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

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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: $BeCl_2$, BF_3, CH_4, NH_3, H_2O; 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)
- ✓ H_2 liberation, O_2 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

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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 lengthrelationship
- ✓ 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

- ✓ Prepare concrete mix of a particular grade [nominal mix may be allowed] and determine compressive strength of concrete for 7 and 28 days.
- ✓ Demonstration of NDT equipment

Transportation Engineering Lab

- ✓ Draw the sketches showing standard cross sections of Expressways, Freeways, NH/SH, MDR/ODR
- ✓ Flakiness & Elongation Index of aggregates
- ✓ Aggregate impact value test
- ✓ Los Angeles Abrasion test
- ✓ Aggregate crushing value test
- ✓ Softening point test of bitumen.
- ✓ Penetration test of bitumen.
- ✓ Flash and Fire Point test of bitumen.
- ✓ Ductility test of Bitumen.
- ✓ Visual inspection of constructed road to identify defects, suggest remedial measures. Prepare the photographic report containing details
- ✓ Visit any flexible or rigid road to know the drainage condition, prepare a photographic report with details.
- ✓ Prepare photographic report with possible repairs &maintenance for. flexible and pavements
- ✓ Visual inspection of railway track to study fixtures, fasteners; yards; Make photographic report with details.

Suggested Text Books

Construction Materials

- ✓ Duggal, S. K, Building Materials, New International.
- ✓ Singh, Gurucharan, Building Construction & Materials, Standard Book House,

Basic Surveying

- ✓ Basak, N. N., Surveying and Levelling, McGraw Hill.
- ✓ Subramanian, R., Fundamentals of Surveying and Levelling, OUP

Mechanics of Materials

- ✓ Chakraborty, M., Strength of Materials, Kolkata.
- ✓ Khurmi, R.S., Strength of Materials, S Chand and Co. Ltd. New Delhi.

Building Construction

- ✓ Singh, Gurucharan, Building Construction & Materials, Standard Book House.
- ✓ Building Materials, S.K. Duggal, New Age Int. Pvt. Ltd.

Concrete Technology

- ✓ Shetty, M.S., Concrete Technology, S. Chand & Co.
- ✓ Gambhir, M.L., Concrete Technology, Tata McGraw Hill.

Transportation Engineering

- ✓ Khanna S.K., Justo, C E G and Veeraragavan, A., Highway Engineering, Nem Chand & Brothers
- ✓ Saxena S C and Arora S P, A Textbook of Railway Engineering, Dhanpat Rai Publication.

Civil Engineering Planning and Drawing Practices

- ✓ Civil Engineering Drawing by M Chakraborty.

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Ramakrishna Mission Shilpamandira

An AICTE Approved
Self-Financed Polytechnic

Belur Math, Howrah

Syllabus Booklet

Diploma in Civil Engineering

Semester – III (Part-II)

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

Construction Materials

I: Materials Overview

- ✓ Scope of construction materials in Building Construction, Transportation, environmental, & Irrigation Engineering (applications).
- ✓ Selection of materials for different civil structures on basis of strength, durability, Eco friendly, economy.
- ✓ Classification of materials: Natural, Artificial, special, finishing, recycled

II: Natural Construction Materials

- ✓ Requirements of good building stone; general characteristics of stone; quarrying and dressing methods and tools for stone.
- ✓ Timber: Structure, properties & uses, methods of seasoning for preservation, timber defects, use of bamboo in construction.
- ✓ Asphalt, bitumen and tar used in construction, properties and uses.
- ✓ Properties of lime, its types and uses.
- ✓ Properties of sand and uses
- ✓ Classification of coarse aggregate according to size and its use

III Artificial Construction Materials

- ✓ Brick Earth Constituents, Standard, Conventional, Modular, & Special bricks, fly ash bricks, Characteristics of good brick & Field tests
- ✓ Burnt clay bricks: Classification, use.
- ✓ Manufacture process of burnt clay & fly ash bricks, Aerated concrete blocks
- ✓ Flooring tiles – Types, uses
- ✓ Manufacturing process of Cement
- ✓ Dry and wet (only flow chart), types of cement & its uses, field tests.
- ✓ Precast concrete blocks- hollow, solid, pavement blocks, & their use.
- ✓ Plywood, particle board, Veneers, laminated board and their uses.
- ✓ Types of glass: soda lime glass, lead glass & borosilicate glass & their use
- ✓ Ferrous & non-ferrous metals, uses.

IV Special Construction Materials

- ✓ Material Types & suitability for: Waterproofing, Termite proofing; Thermal & sound insulating material
- ✓ Fibers – Types –Jute, Glass, Plastic Asbestos Fibers (only uses).
- ✓ Geopolymer cement: Geo-cement: properties, uses.

V Processed Construction Material

- ✓ Constituents and uses of POP (Plaster of Paris), POP finishing boards, sizes and uses.
- ✓ Paints- whitewash, cement paint, Distemper, Oil Paints & Varnishes & their uses. (Situations where used).
- ✓ Industrial waste materials- Fly ash, Blast furnace slag, Granite & marble polishing waste & their uses.
- ✓ Agro waste materials - Rice husk, Bagasse, coir fibres and their uses.
- ✓ Special processed construction materials; Geosynthetic, Ferro Crete, Artificial timber / sand & their uses

Basic Surveying

Unit–I Overview & Classification

- ✓ Survey-Definition, Purpose and Use.
- ✓ Types of surveying, Classification: Primary: Plane & Geodesic, Secondary: Based on Instrument, Method, Purpose, & Nature of Field.
- ✓ Principles of Surveying.
- ✓ Engineer's scale, Representative Fraction (RF), Plain, Diagonal, Vernier and Chord Scale.

Unit– II Chain Surveying

- ✓ Instruments used in chain survey: Chain, Tapes, Arrow, Ranging rod, Line ranger, Pegs, Offset rod, cross staff, Optical square, Plumb Bob.

b. Connection of main beam with secondary beam in one side
c. Connection of beam with column
d. Unequal column splicing
e. Equal beam splicing
f. Column bracket

- ✓ Steel Roof truss (problems to be supplied by the subject teacher(s)
- ✓ Study of different trusses used in construction; draw welded fink truss [angle or tubular] having standard dimension and minute detailing

Construction Material Lab

- ✓ Identify various sizes of available coarse aggregates from sample of 10 kg in laboratory and prepare report (60, 40, 20, 10 mm)
- ✓ Identify the available construction materials in the laboratory on the basis of their sources.
- ✓ Identify grain distribution pattern in given sample of teak wood; draw the various patterns.
- ✓ Make lime putty by mixing lime (1 kg) with water in appropriate proportion; prepare report on slaking of lime.
- ✓ Identify various layers and types of soil in foundation pit by visiting a construction sites; prepare report consisting photographs and samples.
- ✓ Select first class, second class and third-class bricks from the stack of bricks; prepare report on properties.
- ✓ Bricks: Measure dimensions and find average dimension and weight. Field tests - dropping, striking, scratching by nail; correlate results obtained.
- ✓ Flooring: Study of tiles: vitrified, ceramic, glazed, mosaic, anti-skid, & chequered tiles, paving blocks prepare report on their specifications.
- ✓ Apply the relevant termite chemical on given damaged sample of timber.
- ✓ Identify type of glasses from samples
- ✓ Apply 2 or more coats of paint on the prepared base of a wall surface ($1m^2$) with suitable brush/rollers, safe practice
- ✓ Prepare cement mortar of proportion 1:3 or 1:6 using sand and apply on 1 m X 1 m surface as plastering
- ✓ Prepare mortar using cement and Fly ash or Granite/marble polishing waste (1:6 or 1:3) and apply on 1 m X 1 m surface as plastering

Mechanics of Materials Lab

- ✓ Study the use and components of Universal Testing Machine (UTM).
- ✓ Tension test on mild steel: IS:432(1).
- ✓ Perform tension test on Tor steel as per IS:1608, IS:1139.
- ✓ Compression test on test piece using Compression Testing Machine.
- ✓ Plot Shear force & Bending Moment diagrams for cantilever, simply supported beams
- ✓ Plot Shear force & Bending Moment diagrams for overhanging beams for different loads incl. moment loading.

Concrete Technology Lab

- ✓ Fineness of cement by Blaine's air permeability apparatus Or sieving.
- ✓ Standard consistency of cement.
- ✓ Initial, final setting times of cement.
- ✓ Compressive strength of cement.
- ✓ Sand: Silt content & bulking.
- ✓ Fine & coarse aggregates: Bulk density, Water absorption, Surface moisture, Grading (sieve analysis),
- ✓ Workability of concrete by slump cone test, compaction factor test.

- ✓ Sleepers- functions & Requirement, types & sleeper density [numericals]
- ✓ Ballast: function & types, suitability.
- ✓ Rail fixtures and fastenings: fish plate, spikes, bolts, keys, bearing plates, chairs- types of anchors & anti-creepers.

Unit– V Track geometrics, Construction and Maintenance

- ✓ Alignment- Factors for rail alignment
- ✓ Track Cross sections – standard cross section of single and double line in cutting and embankment. Important terms - formation width, side drains
- ✓ Railway Track Geometrics: Gradient, curves - types and factors affecting, grade compensation, super elevation, limits of Super elevation on curves, cant deficiency, negative cant, coning of wheel, tilting of rail.
- ✓ Branching of Tracks, Points and crossings, Turn out- types, components, functions and inspection. Track junctions: crossovers, scissor cross over, diamond crossing, track triangle.
- ✓ Station - Purpose, requirement of railway station, important technical terms, types of railway station, factors affecting site selection for railway station.
- ✓ Station yard: Classification- Passenger, goods, locomotive and marshalling yards. Function & drawbacks of marshalling yards.
- ✓ Track Maintenance- Necessity, Classification, Tools required for track maintenance with their functions, Organisation of track maintenance, Duties of permanent way inspector, gangmate, key man.

Civil Engineering Planning and Drawing Practices

- ✓ Draw submission drawing to scale 1:100 of a single storey load bearing residential building (2BHK) with flat Roof, staircase, 2 nos WC and Bathroom (min. one attached), one Varandah showing
  a) Developed plan, Front elevation, one side elevation
  b) Section passing through Stair, W.C. and Bath
  c) Foundation plan and schedule of openings.
  d) Site plan (1:200), area statement, construction notes.
- ✓ Draw working drawing for above:
  a) Excavation trench plan
  b) Foundation plan to the scale 1:50
  c) Detailed enlarged section of Lintel and Chajjas including standard reinforcement.
  d) Detailed nlarged section of RCC staircase and landing slab including standard reinforcement
  e) Plan of Roof slab showing ridge line, drainage, position of rain water pipe, etc.
- ✓ Culverts
  a) Introduction to culvert & its different components and types and specific use along with demonstration of a model
  b) Half sectional plan and half sectional elevation and side view of a single span slab culvert
  c) Half sectional elevation of a single span two hume-pipe culvert
- ✓ Steel connections [bolted or welded]
  a. Plan elevation and side view of stanchion connected with base plate with gusset plate in concrete foundation

- ✓ Methods of Chaining, obstacles.
- ✓ Principles of chain survey.
- ✓ Well and ill Conditioned Triangle.
- ✓ Errors in length: Instrumental error, personal error, error due to natural cause, random error.
- ✓ Calculation of Chain & Tape Correction.
- ✓ Offsets: Perpendicular, Oblique.
- ✓ Chain survey Station, Base line, Check line, Tie line, Tie station.
- ✓ Ranging: Direct & Indirect Ranging.
- ✓ Conventional Signs, Recording of measurements in a field book.
- ✓ Area calculation from field book entry
- ✓ Simple numerical problems.

Unit– III Compass Traverse Survey

- ✓ Compass Traversing- open, closed.
- ✓ Terms: Meridians and Bearings of a Line-True, Magnetic, Arbitrary
- ✓ Whole Circle Bearing system & Reduced Bearing system; Conversion of given bearing to another bearing, Fore Bearing & Back Bearing, Calculation of internal and external angles from bearings at a station and Vice-versa, Dip of Magnetic needle, Magnetic Declination and It's variation, Isogonic and Agonic line.
- ✓ Principles of Compass Traversing.
- ✓ Components of Prismatic Compass, their Functions, Difference between Prismatic and Surveyor compass. Methods of using Prismatic Compass - Temporary adjustments and observing bearings.
- ✓ Local attraction, different methods of correction of observed bearings - Correction at station and correction to included angles including cases when all stations in a traverse are affected with local attraction
- ✓ Plotting a traverse, closing error, Graphical adjustment of closing error.
- ✓ Errors in Compass Surveying- Instrumental, Personal and Natural.
- ✓ Simple numerical problems.

Unit– IV Levelling and Contouring

- ✓ Levelling-Definition, Object & Uses.
- ✓ Terminology: Level, Horizontal & vertical surfaces & Lines, Datum surface or Line, Bench Marks- GTS, Permanent, Arbitrary &Temporary, Reduced Level, Rise, Fall, Line of collimation, Axis of the Telescope, Axis of Bubble Tube, Station,
- ✓ Back sight, Fore sight, Intermediate sight, Change point, Height of instruments, Focussing and Parallax.
- ✓ Types of levels: Dumpy, Tilting, Auto level, Digital level, Components of Dumpy Level and its fundamental axes, Temporary adjustments of Level.
- ✓ Types of Levelling Staff: Self-reading staff and Target staff.
- ✓ Curvature and Refraction correction.
- ✓ Reduction of level by Line of collimation or Height of Instrument and Rise and Fall Method.
- ✓ Levelling Types: Simple, Differential, Fly, Profile, Cross sectional, Check and Reciprocal Levelling.
- ✓ Level book Entry, arithmetical check and accuracy check of level work
- ✓ Errors in Levelling-Instrumental, Personal and Natural, Permissible limits of Error in Levelling.
- ✓ Contour, contour intervals, horizontal equivalent. Contour gradient.
- ✓ Contour map uses, Characteristics of contours, Methods of Contouring: Direct and indirect.
- ✓ Simple numerical problems

Unit– V Plane Table Surveying

- ✓ Principles of plane table survey.
- ✓ Plane table Accessories, their uses.
- ✓ Setting of plane table- Leveling, Centering, Orientation.
- ✓ Orientation of plane table - Back sighting & Magnetic needle method.
- ✓ Plane table survey Methods: Radiation, Intersection, Traversing, Resection.
- ✓ Merits, demerits of plane table survey
- ✓ Errors in Plane table Surveying- Instrumental, Personal and Plotting.

Mechanics of Materials

Unit– I: Moment of Inertia

- ✓ Moment of inertia (M.I.): Definition, MI of plane lamina, Radius of gyration, section modulus, Parallel & perpendicular axes theorems, MI of rectangle, square, circle, semi-circle, quarter circle and triangle section
- ✓ MI of symmetrical & unsymmetrical sections: I-section, Channel section, T- section, Angle section, Hollow sections and built up sections about centroidal axes / any reference axis.
- ✓ Polar Moment of Inertia of solid circular sections. Simple numericals.

Unit – II: Simple Stresses & Strains

- ✓ Definition of rigid, elastic and plastic bodies, deformation of elastic body under various forces, Definition of stress, strain, elasticity, Hooke's law, Elastic limit, Modulus of elasticity.
- ✓ Types: Tensile Compressive stresses, Shear and Bending stresses.
- ✓ Standard stress strain curve for Mild steel & HYSD bar under tension: Yield / Proof / Ultimate stress, Strain at critical points, strain hardening, % elongation, Factor of safety.
- ✓ Deformation of body due to axial force, forces applied at intermediate sections, maximum and minimum stress induced, Composite section under axial loading.
- ✓ Temperature stresses & strain: Concept, Temp. stress & strain in homogeneous simple bar.
- ✓ Longitudinal & lateral strain, Modulus of Rigidity, Poisson's ratio, Biaxial and tri- axial stresses, volumetric strain, change in volume, Bulk modulus.
- ✓ Relation between modulus of elasticity, modulus of rigidity and bulk modulus, Simple numericals.

III Shear Force & Bending Moment

- ✓ Types of supports, beams and loads.
- ✓ Concept, definition of shear force & bending moment, Relation between load, shear force, bending moment.
- ✓ Shear force & bending moment diagram for cantilever, simply supported and over hang on one or both side beams subjected to point / uniformly distributed loads or their combination (for udl - over full span or partial span), point of contra flexure, Simple numerical problems.

IV Bending & Shear Stresses in beams

- ✓ Theory of Pure bending, assumptions, flexural equation, nature of bending stresses, concept of neutral plane and neutral axis, bending stress distribution diagram for square, rectangular, circle, I-section, T- section.
- ✓ Concept of moment of resistance and simple numerical problems using flexural equation
- ✓ Shear stress equation, relation between maximum and average shear stress for rectangular and circular section, shear stress distribution diagram for square, rectangular, circle, I-section, T- section. Numericals based on shear equation.

Unit – V Steel connections & Steel Roof truss

- ✓ Plan elevation and side view of stanchion connected with base plate with gusset plate in concrete foundation
- ✓ Connection of main beam with secondary beam in one side
- ✓ Connection of beam with column
- ✓ Unequal column splicing
- ✓ Equal beam splicing
- ✓ Column bracket
- ✓ Truss Introduction – wooden (king post and queen post), steel (with angles and tubular truss); models
- ✓ Details of a fink truss with welded /riveted joints; & column connection
- ✓ Wooden king post and queen post truss of the building drawing

Transportation Engineering

Unit – I Overview of Highway Engg.

- ✓ Role of transportation in the development of nation, Importance, characteristics, scope of Indian roads
- ✓ Different modes of transportation – land way, waterway, airway. Merits, demerits of roadway and railway;
- ✓ General classification of roads.
- ✓ Selection, factors for road alignment.

Unit–II Geometric Design of Highway

- ✓ Design speed, design vehicle, PCU, volume of traffic, terrain classification
- ✓ Camber: Definition, purpose, types as per IRC – recommendations.
- ✓ Kerbs, Road margin, road formation, right of way as per IRC
- ✓ Design speed and various factors affecting design speed as per IRC.
- ✓ Gradient: Definition, types as per IRC – Recommendations, grade compensation at curve
- ✓ Sight distance: Definition, types IRC – recommendations, numericals.
- ✓ Curves: Necessity, types: Vertical, Horizontal incl. transition curve.
- ✓ Extra widening of roads: numericals.
- ✓ Super elevation: Definition, minimum & maximum Super elevation formula, method of providing super-elevation.
- ✓ Standards cross-sections of national highway in plain, embankment, cutting.

III Construction of Road Pavements

- ✓ Types of road materials and their Tests – Test on aggregates-Flakiness and Elongation Index tests, Angularity Number test, test on Bitumen- penetration, Ductility, Flash & Fire, Softening point tests.
- ✓ Pavement – Definition, Types, Structural Components of pavement and their functions
- ✓ Construction of WBM road. Merits, demerits of WBM & WMM road.
- ✓ Construction of Flexible pavement / Bituminous Road, Types of Bitumen &properties, emulsion, Cutback, Tar, Terms used - prime coat, tack coat, seal coat, premix carpet., penetration macadam, mastic asphalt, Merits Demerits of Bituminous Road.
- ✓ Cement concrete road: construction methods, Alternate & Continuous Bay Method, joints in concrete pavement, filler and sealers, merits and demerits of concrete roads.

Unit– IV Basics of Railway Engg.

- ✓ Classification of Indian Railways, zones of Indian Railways
- ✓ Permanent way: Ideal requirement, Components; Rail Gauge, types, factors affecting selection of a gauge
- ✓ Rail, Rail Joints: requirements, types.
- ✓ Creep of rail: causes and prevention, wear in rail.

types of Special concrete: Ready mix Concrete, Fiber Reinforced Concrete, High performance Concrete Self-compacting concrete and light weight concrete.

- ✓ Cold weather concreting: effect of cold weather on concrete, precautions to be taken while concreting in cold weather condition.
- ✓ Hot weather concreting: effect of hot weather on concrete, precautions to be taken for hot weather condition.

Civil Engineering Planning and Drawing

Unit – I Conventions and Symbols

- ✓ Conventions as per IS 962, symbols for different materials such as earthwork, brickwork, stonework, concrete, woodwork and glass.
- ✓ Graphical symbols for doors and windows, Abbreviations, symbols for sanitary and electrical installations.
- ✓ Types of lines-visible / centre / hidden / section / dimension / extension line, pointers, arrow head or dots. Appropriate size of lettering and numerals for titles, sub-titles, notes and dimensions.
- ✓ Types of scale- Monumental, Intimate, criteria for Proper Selection of scale for various types of drawing.
- ✓ Sizes of standard papers/sheets.
- ✓ Reading and interpreting readymade Architectural building drawing (Procured from Planning Engineer).

Unit– II Planning of Building

- ✓ Principles of planning for Residential and Public building- Aspect, Prospect, Orientation, Grouping, Privacy, Elegance, Flexibility, Circulation, Furniture requirements, Sanitation, Economy.
- ✓ Space requirement and norms for minimum dimension of different units in the residential and public buildings as per IS 962.
- ✓ Rules and bye-laws of sanctioning authorities for construction work.
- ✓ Plot area, built up area, super built up area, plinth area, carpet area, floor area and FAR (Floor Area Ratio).
- ✓ Line plans for residential building of minimum three rooms including water closet (WC), bath, kitchen, staircase per principles of planning.
- ✓ Line plans for public building, school, primary health centre

Unit– III Load Bearing Structure

- ✓ Drawing of Single storey Load Bearing residential building (2 BHK) with staircase.
- ✓ Data drawing –plan, elevation, section, site plan, schedule of openings, construction notes with specifications, area statement, Planning & design of staircase- Rise & Tread for residential &public building
- ✓ Working drawing – developed plan, elevation, sections passing through staircase, and/or WC and bath.
- ✓ Foundation plan of Load bearing structure.
- ✓ CAD - Draw commands, modify commands, layer commands.
- ✓ Area statement of building.

Unit – IV Culverts

- ✓ Culvert: Introduction, components and types and specific use along with demonstration of a model
- ✓ Half sectional plan and half sectional elevation and side view of a single span slab culvert
- ✓ Half sectional elevation of a single span two hume-pipe culvert

Unit–V Simple Trusses

- ✓ Types of trusses (Simple, Fink, compound fink, French truss, Pratt truss, Howe truss, North light truss, King post and Queen post truss)
- ✓ Support reactions for trusses subjected to point loads at joints
- ✓ Forces in members of truss using Method of joints, Method of sections

Building Construction

Unit – I: Building Components

- ✓ Classification of Buildings as per National Building Code Group A to I, As per Types of constructions- Load Bearing Structure, Framed Structure, Composite Structure.
- ✓ Building Components - Functions of Building Components, Substructure – Foundation, Plinth.
- ✓ Superstructure – Walls, Partition wall, Cavity wall, Sill, Lintel, Stair, Doors and Windows, Floor, Mezzanine floor, Roof, Columns, Beams, Parapet.

Unit– II Construction of Substructure

- ✓ Job Layout: Site Clearance, Layout for Load Bearing Structure and Framed Structure by Center Line and Face Line Method, Precautions.
- ✓ Earthwork: Excavation for Foundation, Timbering and Strutting, Earthwork for embankment, Material for plinth Filling, Tools and plants used for earthwork.
- ✓ Foundation: Functions of foundation, Types of foundation – Shallow Foundation: Stepped Footing, Wall Footing, Column Footing, Isolated and Combined Column Footing, Raft Foundation, Grillage Foundation. Deep Foundation: Pile Foundation, Well foundation and Caissons, Pumping Methods of Dewatering, Deep wells, Well points, Cofferdams

III Construction of Superstructure

- ✓ Stone Masonry: Terms used in stone masonry- facing, backing, hearting, Through stone, corner stone, cornice. Types of stone masonry: Rubble masonry, Ashlar Masonry and their types. Joints in stone masonry and their purpose. Selection of Stone Masonry, Precautions to be taken in Stone Masonry Construction.
- ✓ Brick masonry: Terms used in brick masonry- header, stretcher, closer, quoins, course, face, back, hearting, bat, bonding, joints, lap, frog, level and plumb and other related important terms, Bonds in brick masonry- header bond, stretcher bond, English bond and Flemish bond. Requirements of good brick masonry. Junctions in brick masonry and their purpose and procedure. Precautions to be observed in Brick Masonry Construction. Comparison between stone and Brick Masonry. Tools and plants required for construction of stone and brick masonry. Hollow concrete block masonry and composite masonry.
- ✓ Scaffolding, Shoring: Purpose, Types of Scaffolding, Process of Erection and Dismantling. Purpose & Types of Shoring, & Underpinning.
- ✓ Formwork: Definition, Requirement, Materials used, Types of Formwork, Removal of formwork as per BIS.

Unit– IV Building Communication and Ventilation

- ✓ Horizontal Communication: Doors – Components, Full Panelled / Partly panelled and Glazed Doors / Flush / Collapsible Doors, Rolling Shutters,

Revolving Doors, Fully glazed Doors. BIS for Sizes of Door.

- ✓ Windows: Component of windows, Types of Windows - Full Panelled, Partly Panelled and Glazed, wooden, Steel, Aluminum windows, Sliding Windows, Louvered Window, Bay window, Corner window, clear-storey window, Gable and Dormer window, Skylight. Size of Windows recommended by BIS. Ventilators. Fixtures, fastenings for doors & windows- material used; Functions of Window Sill, Lintels, Shed,Chajja
- ✓ Vertical Communication: Means of Vertical Communication- Stair Case, Ramps, Lift, Elevators and Escalators. Terms used in staircase - steps, tread, riser, nosing, soffit, waist slab, baluster, balustrade, scotia, hand rails, newel post, landing, headroom, winder, stringer beam, going, rising. Types of staircase (shape basis): Straight, dog-legged, open well, Spiral, quarter turn, bifurcated, Three quarter turn and Half turn, (On Material): Stone, Brick, R.C.C., wooden and Metal.

Unit– V Building Finishes

- ✓ Floors and Roofs: Types of Floor Finishes & suitability- Kota, Marble, Granite, Ceramic Tiles, Vitrified, Chequered Tiles, Paver Blocks, Concrete Floors, wooden Flooring, Skirting and Dado. Process of Laying and Construction, Finishing and Polishing of Floors, Roofing Materials- RCC, Mangalore Tiles, AC Sheets, G.I. sheets, Corrugated G.I. Sheets, Plastic and Fibre Sheets. Types of Roof: Flat roof, Pitched Roof-King Post truss, queen Post Truss, terms used in roofs.
- ✓ Wall Finishes: Plastering – Necessity of Plastering, Procedure of Plastering, Single Coat Plaster, Double Coat Plaster, Rough finish, Neeru Finishing and Plaster of Paris (POP). Special Plasters- Stucco plaster, sponge finish, pebble finish. Plaster Board and Wall Claddings. Precautions to be taken in plastering, defects in plastering. Pointing – Necessity, Types of pointing and procedure of Pointing. Painting – Necessity, Surface Preparation for painting, Methods of Application, Whitewashing and colour washing, distempering.

Concrete Technology

Unit I: Cement, Aggregates, Water and Admixture

- ✓ Physical properties of OPC and PPC: fineness, standard consistency, setting time, soundness, compressive strength. Different grades of OPC and relevant BIS codes
- ✓ Testing of cement: Field test and Laboratory tests -fineness, standard consistency, setting time, soundness, compressive strength. Storage of cement and effect of storage on properties of cement.
- ✓ BIS Specifications, field applications of different cements: Rapid hardening, Low heat, Portland pozzolana, Sulphate resisting, Blast furnace slag, High Alumina, White cement
- ✓ Aggregates: Requirements of good aggregate, Classification according to size and shape.
- ✓ Fine aggregates: Properties, size, specific gravity, bulk density, water absorption and bulking, fineness modulus and grading zone of sand, silt content and their specification as per IS 383. Concept of crushed Sand.
- ✓ Coarse aggregates: Properties, size, shape, surface texture, water absorption, soundness, specific gravity and bulk density, fineness modulus of coarse aggregate, grading of coarse aggregates, crushing value, impact value and abrasion value of coarse aggregates, specifications.
- ✓ Water: Quality of water, impurities in mixing water and permissible limits for solids as per IS: 456.
- ✓ Admixtures in concrete: Purpose, properties and application for different types of admixture such as accelerating admixtures, retarding admixtures, water reducing admixtures, air entraining admixtures and super plasticizers.

Unit II: Concrete

- ✓ Concrete: Different grades of concrete, provisions of IS 456.
- ✓ Duff Abraham water cement (w/c) ratio law, significance of w/c ratio, selection of w/c ratio for different grades, maximum w/c ratio for different grades of concrete for different exposure conditions IS 456.
- ✓ Properties of fresh concrete: Workability: Factors affecting workability of concrete. Determination of workability of concrete by slump cone, compaction factor, Vee-Bee Consistometer. Value of workability requirement for different types of concrete works. Segregation, bleeding and preventive measures.
- ✓ Properties of Hardened concrete: Strength, Durability, Impermeability.

Unit III: Concrete Mix Design and Testing of Concrete

- ✓ Concrete mix design: Objectives, ordinary concrete and controlled concrete, methods of mix design, study of mix design as per IS 10262 (only procedural steps), factors affecting concrete mix design
- ✓ Testing of concrete, determination of compressive strength of concrete cubes and cylinder at different ages, interpretation and co-relation of test results.
- ✓ Non-destructive testing of concrete: Rebound hammer test, working principle of rebound hammer and factor affecting the rebound index, Ultrasonic pulse velocity test as per IS13311 (part 1 and 2), Importance of NDT tests.

Unit IV: Quality Control of Concrete

- ✓ Concreting Operations: Batching, Mixing, Transportation, Placing, Compaction, Curing and Finishing of concrete.
- ✓ Forms for concreting: Different types of form works for different structural members, requirement of good form work. Stripping time for removal of form works per IS 456.
- ✓ Waterproofing: Importance and need of waterproofing, methods of waterproofing and materials used for waterproofing.
- ✓ Joints in concrete construction: Types of joints, methods for joining old and new concrete, materials used for filling joints.

Unit- V: Special Concrete and Extreme Weather concreting

- ✓ Special Concrete: Properties, advantages, limitation of following

Ramakrishna Mission Shilpamandira

An AICTE Approved
Self-Financed Polytechnic

Belur Math, Howrah

Syllabus Booklet

Diploma in Civil Engineering

Semester – IV (Part-II)

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

Hydraulics

Unit-I: Pressure measurement

Hydrostatic pressure

- ✓ Technical terms used in Hydraulics- fluid, fluid mechanics, hydraulics, hydrostatic & hydrodynamics - ideal & real fluid, application of hydraulics.
- ✓ Physical properties of fluid - density- specific volume, specific gravity, surface tension, capillarity, viscosity - Newton's law of viscosity.
- ✓ Types of pressure - Atmospheric Pressure, Gauge Pressure, Absolute Pressure, Vacuum Pressure. Concept of Pressure head and its unit, Pascal's law of fluid pressure and its uses. [simple numerical problems]
- ✓ Measurement of pressure at a point and differential Pressure between two points by different methods. [simple numerical problems]
- ✓ Variation of pressure with depth, Pressure diagram, hydrostatic pressure and center of pressure on immersed surfaces inclined at any angle and on tank walls. Determination of total pressure & center of pressure on sides and bottom of water tanks, sides and bottom of tanks containing two liquids, vertical surface in contact with liquid on either side. [problems]

Unit-II: Fluid Flow Parameters

- ✓ Types of flow – Gravity and pressure flow, Uniform, Non-uniform, Steady, Unsteady flow. Reynolds number, Laminar, Turbulent.
- ✓ Discharge and its unit, continuity equation of flow.
- ✓ Energy of flowing liquid: potential, kinetic and pressure energy.
- ✓ Bernoulli's theorem: statement, assumptions, equation [no deduction]
- ✓ simple numerical problems

Unit– III Flow through Pipes

- ✓ Major Head loss in pipe: Frictional loss and its computation by Darcy's Weisbach equation [Numericals]
- ✓ Minor losses in pipe: loss at entrance, exit, sudden contraction, sudden enlargement and fittings. [problems]
- ✓ Flow through pipes in series, pipes in parallel and Dupuit's equation for equivalent pipe. Hydraulic gradient line and total energy line. [problems]
- ✓ Water hammer in pipes: concept only
- ✓ Discharge measuring device for pipe flow: Venturimeter - construction & working, orifice meter- construction & working [simple numerical problems]
- ✓ Discharge measurement using Orifice, Hydraulic Coefficients of Orifice. [simple numerical problems]

Unit– IV Flow through Open Channel

- ✓ Geometrical properties of channel section: Wetted area & perimeter, hydraulic radius for rectangular and trapezoidal channel section.
- ✓ Discharge by Chezy's equation & Manning's equation. [problems]
- ✓ Most economical rectangular & trapezoidal channel section, problems
- ✓ Discharge measuring devices: Triangular & rectangular Notches [simple numerical problems]
- ✓ Velocity measurement devices: current meter, floats & Pitot's tube. [problems]
- ✓ Specific energy diagram, Froudes' Number, critical flow, super critical flow & subcritical flow, critical depth of flow, critical velocity of flow, minimum specific energy, concept of sequent depth. [numerical problems]
- ✓ Hydraulic jump, condition of its occurrence, finding alternate depth of flow [simple numerical problems]

- ✓ The following provisions are to be considered during the project planning:- a) Security room(Single room with WC, Load bearing wall structure), b) Central Park, c) Play Ground, d) Hume Pipe Culvert in between the complex and the 12m wide main road, e) Boundary Wall with main gate, f) Submersible Pump, g) Pump House (Load bearing wall structure), h) Surface Drainage System, i) Bituminous road over WBM inside the complex etc.
- ✓ The project report shall include Topographical surveying map, Architecture planning, preparation of drawing sheet –Key Plan, Site plan, a typical floor plan, roof plan with provision of drainage, sectional elevation including staircase, front view, preparation of Rough cost estimate of the project, calculation of FAR, Specification of different item of works & Cost of Land.
- ✓ The project report shall also comprise of drawing sheets of the following-
- ✓ Floor plan & front elevation of Security Room & Pump house, Plan and sectional elevation of Hume pipe culvert, Plan and front elevation of Boundary Wall with main gate, Sectional elevation of Bituminous road over WBM.
- ✓ [NOTE: In addition to conventional approach to Civil Engineering Drawing, student may also take the help of CAD in preparing their sessional works if he/she desires so.]

Text Books List

Hydraulics

- ✓ Fluid Mechanics & Hydraulic Machines, RK Bansal, Laxmi Publication
- ✓ Fluid Mechanics & Hydraulic, R.K. Rajput, S.Chand

Advance Survey

- ✓ Survey & Levelling, NN Basak, TMH
- ✓ Survey & Levelling, R.Subramanian, Oxford

Theory of Structure

- ✓ Theory of Structure, R.S. Khurmi, S.Chand

Geotechnical Engineering

- ✓ Soil Mechanics & Foundation Engineering, V.N.S. Murthy, CBS Publishers & Distributors
- ✓ Soil Mechanics & Foundation Engineering, B.C. Punmia, Ashok Kumar Jain (Laxmi Publication)
- ✓ Geotechnical Engineering, T.N. Ramamurthy, S. Chand

RCC

- ✓ Reinforced Concrete Design, N. Krishnaraju, R.N. Pranesh, New Age Publication
- ✓ R.C.C Design & Drawing, Neelam Sharma, S.K. Kataria & Sons

Steel Structure

- ✓ Limit State Design of Steel Structures, S.K. Duggal, Tata Mc-Graw Hill
- ✓ Design of Steel Structures, N.R. Chandrak, S.K. Kataria & Sons

Precast & Prestressed Concrete

- ✓ Prestressed Concrete, Muthu KU, I Azmi, J Maganti, Vijayanand M, PHI
- ✓ Prestressed Concrete Structures, P. Dayaratnam, Medtech
- ✓ Prestressed Concrete, N. Krishna Raju, McGraw Hill

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- ✓ Modular co-ordination, modular grid, and finishes
- ✓ Prefab systems: structural schemes & classification, design considerations.
- ✓ Joints – requirements of structural joints and their design considerations
- ✓ Testing of Precast components as per BIS standards
- ✓ Manufacturing, storage, curing, transportation and erection of above elements, equipment needed.

Unit– III : Introduction to Prestressed Concrete

- ✓ Principles of pre-stressed concrete and basic terminology.
- ✓ Pre-stressed concrete: Applications, advantages & disadvantages.
- ✓ Materials used and their properties, Necessity of high-grade materials
- ✓ Types of Pre-stressing steel -Wire, Cable, tendon, Merits-demerits & applications

Unit– IV : Methods & systems of prestressing

- ✓ Methods of prestressing – Internal & External pre-stressing, Pre & Post tensioning applications
- ✓ Systems for pre tensioning – process, applications, merits and demerits – Hoyer system
- ✓ Systems for post-tensioning - process, applications, merits & demerits - Freyssinet system, Magnel Blaton system, Gifford Udall system.
- ✓ Prestressing force in Cable, Loss of prestress during tensioning process - loss due to friction, length effect, wobbling, & curvature effects, (problems on loss of prestress), Loss of prestress at anchoring stage.
- ✓ Subsequent Loss of pre-stress: due to shrinkage / creep of concrete, elastic shortening, & creep in steel (Problems on loss of prestress).
- ✓ BIS recommendations for losses in case of Pre and Post tensioning.

Unit– V : Analysis & design of Prestressed rectangular beam section

- ✓ Basic assumptions in analysis of pre-stressed concrete beams.
- ✓ Cable Profile in simply supported rectangular beam section: concentric, eccentric- straight & parabolic
- ✓ Effect of cable profile on maximum stresses at mid span and at support.
- ✓ Numerical problems on determination of maximum stresses at mid spans with linear (con- centric and eccentric) cable profiles only.
- ✓ Simple steps involved in Design of simply supported rectangular beam section.

Minor Project

- ✓ Title of the Project:-Planning of (G+2) Residential Complex for Middle Income Group (as per SP-7 and rules & regulation of local bodies) for sanction before Project approval committee.
- ✓ NOTE: Same Planning, Drawings & detailing of the problem given in this semester will have to be used in Major Project I and Major Project II in semester 5 & 6.
- ✓ The details of the Project are given below:-
- ✓ Each building (RCC framed structure) shall comprise of two symmetrical flat per floor each containing two rooms, bath, WC, kitchen, front verandah with a provision of common staircase and mumty for utilization of roof space and overhead water tank (on 10000 sq m. of total land area). Ground floor to be used for parking spaces.

Unit– V Hydraulic Pumps

- ✓ Concept of pump, Types of pump - centrifugal, reciprocating, submersible.
- ✓ Centrifugal pump: parts, working
- ✓ Reciprocating pump: single / double acting; components & working.
- ✓ Suction head, delivery head, static head, Manometric head Power of centrifugal pump
- ✓ Selection and choice of pump.
- ✓ Hydraulic Machines
- ✓ Turbines-Definition and types

Advanced Surveying

Unit–I: Area & Volume Measurement

- ✓ Planimeter: Components & use.
- ✓ Cross section area Calculation - i) From field book entry, ii) From plotted Plan -Mid ordinate rule, The average ordinate rule, The trapezoidal rule, Simpson's rule.
- ✓ Computation of volume - i) The trapezoidal rule (Av. End area rule), ii) prismoidal formula.
- ✓ Volume of reservoir Measurement: from contour map, volume of earth work involved in highway & canal.
- ✓ Simple numerical problems.

Unit– II: Theodolite Surveying

- ✓ Definition, Types & uses of Theodolite, Components of transit Theodolite & functions, Reading the Vernier of transit Theodolite.
- ✓ Swinging the Telescope, Centering, Transiting, Face left, Face right, Changing Face.
- ✓ Transit Theodolite: Fundamental Lines & relationships, Temporary adjustment.
- ✓ Measurement of horizontal angle- Direct, Repetition and Reiteration method
- ✓ Measurement of magnetic bearing of a line, Prolonging and ranging a line
- ✓ Measurement of deflection angle.
- ✓ Measurement of vertical Angle.
- ✓ Theodolite traversing by included angle method, Deflection angle method & Magnetic bearing Method.
- ✓ Checks for open & closed traverse.
- ✓ Calculations of Magnetic bearing from angles.
- ✓ Traverse computation - Latitude, Departure, Consecutive coordinates, Independent coordinates, balancing the traverse by Bowditch's rule Transit rule & Third Rule, Gale's Traverse table computation.
- ✓ Errors in Theodolite Surveying- Instrumental, Personal & Natural.
- ✓ Simple numerical problems

Unit– III: Tacheometric Surveying & Curve Setting

- ✓ Tacheometry: Principles, Instruments used, & Characteristics, Anallatic lens, uses of a Tacheometer.
- ✓ Tacheometric formula for horizontal distance with telescope horizontal & staff vertical.
- ✓ Constants of tacheometer: Field method, horizontal & vertical distances by fixed hair method, & staff held vertical & normal to line of collimation (angle of elevation & depression)
- ✓ Limitations of Tacheometry Survey.
- ✓ Curves used in roads & railway alignments. Designation, Properties
- ✓ Setting simple circular curve by offsets from long chord & Rankine's method of deflection angle. [problems].

Unit–IV: Advanced Surveying Equipment

- ✓ Principle of Electronic Distance Meter (EDM), Types, its component parts & their Functions, use of EDM.
- ✓ Use of micro optic Theodolite & Electronic Digital Theodolite.

- ✓ Total Station: Features, components, Functional operation, Use, Description & use of Function keys.
- ✓ Total Station: Horizontal angles, vertical angles, distances & coordinate, Traversing, Profile Survey & Contouring.

Unit– V Remote Sensing, GPS & GIS

- ✓ Remote Sensing: Principles, Process, Components, Types, Sensors used in practice, Use in land use / Land cover, mapping, disaster management.
- ✓ Global Positioning System (GPS): Definition, Overview, Function, Principle, Application.
- ✓ Introduction to Differential Global Positioning System(DGPS)
- ✓ Geographic Information System (GIS): Definition, Overview, Components, Applications, Software.
- ✓ Introduction to Drone Surveying.

Construction Surveying

- ✓ Introduction, requirements of setting out, horizontal & vertical control
- ✓ Setting out a pipe line, Setting out of building and structure
- ✓ Staking out a highway

Theory of Structure

Unit– I: Column

- ✓ Compression member, short & long column, Effective length, Radius of gyration, Slenderness ratio, Types of end condition for columns, Buckling of axially loaded columns.
- ✓ Euler's theory: assumptions & limits, Application to buckling load.
- ✓ Rankine's formula: application to calculate crippling load.
- ✓ Working load/safe load, design load and factor of safety. Simple problems

Unit – II: Direct & Bending Stresses in vertical members

- ✓ Axial & eccentric loads, combined stress, eccentricity about principal axis, Stresses: Nature, Max & min. resultant stress distribution diagram.
- ✓ Condition for no tension or zero stress at extreme fiber, Limit of eccentricity, core of section for rectangular & circular cross sections, Middle third rule.
- ✓ Chimneys of circular cross section subjected to wind pressure, Max. & min stresses, resultant stress distribution diagram at base.
- ✓ Analysis of dams subjected to horizontal water pressure, conditions of stability, Max & min stresses, resultant stress distribution diagram at base, numerical problems.

Unit–III: Slope and Deflection

- ✓ Beams: slope & deflection, stiffness, Bending moment, slope, deflection, radius of curvature & relationships.
- ✓ Moment Area method for slope & deflection of cantilever, simply supported beams subjected to point load & UDL on entire / partial span.
- ✓ Simple numerical problems.

Unit-IV: Fixed and Continuous Beam

- ✓ Concept of fixity, effect of fixity, advantages & disadvantages of fixed beam over simply supported beam.
- ✓ Superposition Principle, End moments / reactions, SF & BM diagrams for a fixed beam subjected to point loads, UDL on entire span.
- ✓ Continuous Beam: Effect of continuity, nature of moments induced due to continuity, concept of deflected shape, practical examples.
- ✓ Clapeyron's theorem of three moment, Application to maximum up to three spans and two unknown support moment only [no end is fixed in continuous beam], Support at same

- ✓ Layout of a building for a given problem (building of any type consisting of a frame structure or load bearing walls system or composite structure). Plotting the Layout Plan of the building on A-1 size imperial drawing sheet.

Hydraulics Lab

- ✓ Piezometer to measure pressure at a given point.
- ✓ Bourdon's Gauge to measure pressure at a given point.
- ✓ U tube differential manometer to measure pressure difference between two given points.
- ✓ Bernoulli's apparatus for total energy line for a flow in a closed conduit of varying cross sections.
- ✓ Friction factor Apparatus to determine friction factor for a pipe.
- ✓ Calibrate Venturimeter to find out the discharge in a pipe.
- ✓ Calibrate the Orifice to find out the discharge through a tank
- ✓ Use Pitot tube to measure velocity of flow of water in open channel.
- ✓ Use triangular notch to measure the discharge through open channel.
- ✓ Use Rectangular notch to measure the discharge through open channel.

Geotechnical Engineering Lab

- ✓ Identification of rocks from specimen.
- ✓ Water content of soil sample by oven drying method : IS: 2720 (Part- II).
- ✓ Pycnometer method for Specific gravity of soil : IS 2720 (Part- III).
- ✓ Determine dry unit weight of soil in field by core cutter method as per IS 2720 (Part- XXIX).
- ✓ Determine dry unit weight of soil in field by sand replacement method as per IS 2720 (Part- XXVIII).
- ✓ Plastic, Liquid, Shrinkage Limits, & Plasticity Index of soil sample IS 2720 (Part V)
- ✓ Identify & classify soils by field testing: Visual inspection, Dry strength, Dilatancy, & Toughness test; Grain size distribution of soil sample: IS 2720 (Part IV)
- ✓ Constant head / Falling head tests for Coefficient of permeability: IS 2720 (Part- XVII).
- ✓ Determine shear strength of soil by Direct Shear Test: IS 2720 (Part-XIII), Vane Shear Test: IS 2720 (Part XXX)
- ✓ Determine MDD and OMC by standard Proctor test of given soil sample as per IS 2720 (Part- VII).
- ✓ Determination of CBR value on the field as per IS2720 (Part - XVI).

Precast & Prestressed Concrete

Unit – I : Precast concrete Elements

- ✓ Advantages and disadvantages of precast concrete members
- ✓ Non-structural Precast elements- Paver blocks, Fencing Poles, Transmission Poles, Manhole Covers, Hollow and Solid Blocks, kerb stones as per relevant BIS specifications (Overall Idea)
- ✓ Structural Precast elements – tunnel linings, Canal lining, Box culvert, bridge panels, foundation, sheet piles (Overview without detail design)
- ✓ Testing of Precast components (BIS)

Unit– II : Prefabricated building

- ✓ Precast Structural Building components: slab panels, beams, columns, footings, walls, lintels & chajjas, stair case elements.
- ✓ Prefabricated building using precast load bearing & non-load bearing wall panels, floor systems - Material characteristics, Plans & Standard specifications

- ✓ Bolted Connection; Types of bolts– Bearing type Bolts– Nominal & Design shear strengths of bolts– Reduction factors for Long joints, Large grip lengths, Thick packing plates– Nominal & Design bearing strengths of bolts– Reduction factors for oversized & slotted holes– Nominal & Design tensile strengths (tension capacity) of bolts- Problems.
- ✓ Welded Connection- Types of welds– Fillet welds– Minimum & maximum sizes– Effective length of weld- Fillet welds on inclined faces–- Design strengths of shop/site welds– Butt welds– Effective throat thickness & effective length of butt weld- Simple problems.

Unit- V: Design of Steel Beams For BM and SF by L.S.M

- ✓ General-Formation of Plastic hinges in Flexural members– Plastic Moment of Resistance & Plastic Modulus of Sections– Shape Factors of rectangular / circular/ I / T-Sections– Collapse load.
- ✓ Effective span of Beams, Design strength of bending,(Flexure), Limiting deflection of beams – Design of laterally supported Simple beams for Bending moment & Shear force using single / double rolled steel sections (symmetrical cross sections only) – Problems.

RCC Design

- ✓ Design of Slab, Column, Footing, Stair

Design of Steel Structures

- ✓ Design of Tension member, Compression member, Truss

Basic Surveying Field Practice

- ✓ Chain & compass traverse survey – simple closed traverse of minimum five sides enclosing a building / site: Reconnaissance, preparation of index map, selection & finalisation of survey station, taking FB & BB of lines, ranging a line, chaining a line, taking offset with chain & tape, setting out right angles, calculation of included angles, angular error adjustment, closing error and its balancing by Bowditch method, locating details and plotting them on a A1 size imperial drawing Sheet.
- ✓ Profile & Cross-section Levelling – running a longitudinal section for a length ≥250 m for a road using dumpy /auto level & levelling staff. At least four cross sections shall be taken suitably. Undertake fly leveling to check the precision of levelling. Plotting alignment (at least one deviation), L- section including profile leveling & Cross section on a A1 size imperial sheet. All data will be booked in standard level book. Arithmetical check will have to be performed each and every pages.
- ✓ Block contouring: of suitable area with spot levels at suitable interval will be chosen for plotting contours by indirect method on A-1 size imperial drawing sheet with a contour interval suitable for the site.
- ✓ Measure area of irregular figure using Simpson / trapezoidal formula, Graph paper, Digital planimeter.
- ✓ Plane table surveying –accessories & their function; centering, levelling & orientation of plane table; traversing by plane table; plane table surveying around a building / small area of closed traverse of min four sides suitably including filling in details by radiation, intersection and traversing method on A1 size imperial drawing sheet.

level [no yield] spans having same and uniform moment of inertia subjected to concentrated loads and UDL over entire span, SF diagrams with point of contraflexure, shear and BM diagrams showing net BM & point of contraflexure for continuous beams. Simple numerical problems.

Unit–V: Moment distribution method

- ✓ Introduction to moment distribution method, sign convention, Carry over, stiffness, & distribution factors.
- ✓ Moment distribution method for continuous beams subjected to point & UDL over entire span having same moment of inertia, supports at same level, up to two spans.
- ✓ Introduction to portal frames.
- ✓ Simple numerical problems.

Strain Energy

- ✓ Types of loading – gradual, suddenly applied load & Impact load
- ✓ Definition of strain energy, modulus of resilience and proof resilience.
- ✓ Comparison: stresses due to gradual load, sudden load & impact load.

Geotechnical Engineering

Unit – I: Overview

- ✓ Introduction, Definition of a rock: Classification by origin, formation. Uses of igneous, sedimentary, metamorphic rocks.
- ✓ Importance of soil as construction material & as supporting medium for structures.
- ✓ Field application for design of: Foundation, Pavement, Earth retaining structures, Earthen dam.

Unit– II: Physical & Index Properties of Soil

- ✓ Soil as three phase system, water content, purpose & determination of water content: oven drying method (per BIS), void ratio, porosity & degree of saturation, density index, Bulk & dry unit weight of soil mass, unit weight of solids, saturated & submerged unit weight & their relations, purpose & determination of bulk & dry unit weight by core cutter & sand replacement method, Specific gravity by pycnometer.
- ✓ Consistency of soil, Atterberg limits of consistency: Liquid, plastic, & shrinkage limits. Indices: Plasticity, liquidity, consistency, & toughness index & their significance.
- ✓ Particle size distribution test & curve, uniformity coefficient & coefficient of curvature, Determination of effective diameter of soil, well graded and uniformly graded soils
- ✓ Importance of soil classification system, BIS classification of soil.
- ✓ Simple numerical problems

Unit– III : Permeability and Shear Strength of Soil

- ✓ Permeability: Definition, Darcy's law, & affecting factors; Coefficient of permeability, determination of coefficient of permeability by constant, & falling head tests, simple problems to determine coefficient of permeability.
- ✓ Seepage through earthen structures, seepage velocity, & pressure, phreatic, flow, & equipotential lines, flow net characteristics & application
- ✓ Shear failure of soil, concept of shear strength of soil. Components of shearing resistance – cohesion, internal friction. Mohr-Coulomb failure theory, Strength envelope, strength equation for purely cohesive & cohesion less soils. Laboratory methods for shear strength

parameters -Direct shear, triaxial, unconfined compression test & vane shear test –application & importance, unconfined compressive strength

- ✓ Simple numerical problems.

Unit– IV: Bearing Capacity of Soil and Earth Pressure

- ✓ Bearing capacity: Concept, Ultimate &, Safe bearing capacity; allowable bearing pressure. Bearing capacity of shallow foundation, Terzaghi's analysis & assumptions, effect of water table on bearing capacity, bearing capacity determination (BIS)
- ✓ Field methods for bearing capacity – Plate load & Standard Penetration Test, as per IS:1888 & IS:2131.
- ✓ Introduction to deep foundation – pile, caisson & well foundations. Bearing capacity of pile foundation – dynamic formula (Engineering News & modified Hilley's formula) & static formula, problems based on dynamic formula, Piles: negative skin friction, & group action.
- ✓ Earth pressure: Definition, Active & Passive earth pressure for horizontal backfill (no inclination) including surcharge on moist soil, coefficient of earth pressure, Rankine's theory & assumptions, extension of earth pressure theory to cohesive soil only for horizontal backfill including surcharge on moist soil [ground water table well below foundation level], Simple numerical problems.

Unit– V Compaction, consolidation, stabilization and exploration of soil

- ✓ Compaction & its importance, Standard & Modified proctor test (BIS) Compaction curve for: Optimum moisture content (OMC), maximum dry density(MDD), Zero air voids line. Factors affecting compaction, field methods of compaction – rolling, ramming, & vibration. Suitability of compaction equipments- smooth wheel roller, sheep foot roller, pneumatic tyred roller, Rammer & Vibrator, Compaction *vs*. Consolidation.
- ✓ One dimensional consolidation & consolidation settlement (simple numerical problems on compaction).
- ✓ Soil stabilization: necessity, methods.
- ✓ Necessity of site investigation & soil exploration: Types of exploration, criteria for location & number of test pits & bores, sample soil exploration report, Field identification of soil: dry strength, dilatancy, toughness test
- ✓ Well foundations
- ✓ Ground Improvement techniques

Design of RCC & Steel Structure

Unit I: Introduction

- ✓ Aim of design, Concept of R.C.C., Necessity of steel as reinforcement & its position in a Simply Supported & continuous member.
- ✓ Functional & Structural Design.
- ✓ Scope of a Structural Designer- Structural Planning, Calculation of loads, Analysis, Design & Detailing, Advantages of symmetrical planning over un-symmetrical planning
- ✓ Loads: Dead load, Imposed load, Wind loads & other loads as per IS 875(Part-I to Part III)
- ✓ Earthquake forces. IS 1893 (Part -1), Seismic zones, Combination of loads.
- ✓ Introduction of IS 456 and SP-16
- ✓ Detailing- intro to SP-34 & IS 13920.
- ✓ Necessity of IS 13920 & Definition, types of limit states, partial safety factors for materials strength, characteristic strength, characteristic load, design load. Loading on structure as per IS 875.

Unit II: Analysis & Design of Singly & Doubly Reinforced Sections by LSM and Shear, Bond and Development Length (LSM)

- ✓ Limit State of collapse (Flexure), Assumptions, stress-Strain relationship for concrete & steel, neutral axis, Stress block & Strain diagram for singly reinforced section.
- ✓ Concept of under- reinforced, over-reinforced and balanced section, neutral axis co- efficient, limiting value of moment of resistance, limiting percentage of steel required for balanced singly R.C. Section.
- ✓ Problems on design constants, moment of resistance and area of steel.
- ✓ General features, necessity of providing doubly reinforced Section, reinforcement limitations.
- ✓ Analysis of doubly reinforced section, strain diagram, stress diagram, depth of neutral axis, moment of resistance of the section.
- ✓ Problems on moment of resistance and design of beam sections.
- ✓ Nominal Shear stress in R.C. Section, design shear strength of concrete, maximum shear stress, Design of shear reinforcement, Minimum shear reinforcement, forms of shear reinforcement.
- ✓ Bond and types of bond, Bond Stress, check for bond stress, Development length in tension and compression, anchorage value for hooks 90° bend and 45° bend Standard Lapping of bars, check for development length.
- ✓ Problems on requirement of shear reinforcement, check for adequacy of section in shear. Design of shear reinforcement;
- ✓ Minimum shear reinforcement in beams; Determination of Development length required for tension reinforcement of cantilevers beam & slab, check for development length.

Unit III: Analysis & Design of T-Beam and Lintel by LSM

- ✓ General features, advantages, effective width of flange (IS:456).
- ✓ Analysis of singly reinforced T-Beam, strain diagram & stress diagram, depth of neutral axis, moment of resistance of T-beam Section
- ✓ T-beam Design for moment & shear: Neutral axis within or up to flange bottom [problems on effective flange width, moment of resistance, design a T beam for the case of neutral axis lies within the flange only]
- ✓ Design of lintel for flexure & shear (all cases of loading]) - [Problems on design of lintel for flexure & shear [triangular or rectangular loading]

Unit IV: Introduction & Design of Steel Connections & Detailing by LSM

- ✓ Advantages & disadvantages of steel as construction material. Types of sections, Grades of steel (IS 2062) & strength characteristics; Use of Steel table (SP6-Part1).
- ✓ Geometrical properties of gross & effective cross sections – Classification of Cross Sections as per IS: 800-2007 – Internal, external (outstands) & tapered elements of sections– Maximum Effective Slenderness ratio.
- ✓ Types of connections: Bolted, Riveted & Welded; Rigid & Flexible connections Components of connections; Basic requirements of connections- Clearance for holes– Min & Max spacing of fasteners– Minimum edge/end distances– Requirements of Tacking fasteners.

Ramakrishna Mission Shilpamandira

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Belur Math, Howrah

Syllabus Booklet

Diploma in Civil Engineering

Semester – V (Part-III)

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

Water Resource Engineering

Unit-I: Introduction to Hydrology

- ✓ Hydrology: Definition and Hydrological cycle
- ✓ Rain Gauge: Symons rain gauge, automatic rain gauge
- ✓ Methods of calculating average rainfall: Arithmetic mean, Isohyetal, & Theissen polygon method.
- ✓ Runoff, concept of hydrograph, Factors affecting Run off, Computation of run–off [using runoff coefficient method]
- ✓ Maximum Flood Discharge measurement: Rational methods, Simple numerical problems.
- ✓ Simple numerical problems.

Unit-II: Crop water requirement and Reservoir Planning

- ✓ Irrigation and its classification
- ✓ Crop Water requirement: Cropping seasons, Crop period, base period, Duty, Delta, CCA, GCA, intensity of irrigation, factors affecting duty, methods for improving duties, Problems on water requirement and capacity of canal, Kor irrigation, kor depth of water, kor period, paleo irrigation, capacity factor, outlet factor, time factor, cumec day, overlap allowance
- ✓ Methods of application of irrigation water, their merits and demerits, suitability
- ✓ Silting of reservoir, Rate of silting, factors affecting silting and control measures.
- ✓ Control levels & storage in reservoir definition of different related technical terms explained with a neat sketch, Area capacity curve

Unit– III Dams and Spillways

- ✓ Dams and its classification: Earthen dams and Gravity dams (masonry and concrete)
- ✓ Earthen Dams – Components with function, typical cross section, seepage through embankment and foundation and its control.
- ✓ Methods of construction of earthen dam, types of failure of earthen dam and preventive measures.
- ✓ Gravity Dams – Forces acting on dam, Theoretical and practical profile, typical cross section, inspection gallery, drainage gallery, joints in gravity dam, concept of high dam and low dam.
- ✓ Spillways - Definition, function, location, types, spillway gates - types and function, Energy dissipaters and types.

Unit– IV Minor & Micro Irrigation

- ✓ Bandhara irrigation: Layout, components, construction and working, solid and open bandhara.
- ✓ Percolation Tanks – Need, selection of site.
- ✓ Lift irrigation Scheme - Components and their functions
- ✓ Drip and Sprinkler Irrigation- Need, components
- ✓ Well irrigation: types and yield of wells, advantages & disadvantages of well irrigation

Unit–V: Diversion Head Works & Canals

- ✓ Weirs – components, parts, types only
- ✓ Diversion head works – Layout, components and their function.
- ✓ Barrages – components and their functions. Difference between weir and Barrage.

- ✓ The following provisions are to be considered during the project planning: - a) Security room (Single room with WC, Load bearing wall structure), b) Central Park, c) Play Ground, d) Hume Pipe Culvert in between the complex and the 12m wide main road, e) Boundary Wall with main gate, f) Submersible Pump, g) Pump House (Load bearing wall structure), h) Surface Drainage System, i) Bituminous road over WBM inside the complex etc.

The project report shall include: -

- ✓ Load calculation & design of all structural components, structural details – rein- forcement of: floor slab (as a whole), critical beam, central column and corner column including footing (Drawing of trench plan), tie beam (tie beam layout plan, and rein- forcement detailing), stair with landing etc.
- ✓ Details structural drawing of
  a) RCC footing, Column, Beam, Lintel & chajja, staircase – landing slab & waist slab, stringer beam etc., floor slab and roof slab
  b) drawing of various types of doors and windows etc. used in construction
- ✓ Prepare bar bending schedule and determine cutting length of all structural items of workshop
- ✓ Prepare a design mix for the project
- ✓ Specification of different items of works.

Text Books List

Water Resource Engineering

- ✓ Irrigation Engineering, N.N. Basak, Tata McGraw Hill.
- ✓ Irrigation and Hydraulic Structures, Santosh Kumar Garg, Khanna Publishers, Delhi.

Estimating, Costing and Valuation

- ✓ Estimating, Costing, Specification & Valuation in Civil Engineering M. Chakraborty.
- ✓ PWD Schedule of Rates, IS-1200.

Advanced Design of Structures

- ✓ Design of Steel Structures, N. R. Chandak, Katson Books
- ✓ Limit State Design of Steel Structures, S.K. Duggal, Tata McGraw Hill
- ✓ R.C.C. Design & Drawing, Neelam Sharma, Katson Books
- ✓ R.C.C. Designs, B.C Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publisher.
- ✓ Reinforcement Concrete Design, N. Krishna Raju, R.N. Pranesh, New Age Publication.

Building Services and Maintenance

- ✓ Building Services, Subhash. M. Patil, S. M Patil & Savita S. Patil.
- ✓ Maintenance Engineering, B.S Nayak, Khanna Publishers.

Safety Engineering & Management in the Construction Sector

- ✓ Akhil Kumar Das, Principles of Industrial Safety Management, PHI
- ✓ S.C. Sharma and Vineet Kumar, Safety, occupational health and Environmental Management in Construction.

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- ✓ Methods of stack measurement at site for stone chips etc.
- ✓ Prepare detailed estimate of steel roof truss.

Water Resource Engg. Practices

- ✓ Calculate average rainfall for the given area using isohyetal, Theissen polygon method.
- ✓ Compute the yield of Catchment area demarcated above.
- ✓ Delineation of contributory area for the given outlet from the given topo sheet
- ✓ Estimate water requirement of crops in different season from data provided by the subject teacher.
- ✓ Estimate capacity of the canal for the data provided by subject teacher
- ✓ Calculate reservoir capacity from the data provided by subject teacher.
- ✓ Draw a neat sketch showing different control levels and storage for a reservoir.
- ✓ Draw a labeled sketch of the given different types of earthen dam section
- ✓ Draw the theoretical and practical profile of the given high type gravity dam section.
- ✓ Draw a labeled sketch of the given diversion head works & Cross Drainage works.
- ✓ Draw a labeled sketch of a canal section - a. in partly cutting and partly filling b. fully in cutting c. fully in filling.
- ✓ Prepare a presentation on the technical details of any one micro or minor irrigation scheme.
- ✓ Prepare a model of any irrigation structure using suitable material.
- ✓ Prepare summary of the technical details of any existing water resource project in West Bengal

Major Project I

- ✓ The project report shall be in the following format:(The project shall be undertaken by a group of 4 to 6 students)
  - Topic and objectives
  - Collection of data, required survey work,
  - Management & construction procedure
  - Resources scheduling & networking
  - Design details
  - Required drawing set
  - Utility to society if any
  - Conclusion

NOTE: Same Planning, Drawings and detailing of the problem given in the semester 4 will have been used in Major Project I and Major Project II in semester 5 and 6. All drawing will be done using CAD.

Contents: -

- ✓ Title of the Project:-Planning and designing of (G+2) Residential Complex for Middle Income Group.
- ✓ The details of the Project are given below:-(Same topic from the 4th semester shall be considered)
- ✓ Each building (RCC framed structure) shall comprise of two symmetrical flat per floor each containing two rooms, bath, WC, kitchen, front verandah with a provision of common staircase and mumty for utilization of roof space and overhead water tank (around 210 sq m. covered area for each building unit and total 100 Nos of flat in the Complex of around 10000 sq m. of total land area) Ground floor to be used for parking spaces.

- ✓ Canals – Classification according to alignment and position in the canal network, Cross section of canal in embankment and cutting, partial embankment and cutting, balancing depth, Design of most economical canal section.
- ✓ Canal lining - Purpose, material used and its properties, advantages.
- ✓ Cross Drainage works - Aqueduct, siphon aqueduct, super passage, level crossing.
- ✓ Canal regulators - Head regulator, Cross regulator, Escape, Falls and Outlets

Estimating, Costing & Valuation

Unit–I Fundamentals of Estimating and Costing

- ✓ Estimating and Costing – Meaning, purpose, Administrative approval, Technical Sanction
- ✓ Types of estimates – Approximate and Detailed estimate.
- ✓ Types and Uses of Estimates: Revised estimate, Supplementary estimate, Repair and maintenance estimate, renovation estimate.
- ✓ Checklist of items in load bearing and framed structure.
- ✓ Standard formats of Measurement sheet, Abstract sheet, Face sheet.
- ✓ Modes of measurement and desired accuracy in measurements for different items of work as per IS:1200
- ✓ Rules for deduction in different category of work as per IS:1200.
- ✓ Description / specification of items of building work as per PWD
- ✓ Approximate estimate for roads, culvert

Unit– II Approximate Estimates

- ✓ Approx estimate Definition, Purpose
- ✓ Methods of approximate estimate - Service unit method, Plinth area rate method, Cubical content method, Approximate quantity method (with simple numerical)

Unit– III Detailed Estimate

- ✓ Detailed Estimate- Definition and Purpose, Data required for detailed estimate - Civil cost, GST, Contingencies, Supervision charges, Agency charges, Procedure for preparation of detailed estimate- Taking out quantities and Abstracting.
- ✓ Long wall and Short wall method, Centre line method – for building
- ✓ Bar bending schedule for footing, column, beam, Lintel, chajja and slab elements
- ✓ Provisions in detailed estimate: contingencies, work charged establishment, percentage charges, water supply and sanitary Charges and electrification charges etc.
- ✓ Prime cost, Provisional sum, Provisional quantities, Bill of quantities, Spot items or Site items.

Unit– IV Estimate for other Civil Engineering Works

- ✓ Earthwork - Quantities for roads, Embankment and canal by – Mid sectional area method, mean sectional area method, Prismoidal and trapezoidal formula method.
- ✓ Detailed estimate for septic tank, Community well.
- ✓ Case study: steel structure - industrial shed, chimney, transmission tower & like structure, frame & shutter of door window (wooden, steel)

Unit– V Rate Analysis & Valuation

- ✓ Rate Analysis: Definition, purpose and importance.
- ✓ Lead (Standard and Extra), lift, overhead charges, water charges and contractors' profit,
- ✓ Procedure for rate analysis.
- ✓ Task work- Definition, types. Task work of different skilled labour for different items.
- ✓ Categories of labours, their daily wages, types and number of labours for different items of work.
- ✓ Transportation charges of materials - Lead and Lift, Hire charges of machineries and equipment's.
- ✓ Preparing rate analysis of different items of work pertaining to buildings and roads.
- ✓ Definition, purpose and importance of valuation.
- ✓ Factors affecting the value of a property. Simple definitions and concepts on scrap value, salvage value, market value, booked value, assessed value, sinking fund, de-preciation, obsolescence.
- ✓ Different methods of valuation.

Advanced De-sign of Structures

Unit–I: Design of Concrete Slab (LSM)

- ✓ Design and detailing of simply supported one-way slabs for flexure, check for deflection control, and shear.
- ✓ Design and detailing of one-way cantilever slabs and cantilevers chajjas for flexure, check for deflection control and check for development length and shear.
- ✓ Design and detailing of two-way simply supported slabs for flexure with corner free to lift.
- ✓ Design and detailing of dog-legged stair.
- ✓ Simple numerical problems on design of one-way simply supported slabs, cantilever slab, two-way simply supported slab, waist slab and landing slab of a dog-legged stair.

Unit – II: Design of Axially Loaded Concrete Column & Footing(LSM)

- ✓ Assumptions in limit state of collapse – compression
- ✓ Definition and classification of columns, effective length of column. Specification for minimum reinforcement; cover, maximum reinforcement, number of bars in rectangular, square and circular sections, diameter and spacing of lateral ties.
- ✓ Analysis & design of axially loaded short, square, rectangular & circular columns with lateral ties only; check for short column & check for minimum eccentricity may be applied.
- ✓ Types of footing, Design of isolated square footing of uniform thickness for flexure, and shear.
- ✓ Simple numerical problems on the design of axially loaded short columns and isolated square footing.

Unit–III Design of Steel Tension Members & Compression Members by L.S.M

- ✓ Tension Members-introduction & different provision of relevant code, Design Strength of Tension members against yielding of gross section requirements: Deflection limits, Vibration, Durability & Fire resistance against rupture of critical section & due to block shear.

- ✓ Prepare a plan and draw a sectional elevation showing reinforcement detailing for a typical isolated square footing having one column
- ✓ Prepare a plan & draw a sectional elevation showing reinforcement detailing of a typical waist slab & landing for single flight of a dog-legged stair
- ✓ Prepare a plan and draw a sectional elevation showing reinforcement detailing of a typical lintel with chajja
- ✓ Interpret the actual RCC Structural Drawings used on site with reference to reinforcement details of various structural elements and prepare a checklist for reinforcement provided from actual drawings used on site for various structural elements.
- ✓ Prepare a detailed report of site visit for reinforcement detailing of structural elements like beams, columns, staircase & footing.
- ✓ Prepare a detailed report of site visit for study of different elements of a bridge and roof truss

Estimating, Costing & Valuation Practices

- ✓ Prepare the list of items to be executed with units for detailed estimate of a given structure from the given drawing.
- ✓ Prepare a report on market rates for given material, labour wages, hire charges of tools & equipment required to construct the structure as mentioned above.
- ✓ Study of items with specification given in the PWD Schedule of Rates. (for any ten item)
- ✓ Recording in Measurement Book (MB) for any four items
- ✓ Prepare bill of quantities of given item from actual measurements.
- ✓ Prepare approximate estimate for the given civil engineering works for buildings, road and culvert.
- ✓ Prepare detailed estimate from the given set of drawings using "standard measurement & abstract format" for (G+1), 2 BHK RCC framed structure Residential Building using description of item from PWD Schedule of Rates along with face sheet & prepare quarry chart, lead statement.
- ✓ Prepare detailed estimate from the given set of drawings of Door (panelled door) & Window (partly glazed) - frame & shutter [wooden]
- ✓ Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m X 4 m with bar bending schedule (footing, column, beam, lintel with chajja, slab)
- ✓ Prepare rate analysis for the given five items of works.
- ✓ Prepare detailed estimate of road of one kilometre length from the given drawing.
- ✓ Prepare detailed estimate of small Septic tank from the given set of drawings.
- ✓ Prepare detailed estimate of Tube well with Hand pump from the given set of drawing.
- ✓ Assess the valuation of an old building from the given drawing by any one method.
- ✓ Prepare detailed estimate for a two lane bituminous road & culvert (slab type)

construction, design & use of gangways, floors, ladders of different types, scaffolds of different types, other safety requirements while working at height, prevention of falls at floor level.

- ✓ Potential tripping, slipping hazards. Precautions from falling of materials. Laws & Regulations– Relevant Provisions of Building & Other Construction Workers (Regulation of Employment & Conditions of Service) Act & Rules – National Building Codes.

Unit IV: Hygiene Concept, definition and importance of hygiene in construction industry : Difference between domestic hygiene & industrial hygiene. Physical hazards – heat stress & its control, ventilation, noise, vibration, illumination, thermal radiation, X rays, ultra violet radiation, ionizing & non-ionizing radiations, sensitization to different air, water & waste water, soil contaminant related to construction industries, permissible exposure limits, effects of exposure, preventive and control measures.

V: Strategic management & planning for prevention & control of contaminant discharge from process operation in construction industries: sensitization to process operations in construction industries, identification of sources of contamination & hazards, planning for control & prevention, implementing measures, safety audits, noncompliance reports, turnaround time for post audit compliance & implementation through proper measures

Design of R.C.C and Steel Structure Practices

- ✓ Draw any five commonly used rolled steel sections and five built up sections.
- ✓ Summarize the provisions of IS 800 required for the design of
  a) Tension member,
  b) Compression members,
  c) Flexural members in report form.
- ✓ Draw sketches for a) single lacing, b) double lacing, & c) battening of a given built up columns.
- ✓ Draw cross section, strain diagram & stress diagram for a) singly reinforced section, & b) doubly reinforced section.
- ✓ Draw sketches of different types of column footings.
- ✓ Prepare a plan and draw sectional elevation showing reinforcement detailing in the longer and shorter direction of a single span [four edges discontinuous] for a) one way slab, & b) two way slab
- ✓ Prepare a plan and draw sectional elevations showing reinforcement detailing in the longer and shorter direction of two or more span of a two-way slab (having two adjacent edges discontinuous) inclusive of reinforcement for negative moment at support and torsional reinforcement where required.
- ✓ Draw a sectional elevation showing reinforcement detailing of a beam having three span of unequal/equal length with cross section details at mid span & support

- ✓ Problems on determination of design strength of given members & designing tension members using rolled steel sections for given loads.
- ✓ Compression Members - Effective Length and Effective Sectional Area of Compression members, Design Stress and design strength – Buckling Class of cross sections– Im- perfection factor– Stress reduction factor– Thickness of elements.
- ✓ Analysis and design of axially loaded column.
- ✓ Introduction to lacing and battening (No numerical problem on Lacing and Battening).

Unit- IV Column Bases by L.S.M

- ✓ Slab base and Gusseted base – Code Provisions (IS:800-2007) – Minimum thickness and Effective Area of Base plate.
- ✓ Design of Slab base for axially loaded columns using bolts /welds.
- ✓ Introduction to Gusseted base (no numerical problems on gusseted Base).

Unit–V Steel Roof Truss

- ✓ Types of steel roof truss & its selection criteria.
- ✓ Calculation of panel point load for Dead load; Live load and wind load as per I.S. 875- 1987.
- ✓ Analysis and Design of steel roof truss. Design of Angle purlin as per I. S. Arrangement of members at supports.

Building Services &Maintenance

Unit I: Overview of Building Services

- ✓ Introduction to building services, Classification of buildings as per National Building code;
- ✓ Necessity of building services, Functional requirements of building, Building services: HVAC (Heat, Ventilation & AC), lifts & Escalators, fire safety, protection & control, plumbing services, rain water harvesting, solar water heating system, lighting, lightening proof arrangement in building, acoustics, sound insulation & electric installation etc.
- ✓ Role and responsibility of Building Service Engineers, Plumbers, licensing of a plumber,
- ✓ BMS (Building Management Services) Introduction & Role of BMS, concept of smart building.

II: Modes of vertical communication

- ✓ Objectives and modes of vertical communication in building.
- ✓ Lifts: Different types of lifts and its uses, Component parts: Lift Well, Travel, Pit, Hoist Way, Machine, Buffer, Door Locks, Suspended Rope, Lift Car, Landing Door, Call Indicators, Emergency Call Push, machine room etc.,
- ✓ Design provisions for basic size calculation of space enclosure to accommodate lift services, number of required lifts in multi storeyed apartment, Safety measures.
- ✓ Escalators: Different Types of Escalators & its Uses, Components of escalators, Design provisions for basic size calculation of space enclosure to accommodate escalator services, Safety measures.
- ✓ Ramp: Necessity, design consideration, gradient calculation, layout & Special features required for physically handicapped and elderly, safety measures.

Unit– III Fire Safety

- ✓ Fire protection requirements for multi-storeyed building, causes of fire in building, Fire detecting and various extinguishing systems, Working principles of various fire protection systems.
- ✓ Safety against fire in residential and public buildings (cinema hall, theatre hall, mall and other multi-storeyed buildings), National Building Code provision for fire safety, Fire resisting materials and their properties, Fire resistant construction, procedures for carrying out fire safety inspections of existing buildings, Provisions for evacuation.

Unit– IV Plumbing Services

- ✓ Importance of plumbing, AHJ (Authority Having Jurisdiction) approval, Plumbing Terminology and fixtures: Terms used in plumbing, Different types of plumbing fixtures, shapes/ sizes, capacities, situation and usage, Traps, Interceptors.
- ✓ System of plumbing for building water supply: storage of water, hot and cold water supply system.
- ✓ System of plumbing for building drainage: Types of drainage system such as two pipe system, one pipe system, types of Vents and purpose of venting, Concept of grey water and reclaimed water, maintenance of building drainage.
- ✓ Different types of pipes, common joints and valves, materials, and jointing methods, fittings, hanger, supports and valves used in plumbing and their suitability.

V. Lighting, Ventilation & Acoustics

- ✓ Concept of SWH (Solar water heating), component parts of SWH, various system of SWH (heat transfer, propulsion, passive direct system, active direct system, Do- it-yourself), installation, maintenance.
- ✓ Concept of lighting, types of lighting (natural and artificial), factors influencing the brightness of room, factors affecting selection of artificial lighting, installation of light (direct, half-direct, indirect, half-indirect and direct- indirect), types of light control (manual switch, one way and two way switch, remote switch, timer switch and photo-electric cell switch), types of lamps (incandescent, tungsten halogen and electric discharge), Lamp selection as per room sizes.
- ✓ Concept of ventilation, necessity and Types of ventilation.
- ✓ Building Acoustic, Objectives, acoustic Control in a building, acoustic material (porous absorber and cavity resonator), factors to be considered in acoustic design of cinema halls and auditoriums.

Safety Engineering & Management in the Construction Sector

Unit I: Safety Philosophy

- ✓ Physical, Physiological & Psychological Factors of Safety. Safety Education &Training. Employees Participation in Safety. Economics of Safety. Behavioral Safety culture & motivation. Safety Laws: Provisions of Factories Act & Rules, Employees State Insurance Act.

Unit II: Safety Management system & Guidelines

- ✓ Key elements of Safety Management system & Guidelines (ISO 14001, ISO 45001: 2018/ OHSAS 18001 etc.), ILO Legislation–Convention & Recommendation concerning Safety.
- ✓ Health & Environment – Safety, Health & Environment as Human Right Issue, Awareness programme, types of occupational health hazards in industries, physical, chemical, biological, mechanical & psychological hazards.
- ✓ Common work related or occupational diseases, occupations involving risk of contracting these diseases, mode of causation of the diseases & its effect, diagnostic methods, methods of prevention, notifiable occupational diseases, compensation for occupational diseases, evaluation of injuries, medical services in an industrial establishment and its functions, occupational health audit & survey
- ✓ Occupational diseases relating to construction work, emergency medical treatment of injuries & rehabilitation at construction site. Personal protective equipment Introduction & requirements & assessment of PPE, type of PPE.
- ✓ Non respiratory personal protective devices: head protection, ear protection, face and eye protection, hand protection, feet protection, body protection. Supply, use, care and maintenance of personal protective equipment.
- ✓ Requirements under Factories Acts and Rules. Respiratory personal protective devices,
- ✓ Classification of hazards, classification of respiratory personal protective devices, selection of respirators, instructions and hints in the use of breathing apparatus, supply, use, care and maintenance of breathing apparatus, training in the use of breathing apparatus.

Unit III: Safety in Construction and Demolition Operation

- ✓ **Safety in Conventional Construction Operations**: Underground works, above ground works, underwater portions, movements of construction machinery, special works, & safety in use of explosives. Safety in stacking, storage & transport of construction materials: cement, sand, reinforcements, aggregates, chemicals, organic binders, gas cylinders. Safety in use of construction machinery & equipment: batching plant, mixers, earth moving equipment, cranes, pile driving equipment, excavators, drilling equipment, welding equipment, gas cutting equipment, grinding equipment, derricks, compressors, crushers, layers.
- ✓ **Safety in Special Construction Operations**: Transmission towers, railways, power plants, transformer installations. Working at heights & prevention of falls of persons: high incidence of serious accidents in working at heights, types of operations, planning operations, safety features associated with

Ramakrishna Mission Shilpamandira

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Belur Math, Howrah

Syllabus Booklet

Diploma in Civil Engineering

Semester – VI (Part-III)

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

Public Health Engineering

Unit – I: Sources, Demand & Quality of water

- ✓ Water supply schemes - Objectives, components
- ✓ Sources of water: Surface and Subsurface sources of water,
- ✓ Intake Structures, Definition and types, Factors governing the location of an intake structure, Types of intakes.
- ✓ Demand of water: Domestic, Industrial, commercial & institutional, public use, losses & wastes, fire demand. Factors affecting rate of demand, Variations of water demands, Forecasting of population, Methods of forecasting of population, (Simple problems on forecasting of population), Design period, Estimation of quantity of water supply required for city or town.
- ✓ Quality of water: Need for analysis of water, Characteristics of water- Physical, Chemical and Biological, Meaning and importance of different parameters of water- Total solids, hardness, chlorides, dissolved Oxygen, pH, Fluoride, Arsenic, Nitrogen and its compounds, Bacteriological tests, Ecoli, Bcoli index, MPN, Sampling of water, Water quality standards as per IS:10500

Unit – II: Purification of water

- ✓ Purification of Water: Objectives of water treatment, Screening, Aeration- objects and methods of aeration, Plain sedimentation, Sedimentation with coagulation, principles of coagulation, types of coagulants, Jar Test, process of coagulation, types of sedimentation tanks, Clariflocculator.
- ✓ Filtration - mechanism of filtration, classification of filters: slow sand filter, rapid sand filter, pressure filter. Construction and working of slow sand filter and rapid sand filter, operational problems in filtration. Disinfection: Objects, methods of disinfection, Chlorination- Application of chlorine, forms of chlorination, types of chlorination practices, break-point chlorination, residual chlorine and its importance, Flow diagram of water treatment plants.
- ✓ Miscellaneous water Treatments: Removal of colour, taste & odour, Introduction to water softening & Defluoridation techniques.

Unit III: Conveyance and Distribution of water

- ✓ Conveyance: Types of Pipes used for conveyance of water, choice of pipe material, Types of joints & Types of valves- their use, location and function on a pipeline.
- ✓ Distribution of water: Methods of distribution of water- Gravity, pumping, and combined system, Service reservoirs- functions & types, Layouts of distribution of Water- Dead end system, grid iron system, circular system, radial system; their suitability, advantages and disadvantages.

Unit IV: Domestic sewage & System of Sewerages

- ✓ Building Sanitation: Necessity of sanitation, Necessity to treat domestic sewage, Definitions- Sewage, sullage, types of sewage.

- ✓ The detailed report shall contain total Cost of the Project, Bar Chart, Project completion time using CPM/PERT & Preparation of tender documents for NIT (Notice inviting tender).
- ✓ (Rate should be taken as per West Bengal PWD Schedule w.e.f 01.11.2017 with latest Corrigendum.)
- ✓ PPT Presentation of the whole projects group wise.

Practical Project Work:

- ✓ Reinforcement Details of slab, beam, reinforcement placement & binding
- ✓ Use of Glass Fibre in Concrete Cube and Cylinder.
- ✓ Brick Masonry with Plastering & Pointing
- ✓ Reinforcement detailing in Beam-Column Junction

Books and References:

Public Health Engineering

- ✓ Garg, S.K., Environmental Engineering Vol. I and Vol. II, Khanna Publishers
- ✓ Punmia, B C, Environmental Engineering, vol. I and II, Laxmi Publishers
- ✓ Basak N N, Environmental Engineering, McGraw Hill Publishers.

Tendering and Accounts

- ✓ Chakraborti, M., Estimating and Costing, Specification and Valuation in Civil Engineering, Monojit Chakraborti, Kolkata.
- ✓ Datta, B. N., Estimating and Costing in Civil engineering, UBS Publishers Pvt. Ltd., New Delhi

Entrepreneurship & Start-ups

- ✓ Entrepreneurship Development Sangeeta Sharma Prentice Hall of India Learning Private Ltd
- ✓ Entrepreneurship and Small Business Management S.S. Khanka S. Chand & Sons, New Delhi.

Engineering Economics & Project Management

- ✓ Principles of Economics – Case and Fair, Pearson Education Publication
- ✓ Project Planning, Analysis, Selection, Implementation and Review – Prasannachandra–Tata McGraw Hill.
- ✓ Business Economics & Accounts, Saibal Guha, Lakshmi Prakashani
- ✓ Business Economics & Accountancy, Chattopadhyay & Saha, Bhagabati Publication.

Solid Waste Management

- ✓ Gupta O.P, Elements of Solid Hazardous Waste Management, Khanna Book Publishing Co., Delhi Ed. 2018.

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- ✓ Definition of the terms related to Building Sanitation-Water-pipe, Rainwater-pipe, Soil-pipe, Sullage-pipe, Vent-pipe. Building Sanitary fittings-Water closet – Indian & European type, flushing cistern, wash basin, sinks, Urinals. Traps-types (P, Q, S, intercepting trap, gully trap, floor trap), qualities of good trap.
- ✓ Systems of plumbing-one pipe, two pipe, single stack, choice of system. Principles regarding design of building drainage, inspection & junction chambers, their necessity, location, size & shape.
- ✓ Systems of Sewerage & Sewer Appurtenances: Types of Sewers, Systems of sewerage, self-cleansing velocity & non-scouring velocity, Laying, Testing & maintenance of sewers, Manholes & Drop Manhole-component parts, location, spacing, construction details, Sewer Inlets, Street Inlets.

Unit V: Characteristics and treatment of Sewage

- ✓ Analysis of sewage: Characteristics of sewage-Major parameters, B.O.D., C.O.D. & its significance, C.P.C.B Norms for discharge of treated sewage.
- ✓ Treatment of Sewage: Objects of sewage treatment & flow diagram of conventional sewage treatment plant-Screening, Types of screens, Grit removal, Skimming, Sedimentation of sewage, Aerobic & anaerobic process, Sludge digestion, trickling filters, Activated sludge process,
- ✓ Disposal of sewage, Oxidation pond, Oxidation ditch. Septic tank.
- ✓ Recycling & Reuse of domestic waste.

Tendering and Accounts

Unit – I: Procedure to execute the work

Administrative approval, Technical sanction, budget provision, expenditure sanction. Methods for carrying out works-contract method, departmental method-rate list method, piece work method, day's work method, employing labours on daily wages basis.

Unit– II Contracts

- ✓ Definition of contract, objects of contract, requirements of contract, overview of Indian Contract Act.
- ✓ Types of engineering contract with advantages, disadvantages & their suitability - Lump sum contract, item rate contract, percentage rate contract, cost plus percentage, cost plus fixed fee, cost plus variable percentage & cost plus variable fee contract, labour contract, demolition contract, target contract, negotiated contract, Engg Procurement Construction Contract (EPC), Annuity Contract.
- ✓ Introduction of FIDIC Conditions of contract. Classification of contractor on basis of financial limits, Requirement of documents for registration of contractor.
- ✓ Build Operate Transfer Project, BOT Toll contract, BOT (Annuity) contract, Design, Build, Finance, Operate & Transfer (DBFOT) contract, Hybrid Annuity contract, Operate Maintain & Transfer (OMT) contract, Operation & Maintenance contract (Introduction only).

Unit– III Tender & Tender Documents

- ✓ Definition of tender, necessity of tender, types of tender- Local, Global, Limited.
- ✓ E-Tendering System – Online procedure of submission & opening of bids (Technical & Financial).
- ✓ Notice to invite tender- Points to be included while drafting tender notice, Drafting of tender notice.
- ✓ Procedure of submitting filled tender Documents (Two envelope system), procedure of opening tender, comparative statement, scrutiny of tenders, award of contract, letter of award.
- ✓ Meaning of terms - Earnest Money Deposit, Performance Security Deposit, Validity period, corrigendum to tender notice & its necessity, Unbalanced bid.
- ✓ Tender documents – Index, tender notice, general instructions, special instructions, Schedule A, Schedule B, Schedule C etc.
- ✓ Terms related to tender documents – contract conditions- time limit, time extension, penalty, defective material & workmanship, termination of contract, suspension of work, subletting of contract, extra items, price variation clause (escalation), defect liability Period, liquidated Damages.
- ✓ Arbitration Meaning, Qualification of an arbitrator, Appointment, Dispute & Settlement of disputes, Arbitration & Conciliation Act, Arbitration award.

Unit– IV Accounts

- ✓ Various account forms & their uses – Measurement Books, E-Measurement book, Nominal Muster Roll, Imprest Cash, Indent, Invoice, Bill, Vouchers, Hand receipt Cash Book, Temporary Advance. Heads of Accounts.
- ✓ Mode of Payment to the contractor and its necessity -Interim Payment, Advance Payment Secured Advance, Petty advance, Mobilization advance, Running account bill, Final bill, Retention money, E - payment.

Unit– V Introduction to Valuation

- ✓ Definition and purpose of Valuation, role of valuer. Definition - Cost, Price & Value, Characteristics of Value, Factors Affecting Value.
- ✓ Types of Value - Book Value, Scrap Value, Salvage Value, Speculative Value, Distress Value, Market Value, monopoly Value, Sentimental Value. Factors affecting value.
- ✓ Depreciation, Obsolescence, Sinking Fund, Methods of Calculation of Depreciation – Straight Line Method, Sinking Fund Method, Constant Percentage Method.
- ✓ Fixation of rent, Lease – types of lease, lease hold property and free hold property. Mortgage– Mortgage deed, precautions to be taken while making mortgage.

Entrepreneurship and Start-ups

Unit– I: Entrepreneurship – Introduction & Process

- ✓ Concept, Competencies, Functions and Risks of entrepreneurship
- ✓ Entrepreneurial Values & Attitudes and Skills

- ✓ Construction of a closed traverse of minimum 5 sides for any suitable site- collection and saving of field data in total station, downloading and transfer of raw data from total station to computer, processing of raw data with the help of any suitable software for preparation of drawing.
- ✓ Use Theodolite as a Tacheometer to compute reduced levels and horizontal distances.
- ✓ GPS Surveying: Working with hand held GPS instrument. Collection coordinates of different objects. Downloading raw data from GPS instrument and prepare a report sheet (excel or doc or pdf format).

Major Project II

The project report shall be in the following format:

- (The project shall be undertaken by a group of 4 to 6 students)
- Topic and objectives
- Collection of data, required survey work,
- Management and construction procedure
- Resources scheduling and networking
- Design details
- Required drawing set
- Utility to society if any
- Conclusion

NOTE: Same Planning, Drawings & detailings of the problem given in the semester 4 will have be used in Major Project I and Major Project II in semester 5 and 6. All drawing will be done by using CAD

Contents:-

- ✓ Title of the Project:-Planning and designing of (G+2) Residential Complex for Middle Income Group.
- ✓ The details of the Project are given below:
- ✓ Each building (RCC framed structure) shall comprise of two symmetrical flat per floor each containing two rooms, bath, WC, kitchen, front verandah with a provision of common staircase and mumty for utilization of roof space and overhead water tank (around 210 sq m. covered area for each building unit and total 100 Nos of flat in the Complex of around 10000 sq m. of total land area) Ground floor to be used for parking spaces.
- ✓ The following provisions are to be considered during the project planning:- a) Security room(Single room with WC, Load bearing wall structure), b) Central Park, c) Play Ground, d) Hume Pipe Culvert in between the complex and the 12m wide main road, e) Boundary Wall with main gate, f) Submersible Pump, g) Pump House (Load bearing wall structure), h) Surface Drainage System, i) Bituminous road over WBM inside the complex etc.

The project report shall include detailed Estimate and costing of:-

1. (G+2) Building Unit.
2. Security Room.
3. Pump House.
4. Boundary Wall with main gate.
5. Submersible Pump.
6. Hume Pipe Culvert.
7. Bituminous road over WBM.
8. Surface Drainage System.

- ✓ Incineration of waste: Introduction of incineration process, Types of incinerators – Flash, Multiple chamber Incinerators, Products of incineration process with their use, Pyrolysis of waste–Definition, Methods
- ✓ Energy generation from Waste (elementary idea)

Unit- V: Biomedical and E-waste management

- ✓ Definition of Bio medical Waste.
- ✓ Sources & generation of Biomedical Waste & its classification. Bio medical waste Management technologies.
- ✓ Definition, varieties and ill effects of E- waste, Recycling and disposal of E- waste.

Public Health Engineering Lab

- ✓ Draw sketches of various valves used in water supply pipe line
- ✓ Draw a sketch of one pipe and two pipe system of plumbing
- ✓ Determine pH value of given sample of water/sewage.
- ✓ Determine the turbidity of the given sample of water.
- ✓ Determine residual chlorine in a given sample of water.
- ✓ Determine suspended, dissolved solids and total solids of given sample of water/sewage.
- ✓ Determine the dissolved oxygen in a sample of water/sewage.
- ✓ Determine Fluoride concentration in given water sample.
- ✓ Determine Arsenic concentration (semi-quantative) in given water sample.
- ✓ Determine the optimum dose of coagulant in a given raw water sample by jar test.
- ✓ Determine B.O.D. & C.O.D. of given sample of sewage.
- ✓ Prepare a report of a field visit to water treatment plant and/or sewage treatment plant if possible

Note: Item no. 12 may be included in internship.

Advanced Surveying Practices

- ✓ Theodolite traverse Survey: A simple closed traverse of at least 5 sides for any suitable site. Preparation of Gale's traverse table. Plotting the traverse with details on A1 size imperial drawing sheet and calculation of area of the closed traverse. Interior details will have to be filled up by theodolite or by plane table which is found to be more suitable.
- ✓ Simple circular curve setting: Setting out a simple circular curve by Rankine's method of Deflection angles (both one theodolite and two theodolite methods) for a given problem and plotting the curve showing the necessary supporting calculations in a tabular form mentioning suitable scale on A-1 size imperial drawing sheet.
- ✓ Surveying with Total Station: Introduction, description of different parts of total station and reflector prism with stand, set up and orientation
- ✓ Measurement of distances, measurement of horizontal and vertical angles, methods of measuring remote height and area, etc.,

- ✓ Mindset of an employee/manager and an entrepreneur
- ✓ Types of Ownership for Small Businesses, Sole proprietorship, Partnerships, Joint Stock company public limited & private limited companies, Difference between entrepreneur and Intrapreneur.

Unit – II: 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.
- ✓ Students are just expected to know about the features and key inclusions under, Business Plan and Project Report. They may not be asked to prepare a Business Plan/ Project Report/ Project Feasibility Report in the End of Semester Examination.

Unit–III Establishing Small Enterprises

Legal Requirements and Compliances needed for establishing a New Unit-

- NOC from Local body
- Registration of business in DIC
- Statutory license or clearance
- Tax compliances

Unit-IV 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 and Case Studies to be discussed in the class.
- ✓ Case studies have been included in the syllabus to motivate and inspire students toward an entrepreneurial career from the success stories. No questions are to be set from the case studies.

Unit–V Financing Start-Up Ventures in India

- ✓ Communication of Ideas to potential investors – Investor Pitch
- ✓ Equity Funding, Debt funding – by Angel Investors, Venture Capital Funds, Bank loans to start-ups
- ✓ Govt Initiatives including incubation centre to boost start-up ventures
- ✓ MSME Registration for Start-ups – its benefits

Unit–VI: Exit Strategies For Entrepreneurs

Merger and acquisition exit, Initial Public Offering (IPO), Liquidation, Bankruptcy – Basic Concept only

Engineering Economics & Project Management

Group-A

Unit – I: Introduction, Theory of Demand & Supply

- ✓ Distinguish between Micro and Macro Economics.
- ✓ Definition of economics (Adam Smith, Alfred Marshall, Lionel Robbins).
- ✓ Definition of Engg Economics. Why do Engineers need to learn about Economics?
- ✓ Definition of Resource, Resources for production of goods and services for the market.
- ✓ Scarcity of Resources, Alternative uses of resources & Choice of resources.
- ✓ Opportunity Cost, Rationality, Production Possibility Frontier (PPF) curve and it's uses, defects.
- ✓ Basic problems of Economy and how those are solve.

Theory of Demand:

- ✓ Law of Demand, Determinants of demand(individual & Market), Demand function, Exception of demand, Draw a market demand curve from individual demand, Reason for downward sloping of demand curve, Price Elasticity of demand, Classification of goods by using price elasticity of demand, Mathematical problem on elasticity.

Theory of Supply:

- ✓ Law of supply, determinants of supply, supply function,

Market Mechanism:

- ✓ Classification of Market, Determine equilibrium price using demand and supply
- ✓ Extension in demand and increase in demand.

Unit– II: Theory of Production & Costs

- ✓ Definition of production, factors of production, production function, Short-run (Law of variable proportion) & long-run in production (Return to scale)

Theory of Cost:

- ✓ Short-run and Long run cost curves, Concept of TFC, TVC, TC, AC, AVC, MC, Relation between AC & MC, LAC curve

Unit– III Different Types of Market & Role Of Government

- ✓ Discussion about various types of market & their characteristics, Profit Maximization concept, Long run & Short run equilibrium.
- ✓ Role of government in Socialist, capitalist, Mixed economy structure

Group-B

Unit– IV Concept of Project

- ✓ Definition & classification of projects
- ✓ Importance of Project Management.
- ✓ Project life Cycle [Conceptualization→Planning→Execution→Termination]

Unit– V 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 & uncertainty: Technical, economical, socio-political, & 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 (Basic concept only).
- ✓ *N.B: Knowledge of financial statements is not required; for the estimation of ratios the values of the relevant variables will be provided.*

Unit– VI: Project Administration

- ✓ Gantt Chart– a system of bar charts for scheduling & 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

Solid Waste Management

Unit I: Introduction

- ✓ Definition of solid waste, different solid waste – domestic Waste, commercial waste, industrial waste, market waste, agricultural waste, biomedical waste, E-waste, hazardous waste, institutional waste, etc.
- ✓ Sources of solid waste, Classification of solid waste – hazardous & non- hazardous waste.
- ✓ Composition of municipal solid waste.

Unit II: Storage, Collection & Transportation of Municipal Solid Waste

- ✓ Collection, segregation, storage and transportation of solid waste.
- ✓ Tools & Equipment-Litter Bin, Broom, Shovels, Handcarts, Mechanical road sweepers, Community bin - like movable & stationary bin.
- ✓ Transportation vehicles with their working capacity-Animal carts, Auto vehicles, Tractors or Trailers, Trucks, Dumpers, Compactor vehicles. Transfer station-meaning, necessity, location.
- ✓ Role of rag pickers and their utility for society.

Unit III: Composting of Solid Waste

- ✓ Concept of composting of waste, Principles of composting process. Factors affecting the composting process.
- ✓ Methods of composting – Manual Composting – Bangalore method, Indore Method, Mechanical Composting – Dano Process, Vermi composting.

Unit IV: Techniques for Disposal of Solid Waste

- ✓ Solid waste management techniques – solid waste management hierarchy, waste prevention, waste reduction, reusing, recycling & materials recovery techniques
- ✓ Land filling technique, Factors to be considered for site selection, Land filling methods-Area method, Trench method and Ramp method, Leachate and its control, Biogas from landfill, Advantages and disadvantages of landfill method, Recycling of municipal solid waste, Ill effects of unplanned solid waste dumping