD to seven segment Decoder, Operation of 4: 2 Encoder, 8: 3 Encoder and Priority Encoder.
- Multiplexer – Operation, Truth Table and Circuit diagram of 2 to 1 MUX, 4:1 MUX, 8:1 MUX and 16: 1 MUX. Cascading of MUX, Realization of Boolean functions by using MUX, Design of Universal Gate by using MUX.
- Demultiplexer – Operation, Truth Table and Circuit diagram of 1:2 DEMUX, 1:4 DEMUX, 1:8 DEMUX, Conversion in between Decoder and Demultiplexer.
- Design of 2,3,4 bit odd and even Parity Generator and Checker, Design of 2, 3 and 4 bit Binary Comparators.

Group – B
Unit-4: Sequential Logic Circuits (FLIP-FLOP)
- Difference between Combinational and Sequential Logic Circuits, Idea of clock pulse, Concept of Flip Flops – Difference between flip flop and latch
- Construction and Operation of RS, JK, D and T Flip Flops, Operation of preset and clear signal. Race around Condition, Master slave JK Flip flop, Positive and Negative Edge triggered flip-flop, Excitation/ Transition Table of all Flip flops.

Unit-5: Sequential Logic Circuits (COUNTERS and REGISTERS)
- Concept of Counter, Difference between Asynchronous and Synchronous counter

- Operation of 3 & 4 bit Ripple UP/DOWN counter with timing diagram–Programmable ripple counter, Application of counter
- Design of (a) Ring (N:1) counter with Truth Table and waveform diagram. (b) Johnson counter (2N:1) with Truth Table and waveform diagram.
- Design of Synchronous counter with the help of RS, JK, D, and T Flip-Flop (e.g Mod 5,7,10 etc.)
- Registers – 4bit Shift Register: Operation of Serial In Serial Out, Serial in Parallel Out, Parallel In Serial Out, Parallel In Parallel Out, Concept of Bidirectional Shift Register, Application of Shift Register

Group – C
Unit-6: Memory Devices
- Classification of Memories – RAM Organization, Address Lines and Memory Lines, Static RAM, Bipolar RAM, cell Dynamic RAM, D RAM, DDR RAM
- Read Only memory – ROM organization, Expanding memory, PROM, EPROM, EEPROM, Flash memory CDROM
- Digital Logic Arrays- PLA, PAL, GAL, FPLA, FPGA

Unit-7: Data Converters
- **Digital To Analog Converters**: Binary weighted resistor type DAC, R-2R ladder type DAC, specifications and applications of DAC.
- **Analog To Digital Converter**: Comparator type, Successive approximation type, Dual slope AD converter specifications and applications of AD converter.

Digital Electronics Lab
- To verify the truth tables for all logic fates – NOT, OR , AND, NAND, NOR , XOR and XNOR using CMOS Logic gates [CMOS ICs4001,4011,4030,4070,4071,4077,4081,4093] & TTL Logic Gates [TTL ICs-7400, 7402, 7404, 7408, 7432,7486]
- Realize Boolean Expressions with different Logic Gates
- Implement Half Adder, Full Adder, Half Sub tractor and Full sub tractor by using different digital ICs
- Realization of parallel and serial full-adder using ICs (IC- 74LS83)
- To implement encoder (IC-74147), decoder (IC-74138), multiplexer (74151) & demultiplexer (74138).
- Construct a Single digit Decade Counter (0-9) with 7 segment display (74LS90)
- To construct 2 bit parity generator and checker & 2 bit comparator by using logic gates.
- To verify the Truth Table of SR, D, JK and T Flip-flops (IC-74LS76)
- To construct binary synchronous and asynchronous counter.
- Design programmable up/down counter
- To design controlled shift register and study their function as SIPO, SISO, PIPO, PISO (IC74LS76)
- To study different memory ICs.
- To study DA and AD converters

Electric Circuits & Network
Group – A
Unit-1: Basics ; Network Theorems
- Kirchhoff's Voltage Law, Kirchhoff's Current Law

- Voltage divider, current divider rule, star – delta conversion, Source Transformation and duality.
- Node and Mesh Analysis using Independent and Controlled Source
- Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem – simple problems.
- Idea of resonance – series and parallel resonant circuits – Q value, Selectivity and Bandwidth.

Unit-2: Graph Theory
- Graph of a network, tree, incident matrix, concepts of path, cycle and tree, independent loops
- F – Tie Set and analysis of resistive network using tie – set
- F - Cut Set and analysis of resistive network using cut – set. Duality.

Unit-3: Two Port Network
- Introduction of Two Port Network - Open circuit impedance parameters, Short circuit impedance parameters, hybrid parameters, transmission parameters – simple problems.
- Open and short circuit impedance, characteristics impedance and its relation with open and short circuit impedance, propagation constant and image impedance.

Group – B
Unit-4: Filter Circuits
- Definition and relationship between neper and decibel.
- Basic idea of passive filters – definition of pass band, stop band, cut – off frequency.
- Constant K – prototype filters: a) Low pass filter b) high pass filter c) Band pass filter d) Band reject filter

Ramakrishna Mission Shilpamandira

An AICTE Approved
Self-Financed Polytechnic

Belur Math, Howrah

Syllabus Booklet

Electronics & Tele-Communication Engineering [ETCE]

Semester – IV (Part-II)

Microcontroller & Applications

Group – A

Unit-1: Introduction & Basics of 8051 Microcontroller
- Harvard & Von Neuman Architecture, Intro to Microprocessor & Microcontroller, Comparison.
- Architecture of 8051; Memory organization & Boolean processor
- Intel MCS51 family features (8951, 8952, 8031, 8751)

Unit-2: Instruction Set & Programming With 8051
- 8051 instruction set, addressing modes
- Assembly Language programming (ALP), I/O Programming
- Program on interrupt handling, programming counters / timers, & serial communication.
- Software Development cycle: Editor, Assembler, cross compiler, linker, locator, compiler
- Assembler Directives: ORG, DB, EQU, END, CODE, DATA.

Group – B

Unit-3: External Interfaces with 8051 using C programming
- Memory interfacing (Program & Data memory) Timers/Counters programming
- I/O interfacing: keyboard, LCD / LED 7 segment display, stepper motor
- Real world interface -ADC, DAC, Sensors, Communication interfaces [RS 232], Interrupt programming.

Group – C

Unit-4: Applications of 8051 μC
- Square wave generation using port pins of 8051, Square & triangular

waveform generation using DAC, Water level &, Temperature controller using ADC
- Stepper motor control for clockwise, anticlockwise rotation, Traffic light controller

Unit-5: ARM Core Based Microcontrollers
- Need for RISC Processor - ARM processor fundamentals, Basics of ARM core based controller [LPC214X], simple applications.

Microcontroller & Applications Lab

1. To develop programming using ASM & C, and implementation in flash 8051 μC.
2. Programming with Arithmetic logic instructions [Assembly] (8051 μC)
3. Program: array sorting [Assembly] 8051
4. Programming using Ports [Assembly & C] (8051 μC)
5. Programming for Delay generation using Timer [Assembly & C] (8051 μC)
6. Programming for interrupt handling [Assembly & C] (8051 μC)
7. Programming for standard UART communication (using hyper terminal) [Assembly & C] (8051 μC)
8. Programming for interfacing with LCD Display. [Assembly & C] (8051)
9. Programming for interfacing with Keypad [Assembly & C] (8051)
10. Programming for interfacing ADC/DAC [Assembly and C] (8051)
11. Programming for interfacing with stepper motor. [Assembly and C] (8051)
12. Pulse Width Modulation Programming in ARM Microcontroller using simulator
13. GPIO programming in ARM μC [in C]
14. Timers programming in ARM μC. [in C]

Digital & Microwave Communication Systems Lab

1. To study generation of TDM signal and the detected waveforms.
2. To study generation of FDM signal and the detected waveforms.
3. To study generation of ASK signal and the detected waveforms.
4. To study generation of FSK signal and the detected waveforms.
5. To study generation of PSK signal and the detected waveforms.
6. To study the characteristics of Gunn diode.
7. To study the characteristics of Klystron
8. Characteristics of Directional Coupler.
9. To study the characteristics of Attenuator.
10. To study the characteristics of Isolator.
11. To study characteristics of Magic Tee.
12. Mini projects on a)TDM transmitter b)TDM receiver, c)FDM transmitter, d)FDM receiver

Internship - II

- To study the voltage regulation with Zener voltage regulator.
- To study the series pass voltage regulator with Zener follower.
- Series regulator with transistor feedback.
- Series regulator with Op Amp feedback.
- Variable voltage regulator with LM723.
- To study the maximum current limiting.
- To study the foldback current limiting.
- Variable voltage series regulator with TL431.
- Linear Regulated Power Supply Project.

Text Books List

Microcontroller and Applications
- 8051 Microcontroller,V. Udayasankara & M. S. Mallikarjuna Swamy, TMH
- Microprocessors & Microcontrollers by N. Senthil Kumar, M. Saravanan, S. Jeevananthan, Oxford.

- 8051 Micro Controller & Embedded Systems by Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D. Kinely, PHI Pearson Education

Consumer Electronics
- Audio video systems by Gupta R.G., Tata McGraw Hill, New Delhi, India
- Basic Radio and Television by S. P. Sharma, Tata McGraw Hill.
- Monochrome and Colour Television by R R Gulati, New Age International
- Consumer Electronics by B.R. Gupta, V. Singhal, SK Kataria & Sons

Linear Integrated Circuits
- Linear Integrated Circuits by D.Roy Choudhry, Shail Jain, New Age Intl.
- Operational Amplifier & Linear ICs, Ramakant A. Gayakwad, PHI Pearson
- Electronic devices and circuits, J.B. Gupta, SK Kataria & Sons

Electronic Measurements and Instrumentation
- Electronic Instrumentation by H.S. Kalsi, Tata McGraw-Hill
- A Course in Electrical and Electronic Measurement and Instrumentation by A. K. Sawhney, Dhanpat Rai & Sons
- Electrical & Electronics Measurement by J.B. Gupta, SK Kataria & Sons

Digital & Microwave Communication Systems
- Electronics Communication Frenzel, T.M.H.
- Electronic Communication Kennedy, Devis, T.M.H.
- Communication Systems (Analog and Digital) by Dr. Sanjay Sharma, S. K. Kataria & Sons
- Microwave & Radar Engineering by Rajesh Dhiman, S.K. Kataria & Sons

4. Measurement of strain/force with the help of strain gauge load cell.
5. Draw the characteristics of the following temperature transducers (a) RTD (Pt-100) (b) Thermistor.
6. Calibrate a single-phase energy meter by phantom loading.
7. Calibrate a voltmeter using Crompton potentiometer.
8. Study working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (ii) C.R.O. Probes.
9. Study the working of Q-meter and measure Q of coils.
10. To study the spectrum analyzer.

Digital & Microwave Communication Systems

Group – A
Unit 1: PCM & Delta modulation
✓ Basic concept of PCM system – Sampling – Quantizing – Encoding.
✓ Block schematic description of Transmitter & Receiver of PCM system.
✓ Principle of uniform & non-uniform quantization – Companding - signal to quantization noise ratio analysis of linear and nonlinear quantizer.
✓ Block schematic diagram of Delta modulation technique.
✓ Limitations of Delta modulation – Slope overload & Granular noise, Adaptive Delta Modulation Concept

Unit 2: Digital modulation techniques
✓ RF Modulation for base band signal – Geometric representation of signals.
✓ Basic idea of Maximum likelihood decoding.
✓ Generation, detection & waveform of ASK, BPSK, coherent & non-coherent FSK, QPSK & DPSK, comparison of bandwidth & bit rate of digital modulation scheme.

✓ QAM, MSK & multicarrier modulation – Comparison of bandwidth & bit rate of digital modulation schemes.

Group – B
Unit 3: Multiplexing
✓ Idea of multiplexing and its necessity.
✓ Types of multiplexing – Time division multiplexing – Frequency division multiplexing – Code division multiplexing.
✓ Principles of Time division multiplexing and synchronization in a digital communication system.
✓ PCM – TDM in modern applications.
✓ Frequency division multiplexing with practical examples.

Unit 4: Spread Spectrum Modulation
✓ Introduction to PN sequence.
✓ Model of spread spectrum modulation.
✓ Direct sequence spread spectrum (DSSS).
✓ Frequency hop spread spectrum (FHSS) – Slow frequency hopping and Fast frequency hopping.
✓ Application of spread spectrum modulation.

Group – C
Unit 5: Microwave Communication
✓ Problems associated with conventional tubes at microwave frequency
✓ Basic idea of amplification with velocity and density modulation – multi cavity Klystron – Reflex Klystron – Travelling Wave Tube (TWT) with efficiency, power output and frequency range of operation –application.
✓ Principle operation of GUNN and IMPATT and their field of operation
✓ Detectors used at microwave frequency – detector diode.
✓ Microwave passive devices – Directional coupler – Attenuator – Isolator – Magic Tee.
✓ Basics: Rectangular &, Circular waveguide
✓ Concept of Propagation of EM wave through waveguide with TE & TM modes.

Consumer Electronics

Group – A
Unit-1: Audio Fundamentals & Devices
✓ Basic Characteristics of sound signals; audio level metering; acoustic measuring in decibel level
✓ Characteristics of microphones, Principle of operations, constructions, Advantages & disadvantages, Applications of: Moving Coil Microphone, Wireless Microphone etc.
✓ Characteristics of Loudspeakers, Principle of operations, Construction, Advantages & disadvantages, Applications of Direct & Indirect type loudspeaker, Types of Baffles; Multi-way Speakers (Woofer, Tweeter); Cross-over network
✓ Sound recording principles & types: Optical & Digital Recording

Unit-2: Audio Systems
✓ Monophonic and stereophonic sound systems. Home Theatre sound system, surround sound system
✓ Public address system: Its Block diagram and its applications
✓ Digital Console Block diagram; working principle and applications.
✓ FM tuner, ICs used in FM tuner TDA 7021T.

Unit-3: Television Systems
✓ Monochrome TV Standards: Aspect Ratio, Flicker, Interlace Scanning, Resolution, Tonal gradation.
✓ Composite Video Signal; Horizontal and Vertical Scanning.
✓ Fundamental concepts of RGB colour systems and Colour theory (additive and subtractive colour mixing); Hue, Luminance; Saturation; Chrominance
✓ Colour TV camera (CCD), Colour TV Standards

Unit-4: Television Receivers and Video Systems
✓ Colour TV signals (I, Q, U, V); Working principle of PAL-D colour TV coder and decoder
✓ Digital Televisions: - LCD, LED, Plasma, HDTV, 3-D TV, Projection TV
✓ Block diagram of DTH receiver
✓ Types of Interfaces: Video interface, Digital Video, SDI, HDMI Multimedia Interface, Digital Video Interface, Flash Drive, concept of Bluetooth and its applications.

Unit-5: Home/Office Appliances
✓ Operating principles, Diagrams & Controller: Photocopier; Microwave Oven; Washing machine; Air conditioners & Refrigerators; Digital camera & Cam corders.

Consumer Electronics Lab

1. Test the performance of speaker
2. Measure voltage level to sketch composite video signal at different stages of TV receiver.
3. Study the internal layout of black and white TV receiver.
4. Study the internal layout of colour television
5. Fault finding in given Colour TV: i) No color ii) Red Colour only iii) Blue color only iv) Green color only v) Magenta color only vi) Cyan only vii) Yellow only viii) No raster, No Sound.
6. Test sections of LED TV receivers.
7. Installation of DTH trainer.
8. Demonstration of Photocopier.
9. Demonstration of Microwave Oven.
10. Demonstration of Washing machine.
11. Demonstration of Refrigerator.

12. Demonstration of Digital Camera.
13. Soldering & de-soldering of SMD components.
14. CC Amplifier (input & output resistance, voltage gain)
15. To construct audio amplifier.
16. FET amplifier design. (CS)

Linear Integrated Circuits

Group – A
Unit-1: Operational Amplifier
- ✓ Circuit operation of differential amplifier – single & double ended
- ✓ Introduction to Operational Amplifier: Common mode rejection ratio – Bias current – Offset voltage and current – Slew rate & Frequency response – Open loop & closed loop gain – Input & output impedance - Concept of virtual ground, Inverting & non-inverting mode and their gain calculation (Sign Changer, Scale Changer, Phase Shift Circuits)
- ✓ Applications: Voltage Follower, V-to-I, & I-to-V converter; Peak detector, Comparator, Clipper & Clamper; Schmitt trigger, Precision rectifier, Amplifier: Logarithmic, Anti-logarithmic, & Instrumentation
- ✓ Low-pass, high-pass and band-pass Butterworth filters.
- ✓ Op Amp Oscillators: a) Hartley, b) Colpitt, c) Wein-bridge, d) Phase Shift, e) Crystal.

Unit-2: Waveform Generators and Special Function ICs
- ✓ Sine, Triangular, & Saw-tooth wave generator, ICL8038 Signal generator
- ✓ Monostable, astable & bistable multivibrator with waveforms, Timer IC 555: internal block diagram, pin function, multivibrators with IC-555

- ✓ IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator, Monolithic switching regulator, Switched capacitor filter IC MF100.
- ✓ Frequency to Voltage & Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers & fiber optic IC.

Unit-3: IC Fabrication and Circuit Configuration for Linear IC
- ✓ Advantages of ICs over discrete elements
- ✓ Types of ICs: Linear & Digital – Monolithic & Hybrid.
- ✓ Manufacturing process of monolithic ICs- Construction of monolithic BJT & diodes – Integrated Resistors, Monolithic Capacitors – Inductors.
- ✓ Fabrication of NMOS, PMOS & CMOS.
- ✓ Current mirror & current sources, Current sources as active loads, Voltage sources, Voltage References.

Unit-4: Analog Multiplier and PLL
- ✓ Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications.
- ✓ Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565.

Linear Integrated Circuits Lab

1. Op-amp characteristics: a) input offset voltage, b) slew rate, c) non-inverting gain, d) inverting gain.
2. Op-amp IC741as :a) clipper, b) clamper, c) Schmitt trigger, d) voltage follower.

3. Operation of low-pass, high-pass and band-pass Butterworth filters.
4. Op Amp Oscillators - a) Hartley, b) Colpitt, c) Wein-bridge, d) Phase Shift, e) Crystal.
5. Generate Sine, Triangular &Saw-tooth wave using ICL8038
6. IC555 timer as: astable, &monostable multivibrator.
7. To study the operation of IC 723 Voltage Regulator.
8. To study operation of Current mirror.
9. Operation of: Frequency to Voltage &, Voltage to Frequency converter
10. Study operation of analog multiplier ICs and their applications.
11. Study of Voltage controlled oscillator

Electronic Measurements & Instrumentation

Unit1: Basics of Measurements
- ✓ Accuracy, precision, sensitivity, resolution, Dynamic range, response & repeatability of measuring instruments
- ✓ Units in measurements and different types of units, Definition of Errors and type of errors, Concept of Calibration.

Unit 2: Types of DC & AC Bridges
- ✓ DC Bridges – Wheatstone and Kelvin Double Bridge and its application
- ✓ AC Bridges - Maxwell's Bridge, Hay's Bridge, Wien Bridge & its application.

Unit3:Transducers, & Potentiometers
- ✓ RTD, Thermocouple, Thermistor, LVDT, Strain Gauge, Load Cell, Piezoelectric Transducers: Working Principles, Application & Classification, Selection Criteria, Characteristics, & Construction.
- ✓ DC & AC Potentiometer -Basic Slide wire &, Crompton's DC Potentiometer; DC & AC Potentiometer applications.

Unit4: Measuring Instruments
- ✓ Permanent Magnet Moving Coil Instruments: Principle & Construction

- ✓ Moving Iron (MI) Instruments.
- ✓ Electro Dynamometer Instruments.
- ✓ Single Phase Energy Meter.

Unit 5: Electronic Instruments
- ✓ Principle of Analog & Digital Ammeter, Voltmeter & Multimeter.
- ✓ DMM: Integration & successive approximation type. Advantages of DMM over Analog MultiMeter.
- ✓ Q-Meter, Vector Impedance Meter.
- ✓ Spectrum Analyzer, Function Generator.

Unit 6: Cathode Ray Oscilloscope
- ✓ Block diagram of CRO, CRT-constructional features, principle of operation screens, graticules.
- ✓ Block schematic description of: Vertical Amplifier, (b) Time Base Generator,(c) Trace Synchronization, (d) Triggering Modes, (e) Front Panel Controls, (f) Probe Characteristics (Structure of 1:1 and 10:1 probe).
- ✓ Features of dual trace oscilloscopes, chopper beam switch, alternate beam switch.
- ✓ Block schematic description of digital storage oscilloscope.
- ✓ Measurement of amplitude, frequency, time period, phase angle, modulationindex (trapezoidal method) and delay time by CRO.

Electronic Measurements & Instrumentation Lab

1. Study operation of :(a)Multimeter (b) Function Generator (c) PMMC (d) Single Phase Energy Meter.
2. Measure unknown inductance using: Wheatstone , & Maxwell Bridges.
3. Measurement of displacement with the help of LVDT

Unit -05
- ✓ Introduction to Lambda, defining a lambda function, call a lambda function. Recursion in Python, anonymous functions, global and local variables, recursion function.
- ✓ Import a module: math, random, packages etc. Modular approach using user defined functions.

Unit-06
- ✓ Concept of Exception Handling, use of except clause, try, except, finally and user defined exception.
- ✓ Introduction of NumPy, creating, accessing NumPy array, manipulation and subarrays, split, reshape, join arrays examples.
- ✓ Many Examples & Miscellany.

Project
- ✓ Learning Modules
- ✓ Thermal Sensors: RTD, Thermocouple
- ✓ Temperature Controller: On–Off, PID
- ✓ Optocoupler:PC817,MCT2E,MOC3041
- ✓ Regulated Power Supplies: Series regulator using Op-Amp feedback
- ✓ Regulated Power Supply LM723, TL431
- ✓ Proximity Sensors: Types, Specs, Applications of different sensor types.
- ✓ Photo-electric sensors: Types, Specs, Applications.
- ✓ Distance sensor (IR Sensor)
- ✓ Strain Gauge: Types, Specification, Applications.
- ✓ Limit Switch, Float, & Centrifugal Switch: Types, Specs, Applications.
  - ✓ Group Projects
- ✓ DC Regulated Power Supply
- ✓ Alarm circuit for Security using LDR
- ✓ Automatic Lawn Light (using LDR)
- ✓ Fire alarm LDR & Thermistor based
- ✓ Digital Temperature Meter
- ✓ Industrial Thermometer (Using TC)
- ✓ Motion sensor (with IR sensor)

- ✓ Digital Distance meter (with Laser)
- ✓ Digital Weight Meter
- ✓ Wireless Health Monitoring System

Text Books List

Embedded Systems
- ✓ M.A. Mazidi, R.D. Mckinlay and D. Causey, PIC Microcontroller and Embedded Systems using Assembly & C for PIC18, Pearson.
- ✓ Kanta Rao, Embedded Systems, Mediamatics

Advance Communication System
- ✓ Frenzel, Electronics Communication T.M.H.
- ✓ V. Chandrasekhar, Communication Systems, OUP.
- ✓ John M. Senior, Optical Fiber Communications: Principles and Practice, Pearson.
- ✓ Kennedy, Davis, Electronic Communication Systems, T.M.H.

Mobile Communication
- ✓ TS Rappaport, Wireless Communications Principles, Pearson.
- ✓ Mobile Cellular Communications by W.C.Y. Lee, McGraw Hill.
- ✓ T. L. Singal Wireless, Communication, McGraw Hill
- ✓ Iti Saha Misra, Wireless Communications and Networks: 3G and Beyond, Payal Books.

Industrial Electronics
- ✓ Power Electronics by P.S Bimbhra, Khanna publishers.
- ✓ Power Electronics by B. R. Gupta & V. Singhal, S. K. Kataria & Sons

Python
- ✓ Let Us Python by Yashavant Kanetkar, Aditya Kanetkar, BPB.

***

Ramakrishna Mission Shilpamandira

**An AICTE Approved
Self-Financed Polytechnic**

Belur Math, Howrah

Syllabus Booklet

Electronics & Tele-Communication Engineering [ETCE]

Semester –V (Part-III)

Based on the Latest Syllabus published by the
West Bengal State Council of Technical & Vocational Education and Skill Development

Embedded Systems

Group–A
Unit1:Embedded System Design Basics
- ✓ Introduction to embedded systems.
- ✓ Components of embedded system.
- ✓ Comparison: 8051, Arduino, & PIC

Unit-2: Architecture review of Arduino Uno board
- ✓ Introduction to Arduino, Arduino history and family- Mega, Nano, Bluetooth, Lilypad.
- ✓ Pin configuration and architecture of ATmega328 microcontroller
- ✓ Study of an Arduino Board- Power Supply, Power Connectors, Analog Inputs, Digital Connections, crystal oscillator, Reset switch, Serial Programming Connector etc.
- ✓ Concept of digital and analog ports.
- ✓ Hardware Interfacings: LED's, Switches, Seven Segment Display, Multi Segment Displays, Relays (AC Appliance Control), LCD Buzzer

Group–B
Unit-3: Embedded C programming simulation model for Arduino
- ✓ Introduction to Embedded C and steps to install Arduino Integrated development platform.
- ✓ Commands for Arduino Functions, Parameters, Variables- Global, local & static, Numeric variables: int, float, Boolean, #Define directives,
- ✓ Looping statements-if, for, while,
- ✓ Logical Operators, Mathematical operators, Return values, Coding styles – Indentation, opening Braces, Whitespace, Comments,
- ✓ Arrays and strings, Morse code translator, Pinmode- to configure the Digital and Analog pins as Input or Output pin,

- ✓ Standard Arduino library- Random number, Math function, bit manipulation, Advanced I/O, Interrupts, storing a Integer, Float and string data types in EEPROM, Clearing the contents of EEPROM, Range compression, Arduino Ethernet programming,
- ✓ Programming with Arduino IDE, Compiling & Debugging using IDE
- ✓ Proteus simulation model for Arduino

4: PIC 18 Architecture, Programming:
PIC 18 architecture & assembly level programming:
  a) WREG register, & file register
  b) Default access bank, Status register
  c) PIC data format and directives
  d) Branch, call and time delay loop
- ✓ Proteus simulation model for PIC
- ✓ PIC I/O port programming
- ✓ ADC programming

Group–C
Unit-5:I/O interfacing, Prog and Simulation Model
- ✓ LED interfacing with Arduino /PIC - Circuit diagram, program for LED blinking, Proteus simulation model
- ✓ 2Single switch and seven segment interface with Arduino /PIC - Circuit diagram, program for increment digit, Proteus simulation
- ✓ Sensors (Temperature, Light, Proximity) & LED/LCD interface with Arduino/PIC- Circuit diagram, program, Proteus simulation model
- ✓ Interfacing with DC motor with Arduino/PIC–speed control program with direction change: Circuit diagram, program, Proteus simulation model

- ✓ AC Power Regulators - Phase Control AC Regulator, Sequence Control of AC Regulators

Unit-6: Speed Control of Motors
- ✓ Types of speed control of dc motor: Armature Voltage Control, Field Current Control, Quadrant Drive
- ✓ Types of speed variation of AC Motor- Frequency variation, Stator volt variation

Industrial Electronics Lab
- ✓ To measure the reverse recovery time and softness factor of a diode
- ✓ To plot V/I characteristics of SCR
- ✓ To plot V/I characteristics of Triac.
- ✓ To plot V/I characteristics of Diac
- ✓ To study the operation of a triggering circuit of SCR
- ✓ To study the operation of a single phase rectifier—output waveform with phase control circuit
- ✓ To study the operation of a polyphase rectifier
- ✓ To study the operation of SMPS
- ✓ To study the operation of a phase control AC regulator
- ✓ To study the operation of a Jones chopper
- ✓ To study the operation of an Online UPS system
- ✓ To study the operation of a single-phase bridge inverter with resistive load
- ✓ To study the speed control of DC motor by: —
  (A) varying field current keeping armature voltage constant; and,
  (B) varying armature voltage keeping field current constant
- ✓ To study speed control of an induction motor by voltage and frequency variation

Python (Theory + Lab)

Unit -01
- ✓ History, Features & Technical strength of Python, setting up path & Basic Syntax; working with Python.
- ✓ Python Variable and Data Types in Python, discuss Python operators and working with operator

Unit -02
- ✓ Conditional statements: if, if-else and Nested if-else, work with conditional statement.
- ✓ Loop and Control statement : for, while and Nested Loops, work with while statement like break, continue, pass, assert etc.

Unit -03
- ✓ Lists: Introduction, create & access a list, list with function and methods, list operations: compare, delete, append etc.
- ✓ Tuple: Introduction, create & access a tuple, tuple with function and methods, tuple operations like slicing, concatenation etc.
- ✓ Introduction to Set, create a set, access the set, different operation in set, working with function & method in set.
- ✓ Discuss Dictionaries, access values from dictionaries, working with dictionaries properties & function.

Unit -04
- ✓ String manipulation, access string, slicing, pattern matching and membership in string, working with different string function, methods.
- ✓ Discuss numerical function and working with different numerical function in Python.
- ✓ User defined functions: creating & calling a function, types of function and functional arguments etc.

- ✓ Demonstrate the impact the received power levels for hand-off in case of mobile cellular communication using fading channel mobile communication virtual lab.
- ✓ Estimate the impact of sectoring in increasing cellular system capacity using fading channel mobile communication virtual lab.
- ✓ Study the GPRS system and use it for sending an e-mail through WI-GPRS trainer.
- ✓ Study the GSM modem and its different module for phone book, setting up a call, sending SMS and identifying call history using AT commands.

Industrial Electronics

Group–A
Unit-1: Power Semiconductor Devices
- ✓ Principle of operation, VI characteristic & switching characteristics, Applications: Power Diode, Power Transistor, MOSFET and IGBT
- ✓ Concept of thermal resistance, heat sink and thermal equivalent circuit
- ✓ Protection of Power Semiconductor Devices: MOV, Snubber

Unit-2: Thyristor
- ✓ Switching characteristics & Two transistors method of SCR, Ratings of SCR
- ✓ Triggering circuits of SCR
- ✓ Need for series & parallel methods of SCR. Reasons of unequal voltage & current distribution & equalization networks
- ✓ Family devices - Photosensitive SCR, GTO, SCS, TRIAC & DIAC

- ✓ Commutation circuits of SCR – natural and forced commutation – Class A, B, C, D and Class E

Unit-3: Single phase & Polyphase controlled rectifier
- ✓ Single phase half wave and full wave control rectifier circuit – Principle of operation with resistive and inductive load – Use of free wheel diode. Calculation of Vdc
- ✓ Three phase half wave and full wave control rectifier – Operation with inductive and resistive load. Calculation of Vdc
- ✓ Concept of full control and half control rectifier

Group–B
Unit-4: Application of SCR in Power Supply
- ✓ Switching Regulator (SMPS) principle of operation, Block & circuit diagram & PWM control circuit consideration of switching regulator
- ✓ Advantage and disadvantage of switching regulator in comparison with linear regulator
- ✓ Principle of operation of ON-line UPS and OFF-line UPS

Unit-5: Converters
- ✓ Chopper - Principle of operation with an example (Jone's chopper) and its application
- ✓ Inverters - Voltage source inverter and current source inverter; Single Phase half bridge and full bridge inverter; Three phase inverter; Applications of inverters
- ✓ Principle of operation of Cycloconverter and its applications
- ✓ Dual Converter and its applications

- ✓ Interfacing with Stepper motor with Arduino /PIC –speed control program with direction change: Circuit diagram, program, Proteus simulation model

Embedded Systems Lab
- ✓ Installation of Arduino software from the website www.arduino.cc.
- ✓ Installation software From MPLAB IDE and MPLAB XC from microchip website.
- ✓ Installation of Proteus software for simulation purpose.
- ✓ Built-in LED state control by push button sketch implementation (Arduino /PIC)
- ✓ Built-in LED blinking sketch implementation (Arduino /PIC)
- ✓ Built-in LED blinking by toggling states based on binary operation (Arduino /PIC)
- ✓ Controlling multiple LEDs with a loop and an array (Arduino /PIC)
- ✓ Use a potentiometer to control the blinking of an LED (Arduino /PIC)
- ✓ Temperature monitor using LCD display & LM35 (Adrino /PIC)
- ✓ Light sensor interfacing, sending its reading using I2C Communication Protocol (Arduino /PIC)
- ✓ Servo Motor Control using PWM (Arduino /PIC)
- ✓ Mini projects on
  1. Home automation. (Arduino /PIC)
  2. Solar Street Light system. (Arduino /PIC)
  3. Clock. (Arduino /PIC)
  4. Solar charge controller(Arduino /PIC)
  5. RTC clock(Arduino /PIC)

Advance Communication System

Group–A
Unit-1: Satellite Communication
- ✓ Kepler's Law, Orbital period & Satellite speed, Types of orbits, polar, inclined, equatorial, LEO, MEO, GEO, Station keeping, Satellite Launching process, Attitude control
- ✓ Transponder- Frequency allocation – Frequency reuse
- ✓ Function of Communication Satellite with block diagram
- ✓ Principles of FDMA and TDMA & use in Satellite communication.

Unit-2: RADAR Systems
- ✓ Principle operation of RADAR, PPI, Duplexer, RADAR range, Frequency & Power range.
- ✓ Function of Pulsed RADAR, MTI, Doppler effect, Blind speed

Group–B
Unit-3: Mobile Communication and modern wireless comm. system
- ✓ Overview of cellular system, 2G, 3G, 4G & 5G concept, Frequency reuse, location update & call setup, Hand off and power control
- ✓ Block diagram & operation of mobile (hand set) unit, Frequency synthesizer Transmitter unit Receiver unit, Logic & Control unit
- ✓ Base Station, Control Station
- ✓ Digital cellular system, GSM architecture, protocol, security aspect
- ✓ Modern wireless Network, Universal mobile telecommunication service (UMTS), LTE, CDMA, SCDMA, Wireless local loop (WLL), Local multipoint distribution service (LMDS) technology
- ✓ Concept: Blue-tooth, Wi-Fi Wi-max

Unit-4: Antenna

✓ Basic principle of Antenna – Characteristic & features of different Antenna, Dipole Half wave dipole, folded dipole, horn antenna, dish antenna, parabolic antenna, array antenna, Yagi-Uda antenna, their application and use.
✓ Properties of antenna, Gain Bandwidth, beam width, impedance radiation pattern of different antenna (Dipole, half & full wave dipole, half and full wave folded dipole)

Group–C
Unit-5: Optical Communication Sys

✓ Basic principle of fiber optic communication system, advantage and limitations of optical fiber communication, Construction of optical fiber, types of fibers, mono mode, multimode, step index and graded index
✓ Optical fiber performances, bandwidth distance product, Transmission Losses
✓ Optical Sources, LED, LASER, Modulation of LED and LASER, Function and principle operation of optical detectors, Photo diode, PIN , photo transistor, APD
✓ Components of optical fiber – coupler – connector – splices
✓ Block diagram of optical fiber communication system and its operation – basic idea of fiber optic networking
✓ Fiber distributed Data Interface (FDDI) – Synchronous optical network (SONET)
✓ Multiplexing of optical signals – WDM – OFDM.
✓ Application of SS Modulation

Advance Communication System Lab

✓ To study the function of fiber optic analog link
✓ Study frequency response of optical receiver at various load conditions
✓ To study the propagation loss in optical fiber
✓ To study the bending loss in optical fiber.
✓ To study the numerical aperture of optical fiber
✓ To study the radiation pattern and to obtain the polar plot of half wave dipole antenna, full wave dipole antenna, folded dipole antenna and Yagi-Uda antenna.
✓ To set up a satellite communication link and study of change in uplink and downlink frequency
✓ To establish an Audio-Video satellite link between transmitter and receiver
✓ To find the maximum range of RADAR (simulation software)
✓ To study the behavior of the CDMA Direct sequence Spread spectrum modulation, demodulation
✓ Study and analyze Mobile Phone.
✓ Mini projects on
  a) To design an optical fiber link
  b) To develop any control system using optical source & detectors
  c) To develop a voice comm. link using optical fiber
  d) FM transmitter

Mobile Communication

Group–A
Unit-1: Fundamental of Mobile Comm

✓ Personal communication system, Wireless local area network, Wireless broadband access system, Wireless wide area network.

✓ Basic Terminologies related to Cellular Communication: Mobile Station, Base Station, Control channel, forward and reverse channel, MSC, MTSO, PSTN.
✓ Basic Cellular Communication Architecture.
✓ Initialization of Cellular Calls between Mobile Station to Mobile Station, and Landline Phone to Mobile Station - Timing Diagrams illustrating how a call initiated by a mobile and landline phone users.

Unit-2: Cellular Concepts

✓ Features of Cellular system, shapes of cell, Frequency reuse, Co channel interference, Adjacent channel interference, Cell splitting, Sectoring, Segmentation & Dualization.
✓ Roaming & Hands-off Strategies, Call drop & avoidance strategies
✓ Types of hands-off Strategies: Hard Hands-off -Soft Hands-off- Mobile assisted hands- off.

Unit-3: Cellular Telephone System

✓ Features of 1st Generation Analog cellular Telephone- AMPS Frequency allocation.
✓ Features of 2nd Generation Cellular Telephone System, Basic ideas of N-AMPS & Digital Cellular Telephone, Advantages 2G over 1G
✓ Features of 3rd Generation Cellular Telephone System - Advantages of 3G over 2G
✓ Features of 4th Generation Cellular Telephone System- Features of LTE & VOLTE and their difference features of WIMAX-Application of 4G- Advantages over 4G over 3G.
✓ Features of 5th Generation Cellular Telephone System –Application of 5G- Advantages over 5G over 4G.

Group–B
Unit-4: Global System for Mobile Communication (GSM)

✓ Features of GSM services.
✓ Architecture: Mobile Station-Base Station Subsystem (BTS, BSC) - Networking Switching Subsystem (HLR, MSC, VLR, AUC, EIR) - Operational support subsystem.
✓ General Packet Radio System: Concept -Services offered benefits.
✓ Idea of Enhanced Data rates for Global Evolution (EDGE)
✓ PCSS (Personal Communication Satellite system) –Basic concept, Advantages and disadvantages.

Unit5: Antenna used in mobile Phone

✓ Working principle of Mobile Phone Antenna –Working of PIFA (Planar Inverted F Antenna) – Location of antenna in mobile set
✓ Selection of antenna for reducing SAR (Specific Absorption Rate), Microstrip Antenna.
✓ Antenna Used in Mobile Tower - Types and features

Mobile Communication Lab

✓ To study Cellular Fundamentals like Frequency Reuse, Interference, cell splitting, Base Station, Control channel, Forward and reverse channel, MSC, MTSO, PSTN (by using virtual lab).
✓ Study of GSM handset for various signalling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).
✓ To study transmitters and receiver sections in mobile handset and measure frequency band signal.

- ✓ On-Board/Off-Board Charger
- ✓ Brake System in EVs
- ✓ Control Systems in EVs
- ✓ Sizing the Drive system

Unit-3: EV Charging Infrastructure:
- ✓ Fundamental of EV Charging
- ✓ Electric Vehicle Supply Equipment (EVSE)
- ✓ Smart charging technology
- ✓ Energy storage integration into Micro-grid

Unit – 4: Electric Vehicle Grid Integration:
- ✓ Impact of EV charging on grid
- ✓ Vehicle to anything (V2X) technology (V2G, V2V, V2H, V2B)
- ✓ Procedure to get power connection for EV charging station
- ✓ Demand response from EV
- ✓ Voltage/reactive power support from EV & Frequency support

Unit – 5: EVs and Renewable Energy (RE) Integration:
- ✓ RE based EV charging stations
- ✓ Correlation between EV charging and RE integration
- ✓ Coordinated operation of EVs and distributed generation

Electric Vehicles Lab
- ✓ D.C Machines types & construction
- ✓ D.C Motor Starters.
- ✓ Three phase I.M types & construction
- ✓ Load test on 3φ induction motor
- ✓ V/f control of 3φ induction motor
- ✓ SOC estimation by open circuit voltage, & Coulomb Counting
- ✓ Battery management system
- ✓ Operation of DC-DC converters
- ✓ 1φ half wave-controlled rectifier
- ✓ Bidirectional converter
- ✓ Lithium-ion battery modelling and fault detection design

- ✓ Chassis frames for an EV
- ✓ Assembly of EV charging point and study of charging modes
- ✓ State-of-Health (SoH) estimation by discharge capacity method

Text Books List

Engineering Economics & Project Management
- ✓ Business Economics & Accounts, Saibal Guha, Lakshmi Prakashani
- ✓ Business Economics & Accountancy, Chattopadhyay & Saha, Bhagabati Publication.

Entrepreneurship and Start-ups System
- ✓ Entrepreneurship Development by E. Gordon, K. Natarajan, Himalaya Pulishing House.

Control System and PLC
- ✓ Linear Control Systems by B. S. Manke, Khanna Publishers.
- ✓ Programmable Logic Controllers by John W. Webb. Ronald A. Reis, PHI
- ✓ Programmable Logic Controllers by Frank Petruzella, TMH

Computer Networking and Data Communication
- ✓ Data communication and Networking by Behrouz A. Forouzan, TMH

Renewable Energy
- ✓ Non-Conventional Energy Resources by B. H. Khan, TMH.
- ✓ Non-Conventional Energy Resources by S. Hasan Saeed & D. K. Sharma, Katson.

***

Ramakrishna Mission Shilpamandira

**An AICTE Approved
Self-Financed Polytechnic**

Belur Math, Howrah

Syllabus Booklet

Electronics & Tele-Communication Engineering [ETCE]

Semester –VI (Part-III)

Based on the Latest Syllabus published by the
West Bengal State Council of Technical & Vocational Education and Skill Development

Engineering Economics & Project Management

Group–A

Unit-I: Introduction, Theory of Demand & Supply
- Introduction to Engineering Economics, the relationship between Engineering and Economics
- Resources, scarcity of resources, and efficient utilization of resources.
- Opportunity cost, rationality costs, and benefits
- Theory of Demand: the law of demand, different types of demand, determinants of demand, demand function, price elasticity of demand.
- Theory of Supply: determinants of supply, supply function.
- Market mechanism: Equilibrium, basic comparative static analysis (Numerical problems)

Unit-II: Theory of Production & Costs
- Concept of production (goods & services), Different factors of production (fixed & variable factors), Short-run Production function (Graphical illustration), and Long run production function (returns to scale).
- Theory of Cost: Short-run & long-run cost curves with graphical illustration, basic concept on total cost, fixed cost, variable cost, marginal cost, average cost etc.
- Economic concept of profit, profit maximization (numerical problems)

Unit-III: Different Types Of Market And Role Of Government
- Perfect Competition: Features of Perfectly Competitive Market.
- Imperfect Competition: Monopoly, Monopolistic Competition, Oligopoly

- Role of government in Socialist, Capitalist and Mixed Economy structure with example.

Group–B

Unit-I: Concept Of Project
- Definition and classification of projects
- Importance of Project Management.
- Project life Cycle [Conceptualization → Planning → Execution →Termination]

Unit-II: Feasibility Analysis of A Project
- Economic and Market analysis.
- Financial analysis: Basic techniques in capital budgeting– Payback period method, Net Present Value method, Internal Rate of Return method.
- Environmental Impact study– adverse impact of the project on the environment.
- Project risk and uncertainty: Technical, economical, socio-political, and environmental risks.
- Evaluation of the financial health of a project–Understanding the basic concept of Fixed & Working Capital, Debt & Equity, Shares, Debentures etc., and different financial ratios like Liquidity Ratios, Activity Ratios, Debt-equity ratio & Profitability Ratio.

Unit-III: Project Administration
- Gantt Chart– a system of bar charts for scheduling and reporting the progress of a project (basic concept).
- Concept of Project Evaluation and Review Technique (PERT) and Critical Path method (CPM): basic concept and application with real-life examples.

MODULE: 3

Unit-V: Hydropower
- How hydropower plant works?
- Main components of Hydropower plant: Gate, penstock, surge tank, turbine, transformer etc.
- Types of hydropower: Run-of-River power plant (no active storage), Plant with significance storage, Pumped storage, Tidal plant.

Unit-VI: Measuring Instruments
- Basic principle of Pyranometer for solar radiation measurement.
- Idea on different instrument used in Hydroelectric power plant, Solar thermal plant, Wind power plant, Biogas plant.

Internet of Things Lab

- Introduction to IoT Lab, Familiarization with ESP32, ESP8266 (NodeMCU) & IoT Development Board.
- LED Blinking & LED Chaser Program.
- Seven Segment Display Interfacing in IoT Development Board.
- RGB LED Interfacing in IoT Development Board.
- Relay Interfacing in IoT Development Board.
- Bluetooth Interfacing in IoT Development Board.
- Sense & connect with available Networks using ESP32 & ESP8266.
- Controlling Devices from HTML webpage using NodeMCU.
- Sending Sensor Data to Cloud using NodeMCU.
- RFID based Attendance System using NodeMCU and Google Sheets.

Project-II

- Design of AF amplifier circuit using transistor. (Potential divider bias)
- Circuit analysis of R-C integrator and differentiator.
- Design of Hartley, Colpitt Oscillator & Wien Bridge Oscillator (Op-Amp)
- Design and analysis of function generator using IC555, LM 358, LM324, XR2206.
- Study of PLL (IC 4046) & its application in FM demodulator.
- Design 4 bit synchronous counter using IC7476 or IC74191.
- Design decade counter with seven segment display.
- Multi user calling bell. (Priority encoder based with 7segment display)

Medical Electronics

- X-Ray Machine block diagram & working.
- Ultrasound imaging system
- Blood pressure measurement
- ECG, EEG & Pacemaker
- Patient Monitoring System,
- ICU & CCU.

Electric Vehicles

Unit -1: Introduction to Electric Vehicles:
- EV: Introduction & Classification
- EV vs. Conventional vehicle
- EV Deployments Globally & in India: Opportunities & Challenges
- Global experience and success story of EV Production
- Policies and regulation of EV and electric vehicle supply equipment

Unit-2: EV Components:
- Major Components of an EV
- Electric Motor, Type of EV Motor
- Rechargeable Battery,
- EV Power Electronics

Group–C
Unit-5: Network And Cyber Security
- Different aspects of SECURITY: Privacy – Authentication – Integrity – Non- Repudiation.
- Encryption / Decryption: Data Encryption System – Secret key method – Public key method (RSA algorithm), Digital signature.
- Define Cyber Security, Types of Cyber Security Threats -Phishing, Ransomware, Malware, Social Engineering, Emotet, Man in the Middle (MITM), Password Attack, Spyware, Hacking, Viruses, Trojan and Worm.

Computer Networking and Data Communication Lab

- Compare and configure different Network Topologies physically or by using CISCO Packet Tracer software.
- Compare and demonstrate Network directing devices: Repeater, Hub, Switch, Bridge, Router, Gateway.
- Study of different types of Network cables and practically implement the cross wired cable and straight through cable by using crimping tool and RJ-45 Connector.
- Connect the Computers in LAN.
- Different types of IP Addressing & Subnetting & Super netting concepts.
- Configuring TCP/IP Network.
- Study of basic Network and Network configuration commands.
- Web page designing by using HTML.

Renewable Energy
MODULE: 1
Unit-I: Introduction
- Classification of energy: Primary and secondary energy, Commercial & non-commercial energy, Renewable & Non-renewable energy, Conventional and Non-conventional energy.
- Advantage of Renewable energy.
- Sources of Renewable Energy: Solar Energy, Wind Energy, Biomass Energy, Hydro Energy, Geothermal Energy, Tidel and Ocean energy (only brief idea on all these).

Unit-II: Solar energy
- Units of solar power / energy.
- Essential subsystem in solar energy plant: Solar collector / concentrator, energy transport medium, energy storage, energy conversion plant, power conditioning control & protection system, alternative or standby power supply.
- Solar Electric System: Solar water Heater, Solar lighting system, Solar cooker, Electric vehicle charging station (Working principle only).
- Idea on Photovoltaic Technology.

MODULE: 2
Unit-III: Bioenergy
- Introduction on Biogas, Sources of Bioenergy.
- Different forms of Biomass, their composition & fuel properties.
- Production of Biogas: working principle of fixed- dome type and floating gas holder type biogas plant.
- Idea of gasifier, digester.
- Use of Biogas.

Unit-IV: Wind Energy
- Basic working principle of Wind energy production- Speed and power relation, Average power of the wind.
- System components of wind Energy (e.g. Tower, Turbine, Blades etc).
- Control of rotor speed.

Entrepreneurship & Start-ups

Unit-1: Entrepreneurship – Introduction and Process
- Concept, Competencies, Functions and Risks of entrepreneurship.
- Entrepreneurial Values& Attitudes and Skills.
- Mindset of an employee/manager and an entrepreneur.
- Types of Ownership for Small Businesses-Sole proprietorship-Partnerships-Joint Stock company-public limited and private limited
- Difference between entrepreneur and Intrapreneur.

Unit-2: Preparation for Entrepreneurial Ventures
- Business Idea- Concept, Characteristics of a Promising Business Idea, Uniqueness of the product or service and its competitive advantage over peers.
- Feasibility Study – Concept – Locational, Economic, Technical and Environmental Feasibility. Structure and Contents of a standard Feasibility Study Report.
- Business Plan – Concept, rationale for developing a Business Plan, Structure and Contents of a typical Business Plan.
- Project Report- Concept, its features and components
- Basic components of Financial Statements- Revenue, Expenses (Revenue & capital exp), Gross Profit, Net Profit, Asset, Liability, Cash Flow, working capital, Inventory. Funding Methods-Equity or Debt.

Unit-3: Establishing Small Enterprises
- Legal Requirements & Compliances needed for establishing a New Unit-NOC from Local body-Registration of business in DIC-Statutory license or clearance-Tax compliances.

Unit-4: Start-Up Ventures
- Concept & Features.
- Mobilisation of resources by start-ups: Financial, Human, Intellectual and Physical.
- Problems and challenges faced by start-ups.
- Start-up Ventures in India – Contemporary Success Stories & Case Studies to be discussed in the class.

Unit-5: Financing Start-Up Ventures In India
- Communication of Ideas to potential investors – Investor Pitch.
- Equity Funding, Debt funding – by Angel Investors, VentureCapital Funds, Bank loans to start-ups.
- Govt. Initiatives including incubation centre to boost start-up ventures.
- MSME Registration for Start-ups – its benefits.

Unit-6: Exit Strategies For Entrepreneurs
- Merger and acquisition exit, Initial Public Offering (IPO), Liquidation, Bankruptcy (Basic Concept only)

Control System and PLC
Group–A
Unit-1: Basics of Control System
- Control Systems: Definition of Control System, Classification of Control Systems with block diagram-open loop and closed loop control system with examples, Comparison between open loop and close loop control system.

- Mathematical Models of Physical systems: Concept of Transfer Function and deduction of transfer function of close loop control system, Block diagram reduction technique using Laplace Transform, Signal Flow Graphs and Messon's Gain formula for block diagram reduction technique with simple problems.

Unit-2: Time Domain Stability Analysis
- Time Response: Transient and Steady State Response
- Standard Test Inputs: Unit Step, Unit Ramp, Unit Parabolic, Unit Impulse functions and their corresponding Laplace Transform.
- Analysis of First and Second Order Control System:
  i) First Order System: Analysis for Unit Step Input, Concept of Time Constant, Steady State Error.
  ii) Second Order System: Analysis for Unit Step Input, Definition and Effect of Damping.
  iii) Time Response Specifications: Delay time, Rise time, Peak Time, Peak Overshoot, Settling time, Simple Numerical Problems.
  iv) Initial value and final value theorems & their use in control systems.
  v) Types of feedback control systems and error constants.
- Stability: Concept of Poles & Zeroes , Concept of Stability, Root Locations in s- plane & Analysis – Stable System, Unstable System, Critically Stable Systems, Conditionally Stable System.
- Routh's Stability Criteria: Steps and Procedures to find Stability by using Routh's Stability Criteria with simple problems.

Group–B
Unit-3: Process Controllers
- Process Control System: Block Diagram with example, Functions of Each Block
- Control Actions:
  i) Discontinuous Mode: ON-OFF Controllers, Neutral Zone.
  ii) Continuous Modes:
  a) Proportional Controller – Offset, Proportional Band
  b) Proportional, Integral and Derivative Controllers – Output Equation, Response Characteristics
  c) Composite Controllers: PI, PD, PID Controllers – Output Equation, Response Characteristics

Unit-4: Fundamentals of PLC and its Hardware
- Introduction – Advantages of PLC Based Control over Conventional Relay Based Control, Classification of PLC (Fixed and Modular PLCs)
- Architectural Details of PLC: Block Diagram of PLC, CPU and Program Scan, Input Modules (Discrete and Analog), Output Modules (Discrete and Analog), Memory (its organization and addressing), Power Supply and Programming Devices - Function of each block.
- PLC Installation.

Group–C
Unit-5: Basics of PLC Programming
- PLC Instruction Set: Relay Instructions, Logical Instructions, Program Control instructions, Timer and Counter Instructions, Data Handling Instructions.
- Ladder Logic Diagram: Elements of Ladder Diagram, Evaluation of Rung, Program examples and Problems.

Control System & PLC Lab
- Step response of R-C Circuit.
- To study the step response of R-L-C Circuit (Second Order System).
- Operation of an ON-OFF controller.
- Operation of Proportional controller.
- To study a PI controller.
- To study the PD controller.
- Study of the PID controller.
- To study MATLAB simulation for different types of Control System.
- Identify & test parts of a PLC.
- Ladder Diagram to test the functionality of different logic gates.
- Ladder Diagram for Adder and Subtractor by using PLC
- Ladder Diagram for ON-OFF control of a lamp using Timer and Counter.
- Traffic Light Control with PLC
- Ladder for Stepper Motor Control

Computer Networking and Data Communication
Group–A
Unit-1: Network Basics: Structure & Reference Model
- Idea of computer network – Network components
- Types of Network – Classify networks by their Geography- LAN, MAN & WAN; Classify Networks by their Network role: Peer to Peer, Client- Server Model.
- Network topology: Bus Topology, Ring Topology, Star Topology, Mesh Topology, Tree Topology, Hybrid Topology.
- Switching: Circuit Switching – Message Switching – Packet Switching.
- Layered architecture of network system – Seven-layer OSI model

– Functions of each OSI layer – Other ISO structure – TCP / IP Layer Structure, Comparison between OSI and TCP/IP models.

Unit-2: Transmission Media And Networking Devices
- Classification of Transmissions Medium: Compare between Unguided & Guided medium. Twisted Pair Cable (UTP, STP), Coaxial Cable, Optical Fiber Cable and Wireless Transmission Media (IR, Microwave).
- Network Hardware Components – NIC, Hubs, Switches - Layer 2 and Layer 3 Switches, Routers, Bridges, Repeaters, Gateways, Modems.
- Routing Algorithms: Concept of Static Routing, Dynamic Routing, Distance Vector Routing Algorithm and Routing Information Protocol.

Group–B
Unit-3: IP Protocol and Network Applications
- IP addressing: IP v4 Classful and Classless addressing, Subnetting and Super netting, Subnet Mask and Default Mask, Class less Inter Domain Routing (CIDR).
- IPV6: Types & advantages, Difference between IPV4 with IP V6. TCP/IP Protocols & Configuration.
- Other Network Layer Protocols: ARP, RARP, ICMP, UDP, Difference between TCP and UDP.

Unit-4: Application Layer Services
- Structure & Objectives of Intranet & Internet, Firewall & proxy server.
- Working of Email – POP-3, SMTP, MIME; TELNET, FTP, SNMP, World Wide Web, URL, HTTP, Working of DNS and DHCP Server.
- Working of VoIP, VPN and VSAT.