A technical diploma holder is engaged generally as first line supervisor. He forms a bridge between workers and management. He has to understand the language of the modern management and communicate with the workers in their language. This subject will help accomplishment of the task in stipulated time, develop attitude towards cost effectiveness, selection of most effective alternative methods. This course will also help the student to tackle different numerical methods and computational techniques for problem solving in research organization as a programmer.

**Objective:**
- The course enables students to,
- Managerial skill based on mathematical footing
- The ability to find approximate solutions and/or answers to the problems where analytical methods become more complex.
- To choose correct numerical techniques for a given problem.

**Rationale:**

**Contents:**

**GROUP-A (NUMERICAL METHODS & COMPUTATIONAL TECHNIQUES)**

01.01 Introduction to Numerical methods: Approximation and errors (Truncation & Round off). Floating, point presentation of numbers, arithmetic operations with normalized floating point numbers.
01.03 Solution of Linear Simultaneous Equations: Gaussian Elimination method and Gauss-Jordan method.
01.05 Numerical Differentiation & Integration: Newton’s forward and backward differentiation formula. Trapezoidal Rule and Simpson’s 1/3 rule for numerical integration.
01.06 Numerical solution of 1st order ordinary differential equations: Taylor’s Series. Euler’s method. Modified Euler’s method Runge-Kutta methods.

**GROUP-B (STATISTICAL TECHNIQUES)**

02.01 Introduction to statistics: Measure of central tendencies: measures of dispersions: standard deviation and variance for discrete and grouped data: assumed mean and step deviation methods.
02.03 Probability Distribution: Introduction to Arithmetic Mean and Standard Deviation of a probability distribution. Important probability distribution – Binomial distribution. Poisson’s distribution and normal distribution. Their means and variance.
02.04 Sampling Distribution: Sampling Distribution of Mean and Standard Deviation.
02.05 Quality Control: P-Chart and R-Chart.

**GROUP-C (MANAGEMENT TECHNIQUES)**

03.01 Linear Models
03.01.01 Introduction to Operations Research (O.R) Steps of O.R.
03.01.02 Linear Programming Problems: Step in information of a LPP. Mathematical Modelling and Solution Procedure.
03.01.03 Solution by Simplex Method: Basic Feasible Solution (Degenerator and Non-degenerate) Procedure including Big-M Method. Example.
03.01.04 Transportation problem: Introduction and Solution Procedure-
   (i) Finding the initial basic feasible solution by N-W Corner Rule and Vogel’s Approximation Method.
   (ii) Finding the Optimal Solution by U-V Method.
03.01.05 Assignment Problem: Introduction and Solution Procedure–Fundamental theory underlying Hungarian Method.
03.02 Network Analysis. CPM & PERT: Introduction.
03.02.01 Basic concepts – Activities. Nodes. Edges. Networking of a project. Various times calculations. CPM to determine the optimal project schedule.
03.02.02 PERT- Definition, difference between CPM & PERT. Pessimistic times, optimistic times. Most likely times of various activities, probability of meeting the schedule time, standard deviation of the schedule time.

**Books Recommended:**


**SCHEME OF EXAMINATION FOR FINAL EXAMINATION**

<table>
<thead>
<tr>
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<th>Periods</th>
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<tr>
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<td>GROUP –A (Numerical Methods &amp; Computational Techniques)</td>
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<tr>
<td>02</td>
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<td>GROUP-C (Management Techniques)</td>
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**Subject Code:** 00201

**No.of Periods in one session:** 60
Rationale:
The subject forms an important part of Engineering curricula for developing the concepts required in the design of various structures. The subject deals with the basic concept of mechanics of body and the behaviour of material used in practice and in structures under varying load conditions. The first part of the subject deals with the applied mechanics science. Which describe the condition of body in rest or motion under the action of forces. In its preview come variety of general and specialized engineering disciplines concerned with analysis of structures and machines and the mechanism of their parts.

In the Second part, the principles of strength of materials is introduced in which the student will learn to distinguish between different types of stress and strain and also the qualitative assessment of stress and strains in material element under the action of internal forces.

Objective:
Knowledge Workers will be able to:
- Analyze and understand the physical behaviour of members of engineering structures.
- Acquire knowledge of various elements of structures.
- Utilise the basic principles.
- Develop skill to tackle field problem.
- Solve the problems by the application of basic principles.
- Judge the suitability of materials in design process.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Topics</th>
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<th>Periods</th>
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<td>01</td>
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<td>02</td>
<td>Vector Methods</td>
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<td>03</td>
<td>Introduction to system of forces and equilibrium</td>
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<td>(06)</td>
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<tr>
<td>04</td>
<td>Friction</td>
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<td>Kinematics and kinetics of a particle</td>
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<td>Kinematics and kinetics of rigid body</td>
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<td>07</td>
<td>Impulse and Momentum</td>
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<td>08</td>
<td>Work, Energy and Power</td>
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PART-B

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<td>02</td>
<td>Elastic constants</td>
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<td>Moment of Inertia</td>
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<td>05</td>
<td>Shearing force and bending moments</td>
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</table>

CONTENTS:

PART-A

TOPIC: 01 – INTRODUCTION:
Idealisation of mechanics; Concept of rigid body; External forces (Body forces & surface forces) Law of Mechanics. [02]

TOPIC: 02 VECTOR METHODS:
Equality and equivalence of vectors; Free and Bound vector; Moment of a force about a point and a line; Couple and moment of a couple; couple moment as free vector. Wrench. [02]

TOPIC: 03 – INTRODUCTION TO SYSTEM OF FORCES AND EQUILIBRIUM:
Statically equivalent force system; simplest equivalent of a system of forces; force analysis, free body diagram, equation of equilibrium. [06]

TOPIC: 04 – FRICTION:
Types of Friction (Static, Dynamic, Sliding, Rolling, Fluid) Rope & Belt Friction etc. [04]

TOPIC: 05 – KINEMATICS AND KINETICS OF A PARTICLE:
Rectilinear and curvilinear translations; normal and tangential component of acceleration; radial and transverse component of acceleration. Angular Velocity and angular acceleration. Effective forces on a rigid body. D’Alembert’s principle. [04]

TOPIC: 07 – IMPULSE AND MOMENTUM:
Linear impulse and linear momentum, angular impulse and angular momentum. [02]

TOPIC: 08 – WORK, ENERGY AND POWER:
Work done by forces and couples, potential and kinetic energy, work-energy; conservation of energy; concept of power and efficiency. [04]
TOPIC: 01 – SIMPLE STRESSES & STRAIN:

01.01 Definition of various terms and their units (S.I. Units)
01.03 Stress & strain in varying sectional bar & composite bar. Stress & strain due to temperature variation in homogeneous and composite bars.
01.04 Shrinking on hoop’s stresses.

TOPIC: 02 – ELASTIC STRESS & STRAIN:

02.01 Linear strain and lateral strain, poisson’s ratio, volumetric strain
02.02 Change in volume due to axial, biaxial & triaxial loading. Bulk modulus.
02.03 Shear stress and strain, modulus of rigidity.
02.04 Various relations between modulus of elasticity, modulus of rigidity & bulk modulus.
02.05 Simple shear. Complementary shear stress, stress on oblique section.

TOPIC: 03 – CENTER OF GRAVITY (CENTROID):

03.01 Definition of center of gravity & centroid.
03.02 Determination of C.G of various sections symmetrical and unsymmetrical sections.
03.03 Determination of C.G. of perforated sections. C.G. of semi circle, quadrant circle.

TOPIC: 04 – MOMENT OF INERTIA:

04.01 Definition of M.I.; radius of gyration, second moment of area.
04.02 Parallel axis theorem & perpendicular axis theorem.
04.03 Derivation of M.I. of regular area-rectangular, triangular circular about centroidal axis.
04.04 M.I. of built up section, symmetrical and unsymmetrical about centroidal axis, modulus of sections.

TOPIC: 05 – SHEARING FORCE & BENDING MOMENT:

05.01 Types of beams and types of supports, types of loading.
05.02 Concept and definitions of shear force and bending moment, sign convention.
05.03 Shear force and bending moment diagrams for cantilever, simply supported beam, over hanging beam for various types of loading & couples, point of contraflexure.
05.04 Relation between B.M, S.F. and rate of loading.

Books Recommended:

Text Books

7. nZO; lkeF;Z - xq; pj.k flag

SCHEME OF EXAMINATION FOR FINAL EXAMINATION

F.M. : 80
Rationale:
Computers play a vital role in present day life, more so, in the professional life of technician engineers. In order to enable the students use the computers effectively in problem solving, this course offers the modern programming language C along with exposition to various engineering applications of computers.

Objective:
The objectives of this course are to make the students able to:
- Develop efficient algorithms for solving a problem.
- Use the various constructs of a programming language viz. conditional, iteration and recursion.
- Implement the algorithms in “C” language.
- Use simple data structures like arrays, stacks and linked list solving problems.
- Handling File in “C”.

S.No. | Topics | Periods
---|---|---
01 | Introduction to Programming | (03)
02 | Algorithm for Problem Solving | (08)
03 | Introduction to ‘C’ Language | (06)
04 | Condition and Loops | (06)
05 | Arrays | (06)
06 | Functions | (05)
07 | Structures and Unions | (05)
08 | Pointers | (05)
09 | Self Referential Structures and Linked Lists | (03)
10 | File Processing | (03)

Total : (50)

CONTENTS:

**TOPIC: 01 – INTRODUCTION TO PROGRAMMING:**

**TOPIC: 02 – ALGORITHM FOR PROBLEM SOLVING:**
Exchanging values of two variables, summation of a set of numbers. Decimal Base to Binary Base conversion. Reversing digits of an integer, GCD (Greatest Common Division) of two numbers. Test whether a number is prime. Organize numbers in ascending order. Find square root of a number, factorial computation, Fibonacci sequence. Evaluate ‘sin x’ as sum of a series. Compute sine Series. Check whether a given number is Palindrome or not. Find Square root of a quadratic equation. Generate LCM & GCD. Reverse order of elements of an array. Find largest number in an array. Print elements of upper triangular matrix, multiplication of two matrices, Evaluate a Polynomial.

**TOPIC: 03 – INTRODUCTION TO ‘C’ LANGUAGE:**
03.01 Character set, Variable and Identifiers, Built-in Data Types, Variable Definition, Declaration, C Key Words-Rules & Guidelines for Naming Variables.
03.02 Arithmetic operators and Expressions, Constants and Literals, Precedence & Order of Evaluation.
03.03 Simple assignment statement. Basic input/output statement.
03.04 Simple ‘C’ programs.

**TOPIC: 04 – CONDITIONAL STATEMENTS AND LOOPS:**
04.01 Decision making within a program
04.02 Conditions, Relational Operators, Logical Perator.
04.03 If statement, it-else statement.
04.04 Loop statements
04.05 Break, Continue, Switch, Goto and Labels.

**TOPIC: 05 – ARRAYS:**
What is an Array?, Declaring an Array, Initializing an Array.
One dimensional arrays: Array manipulation: Searching, Insertion, Deletion of an element from an array; Finding the largest/smallest element in array; Two dimensional arrays, Addition/Multiplication of two matrices, Transpose of a square matrix; Null terminated strings as array of characters, Representation sparse matrices.

**TOPIC: 06 – FUNCTIONS:**
Top-down approach of problem solving. Modular programming and functions, Definition of Functions Recursion, Standard Library of C functions, Prototype of a function: Formal parameter list, Return Type, Function call, Block structure, Passing arguments to a Function: call by reference; call by value, Recursive Functions, arrays as function arguments.

**TOPIC: 07 – STRUCTURES AND UNIONS:**

**TOPIC: 08 – POINTERS:**
Concept of Pointers, Address operators, pointer type declaration, pointer assignment, pointer initialization pointer arithmetic, Indirection Operator, Pointers to Pointers, functions and pointers, Arrays and Pointers, pointer arrays.
TOPIC: 09 – SELF REFERENTIAL STRUCTURES AND LINKED LISTS:
Creation of a singly linked list, Traversing a linked list, Insertion into a link list, Deletion from a linked list.

TOPIC: 10 – FILE PROCESSING:
Concept of Files, File operation in various modes and closing of a file, Reading from file, Writing onto a file.

Book Recommended:


SCHEME OF EXAMINATION FOR FINAL EXAMINATION

F.M. : 80
CIVIL ENGINEERING DRAWING & DRAFTING

THEORY

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<td>02</td>
<td>Doors and windows</td>
<td>(15)</td>
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<tr>
<td>03</td>
<td>Lintel and Arches</td>
<td>(15)</td>
</tr>
<tr>
<td>04</td>
<td>Stair &amp; Stair cases</td>
<td>(15)</td>
</tr>
<tr>
<td>05</td>
<td>Roof and Roof trusses</td>
<td>(15)</td>
</tr>
<tr>
<td>06</td>
<td>Foundation</td>
<td>(09)</td>
</tr>
<tr>
<td>07</td>
<td>Culvert</td>
<td>(21)</td>
</tr>
</tbody>
</table>

CONTENTS:

TOPIC: 01 – BUILDINGS:
01.01 Plan, Elevation & Section of a single storey building with flat roof.
01.02 Plan, Elevation & Section of a single storey building with inclined roof.
01.03 Plan, Elevation & Section of a double storeyed building with flat roof (ground floor) and inclined roof (1st floor).
01.04 Plan, Elevation & Section of a Godown showing main walls in brick masonry and inclined roof supported over tubular roof truss (Span 15 metres).

Note: The inclined roof should show the slope of the roof covering details of hip end. Gable and valley rafters, Jack rafters etc.

TOPIC: 02 – DOOR AND WINDOWS:
02.01 Ledged and braced door and windows.
02.02 Fully Panelled door and window.
02.03 Glazed door and windows.
02.04 Flush door.

TOPIC: 03 – LINTEL AND ARCHES:
03.01 Longitudinal and Cross Section of R. B. Lintel.
03.02 Longitudinal and Cross Section of R. C. C. Lintel.
03.03 Sectional Elevation of Semi Circular, segmental, Elliptical and Equilateral Arches.

TOPIC: 04 – STAIR AND STAIR CASES:
04.01 Plan and Cross Section of Dog legged stair.
04.02 Plan and Cross Section of open well stair.
04.03 Plan and Cross Section of Cantilever stair.

Note: The landings should be half and quarter space.

TOPIC: 05 – ROOF AND ROOF TRUSSES:
05.01 Sectional Elevation of flat top roof.
05.02 Sectional Elevation of Couple roof.
05.03 Sectional Elevation of Couple close roof.
05.04 Sectional Elevation of King Post truss.
05.05 Sectional Elevation of Queen Post truss.
05.06 Elevation of tubular North Light truss.

Note: Fixing of Roof materials i.e. A.C. Sheets, G.C.I. Sheets. Tiles etc. should also be shown in the above drawings.

TOPIC: 06 – FOUNDATION:
06.01 Foundation Plan and Section of Stepped foundation under load bearing structures.

TOPIC: 07 – CULVERTS:
07.01 Sectional Plan, half Elevation and Cross Section of Arch Culvert.
07.02 Sectional Plan, half Elevation and Cross Section of Pipe Culvert.
07.03 Sectional Plan, half Elevation and Cross Section of R.C.C. Slab Culvert.

Note: The wings walls to be at right angles to the abutments.

Book Recommended:

Text Books
1. Civil Engg. Drawing - D.N. Bose
7. I. S. Code 696 & 962

SCHEME OF EXAMINATION FOR FINAL EXAMINATION

F.M. : 80
SURVEYING - II

THEORY

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Rationale:
The primary job of civil engineering technician is survey work. It is to be carried out for any civil engineering project before any planning & construction can be taken. Hence a thorough knowledge of the methods of surveying & leveling as well as that of plotting is must for any technician. Technicians must also possess skill in the handling of survey instrument for proficiency in carrying out survey work. Therefore the subject is of paramount importance & must necessarily form the base of Civil Engineering curriculum.

Objective:
The student will be made conversant with the various instruments & appliance used in surveying. He will be taught chain survey, plane table survey, compass survey and triangulation survey and would be introduced to the modern survey methods.

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<tr>
<td>02</td>
<td>Curves</td>
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<td>03</td>
<td>Tacheometry</td>
<td>(10)</td>
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<td>04</td>
<td>Contouring</td>
<td>(14)</td>
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<td>05</td>
<td>Modern Surveying</td>
<td>(06)</td>
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CONTENTS:

**TOPIC: 01 – THEODOLITE SURVEYING:**

**TOPIC: 02 – CURVES:**

**TOPIC: 03 – TACHEOMETRY:**
Principle of tacheometry; Instruments used in tacheometry; Methods of tacheometry; determination of Stadia constants; Tacheometric surveying with line of collimation (i) horizontal (ii) inclined with level staff held vertical.

**TOPIC: 04 – Contouring:**
Concept & definition of contour line; contour interval & horizontal equivalent; factors governing contour interval, characteristics of contours; Methods of contouring; Interpolation of contours; Use of contours maps; drawing L section & cross-section from contour maps; Tracing contour gradient for alignment of roads etc; finding volume of earth-work & capacity of reservoir from contour map.

**TOPIC: 05 – MODERN SURVEYING:**
(a) Aerial Surveying & Ground Photogrammetry; Elementary knowledge of both with the basic principles involved especially of stereoscopic vision. Advantages of aerial surveying over conventional methods.

**Book Recommended:**

**Text Books**
1. Surveying & leveling, Vol. II - Kanethar & Kulkarni
2. Surveying, Vol. II - Dr. B. C. Panami
3. Surveying, Vol. II - D. Clark
4. Photogrammetry - F. H. Moffitt
5. Air Photography Applied to Surveys - C. A. Mart

**SCHEME OF EXAMINATION FOR FINAL EXAMINATION**

| F.M. : | 80 |

7
Rationale:
In order to find out the quantities of materials and its cost from the detailed drawing of any structure and find out different material required & cost involved as per drawing.

Objective:
Calculation of detailed quantities of materials and working out their costs is the major objective of a junior engineer technician. The students must be able to arrange the materials as per the detailed drawings need.

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<td>02</td>
<td>Calculation of quantities</td>
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<td>Building Estimates</td>
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<td>04</td>
<td>Estimate of Roofs</td>
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<td>05</td>
<td>Earth Work</td>
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<td>06</td>
<td>Application of Computer Programming</td>
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CONTENTS:

**TOPIC: 01 – PROCEDURE OF ESTIMATING:**

01.01 Definition
01.02 Requirements of an estimate.
01.03 Methods of estimating
01.04 Units of measurements.
01.05 Units of Payment of different items of work.
01.06 Systems for Preparation of an estimate.

**TOPIC: 02 – CALCULATION OF QUANTITIES:**

02.01 General Principles.
02.02 Methods of working of quantities for different items of work.
02.03 Centre Line and Long Short Wall method.

**TOPIC: 03 – BUILDING ESTIMATES:**

03.01 Estimate of a single room building with Verandah.
03.02 Estimate of a two/three roomed building.
03.03 Estimate of an building and a Primary health center.
03.04 Estimate of double buildings.

**TOPIC: 04 – BUILDING ESTIMATES:**

04.01 Estimate of simple buildings with sloping roofs.
04.02 Hipped/gabled/Lean-to-roof with different roofing materials.
04.03 Estimate of King Post and Queen Post Roof Trueces.
04.04 Estimate of Workshop building of an industry or an institution.

**TOPIC: 05 – EARTHWORK:**

05.01 Earthwork Computations.
05.02 Lead and Lift.
05.03 Methods of Calculating earthwork.
05.04 Earthwork of a Road. Canal and embankment party in cuttings and filling, using trapezoidal and prismoidal formula.

**TOPIC: 06 – APPLICATION OF COMPUTER PROGRAMMING:**

06.01 Application of computer programming on a simple estimate.

Book Recommended:

**Text Books**

2. Estimating & Costing                          - G.S. Birdi
Soil Mechanics is a well-recognized subject of Civil Engineering nowadays and its study is considered essential for technicians in effectively executing and main-tenance of a number of Civil Engineering activities like foundation, rigid and flexible pavements, underground dams, etc. The mission of technical education is to develop technical manpower which can be utilized for effective and efficient implementation of modern Civil Engineering projects by theoretical and practical analysis of soil mechanics in Civil Engineering works for strength and durability of the structures.

Rationale & Objective:

Soil Mechanics is essential for technicians to develop a comprehensive understanding of soil properties, classification, and behavior under various engineering conditions. This knowledge is crucial for the design and construction of structures such as foundations, pavements, and underground facilities. By studying Soil Mechanics, technicians will gain skills in:

- Analyzing soil properties and behavior under different conditions.
- Selecting appropriate materials and techniques for construction projects.
- Implementing solutions for soil-related problems in Civil Engineering works.
- Evaluating the strength and durability of structures.

Contents:

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<td>Basic Properties of Soil</td>
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<td>03</td>
<td>Determination of Index Properties of Soil</td>
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<td>04</td>
<td>Classification of Soil</td>
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<td>Soil Structure</td>
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<td>Permeability</td>
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<td>07</td>
<td>Compaction</td>
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<td>08</td>
<td>Shear Strength of Soil</td>
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<td>11</td>
<td>Foundation Engineering</td>
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<tr>
<td>12</td>
<td>Miscellaneous Topics</td>
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</table>

**TOPIC: 01 – INTRODUCTION:**

- Definition of Soil Mechanics & its application in Civil Engineering Works.
- Acquaintance with Indian Soil in general & Soil of Bihar in particular.

**TOPIC: 02 – BASIC PROPERTIES OF SOIL:**

- Soil mass as a three phase system.
- Functional relationship among water content, unit weights, specific gravity, void ratio, porosity, degree of saturation, percentage of air voids, air content, and density index.
- Numerical problems based on above topics.

**TOPIC: 03 – DETERMINATION OF INDEX PROPERTIES OF SOIL:**

- Water content determination by (i) oven drying methods, (ii) Sand Bath Method, and (iii) Pycnometer method.
- Laboratory methods for determination of specific gravity.
- Particle size distribution – basic concept.
- Methodology of sieve analysis.
- Sedimentation analysis – theory and limitations, Stoke’s law.

**TOPIC: 04 – CLASSIFICATION OF SOIL:**

- Objects of classification.
- Properties of soil classification.
- System of soil classification – simple idea of plasticity, consistency index, shrinkage limit, and plasticity index.
- Indian Soil Classification.

**TOPIC: 05 – SOIL STRUCTURE:**

- Brief introduction of soil structure and interparticle forces in a soil mass.
- Particle arrangement in coarse-grained soils, clays, and composite soils.
TOPIC: 07 – COMPACTATION: [04]
07.01 Theory of Compaction and factors influencing compacted density of soil.
07.02 Brief description of laboratory tests related to compaction of soil-Standard Proctor test & Modified Standard Proctor Test.
07.03 Effect of Compaction on Soil Properties.

TOPIC: 08 – SHEAR STRENGTH OF SOIL: [04]
08.01 Brief idea of Shear strength and Stress Analysis by Mohr’s Circle.
08.02 Mohr-Coulomb Failure Theory.
08.03 Measurement of Shear Strength of soil by
(i) Direct Shear Test
(ii) Triaxial Compression Test.

TOPIC: 09 – EARTH PRESSURE: [06]
09.01 Basic Concept of active earth pressure, Passive earth pressure and Earth pressure at rest.
09.02 Rankine’s theory-its assumptions and application in the determination of active earth pressure for the following cases:-
(i) Dry backfill with no surcharge
(ii) Submerged backfill
(iii) Backfill with uniform surcharge.
(iv) Cohesive soil
09.03 Application of Rankine’s theory for determining passive earth pressure in the following cases:-
(i) Cohesionless Backfill.
(ii) Cohesive Backfill.
09.04 Basic Numerical problems on above topics

TOPIC: 10 – BEARING CAPACITY: [05]
10.01 Definition of bearing capacity, Gross pressure intensity, Net pressure intensity, ultimate bearing capacity, Net ultimate bearing capacity, Net safe bearing capacity and allowable bearing pressure etc.
10.02 Rankine’s Analysis for determination of minimum depth of foundation.
10.03 Terzaghi’s Analysis-Assumptions & Limitations.
10.03.01 Derivation of Terzaghi’s general bearing capacity equation for continuous footing and basic numerical problems associated with it.

TOPIC: 11 – FOUNDATION ENGINEERING: [08]
11.01 Pile Foundations-Common types of piles.
11.01.01 Pile Driving-types of hammer
11.01.02 Load carrying capacity of piles by static & dynamic formulae-Basic numerical problems related to it.
11.01.03 Pile Load Test & Cycle Load Test.
11.01.04 Group Action in Pile-Efficiency of Pile group & settlement of pile group in clay.
11.01.05 Under-reamed Pile.
11.02 Well Foundation.
11.02.01 Caissons
11.02.02 Shapes of Well with component parts.
11.02.03 Depth of well foundation & expression for bearing capacity.
11.02.04 Forces acting on a well foundation.

TOPIC: 12 – MISCELLENOUS TOPICS: [06]
12.01 Clay Mineralogy- Kaolinite, Montmorillonite & Illite, Minerals of clay.
12.02 Consolidation and coefficient of consolidation.
12.02.01 Difference between compaction
12.03 Soil Stabilisation- Brief introductions.
12.03.01 Different Methods of Soil Stabilisation:-
(i) Mechanical Stabilisation Method
(ii) Cement Stabilisation Method
(iii) Lime Stabilisation Method
(iv) Bitumen Stabilisation Method
(v) Stabilisation by heating Method
(vi) Electrical Stabilisation Method
12.04 Types of Soil Samples-Disturbed & Undisturbed samples.
12.04.01 Procuring and handing of Disturbed and Undisturbed samples.
12.04.02 Types of Samplers- Open, Drive, Stationary piston and rotary sampler.

Books Recommended:
1. Soil Mechanics & Foundation Engineering Standard Book House, Delhi - 110006 - Dr. B. C. Punamia
5. Soil Testing, Khanna Publishers, Delhi -110006 - S. Mithal
6. Problems on Soil Mechanics, khanna Publishers, Delhi- 110006 - B. P. Verma
7. Soil Mechanics & Foundation Engineering, Standard Publishers Distributors, Delhi- 110006
9. ेरक [kaf=dh - MkWt tsř >k
10. Relevant B. I. S. Codes

SCHEME OF EXAMINATION FOR FINAL EXAMINATION
F.M. : 80
CONSTRUCTION TECHNOLOGY - I

<table>
<thead>
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<th>Subject Code</th>
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Theory

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Rationale:
One of the basic responsibilities of a Civil Engineering is to construct a cost effective, strong, durable and hygienic building. Construction of a building requires knowledge of such foundations, walls, lintels, beam, roof slabe, stairs, drainage and plumbing etc. and constructions details of various elements. Hence this subject has been introduced.

Objective:
The student will be taught the simpler aspects of design practices, detailing & counter claim matters of various elements involved in a building sector such as foundation, beams, roof, terrace, woodwork, painting, so that he can take up the construction of a building independently and with confidence as per given drawings specification.

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<tr>
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<tr>
<td>01</td>
<td>General</td>
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<td>02</td>
<td>Foundation</td>
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<td>03</td>
<td>Masonary</td>
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<td>04</td>
<td>Floor &amp; Floor Finish</td>
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<td>05</td>
<td>Finishing works</td>
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<td>Lintels &amp; Arches</td>
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<td>Doors &amp; Windows</td>
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<td>08</td>
<td>Stairs</td>
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<td>09</td>
<td>Roofs</td>
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Total : (60)

CONTENTS:

**TOPIC: 01 – GENERAL:**
01.01 Definition & Classification of buildings.
01.02 General principles of site selection for different types of building.
01.03 Various Building Terminology.

**TOPIC: 02 – FOUNDATION:**
02.01 Definition, purpose, failure & Remedies.
02.02 Soil Investigation, Bearing Capacity of soil, Testing of Bearing Capacity, Improvement of Bearing Capacity.
02.03.01 Different type of foundations and their details, suitability of different type.
02.03.02 Piles, Type and their details, pile driving.
02.04 Methods of excavation, shoring and dewatering including foundation in water logged area.

**TOPIC: 03 – MASONARY:**
03.01 Introduction, Definition of different terms used in brick masonary and stone masonary, Mortar.
03.02 Classification of stone masonary Requirement of good stone masonary, Dressing of stones, joints of stone masonary, lifting appliances.
03.03 Bonds in brick work, Types, Comparison Bonds in ½ brick, 1 brick, 1½ bricks & 2 bricks wall, junctions & pillars of different sizes, Requirements of good brick masonary.
03.04 Composite masonary, combination of stones & brick stone & cement concrete, cement concrete masonary.
03.05 Partition walls, types, cavity walls, Position of cavity wall tie.

**TOPIC: 04 – FLOOR & FLOOR FINISHES:**
04.01 Introduction, requirement of good floors, types & their details of construction, dodo & skirting.
04.02 Upper floors, types & their details.

**TOPIC: 05 – FINISHING WORKS:**
05.01 Plaster, properties of good plaster, preparation of surface, methods of plastering, types Rendering, stucco. Defects of plaster.
05.02 Painting, preparation of surface, types.
05.03 White washing, Colour washing, distemper, washing with snow-cem Painting.

**TOPIC: 06 – LINTELS & ARCHES:**
06.01 Lintels-Purpose, bearing & thickness, various materials used for lintels such as brick, stone timber, R. C. C. steel girder etc.
06.02 Arches-Introduction, terms used in arch, types shape & materials used.

**TOPIC: 07 – DOORS & WINDOWS:**
07.01 Doors-Location, function, door frames, various types of doors & their details.
07.02 Windows-Location, function, types fan-light special types of Windows, metal Window, fittings.

**TOPIC: 08 – STAIRS:**
08.01 Location, function, various terms used, requirement of good stair, types, material used.
08.02 Planning of stairs.

**TOPIC: 09 – ROOFS:**
09.01 Necessity, pitched & flat roof, terms used in roofs
09.02 Pitched roofs-type of truss, wooden & steel roof covering materials.
09.03 Flat roof-pros & cons, R.C.C. roof, tiled roof wooden roofs, flag stone roof, different types of terrace such as Madras, Punjab, M.P. & Maharashtra etc.

Books Recommended:
1. Building Construction - Sushil Kumar
2. Hkou fuekZ.k VsDukysykWth - oh- y- qyrk
3. Hkou fuekZ.k rduhdh - xq: pj.k flag
4. Building Technology - S.C. Rangwala
5. Building Construction - Ahuja
Hydraulics & Fluid Mechanics

Subject Code: 05209

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<th>Theory</th>
<th>No. of Periods per week</th>
<th>No. of Periods in one session 60</th>
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Rationale:
The Civil Engineering studies involve behaviour of fluids both in static & dynamic stages. The behaviour of fluid and its pressure characteristics when flowing in closed conduit or in open channels has to be studied & analysed for its proper handling. "Hydraulics & Hand Machines" is to be introduced in the curriculum.

Objective:
The study is to introduce the student with topics of fluid properties, fluid statics & dynamics, its flow characteristics in close conduits & open channels. This will enable the student understand the flow in pipes as encountered in planning & sanitary arrangements and open channel flow as open encountered in irrigation channels.

The curriculum has been divided into the following topics, given below:

S.No. | Topics | Periods
---|--------|-------
01 | Fluid Properties | (04)
02 | Hydrostatics | (10)
03 | Buoyancy | (04)
04 | Hydro-Kinematics | (06)
05 | Measurement of flow | (05)
06 | Flow over notch and weirs | (05)
07 | Flow in Pipes | (08)
08 | Flow through open channel | (08)
09 | Pumps | (04)
10 | Hydraulic Machines | (06)

Total: (60)

CONTENTS:
TOPIC: 01 – FLUID PROPERTIES:
01.01 Basic ideas of fluid. [04]
01.02 Physical Properties of fluid.
01.03 Brief study of fluid Properties like density, specitic weight, compressibility, Surface tension, viscososity and Vapour pressure.
01.04 Liquid commonly used in hydraulics.
01.05 Normal values of parameters for water.
01.06 Definition of fluid Mechanics and ideal fluids.
01.07 Knowledge of units and dimensions of various Parameters like discharge, Pressure, Pressure head, energy and Power.

TOPIC: 02 – HYDROSTATICS:
02.01 Total liquid pressure. [10]
02.02 Intensity of liquid pressure and pressure head.
02.03 Atmospheric pressure, pressure gague, Negative pressure and absolute pressure.
02.04 Laws of Liquid pressure.
02.05 Piezometer, simple manometer, Different manometer, inverted manometer, Mechanical gauges and Bordon Pressure gauges.
02.06 Total pressure on plane immersed surface.
02.07 Centre of pressure and its location for horizontal vertical and inclined surfaces.
02.08 Pressure diagram for different cases.
02.09 Forces on vertical dam, walls and gates.

TOPIC: 03 – BUOYANCY:
03.01 Buoyent force and center of buoyancy. [04]
03.02 Kinds of equilibrium of a floating Buoyancy Stable, unstable and neutral Equilibrium.
03.03 Meta-centre and Meta-centric Height.
03.03.01 Analytical and Experimental methods for determination of Metacentric Height.

TOPIC: 04 – HYDRO-KINEMATICS:
04.01 States of Flow-Laminar and Turbulent, [06]
04.02 Types of Flow-Steady and unsteady, uniform and non-uniform sub critical and super critical, compressible and non compressible.
04.03 Reynolds Number, Rounds Number and Webber Number.
04.04 Equation of continuity for one dimensional steady flow.
04.05 Datum head, velocity head, Pressure head and total head.
04.06 Bernoulli’s Equation and its proof, Modified Bernoulli’s Equation.
04.07 Pitot tube-Principle and its use.
04.08 Venturimeter.
04.08.01 Coefficient of Venturimeter.
04.08.02 Discharge of Venturimeter.
04.08.03 Application of Venturimeter.

TOPIC: 05 – MEASUREMENT OF FLOW:
05.01 Orifice. [05]
05.01.01 Orifices and its types-small and orifices, free and drowned orifices.
05.01.02 Flow through
(a) Sharp edged small orifices & loss of head at sharp edged small orifices.
(b) Sharp edged Large orifice of Rectangular shape.
(c) Drowned orifice (sharp edged or bell mouthed) of any shape.
(d) Partially submerged Rectangular orifice.
05.01.03 Velocity or Approach and its effect.
05.01.04  Mouth Piece-External Cylindrical Mouth Piece
05.01.05  Time of emptying rectangular tank.
TOPIC: 06 – FLOW OVER NOTCHES AND WEIRS:

06.01 Notches & weirs, its shape.
06.02 Narrow crested, Broad Crested and submerged weir.
06.03 Flow through Rectangular, triangular, and trapezoidal notches, cipalleti, Francis Formula and contraction.

TOPIC: 07 – FLOW IN PIPES:

07.01 Loss of Energy in a Pipe.
07.02 Laws of Resistance to flow.
07.03 Hydraulic gradient of Pipe-Hydraulic gradient line and total energy line.
07.04 Loss of head due to friction in Pipe-Darcy’s equation for loss of head.
07.05 Loss at sudden enlargement and sudden contraction of cross section of pipe.
07.06 Loss at inlet to a Pipe line.
07.07 Loss at obstruction in a Pipe line.
07.08 Loss at bends and elbows in a Pipe line.
07.09 Siphon Pipes.
07.10 Pipes in series & Parallel, Equivalent length.
07.11 Simple idea of water hammer-its causes, effects and remedial measures.

TOPIC: 08 – FLOW THROUGH OPEN CHANNEL:

08.01 Steady uniform flow through rectangular and trapezoidal channels
08.02 Chazy’s and Minning’s formula.
08.03 Channel of most efficient cross section-Rectangular and Trapezoidal.
08.04 Specific energy diagram.
08.05 Super critical, sub critical and critical depth of Flow.
08.06 Hydraulic jump.
08.06.01 Hydraulic jump with the help of specific energy diagram.
08.06.02 Formation and use of Hydraulic jump.
08.06.03 Elementary idea of standing wave flume without Mathematical treatment.

TOPIC: 09 – PUMPS:

09.01 Pumps and its type. (Working principle only, excluding numerical problems).
09.02 Reciprocative and centrifugal pump-component Parts, working and choice of type of pump comparison and contrast of the reciprocating and centrifugal pump.
09.03 Double acting pump, single cylinder and single acting reciprocating pump, Multi cylinder pump.
09.04 Inertial head of liquid in suction and delivery pump.
09.05 Air lift pump-component parts and working only.

TOPIC: 10 – HYDRAULIC MACHINE:

10.01 Hydraulics transmission of power. Hydraulic Power system.
10.02 Hydraulic Accumulator and its types.
10.03 Hydraulic Intensifier.
10.04 Hydraulic press and Hydraulic lift.
10.05 Impulse and reaction turbine.
10.06 Power Station-Components. Construction working principle and their uses only.

Books Recommended:

Text Books

5. Hydraulics & Fluid Mechanics. - Dr. Jagdish Lal

Reference Books

1. Fluid Mechanics. - S. Nagaratnam

SCHEME OF EXAMINATION FOR FINAL EXAMINATION

F.M. : 80
Rationale:
The engineering profession is called upon to reduce or create infrastructures for production of good services. Besides the engineering and technological aspects involved in the production or creation of facilities, the profession interalia gets involved in the interplay of various elements of economics, accounting and audit. The cost analysis of input materials, labour and services over a period of time require in depth concept of procurement of commodities, escalation of prices, their dependencies on economic indices & functions, demand, cost & cost classifications, pricing & profit elements. The end price of the product will include the profit part. The project of a welfare state will generally have benefits which have benefits which have to be evaluated in terms of economic returns. And in between the profession has to ensure the cost of planning, budgeting, financing procuring, price escalation/depreciation contractual obligations, accounting and audit.

Hence the necessity of introducing this paper on Engineering Economics & Accounts.

S. No. | Topics | Periods
--- | --- | ---
01 | Engineering Economics. | (25)
02 | Accounts | (25)

**Total:**

**CONTENTS:**

**TOPIC: 01 – ENGINEERING ECONOMICS:**

<table>
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<tr>
<td>01.02</td>
<td>Cost concepts and classification actural cost. appertunity cost, fixed cost, variable cost, average cost, marginal cost, total cost, cost-output relation Depreciation.</td>
<td>(06)</td>
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<td>01.03</td>
<td>Pricing. Pricing under perfect &amp; imperfect competition Pricing method. Profit planning. Break even analysis, cost benefit study: evaluation of economic returns of the benefits. Comparison Giwear profit and economic refurns.</td>
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**TOPIC: 02 – ACCOUNTS:**

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<tr>
<td>02.02</td>
<td>Estimates. Register of Sanctional Estimates. Register of works Revised of works. Revised Estimates. Revised sanotion, Muster roll-payment to labours &amp; arrear wages, worked charged establishment, fixed charged register measurement books. Standard Measurement Books.</td>
<td>(06)</td>
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<td>02.03</td>
<td>Advance. Advance to contractors, several advance, advance payment. Advances to subordinates permanents advance or imprest, temporary advance.</td>
<td>(06)</td>
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<td>02.05</td>
<td>System of audit. Contingent audit &amp; works audit. Accounting, Audit &amp; Relation with Accountant. General or Head of Accounts organization.</td>
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Books Recommended:

**Text Books**

4. P.W. Department Code -
5. P.W. Accounts Code -

**SCHEME OF EXAMINATION FOR FINAL EXAMINATION**

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Rationale & Objectives:
The Engineering Mechanics Laboratory is a subject which will help technician to understand the application of theory that he has studied in practice by performing experiments and verifying results. Besides the above the objective of the curriculum with effective skill will be developed in them to observe experimental data, and to analyse the results. These topics of this curriculum will certainly build their confidence in performing the utilization of principle of mechanics in Civil Engineering works.

CONTENTS:
Eight experiments to be performed in the Laboratory:
1. Determination of elongation of wire under external load.
2. Tensile Test on mild steel specimen.
3. Tensile Test on high tensile specimen.
4. Compression Test on metal.
5. Compression Test on bricks.
7. Determination of reaction at the support of beam.
8. Determination of bending moment of a simply supported beam.
9. Determination of reaction at the support of roof truss.
10. Determination of deflection of beams.
12. Determination of bending moment of a over hanging beam.
13. Verification of Polygon Law of forces.
14. Verification of Triangle Law of forces.
15. To find moment of inertia of fly wheel.
16. Compression Test on metal.
17. Tensile Test on M. S. specimen.
18. Determination of co-efficient of friction on inclined plane.

Books Recommended:

Text Books
1. -

SCHEME OF EXAMINATION FOR FINAL EXAMINATION

| F.M.  | 40 |
COMPUTER PROGRAMMING THROUGH C

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CONTENTS:

List of Practicals:
1. Programming exercise on executing a C program.
2. Programming exercise on editing C program.
3. Programming exercise on defining variables and assigning values to variable.
4. Programming exercise on arithmetic and relational operations.
5. Programming exercise on arithmetic expressions and their evaluation
6. Programming on infix, postfix, transformation using stack.
7. Programs on insertion, deletion on link list.

Books Recommended:

SCHEME OF EXAMINATION FOR FINAL EXAMINATION

F.M. : 40
FIELD SURVEY

Subject Code: 05213

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Full Marks : 50
Annual Exam. : 40
Internal Exam. : 10

Rationale:
Survey is the prime work of a technician. No work/no project work can start without survey marks and etc. Main persons responsible in the chain of technician are the Junior Engineers. In other words, we can say that technicians are the back bone of any project work because of the fact that the whole of project depends upon the survey results.

Objective:
Seeing the duties of Junior Engineer, the field survey practical will help students to carry out the actual survey work to be done in field as regular practice work. This will build self confidence towards survey works in student.

CONTENTS

01 Traversing by transit theodolite consisting of at least five sides, preparation of Gale’s Traverse table, plotting of traverse by independent co-ordinates. Details to be filed in the plane tabling.

02 Contouring of an area 200 m x 200 m by spot levelling method.

03 Contouring of an area by square methods – sides of square may be approximately 150 m.

04 Longitudinal section by tacheometry for approximately kilometer distance.

05 Setting out of a simple curve with given data by.

(a) Offset form Long chord method.

(b) Rankine’s method of deflection angle.

Books Recommended:

Text Books

2. Surveying, Vol. II -
3. Surveying, Vol. II - D. Clave

SCHEME OF EXAMINATION FOR FINAL EXAMINATION

F.M. : 40
Rationale:
An important job function of a Civil Engineering technicians is to supervise construction of various Civil Engineering structures. So, the construction practice is very important for Civil Engineers. They have to use the knowledge of construction very widely and frequently in his world of work.

Objective:
The Construction practice will help a student in building a self confidence towards actual construction work.

S.No.    Topics                        Periods
01       Work Study                   (06)
02       Construction Practice       (54)

Total: (60)

CONTENTS:

TOPIC: 01 – WORK STUDY:

Many visits should be arranged to the construction site nearby the institution to acquaint students with site condition, use of various equipment and various construction techniques and to study different components of building including sub structure and super structure.

Study of reinforcement used in different members, details of concrete section. At construction sites, the following should be demonstrated:

(a) Spread foundation, under reamed pile foundation raft foundation.
(b) D.P.C. over plinth.
(c) Scartolding for construction of super structures.
(d) Form work and shuttering for lintel, slab, beam & column.
(e) Bending & binding of reinforcement & fabrication.
(f) Details of water supply and sanitary fittings.

Students shall prepare a journal containing, reports on these visits.

TOPIC: 02 – CONSTRUCTION PRACTICE:

02.01   Making sketches and learning use of various tools and appliances for Civil Engineering works. (06)
02.02   Preparing foundation plan for load bearing and framed structure construction. (06)
02.03   Layout of a building having a plinth area of 50 to 60 m². (06)
02.04   Preparation of mortar, brick masonry in English and Flemish bond for walls, pillars & junctions. (15)
02.05   Preparation of Cement concrete manually and by machine and its laying. (03)
02.06   Plastering and pointing of well. (09)
02.07   Flooring – Preparation of sub surface, brick that soling, brick on edge soling in Herring bond pattern, Indian Patent stone flooring. (09)

Books Recommended:

Text Books

1. Building Construction - Sushil Kumar
2. Hkou fuetZ.r VsDuksykWh - oh- y- qxrlk
3. Hkou fuetZ.r rduhdd - qx: pj.k flag
4. Building Technology - S. C. Rangwala
5. Building Construction - Ahuja
6. Building Construction - J. Jag, Sushil Kumar, K. L Roy

SCHEME OF EXAMINATION FOR FINAL EXAMINATION

F.M. : 40
CIVIL ENGINEERING DRAWING

Subject Code 05215

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Full Marks: 100
Annual Exam.: 60
Internal Exam.: 40

Rationale:
As we all know that Drawing is the language of a technician. Hence in order to make a technician master of Civil Engineering Drawing, he should be able to prepare detailed drawing of civil engineering structures which he will come across during in service.

Objective:
The detailed Drawing prepared in class should be neatly drawn on drawing sheets and should be preserved on drawing sheets as life time record. He may refer their drawings; whenever some compulsion arises in understanding similar drawing.

S.No. Topics
01 Plan, Elevation and Section of a single storey Residential Building having three main rooms, kitchen, bath, store and verandah with flat roof, showing details of stepped foundation.
02 Plan, Elevation and Section of a double storeyed public building with flat roof.
03 Plan, Elevation and Section of a single storey residential building with inclined roof. (Varandah lean to roof and other rooms couple roof).
04 Plan, Elevation and Section of a double storeyed building with Ground floor having flat roof and first floor having inclined roof.
05 Plan, Elevation and Section of a Godown Building 50 metre long, 15 metre wide with inclined roof supported over Tubular Tures.
06 Sectional Elevation of the following showing details of Rafters and purlins. (a) King Post Truss  (b) Queen Post Truss (c) North light Tubular Roof Truss. Enlarged details of important joints should also be shown.
07 Sectional Plan, longitudinal section and Front Elevation of ledged and Braced. Fully paneled and Glazed doors & windows & Flush door.
08 Plan, half Elevation and half cross section of a single span R.C.C. slab culvert. Masonary Arched Culvert and Pipe Culvert.

Books Recommended:

1. Civil Engg. Drawing - D. N. Bose
Rationale:
This field survey work is the primary work of a civil technician without which no project work can be taken up during field survey works, a technician will be able to handle the different survey instruments which he is expected to do in service period. A junior engineer is fully responsible for all types of survey works in field. Hence he must be able to conduct all types of survey works successfully in the field.

Objective:
A student will be able to perform the survey works in the field with the given set of instruments will also be able to identify the errors of the instruments with which he is working. He will also learn to rectify some of the instrument errors personally and then conduct the survey works correctly.

CONTENTS

01 Traversing by transit theodolite consisting of at least five sides, preparation of Gale’s Traverse table, plotting of traverse by independent co-ordinates. Detail to be filed in the plane tabling.
02 Contouring of an area by square methods – sides of square may be approximately 150 m.
03 Contouring of an area 200 m X 200 m by spot leveling method.
04 Longitudinal section by tacheometry for approximately kilometer distance.
05 Setting out of a simple curve with given data by,
   (a) Offset form Long chord method.
   (b) Ranking’s method of deflection angle.

Books Recommended:
Text Books

Rationale & Objective:
The Soil Mechanics Laboratory is essential as soil possess a variety of physical properties, most of which are not constant. This diversity in the nature of the soil need experimental analysis of the soil be performed by the technicians. For this purpose, the present curriculum envisages the skill development of the technicians in performing experiments as well as the presentation and analysis of the experimental data. It will be helpful in building confidence among the technicians in selecting/designing the appropriate components of Civil Engg. works.

CONTENTS

Preparation of Journal based on any Eight experiments of the following:

01 Determination of water content by Oven Drying Method.
02 Determination of water content by Sand Bath Method.
03 Determination of Specific gravity of soil by Density Bottle.
04 Determination of Specific gravity of soil by Pycnometer.
05 Determination of Field Density by Water Displacement Method.
06 Determination of Field Density by Core Cutter Method.
07 Determination of Field Density by Sand Replacement Method.
08 Determination of Grain Size Distribution by Sieving.
09 Determination of Grain Size Distribution by Hydrometer.
10 Determination of Liquid Limit of Soil.
11 Determination of Plastic Limit of Soil.
12 Determination of Shrinkage Limit of Soil.
13 Determination of Permeability by Constant Head Test.
14 Determination Permeability by Falling Head Test.
15 Determination of Compaction of Soil by Standard Proctor Test.
16 Determination of Compaction of Soil by Modified Proctor Test.

Books Recommended:

Text Books

1. Soil Mechanics & Foundation Engineering, Standard Book House, Delhi-110006 - Dr. B. C. Punamia
2. Soil Engineering in Theory and Practice Volume-1 & 2, C. B. S. Publishers & Distributors, Delhi-110006 - Dr. Alam Singh & Dr. G. R. Choudhary
5. Soil Testing, Khanna Publishers, Delhi-110006 - S. Mithal
6. Problems on Soil Mechanics, Khanna Publishers, Delhi-110006 - B. P. Verma
8. Relevant B. I. S. Codes - HkxsqFk yky xqIrk
9. Relevant B. I. S. Codes - MkWÄ tsq >k
10. Relevant B. I. S. Codes -
Rationale:
Experimental verification of the mathematical calculations in operation of some of the hydraulic machines in theory will be useful in service area.

Objective:
It will help student to conduct and operate the hydraulic equipments and know the results, then he can compare their results with mathematical calculations. He will also be able to find out the experimental errors which normally occurs.

CONTENTS
Journals based on any eight experiments performed in the Laboratory is to be prepared.

01 Measurement of pressure by piezometre and pressure gauges.
02 Verification of Bernoulli’s theorem.
03 Discharge through venturimeter.
04 Determination of $C_v$, $C_c$, and $C_d$ through sharp edged circular orifice.
05 Determination of Coefficient of discharge through a rectangular notch.
06 Determination of Coefficient of discharge through a triangular notch.
07 Determination of Coefficient of discharge through a rectangular weir or trapezoidal weir.
08 Determination of loss of head due to friction for a given pipe.
09 Determination of metacentric height of a floating body.
10 Determination of critical value of Reynold’s number.
11 Determination of time to emptying a tank.
12 Determination of velocity head by Pitot tube.
13 Study of working principle of centrifugal pump.
14 Study of working principles of Reciprocating pump.
15 Study of working principle of a peltor wheel.
16 Study of working principles of a francis turbine.