### PROFESSIONAL MATHEMATICS

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Theory</th>
<th>No of Periods Per Week</th>
<th>Full of Period in one session : 60</th>
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<tr>
<th>S.No.</th>
<th>Topics</th>
<th>Periods</th>
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<tbody>
<tr>
<td>01</td>
<td>GROUP –A (Numerical Methods &amp; Computational Techniques)</td>
<td>20</td>
</tr>
<tr>
<td>02</td>
<td>GROUP-B (Statistical Techniques)</td>
<td>20</td>
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<tr>
<td>03</td>
<td>GROUP-C (Management Techniques)</td>
<td>20</td>
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</tbody>
</table>

### CONTENTS:

**GROUP-A** (NUMERICAL METHODS & COMPUTATIONAL TECHNIQUES) (20)
- 01.01 Introduction to Numerical methods: Approximation and errors (Truncation & Round off). Floating, point presentation of numbers, arithmetic operations with normalized floating point.
- 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) (20)
- 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.
- 02.04 Sampling Distribution: Sampling Distribution of Mean and Standard Deviation.
- 02.05 Quality Control: P-Chart and R-Chart.

**GROUP-C** (MANAGEMENT TECHNIQUES) (20)
- 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-degenerator) 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**

| F.M | .80 |

**Rationale:**

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 accomplish 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.

**Notes:**

- Full Marks 80
- No. of Periods Per Week: 60
- Internal Exam.: 20
- Annual Exam.: 80

**Books Recommended:**

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 describes 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.

S.No. | Topics | PART-A | Periods |
--- | --- | --- | --- |
01 | Introduction | | (02) |
02 | Vector Methods | | (02) |
03 | Introduction to system of forces and equilibrium | | (06) |
04 | Friction | | (04) |
05 | Kinematics and kinetics of a particle | | (03) |
06 | Kinematics and kinetics of rigid body | | (04) |
07 | Impulse and Momentum | | (02) |
08 | Work, Energy and Power | | (04) |

Total : | | (27) |

PART-B

01 | Simple stress and strains | | (05) |
02 | Elastic constants | | (03) |
03 | Center of Gravity (Centroid) | | (05) |
04 | Moment of Inertia | | (05) |
05 | Shearing force and bending moments | | (23) |

Total : | | (50) |

CONTENTS:

PART-A

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

**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.

**TOPIC: 03 – INDRODUCTION 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.

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

**TOPIC: 05 – KINEMATICS AND KINETICS OF A PARTICLE:**
Rectilinear and curvilinear translations; normal and tangential component of acceleration; radial and transverse component of acceleration.

**TOPIC: 06 – KINEMATICS AND KINETICS OF RIGID BODY:**
Angular Velocity and angular acceleration; Effective forces on a rigid body. D’ Alembert’s principle.

**TOPIC: 07 – IMPULSE AND MOMENTUM:**
Linear impulse and linear momentum, angular impulse and angular momentum.

**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.

PART-B

**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 | Shrinkage on hoop’s stresses. | | |

**TOPIC: 02 – ELASTIC STRESS & STRAIN:**

2
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**

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**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.


**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
MANUFACTURING TECHNOLOGY - I

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Rationale:
A nation is strong if the industries are strong. A nation is self dependent if it produces its all requirements with its own resources and industry and should have the capacity to export materials in other countries.

A diploma holder technician has to play a vital role in industries. He has to work as a bridge in between Management and Labour.

An industry is rich if its workshop is rich. A workshop is rich if it has recent machines in good number and technical staffs (having good concepts) in sufficient no. A diploma holder technician plays a vital role in act and guidance inside a workshop.

Objective:
For building a diploma holder technician to be more practical with good concept of theories the paper Manufacturing Technology – I has been framed. With the help of this paper a person will be able to get the almost all basic concepts of workshop.

The students will be able to:
(i) Know the basic principles of workshop.
(ii) Select materials, tools, equipments more speedily accurately.
(iii) Prepare a job as per requirement (either by casting of machining).
(iv) Check the qualities and specification of job, tools and equipments.
(v) Develop managerial skill.

S.No. | Topics                                | Periods |
------|---------------------------------------|---------|
01    | Workshop Management                   | (04)    |
02    | Lathe                                 | (16)    |
03    | Shaper and Planner                    | (09)    |
04    | Drilling & Boring Machines            | (05)    |
05    | General Knowledge of Different Types of Machines | (04) |
06    | Welding                               | (10)    |
07    | Pattern Making                        | (08)    |
08    | Moulding                              | (07)    |
09    | Casting                               | (06)    |
10    | Metal Cutting                         | (06)    |
Total :                                | (75)    |

CONTENTS:

**TOPIC: 01 – WORKSHOP MANAGEMENT:** [04]
01.01 Rules and regulations of working in workshop (01)
01.02 Duties and responsibilities of Foreman (01)
01.03 Algorithm or flow diagram for completing a job in different sections of workshop (01)
01.04 A general knowledge of Iron. Coal. Tools used in different section (01)

**TOPIC: 02 – LATHE:** [16]
02.01 Introduction, terminology used in lathe: feed, depth of cut, cutting speed, R.P.M. of pass etc. (01)
02.02 Types of lathe, centre lathe, capstan lathe, turret lathe, automatic lathe of computer guided lathe (C.N.C. lathe) (02)
02.03 Constructional details of centre lathe (02)
02.04 Specification of lathe. Difference between centre lathe & turret lathe (03)
02.05 Operation on lathe – Turning (Cylindrical, toper), facing, drilling, boring, thread cutting, grinding etc – Numericals, (03)
02.06 Tools for each types of operation, special attachment & accessories on lathe (01)
02.07 Sp. Operation on lathe using special attachment, indexing of turret & cross slide (01)
02.08 Faults in lathe & its remedies (01)
02.09 C.N.C. lathe – computer operation for C.N.C. lathe, merits of C.N.C over manually operated lathe (02)
02.10 Visit to factory where C.N.C. is used (01)

**TOPIC: 03 – SHAPER AND PLANNER:** [09]
03.01 Introduction. Construction details of shaper (02)
03.02 Quick return mechanism (01)
03.03 Terminology used (feed. Depth of cut, no. of pass, R.P.M. stroke length cutting speed) (01)
03.04 Specification of shape (01)
03.05 Troubleshooting (01)
03.06 Difference between shaper and planner, Planner operation. Types of jobs prepared on shaper and planner, (02)
03.07 Numerical problems on shaper (01)

**TOPIC: 04 – DRILLING & BORING MACHINES:** [05]
04.01 Introduction, classification, specification (02)
04.02 Tools, accessories, operation, difference in drilling & boring tools (03)

**TOPIC: 05 – GENERAL KNOWLEDGE OF DIFFERENT TYPES OF MACHINES:** [04]
05.01 General knowledge of broaching tools, slotting machine, its use (01)
05.02 Grinding machines, nomenclature of grinding wheel’s abrasive material (03)
TOPIC: 06 – WELDING:
06.01 Introduction, types. (02)
06.02 Description of Gas welding and electric welding, tools used in welding. (02)
06.03 Precaution in welding. (01)
06.04 Brazing & soldering. (01)
06.05 Flame theory: Colour, temperature O₂:C₂H₂ combination for welding & cutting. (02)
06.06 Welding rod, calculation of welding rod, oxygen/acetylene in gas welding. Numerical problems. (02)

TOPIC: 07 – PATTERN MAKING:
07.01 Definition of pattern. General terms used in pattern making. (01)
07.02 Pattern making tools, pattern materials wood, metals like brass, aluminium, white metal, plastics etc. (03)
07.03 Types of pattern – Single piece, split, loose piece, geted cope and drag and shell patterns. (02)
07.04 Pattern allowance: shrinkage, finish and rapping or shake allowance. (02)

TOPIC: 08 – MOULDING:
08.01 Moulding tools and equipments, moulding machine, moulding materials, their types with compositions and characteristics. (02)
08.02 Moulding processes – Hand moulding and machine moulding, types of moulds, methods of moulding, bench moulding/book moulding, pit moulding, loam moulding and mouldings. (02)
08.03 Core binders, core boxes and core print, core preparation and setting of cores, core baking. (02)

TOPIC: 09 – CASTING:
09.01 Melting furnaces, Electric furnace. Coke fired furnaces, oil and gas fired furnaces and cupola furnaces, factors affecting selection of furnaces, sand casting process, use of special methods of casting, centrifugal casting, die-casting, investment casting & their areas of application. Advantages and disadvantages of these casting, clearing and testing of casting, Defects in casting and their remedies. (01)

TOPIC: 10 – METAL CUTTING:
10.01 Metal cutting theory, stages of cutting, factors affecting cutting, cutting speed calculation. (01)
10.02 Chip formation, types of chips, effect of built up edge formation upon surface finish, chip braker. (02)
10.03 Cutting tool classification of cutting tool, tool geometry tool life. (02)
10.04 Tool wear, tool failure, types of cutting fluids & their properties with specific uses. (01)

Book Recommended:
1. Karyashala Takniki (Khand – I) - B.S. Raghuvanshi
   Dhanpat Rai & Sons, New Delhi
2. - R.K. Jain
3. Manufacturing - Begman

SCHEME OF EXAMINATION FOR FINAL EXAMINATION

F.M. : 80

Types of Questions | DISTRIBUTION OF MARKS | Test Knowledge | Test Skill | Test Attitude & Application | Total Marks
--- | --- | --- | --- | --- | ---
Objective type | 30% | 40% | 30% | 16 (1 Question)
Short Answer type | 30% | 40% | 30% | 64 (4 Question)
Long Answer type | (1 Question) | (2 Question) | (1 Question)
Total Marks

7
Rationale:

A diploma holder technician in Mechanical Engineering has to encounter with the use of, and conversion of chemical energy into thermal energy, thermal energy into mechanical energy, waste products carrying heavy amount of useless energy into useful energy. Conversion of solar energy into different types of energies utilized in different plants, like railway, automobile etc.

The E.C.I. has been introduced in Diploma II to give the base for the conversion/utilization of technologies being used or to be used in different organisations.

Objective:

The objective of the course is to provide the basic concepts of the conversion of useless energy into useful energy so that students should be able to develop the new ideas about the energy and can be able to develop a new technology/advance technology to give more & more useful energy.

The basic concepts provide the following items:

(i) Knowledge of different types of energy.
(ii) Utilization of waste products/unutilized material into biogas or biomass.
(iii) Concept of wind mill.
(iv) Better utilization of abundant energy of the sun in the form of solar energy.
(v) Conversion of chemical energy into thermal energy.
(vi) Conversion of other types of energies into thermal energy.
(vii) Chemical capacity of traditional fuel.
(viii) Capacity of steam, use of steam table, molliers chart.
(ix) Production of steam.

(Knowledge of steam generators etc.)

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<th>S.No.</th>
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<td>01</td>
<td>Sources of Energy.</td>
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<tr>
<td>02</td>
<td>Heat Transfer for Solar Energy Utilization</td>
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<td>03</td>
<td>Solar Radiation Analysis</td>
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<td>Fuels and Combustion of fuels</td>
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<td>Steam &amp; Steam Generators</td>
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CONTENTS:

**TOPIC: 01 – SOURCES OF ENERGY:**

01.01 Definition of energy, types of sources of energy (conventional & non conventional) (01)
01.02 Causes for evaluation of non-conventional energy, small description. (01)
01.03 Types of non-conventional energy & their resources. (02)
01.04 Availability of non-conventional energy and its usefulness. (01)
01.05 Description of wind mill, its types and performance. (02)
01.06 Bioconversion and Biomass (photo synthesis, biogas generation Materials for biogas, ocean. (02)
01.07 Thermal electric conversion (OTEC) – introduction only. (01)

**TOPIC: 02 – HEAT TRANSFER FOR SOLAR ENERGY UTILIZATION:**

02.01 Introduction, Conduction, Convection, Radiation, Reflectivity, Transmissibility, Heat exchanger. (03)
02.02 Problems of heat transfer through an insulated wall of pipe. (02)

**TOPIC: 03 – SOLAR RADIATION ANALYSIS:**

03.01 The characteristics of the sun. (01)
03.02 Solar constant, Solar Radiation at the earths surface. (02)
03.03 Determination of solar time, derived solar angles. (03)

**TOPIC: 04 – STORAGE OF SOLAR ENERGY:**

04.01 Types of energy storage (thermal storage, electrical storage, chemical storage, in the form of potential hydraulic energy (hydro storage). (06)

**TOPIC: 05 – METHODS OF SOLAR ENERGY UTILIZATION:**

05.01 Solar furnaces (01)
05.02 Solar pumping (01)
05.03 Solar distillation (01)
05.04 Solar cooking (02)
05.05 Solar green house (01)
05.06 Thermo-electric conversion (02)

**TOPIC: 06 – FUELS AND COMBUSTION OF FUELS:**

06.01 Fuels – Introduction, desirable properties of good fuel. (01)
06.02 Classification – Solid, Liquid, Gas. (01)
06.03 Calorific Value – Lower C. V. Higher C. V. Air/Oxygen required for complete combustion, octane and cetane no. of fuels
Requirements of Aviation fuel, Fuel additive, CNG – Introduction.

**TOPIC: 07 – INTRODUCTION TO THERMODYNAMICS:**

**07.01** Basic concept of thermodynamics. Heat and Energy. Thermodynamic systems, closed system, open system, isolated system.

**07.02** Properties of system and their classification. Properties of perfect gases. Different types of thermodynamic process.

**07.03** Laws of gases and their characteristics equation. Specific heats of gases and their relation with gas constant, Representation of processes on P-V & T-Φ diagram

**07.04** Laws of Thermodynamics – zeroth Law of Thermodynamics.

**07.05** First Law of Thermodynamics, Statement, explanation & application. Non-flow energy equation (closed system), calculation of work done, Heat transfer and internal energy for different thermodynamic process.


**07.07** thermodynamic processes (T-Φ diagram)

**TOPIC: 08 – AIR CYCLES:**

**08.01** Definition of a Cycle, Cylinder Bore, Stroke ratio, Stroke length, Stroke Volume. Clearance, Clearance ratio, Compression ratio, Pressure ratio, m.e.p. and air standard efficiency.

**08.02** Concept of reversible and irreversible processes and cycles.

**08.03** Ideal Cycle (Carnot Cycle), Representation on P-V & T-Φ and H-Φ diagrams Derivation and Calculation of m.e.p. and air standard efficiency.

**08.04** Otto Cycle, Representation on P-V & T-Φ and H-Φ diagrams. Derivation and Calculation of m.e.p. and air standard efficiency.

**08.05** Diesel Cycle, Representation on P-V & T-Φ and H-Φ diagrams. Derivation and Calculation of m.e.p. and air standard efficiency.

**08.06** Dual Cycle, Representation on P-V & T-Φ and H-Φ diagrams. Derivation and Calculation of m.e.p. and air standard efficiency.

**TOPIC: 09 – STEAM AND STEAM GENERATORS:**

**09.01** Formation and properties of Steam.

**09.02** Formation of steam at a constant pressure, constant temperature, constant volume. Total heat graph during steam formation.

**09.03** Important terminology used for steam. Wetsteam, Super saturated steam. Dryness fraction, Latent heat of vaporization, Sensible heat of water.

**09.04** Total heat of enthalpy of steam. Entropy of steam. Steam table and its use.

**09.05** Use of Mollier’s chart.

**09.06** Advantage of super heating, External work done during evaporation, Internal Energy of steam, Problems on properties of steam.

**09.07** Steam generators, Introduction to steam generators, Classification of boilers.

**09.08** Requirements of good steam boilers.

**Books Recommended:**

1. Solar Energy Utilization - G.D. Rai

**SCHEME OF EXAMINATION FOR FINAL EXAMINATION**

<table>
<thead>
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<th>Types of Questions</th>
<th>DISTRIBUTION OF MARKS</th>
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</table>
AUTOMOBILE ENGINEERING - I

Subject Code 02206

<table>
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<tr>
<th>Theory</th>
<th>No of Periods Per Week</th>
<th>Full Marks</th>
<th>No of Period in one session : 75</th>
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<td>P/S</td>
<td>Annual Exam. : 80</td>
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Rationale

Before the students take up the detailed study of Automobile Engineering, they should know it beforehand what the subject is all about. They should be familiarized with the different systems of an Automobile, their function and how they interact with each other to make the complete vehicle serve the purpose of transportation comfortably, smoothly and efficiently with effective controls. This will help the students to understand the subject that they will encounter at higher classes of learning.

Objectives

The contents of the subject are selected to make the students:

- Understand the Automobile Engineering subject as a whole.
- Identify the main parts of engines.
- Understand on the basis of construction between - 2 Stroke and 4 Stroke engines, Petrol and Diesel engines, Air-Cooled and Water-Cooled engine, Single-Cylinder and Multi-Cylinder engines, Two-Wheel Drive and Four-Wheel Drive, and Hydraulic and Pneumatic Brake System.

CURRICULUM

SL. | Topics | Content | Periods |
---|--------|---------|---------|
01 | Function of an Automobile Vehicle | Power output in engines, Transmission through clutch, gear-box and propeller shaft, differential, rear axle and wheels, Steering, accelerating, breaking system, cooling systems. With the help of models of auto parts, O.H.P. transparencies or epidiascope. | 02 |
02 | Engines | Cylinder Block: Identification, General construction, Function, Materials used. | 21 |
02.01 | Cylinder Block | 04 |
02.02 | Cylinder Head: Identification, Function, Materials used. | 02 |
02.03 | Piston, Gudgeon Pin: Function, Location, Inter-link, Materials used. | 01 |
02.04 | Piston Rings: Location and Function, Types, Numbers, Materials of construction. | 01 |
02.05 | Crank Case: Location, Function, Materials of construction. | 01 |
02.06 | Crank and Crankshaft: Function construction, Bearings, Location, Linkage, Materials of construction, Different facilities provided on crankshaft. | 01 |
02.07 | Connecting Rod: Function, Construction, Big end and Small end, Location and Inter-link, Materials of construction. | 01 |
02.08 | Cams and Camshafts: Functions, Construction, Interlinks, Location, Materials of construction. | 02 |
02.09 | Exhaust and Intake parts: Function, Location, Constructional description, Materials of construction. | 01 |
02.10 | Carbureter: Function, Location, Interlink, A general outlay of construction of a simple carbureter, Materials used. | 02 |
02.11 | Flywheel: Function, Location, Construction, Outer Ring, Clutch-side Surface, Materials used. | 02 |
02.12 | Bearings: Function, Identification of locations in engine, Lubrication of bearings, Materials of construction. | 02 |
02.13 | Timing Chain: Function, Location, Interlink, Materials used. | 01 |
03 | Petrol and Diesel Engines | Petrol and Diesel engines | 02 |
03.01 | Petrol and Diesel engines | 01 |
03.02 | Difference of "working and constructional details". | 01 |
04 | Fuel Supply System | Petrol engine fuel supply system, gravity system, pump system, fuel tank, fuel filters and screen. Mechanical and Electric pump. Block diagram, Function of each element of the system. | 08 |
04.01 | Fuel Supply System | 01 |
04.02 | Diesel engine fuel supply system, Block diagram, Functions of fuel injection pump, nozzles, Location, Interlink. Material of construction | 02 |
05.01 | Engine Cooling System. Block diagram - Necessity, Types, Air and Water cooling, Radiator, Water Jacket, Water Pump. Thermostat - Location, Working. | 16 |
06 | Transmission System | Transmission System: Block diagram, Function and Location. Clutch - Function, Basic general construction, Location, Working method, Linkage, Materials used. | 03 |
06.01 | Transmission System: Block diagram, Function and Location. Clutch - Function, Basic general construction, Location, Working method, Linkage, Materials used. | 04 |
06.02 | Gear Box: Function, General construction of simple gear box, Concept of velocity ratio - simple problems also. Location, Interlink, Materials used. | 02 |
06.03 | Universal Joint: Function, Location, Interlink, Materials used. | 02 |
06.04 | Propeller Shaft: Function, Location, Interlink, Materials used. | 02 |
06.05 | Differential: Necessity, Function, Location. Rear Axle: Function, Location. | 02 |
06.06 | Wheels: Function, General constructional idea, tyre, tube, interlink, materials used. Different types of tyres used in automobiles with tyre manufacturing materials. | 03 |
07  Suspension System
07.01  Suspension System: Front and Rear. Frame: Function, general constructional idea, location and materials used.
07.02  Chassis: Function, location, materials used. Axle: Function, Location, Interlink and Materials used.
07.03  Spring: Function, Types - Coil, Leaf, Location, Interlink, Materials used.
07.04  Shock Absorber: Necessity, Function, General constructional idea, Location, Interlink and Materials used.

08  Steering System
08.01  Steering System - Function, Location, Steering wheel, Rod, Drooparen Mechanism, Linkage, King pin, Working method. Toe-in Toein Toe-out, Caster, Chamber.

09  Brakes
09.01  Brakes: Necessity, Function, Types - Mechanical and Hydraulic, Master Cylinder, Valves, Pipes, Bouquets, Break Shoe, Brake drum, Pneumatic break, Pressure pipe, Brake Shoe, Brake Drum.

10  Electrical System
10.02  Spark Plug: Function, Construction, Contact breaker, Distributor.

11  Lubrication

Recommended Books

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Title/Publisher</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Automobile Engineering, Khanna Publishers.</td>
<td>G.B.S. Narang</td>
</tr>
<tr>
<td>2</td>
<td>Automobile Engineering</td>
<td>R. P. Sharma</td>
</tr>
<tr>
<td>3</td>
<td>Automobile Engineering</td>
<td>Kirpal Singh</td>
</tr>
</tbody>
</table>

Reference Books

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Title/Publisher</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Automobile Vehicle</td>
<td>Newton and Steed</td>
</tr>
<tr>
<td>2</td>
<td>Automobile Mechanics</td>
<td>Joseph Heitner</td>
</tr>
</tbody>
</table>

Scheme of Examination: Final Examination Marks = 80
Rationale

Though the students have already studied in brief the anatomy and physiology of automobile vehicles and component parts, they are further required to study in detail about the materials working principles and their functions fuel lubricating oil and cooling principles and electrical system as they may choose career in automobile industry and repair shop.

Objectives

The students will be able to:

• Describe the category of vehicles on the basis of use, Capacity wheels and axles, drive no of cylinder and single mountings.
• Explain the constructions and function of each engine component parts.
• Describe the types of fuel used in an engine V12 petrol and diesel, their molecular structure, properties like volatility, flash point, sulphur content and calorific value.
• Explain air fuel ratio chemically correct mixture, most economical A/F ratio, combustion knock, antiknock quality.
• Explain the principle of carburetion, construction and function of simple carburetor, defects and their remedies.
• Describe the working of spark ignition and compression ignition engine.
• Describe the method of combustion in S.I. Engine, shape and purpose of combustion chamber, turbulent pre-ignition, an to-ignition, detonation, octane number.
• Describe the method of combustion in C.I. Engine, shape and purpose of combustion chamber, turbulent and non-turbulent type, need of pre-combustion chamber, meaning of ignition delay, knocking cetane number.
• Explain with sketches the construction and function of the components used in fuel supply system in petrol engine.
• Explain with sketches the construction and function of the elements used in fuel supply system in diesel engine.
• Explain with sketches intake and exhaust system, inlet and exhaust manifold, their types and component parts.
• Explain the working of supercharger and turbocharger in C.I. Engine.
• Explain the need of cooling, types of cooling system, elements of cooling system, types of coolant used.
• Explain need of lubrication, its classification type of lubricants and their properties and various gradings.
• Describe the electrical system as a whole and explain with sketches the electrical circuits in S.I. and C.I. Engines, generation of electrical energy.
• Explain the construction and function of storage battery, condenser, ignition, coil distributor, C.B. points/ Dynamo/ alternator, cut-out and regulator.
• Explain the starting system including Bendix drive.
• Explain the working of lighting and signaling points, horn, audio equipment and wiper.
• Explain the working of magneto system.
• Describe in brief the air-conditioning in automobile.
• Describe the electrical maintenance system.

CURRICULUM

SL. Topics Periods
1. Review 02
2. Types of Automobile 02
3. Engines 06
4. Valves 03
5. Fuels 04
6. Carburetor 06
7. Spark Ignition Engine and Compression Ignition Engine 09
8. Fuel Supply System in S.I. Engines 03
10. Intake and Exhaust System 05
11. Cooling System for Engines 05
12. Lubrication System 03
13. Electrical System 14
Total 68

CONTENTS

Topics Content Periods
01 Review Review of topics covered in the paper Automobile Engineering - I. 02
01.01 Types of Automobiles Types of automobile with respect to use, capacity, wheels and axles, drive number of cylinders and engine mounting. 02
02 Engines Brief description of Diesel and Petrol engines. 06
03 Cylinder block and liner construction and function/multi-valve cylinder. 01
03.01 Cylinder head construction and function gasket. 01
03.02 Piston gudgeon pin, function, construction. 01
03.03 Connecting rod, working and construction, big and small end, bush and bearing. 01
03.04 Crankshaft, construction, line diagram and working, bearing (types) lubrication, connecting rod alignment, balancing of crankshaft. 01
03.04.01 Flywheel - functions, construction starting ring friction surface. 01
04 Valves
04.01 Functions and construction of Valves and their parts.
04.03 Valve arrangement.
05 Fuels
05.01 Types of fuels used in automobile engines petrol, diesel, molecular structures, properties required volatility, flash point, sulphur content and calorific value, air fuel ratio, chemically correct mixture, most economical A/F ratio, combustion knock, antiknock quality.
06 Carburetor
06.01 Carburetion process meaning operation.
06.02 Simple carburetor, working theory on Bernoulli’s equation, construction and working details.
06.03 Defects in simple carburetor operations, remedies - choke, idling compensation, air bleed jet compensation, submerged jet system. Improved carburetor - Zenith S.U. Carburetor.
07 Spark Ignition Engine and Compression Ignition Engine
07.01 Construction and working of Spark Ignition Engine and Compression Ignition Engine.
07.02 Combustion in spark ignition engine, combustion chamber, air-fuel ratio turbulence, pre-ignition, auto ignition, detonation, Octane number.
07.03 Combustion in compression ignition engine, combustion chamber, non-combustion chamber, ignition delay, knocking, Cetane number.
08 Fuel Supply System in S.I. Engines
08.01 Types of Fuel Feed System, Components of fuel system, Fuel tank filters and screens fuel lines, Fuel Gauges, Air-Cleaner, Fuel Pump, A.C. Mechanical fuel pump, Electric fuel pump, S.U. hing pressure type fuel pump.
09 Fuel Supply System in C.I. Engines
09.01 Fuel Feed System, Diaphragm type pump, Plunger type pump.
09.02 Fuel injection pump, Nozzle and its function types, Fuel injection unit.
09.03 Faults, their causes and remedies.
09.04 Fuel Injection, Pump Calibration.
10 Intake and Exhaust System
10.01 Intake manifold (S.I. and C.I. Engine).
10.02 Exhaust manifold, Different types of Muffler and Tailpipe.
10.03 Supercharger, turbocharger in C.I. Engine.
11 Cooling System for Engines
11.01 Need of cooling engines, types of cooling systems, air and water cooling radiator - tubular and cellular types, thermostat valve water pump, cooling fans, coolant, new techniques in cooling system.
12 Lubrication System
12.01 Need of Lubrication.
12.02 Types of Lubrication System. Gravity Feed, Force Feed.
13 Electrical System
13.01 Main circuits of electrical system in S.I. and C.I. engine vehicles.
13.02 Generation of electrical energy in automobiles. Storage battery construction electrolyte and chemical reaction, probable troubles and maintenance of battery, battery testing, battery charging.
13.03 Condenser, Ignition Coil, Distributor C.B. Point, Firing order.
13.04 Dynamo alternator, cut-out, control of voltage and current, combined regulator and cut-out.
13.05 Starting systems, Bendire drive.
13.06 Different lighting and signaling points, Horn, Audio Equipment, Wiper.
13.07 Magnet System.
13.08 Air-conditioning of automobile (brief idea).
13.09 Maintenance of Electrical System.

Recommended Books
SL  Title/Publisher  Author
2.  Automobile Engineering  R. P. Sharma
3.  Automobile Engineering  Dr. Kirpal Singh
4.  Automobile Engineering  J. Heitner
5.  The Automobile  Rayat Harbans Singh
6.  Automobile Engineering  Banga and Singh
7.  Elements of Automobile Engineering  G.B.S. Narang
8.  Know your Motor-cycle and Scooter  Reyat Harbans Singh
9.  Automobile Engineering  K. Prasad

Reference Books
SL  Title/Publisher  Author
1.  Automobile Vehicle  Newton and Steel

Scheme of Examination: Final Examination Marks = 80
Rationale:

Technician has to understand the basic design principles of machines, mechanism and their parts. He comes across the problem of power transmission, speed control, braking, engagement and disengagement of power balancing etc.

The subject is being prescribed with a view to help the students to develop the knowledge and understanding of the mechanism and machines so that he will be able to develop skill which will help in solving the problems of design, power transmission, maintenance etc.

Objective:
The student should be able to understand:
- Different types of links & mechanisms.
- The problems of friction and their application.
- The principles of power transmission, gear, belt and rope drives.
- The braking system and their application.
- The function of different types of governors and flywheels.
- The design and working of cam.
- The principles of balancing.

S. No. Topics Periods
01 Simple Mechanism (06)
02 Friction (10)
03 Belt & Rope drives (09)
04 Gear drive & gas trains (10)
05 Governors (10)
06 Turning moments & flywheels (10)
07 Brakes & dynamometer (08)
08 Cams (08)
09 Vibration & Balancing (04)

TOPIC: 01 – SIMPLE MECHANISM:
01.01 Introduction, Kinematic links, types of links, structure, comparison between machine and structure.
01.02 Kinematic pairs, classification, types of constrained motion.
01.03 Kinematic pair, kinematic chain, their classification, mechanism, types of joints.
01.04 Number of degrees of freedom
01.05 Inversion of mechanism, inversion of single slider crank chain, crank and slotted bar quick return and Whitworth quick return motion mechanism.

TOPIC: 02 – FRICTION:
02.01 Introduction, classification, limiting friction, dynamic friction, co-efficient of friction, angle of repose.
02.02 Friction on rough inclined plane, laws of solid and fluid friction.
02.03 Screw friction, screw jack, torque required to lift and to lower the load by screw jack overhauling & self-locking screws, efficiency

TOPIC: 03 – BELT & ROPE DRIVE:
03.01 Introduction, classification of drives, materials used for belts.
03.02 Velocity ratio of compound belt drive, slip of belt creep of belt. length of open & cross belt drive.
03.03 Power transmitted by a belt, ratio of driving tension for flat belt drive centrifugal tension, condition for maximum tension in belt.
03.04 V-belt drive, advantages and disadvantages ratio of driving tension rope drive, numericals.

TOPIC: 04 – GEAR DRIVES:
04.01 Toothed Gearing, introduction, terminology, advantages and disadvantages, classification.
04.02 Gear trains, Simple gear trains, compound gear trains, velocity ratio.
04.03 Design of spur gear (to find no of teeth) problems.

TOPIC: 05 – GOVERNORS:
05.01 Introduction, function, terminology, classification, comparison with flywheel.
05.02 Watt governor, Porter & Proell governor.
05.03 Hartnell and Hartung governor.
05.04 Effort and power of a porter governor.
05.05 Hunting sensitiveness and stability of governor, isochronous governor.

TOPIC: 06 – TURNING MOMENT & FLYWHEEL:
06.01 Introduction, turning moment diagram for a single cylinder double acting steam engine.
06.02 Turning moment diagram for a four stroke internal combustion engine.
06.03 Fluctuation of energy, determination of maximum fluctuation energy, co-efficient of fluctuation of energy.
06.04 Flywheel, co-efficient of fluctuation of speed, energy stored in a flywheel. Dimensions of the flywheel rim, Numericals.

TOPIC: 07 – BRAKES:
07.01 Introduction, materials for brake lining, classification.
07.02 Single block brakes, double block shoe brake.
07.03 Simple band brake, Differential band brake, Band and block brake, internal expanding brake.
07.04 Dynamometer, classification, Prony Brake & Rope Brake dynamometer. Numericals.
TOPIC: 08 – CAM:
08.01 Introduction, classification, terminology.
08.02 Displacement, velocity and acceleration diagrams when the follower moves with uniform velocity, simple harmonic
08.03 Construction of cam profile for a radial cam, profile of cam when the axis of follower passes through the axis of cam shaft, profile of the cam when the axis of the follower is offset from the axis of the cam shaft.

TOPIC: 09 – VIBRATION & BALANCING:
09.01 Vibration, classification, natural frequency of free longitudinal and transverse vibrations.
09.02 Balancing, classification, balancing of single rotating mass by a single mass rotating in the same plane, balancing of a single rotating mass by two masses

SCHEME OF EXAMINATION FOR FINAL EXAMINATION

F.M. : 80
Rationale

Drawing is the language of engineers. Without the knowledge and skill of drawing, an engineer is handicapped in understanding the problem of engineering right from design phase to production as well as in communication with his superior and subordinate.

The subject will develop the understanding of drawing, representation of machine parts and skill of good draftsmanship. The subject will help a technician in understanding the functioning of different machine parts, which in turn will help in maintenance and dismaintenance and annually of machine parts in general and automobile parts in particular. It will generate confidence in a technician which will improve the ability of overall shop floor operation and management the technician will be able to communicate with supervision and subordinate through drawings.

Objectives

The students will be able to:

- Understand this I.S. Codes of drawing and use there in their drawing.
- Use different scales used in a drawing.
- Understand and draw the orthographic projections of different machine parts in 1st and 3rd angle projection skill with good draftsmanship.
- Draw missing views.
- Understand and draw isometric and oblique projection.
- Draw dimensional and sectional drawing 1st and 3rd full draftsmanship.
- Develop overall drawing and drafting skill and be able to apply the knowledge skill of drawing in practical field.
- Draw free hand sketches of machine component parts.

CURRICULUM

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<th>SL</th>
<th>Topics</th>
<th>Sheets</th>
<th>Periods</th>
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<td>Introduction to I.S. Codes</td>
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<td>01</td>
<td>Introduction to I.S. Codes</td>
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<td>01.01</td>
<td>Introduction to I.S. codes.</td>
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<td>LS : 696 of 1956 and 1972.</td>
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<td>01.03</td>
<td>Code of practical for general engineering drawing.</td>
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<td>02</td>
<td>Scales and Lettering Technique</td>
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<td>02.01</td>
<td>Introduction to Scales, their use in Engineering Drawing.</td>
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<td>02.02</td>
<td>Recommended scale by I.S. : 696, full scale, reduced scale, enlarged scale.</td>
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<td>02.03</td>
<td>Free hand single stroke lettering of upright (vertical) and inclined capital and small letters and numerical.</td>
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<td>02.04</td>
<td>Block printing of vertical and inclined capital letters and numerical as per as I.S : 696 .</td>
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<td>03</td>
<td>Orthographic Drawing in 1st Angle and 3rd Angle Projection</td>
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<td>03.01</td>
<td>Methods of projection - 1st angle and 3rd angle projection.</td>
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<tr>
<td>03.02</td>
<td>Orthographic projection of simple models and from given isometric drawing of simple blocks and machine parts.</td>
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<td>04</td>
<td>Missing Views</td>
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<td>04.01</td>
<td>Drawing missing view from the given true orthographic views.</td>
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<td>05</td>
<td>Isometric and Oblique Drawings</td>
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<tr>
<td>05.01</td>
<td>Introduction of pictorial drawing, construction of Isometric scale and its use in Isometric drawing.</td>
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<tr>
<td>05.02</td>
<td>Isometric drawing and oblique drawing of simple blocks and machine parts.</td>
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<tr>
<td>06</td>
<td>Conventions used in Machine Drawing</td>
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<td>06.01</td>
<td>Types of lines - Cut lines or main line or parts cutting plane lines, brake lines for short and long breaks, hidden lines, create and focus lines......................... and dimension lines, sectioning lines.</td>
<td>06</td>
<td>24</td>
</tr>
<tr>
<td>06.02</td>
<td>Conventional representation of common features in mechanical drawing like screw threads, rolled sections bearings sections, tension spring, gear, rock and pinion etc. per LS : 696.</td>
<td>06</td>
<td>24</td>
</tr>
<tr>
<td>06.03</td>
<td>Conventional representation of material as per LS : 696 metal glass stone ware insulating and fitting materials, liquids, wood and concrete.</td>
<td>06</td>
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<tr>
<td>06.04</td>
<td>Conventional Method of representation of full sectional and half sectional views of machine parts as per I.S : 696.</td>
<td>06</td>
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<tr>
<td>07</td>
<td>Free Hand Sketch</td>
<td>07</td>
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<td>07.01</td>
<td>Free hand sketches of bolts and nuts, locking devices such as rivet-heads, keys, cutters and simple machine parts.</td>
<td>07</td>
<td>24</td>
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<tr>
<td>07.02</td>
<td>Free hand sketches of the following:</td>
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<tr>
<td>07.02.01</td>
<td>Muzzled and universal couplings</td>
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<td>07.02.02</td>
<td>Different joints like socket and spigot joints, hydraulic joints, union joints, expansion joints</td>
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<td>07.02.03</td>
<td>Spoked and webbed wheel</td>
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<tr>
<td>07.02.04</td>
<td>Bushed bearing</td>
<td>07</td>
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<tr>
<td>07.02.05</td>
<td>Ball and Roller bearings</td>
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</tr>
</tbody>
</table>
● Spring jack
● Spring shaft
● Locks and fast pulleys
● Cylinder blocks

08 Dimensional and Sectional Drawing
08.01 Dimensional and Sectional Drawing of:
● Bearing: Pedestal bearing, Pulmmer block, Foot step bearing
● Machine Parts: Cotter joints, Knuckle joint, Flanged and Flexible Couplings

09 Practical Aspect of Drawing
09.01 Preliminary concept of working drawing concept of machining accuracy and surface drawing and tracing of at least one working drawing.
● Note: The sheets prepared will be treated as Sessional work.
● The students are expected to know the assembly of choice machine parts also which they have drawn under dimensional and sectional drawing.

Recommended Books

<table>
<thead>
<tr>
<th>SL</th>
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<tbody>
<tr>
<td>5.</td>
<td>General Engineering Drawing</td>
<td>Kakkar and Chand</td>
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Scheme of Examination: Final Examination Marks = 80
Rationale:
Water Management has a prime importance in the development of any country. This management covers the qualities of drinking water, its viability, controlling of flow of water, its pressure calculation, different effects produced on the objects by it. The energy associated with it i.e. Hydraulic energy & its use. Now a day it is a great task to control the flood and desert. A diploma holder technician must have the capacity to control the natural hazards occurred due to water or to develop new cultivated area from desert lands. Seeing the today’s requirement this paper, fluid mechanics has been designed.

Objective:
The student should be able to:
(i) Analyse the difference of drinking and not drinking water and should know the principles to convert not drinking water into drinking water.
(ii) Measure pressure to ensure safe working of submerged objects.
(iii) Calculate the specific gravity & wet of fluid on/in an object.
(iv) Assess the requirements of service water for the house.
(v) Maintain & regulate the flow of fluids in a pipe line. And at last should have the basic concepts of almost all types of problems related to water.

S. No. Topics Periods
01 Basic Concepts of Fluids (13)
02 Hydrostatic Forces on Surfaces (07)
03 Buoyancy & Floatation (07)
04 Hydro Kinematics & Dynamics (09)
05 Orifice (05)
06 Loss of Head (05)
07 Mouthpieces & Pipes (07)
08 Hydraulic Gradient (06)
09 Branching of Pipes & Transmission of Power Through Pipes (08)
10 Impact of Jet & Water Wheels (08)

CONTENTS:

TOPIC: 01 – BASIC CONCEPTS OF FLUIDS:
01.01 Fluid (Definition & its types). Formula for Newtonian Fluid Concept of hydraulics/ F.M. classification of hydraulics Hydrostatics, hydro kinematics. (13)
01.02 Water Analysis – Drinking and not drinking water, impurities of water (temperature & permanent), conversion of not drinking water into drinking water (Biological, Chemical & Mechanical processes only). (03)
01.03 Properties of Water – Specific gravity, surface tension, viscosity, cohesion-adhesion. (04)
01.04 Types of Pressures – Atmospheric gauge, vacuum, vapour etc. & its units. Pressure measuring instruments – Barometer, Simple Manometer. Differential Manometer, Inverted manometer, Enlarged End Manometer – Numerical problems. (01)
01.05 Mechanical gauges – Borden tube, diaphragm, dead weight pressure. (02)
01.06 Types of flow – Stream, streak, uniform, non-uniform, steady, unsteady, laminar, turbulent, compressible, incompressible, rotational, irrotational, path line, streamline, stream tube – definition only, Rennaulds No. & its application in laminar & turbulent flow over a plate. (01)

TOPIC: 02 – HYDROSTATIC FORCES ON SURFACES:
02.01 Total Pressure and Centre of Pressure, pressure at a point in a liquid, centre of pressure, total for on-horizontal surface area, vertical surface area & inclined surface area. Practical application on Centre of Pressure, Pressure diagram. Resultant Pressure, Sluice gate, lock gate, masonry wall and dam. (07)

TOPIC: 03 – BUOYANCY AND FLOATATION:
03.01 Principles of buoyancy and floatation, Uses of principles of floatation, Conditions of equilibrium of floating bodies – Stable unstable and natural, metacentre, determination of metacentric height by experimental method & analytical method – Numerical problem. (07)

TOPIC: 04 – HYDROKINEMATICS & DYNAMICS:
04.01 Equation of continuity of flow – Discharge of rate of flow & its units. Equation of continuity of flow. Potential or static head, static energy, pressure head and pressure energy, kinetic head and kinetic energy, conversion of one energy into another energy. (09)
04.02 Bernoulli’s theorem and its proof – Numerical problems. Practical application of Bernoulli’s theorem, venturimeter, pitot tube, measurement of flow through pipes with the help of venturimeter (horizontal or inclined). Derivation of formula for the discharge, venture constant, Numerical problem. (09)

TOPIC: 05 – ORIFICE:
05.01 Definition & types, Vena contracta, C_D, C_V, C_D – Relation among them. Practical application – Numerical problem. (05)

TOPIC: 06 – LOSS OF HEAD:
06.01 Loss of head due to sudden enlargement and sudden contraction, Derivation of formula, head loss at entrance & exit of pipe, loss of head due to obstruction in the path of flow (formula derivation), its practical use – Numerical problem. (05)

TOPIC: 07 – MOUTHPIECES AND PIPES:
07.01 Difference between pipe and mouthpieces. Use of mouthpieces, friction loss in pipes, definition of pipes and channels, Wetted perimeter, hydraulic mean depth, loss of head due to friction in pipes. Chezy’s Equation, Chezy’s Constant, Darcy or Weisback Equation, Darcy’s Coefficient, Value of frictional coefficient for new and old pipes, water requirement for an area (house, colony, town, industry). (07)
TOPIC:08 – HYDRAULIC GRADIENT:

08.01 Hydraulic Gradient line, total energy line for simple and compound pipes. Discharge through pipes, Free discharge, discharging in another vessel through simple and compound pipes. Equivalent size of compound pipes. Siphon – Definition and uses, Negative pressure, Starting of Siphon, Numerical problem.

TOPIC:09 – BRANCHING OF PIPES & TRANSMISSION OF POWER THROUGH PIPES :

09.01 Pipes in parallel, discharge through each pipe, Flow through a diversion or bypass, branching of pipes. Flow through each pipe.
09.02 Hydraulic transmission of power through pipes, its practical uses.
09.03 Nozzle – definition flow through nozzle at the end of the pipe line. Transmission efficiency and maximum available H.P. Determination of dia of nozzle for supplying maximum horse power.

TOPIC:10 – IMPACT OF JET & WATER WHEELS :

10.01 Introduction force of the jet impinging normally on fixed plate, hinged plate, moving plate and on a series of moving vanes, Force of the jet on a fixed curved vanes and on a moving curved vanes – Numerical problem.
10.02 Introduction, types of water wheel overshot, under shot and breast water wheel. Power available by each type of wheel, advantages and disadvantages of water wheels. Development of water turbines.

Books Recommended:

2. Fluid Mechanics & Hydraulic Machines - R.K. Bansal
3. Hydraulics & Hydraulic Machines - Dr. Jagdish Lal

SCHEME OF EXAMINATION FOR FINAL EXAMINATION

<table>
<thead>
<tr>
<th>Types of Questions</th>
<th>DISTRIBUTION OF MARKS</th>
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</table>
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 analyses 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

# COMPUTER PROGRAMMING THROUGH ‘C’ Lab.

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Practical</th>
<th>No of Period in one session : 60</th>
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</table>

## 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 |
Rationale & Objective:
A Diploma holder technician should get more opportunity to know about machines, equipments & its operations which will help to be more confident & practical.

S. No. | Topics          | Periods |
-------|-----------------|---------|
A      | Machine Shop    |         |
B      | Welding Shop    |         |
C      | Foundry Shop    |         |
D      | Fitting Shop    |         |

CONTENTS:

**TOPIC:A – MACHINE SHOP:**
A.01 Safety precautions, Machine cleaning, checking, making ready for operation. Selection of tools, preparing it in ready condition (tool sharpening)
A.02 Lathe:
   Setting of job on three jaw, four jaw check, centering, tool/tools fitting, adjustment of tail stocks (if required).
   Practice of operations: Turning, facing, taper turning on sample jobs. Job configuration checking.
   Preparing a job by above processes (Sessional Preparation)
A.03 Shaper:
   Study of quick return mechanism.
   Repair of faults (minor) in machines.
   Tool setting on Ram.
   Practice of feed depth of cut, no. of pass on sample job.
   Preparation of V block on a sample job.
A.04 Drilling:
   Checking of drill bit.
   Making of sample blind hole.
   Making hole in a tapered job/V block.

**TOPIC:B – WELDING SHOP:**
B.01 Safety precautions, handling of tools & equipment.
B.02 Gas welding: Flame adjustment, practical on welding, soldering & brazing on two parts (sample job).
B.03 Electric welding:
   (i) Flame adjustment, use of electrodes on jobs (T- shape, L-shape), Coarse & fire welding.
   (ii) Preparation of chair & grill.

**TOPIC:C – FOUNDRY SHOP:**
(Pattern, Moulding & Cutting)
C.01 Tools, cope, drag. Different types of pattern – introduction & use.
C.02 Preparation of foundry sand.
C.03 Demonstration & handling of mould (A sample mould should be prepared by teacher/Institute)
C.04 Preparation of different types of moulds using single piece, split or any available pattern – at least 3 moulds should be prepared by each student.
C.05 Taking photographs of different moulds prepared by students.
C.06 Non-Fe Casting of one of the above.

**TOPIC:D – FITTING SHOP:**
D.01 Tools – Introduction & its use.
D.02 Different processes (Sawing, filing, drilling, tapping, dieing, scraping, reaming etc.)
D.03 Different types of fitting – Round fitting, Square fitting, Triangular fitting etc.
D.04 Use of above D. 02 & D.03 on sample jobs, L-shape, T-shape etc.
D.05 Practical Use of fitting.
D.06 Preparation of threads in pipes using tap & die – sessional preparation.

**SCHEME OF EXAMINATION FOR FINAL EXAMINATION**

<table>
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MACHINE DRAWING

Subject Code
15214

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Rationale & Objective:
A Diploma holder technician should be able to command the concepts of machines through vigorous practice by copying, plotting, orthographic-isometric conversion, different fastening devices, assembly & disassembly etc.

<table>
<thead>
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<th>No. of Sheets</th>
<th>Periods</th>
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<td>Introduction</td>
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<td>(12)</td>
</tr>
<tr>
<td>02</td>
<td>Free Hand Sketching of Machines Parts</td>
<td>(02)</td>
<td>(36)</td>
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<tr>
<td>03</td>
<td>Riveting</td>
<td>(01)</td>
<td>(09)</td>
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<tr>
<td>04</td>
<td>Nuts and Bolts</td>
<td>(01)</td>
<td>(06)</td>
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<tr>
<td>05</td>
<td>Conversion of Isometric Views into Orthographic Projection.</td>
<td>(02)</td>
<td>(21)</td>
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<td>06</td>
<td>Sectional Views</td>
<td>(01)</td>
<td>(09)</td>
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<tr>
<td>07</td>
<td>Assembling of Different Machine Parts from Disassembled Views</td>
<td>(02)</td>
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<td>08</td>
<td>Disassembling of Machine Parts from Assembled Views</td>
<td>(02)</td>
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</tbody>
</table>

CONTENTS:

**TOPIC:01 – INTRODUCTION:**

01.01 Representation of:
(i) Different types of lines 09
(ii) Different materials – Ferrous, non ferrous, stone, bricks, wood.
(iii) Limits & fits –
  a) Selection of margin 03
  b) Concept of g & II
  c) Go and Not go gauge
  d) Difference between theoretical drawing and actual drawing (Conversion of drawing into job & job into drawing)

**TOPIC:02 – FREE HAND SKETCHES:**

02.01 (i) Rules of free hand sketches & its use. 03
(ii) Concept of Sectioning, full sectioning, half sectioning, part sectioning. 06
(iii) Sketching of different machine parts i.e. knuckle joint, cotter joint, coupling (flange, flexible, universal), Bearing (All types i.e. journal, bush, pedestal, foot step etc.), Plumber block, Fast & loose pulley. (At least 4 machine parts should be shown in each sheet) - (Not to the scale) 27

**TOPIC:03 – REVETTING:**

03.01 Introduction of shapes of rivet heads. Caulking & fullering, pitch. Diagonal pitch, margin, back pitch etc. types of riveting (lap & butt joint, zig zag & chain structure, Boiler joint).

**TOPIC:04 – NUTS & BOLTS:**

04.01 Classification of nuts, terminology used in the drawing of nuts & bolts. Drawing of orthographic projections (Top view, Front view & Side view) of a bolt, imperical relations of dimensions of nut & bolt w.r.t. bolt head dia. 09

**TOPIC:05 – CONVERSION OF ISOMETRIC VIEW INTO ORTHOGRAPHIC PROJECTION (GENERAL):**

**TOPIC:06 – SECTIONAL VIEWS:**

06.01 Orthographic Sectional View of Piston of 2 stroke & 4 stroke I.C. Engine. 07

**TOPIC:07 – ASSEMBLING OF DIFFERENT MACHINE PARTS FROM DISASSEMBLED VIEWS:**

07.01 Expansion joint, cross head of steam engine, steam stop valve big end of connecting rod. 07

**TOPIC:08 – DISASSEMBLING OF MACHINE PARTS FROM ASSEMBLED VIEWS:**

08.01 Knuckle joint, coupling, (any one coupling) bearing (any one bearing), I.C. engine parts. (At least 10 sheets should be done in sessional). (As far as possible, proper sheets should be provided by Institution to avoid level difference & confusion.).

Books Recommended:

Rationale & Objective:
A Diploma holder technician (Mechanical) should be able to handle types of machines and can think about the better use of modification of the machines.

<table>
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<td>B</td>
<td>Hydraulics Laboratory</td>
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<tr>
<td>C</td>
<td>Energy Conversion Laboratory</td>
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</table>

**CONTENTS:**

**TOPIC:A – APPLIED MECHANICS LABORATORY:**

At least five experiments to be done:

A.01 Verification of Law of Parallelogram of Forces.
A.02 Verification of Hooke’s Law by Searl’s Apparatus.
A.03 To find modulus of rigidity of M.S. Rod by Torsion method.
A.04 To find the reaction at supports for a simply supported beam having point loads at different position and Draw S.F. and B.M.
A.05 To find the moment of inertia of a fly wheel.
A.06 To determine stiffness of a spring and its modulus of rigidity.
A.07 To find the maximum deflection of a simply supported beam and cantilever beam having point load at the middle and the free end respectively.
A.08 To find the reactions at fixed end and draw S.F. and B.M. diagram having point loads at free end.

**TOPIC:B – HYDRAULICS LABORATORY:**

At least five experiments to be done:

B.01 Determination of C<sub>C</sub>, C<sub>V</sub>, C<sub>D</sub> of discharge through Orifice.
B.02 Determination of Metacentric height of a Ship. (Experimental method),
B.03 Verification of Bernoulli’s Equation,
B.04 Friction Loss in pipes
B.05 Discharging through notch.
B.06 Hardness test of (different types of samples) water.
B.07 Conversion of non-drinking water into drinking water.

**TOPIC:C – ENERGY CONVERSION LABORATORY:**

At least four experiments should to be done, in which, Experiment No. C.01 is compulsory:

C.01 Study of Solar devices:
   a) Solar Cooker
   b) Solar Street Lighting System
   c) Solar Pumping
   d) Solar Heating & Cooling System
   e) Solar Drier
   f) Any device which uses solar energy,
      (At least one device should be prepared by group of students)

C.02 Detailed study of Gobar Gas Plant
C.03 Working of 2 stroke/4 stroke I.C. Engines.
C.04 Study of Boilers (Water tube/ Fire tube)
C.05 Calculation of I.H.P., B.H.P., of a Heat Engine
C.06 Troubleshooting of Water Cooler/Refrigerator.
C.07 Visit to Factory/Power Plant for knowing about steam generation & its utilization.
WORKSHOP PRACTICE

**Subject Code**

15216

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Rationale & Objective:
A Diploma holder technician should get more opportunity to know about machines, equipments & its operations which will help him to be more confident & practical.

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<td>C</td>
<td>Foundry Shop</td>
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<tr>
<td>D</td>
<td>Fitting Shop</td>
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**CONTENTS:**

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A.01 Safety precautions, Machine cleaning, checking, making ready for operation. Selection of tools, preparing it in ready condition (tool sharpening)
A.02 Lathe:
(i) Setting of job on three jaw, four check, centering, tool/tools fitting, adjustment of tail stocks (if required).
(ii) Practice of operations: Turning, facing, taper turning on sample jobs. Job configuration checking.
(iii) Preparing a job by above processes (Sessional Preparation)
A.03 Shaper:
(i) Study of quick return mechanism.
(ii) Repair of faults (minor) in machines.
(iii) Tool setting on Ram.
(iv) Practice of feed depth of cut, no. of pass on sample job.
(v) Preparation of V block on a sample job.
A.04 Drilling:
(i) Checking of drill bit.
(ii) Making of sample blind hole.
(iii) Making hole in a tapered job/V block.

**TOPIC:B – WELDING SHOP:**

B.01 Safety precautions, handing of tools & equipment.
B.02 Gas welding: Flame adjustment, practical on welding, soldering & brazing on two parts (sample job)
B.03 Electric welding:
(i) Flame adjustment, use of electrodes on jobs (T-shape, L-shape), Coarse & fire welding.
(ii) Preparation of chair & grill.

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(Pattern. Moulding & Cutting)
C.01 Tools, cope, drag. Different types of pattern – introduction & use.
C.02 Preparation of foundry sand.
C.03 Demonstration & handling of mould (A sample mould should be prepared by teacher/Institute).
C.04 Preparation of different types of moulds using single piece, spit or any available pattern – at least 3 moulds should be prepared by each student.
C.05 Taking photographs of different moulds prepared by students.
C.06 Non-Fe Casting of one of the above.

**TOPIC:D – FITTING SHOP:**

D.01 Tools – Introduction & its use.
D.02 Different processes (Sawing, filing, drilling, tapping, diceing, scraping, reaming etc.).
D.03 Different types of fitting – Round fitting, Square fitting, Triangular fitting etc.)
D.04 Use of above D.02 & D.03 on sample jobs, L-shape, T-shape etc.
D.05 Practical Use of fitting.
D.06 Preparation of threads in pipes using tap & die – sessional preparation.
Rationale
A diploma holder technician is mainly required to detect a fault and take remedial and preventive measures to replace, recover and repair worn out parts. He has to be conversant with the maintenance of automobiles. He has to identify the parts, understand their functions, the relation of such part with respect to others. He has to be conversant with the use of hand tools and develop skill of measurement.

Objectives
With this in view, the topics have been selected, so that a student is able to:
• Understand the automobile system and sub-system by disassembly and assembly of the parts.
• Develop skill of safe and correct use of hand tools and measuring instruments.
• Develop skill of measurement of different dimensions and parameters.

CURRICULUM

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<tr>
<td>3</td>
<td>Disassembly and Assembly of Old Braking System</td>
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<td>4</td>
<td>Disassembly and Assembly of Ignition System in a Petrol Engine</td>
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<td>Disassembly and Assembly of Wheels of an old Automobile</td>
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<td>6</td>
<td>Measurement</td>
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LIST OF SESSIONALS

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<tr>
<td>01.01</td>
<td>Study from models and charts two stroke and four stroke petrol and diesel engines.</td>
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<tr>
<td>01.02</td>
<td>Study from models and charts the air cooled and water cooled engines.</td>
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<td>01.03</td>
<td>Study of lubricating system.</td>
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<td>Tools and Measuring Instruments</td>
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<td>Identification with specification of hand tools used in Automobile garage.</td>
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<td>02.02</td>
<td>Identification with specification of measuring instruments used in Automobile garage.</td>
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<td>Safety precautions, safe and correct use of hand tools and measuring instruments.</td>
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<td>03.01</td>
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<td>To maintain proper sequence of disassembly and assembly.</td>
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<td>03.03</td>
<td>Selection of correct tools for the job.</td>
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<td>Disassembly, name of each dissembled part with their functions.</td>
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<tr>
<td>06.01</td>
<td>Sequence of disassembly.</td>
<td></td>
</tr>
<tr>
<td>06.02</td>
<td>Selection of appropriate tools for the job.</td>
<td></td>
</tr>
<tr>
<td>06.03</td>
<td>Disassembly, in sequence.</td>
<td></td>
</tr>
<tr>
<td>06.04</td>
<td>Name of each dissembled parts.</td>
<td></td>
</tr>
<tr>
<td>06.05</td>
<td>Assembly as per correct sequence.</td>
<td></td>
</tr>
<tr>
<td>07</td>
<td>Measurement</td>
<td>02</td>
</tr>
<tr>
<td>07.01</td>
<td>Measurement of wheel pressure and correcting thereof.</td>
<td></td>
</tr>
<tr>
<td>07.02</td>
<td>Measurement of oil level and adjustment thereof.</td>
<td></td>
</tr>
<tr>
<td>07.03</td>
<td>Measurement of cells of battery with the help of cell tester.</td>
<td></td>
</tr>
<tr>
<td>07.04</td>
<td>Measurement of specific gravity of battery with the help of hygrometer.</td>
<td></td>
</tr>
<tr>
<td>07.05</td>
<td>Measurement of spark plug gap and adjustment thereof.</td>
<td></td>
</tr>
<tr>
<td>07.06</td>
<td>Measurement of Cylinder bore of an old automobile engine.</td>
<td></td>
</tr>
<tr>
<td>07.07</td>
<td>Measurement of clearance of bearings of an old automobile: Journal Bearing - Wheel Bearing.</td>
<td></td>
</tr>
<tr>
<td>08</td>
<td>Brakes</td>
<td>03</td>
</tr>
<tr>
<td>08.01</td>
<td>Bleeding of Wheel breaks.</td>
<td></td>
</tr>
<tr>
<td>08.02</td>
<td>Adjustment of brake shoes.</td>
<td></td>
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Scheme of Examination: Final Examination Marks = 30