

3.1 WORKSHOP TECHNOLOGY-I

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03 06

RATIONALE

This subject provides knowledge about various welding processes and foundry work.

Welding is very useful for fabrication work and foundry for production of castings used for manufacturing of machines which is included in this subject and it is very essential for diploma holders.

DETAILED CONTENTS

Section – A (Welding)

1. Welding Process

- 1.1 Principle of welding
- 1.2 Classification of welding processes
- 1.3 Advantages and limitations of welding
- 1.4 Industrial applications of welding
- 1.5 Welding positions and techniques, symbols.

2. Gas Welding

- 2.1 Principle of operation
- 2.2 Types of gas welding flames and their applications
- 2.3 Gas welding equipments
 - 2.3.1 Gas welding torch
 - 2.3.2 Oxy acetylene cutting torch
 - 2.3.3 Blow pipe
 - 2.3.4 Pressure regulators
 - 2.3.5 Filler rods and fluxes

3. Arc Welding

- 3.1 Principle of operation
- 3.2 Arc welding machines and equipment
- 3.3 A.C. and D.C. arc welding
- 3.4 Effect of polarity, current regulation and voltage regulation
- 3.6 Flux for arc welding

4. Other Welding Processes

- 4.1 Resistance welding: Principle, advantages, limitations, working and applications of spot welding, seam welding, projection welding and percussion welding.
- 4.2 Shielded metal arc welding, submerged arc welding.

5. Modern Welding Methods

Principle of operation, advantages, disadvantages and applications of:

- 5.1 Tungsten inert gas (TIG) welding

5.2 Metal inert gas (MIG) welding

5.3 Thermit welding

5.4 Electro slag welding

Section – B (Foundry)

6. Pattern Making

6.1 Types of pattern

6.2 Pattern material

6.3 Pattern allowances

6.4 Introduction to cores, core boxes and core materials

6.5 Core making procedure

6.6 Core prints, positioning of cores

7. Moulding Sand

7.1 Properties of moulding sand

7.2 Various types of moulding sand

7.3 Testing of moulding sand.

8. Mould Making

8.1 Types of moulds

8.2 Step involved in making a mould

8.3 Molding boxes, hand tools used for mould making

8.4 Molding processes: Bench molding, floor molding, pit molding

9. Melting Furnaces

Construction and working of:

9.1 Pit furnace

9.2 Cupola furnace

9.3 Crucible furnace – tilting type

10. Casting Defects

10.1 Different types of casting defects and their reasons

10.2 Testing of defects: radiography, magnetic particle inspection, and ultrasonic inspection.

LIST OF PRACTICALS

1. Preliminary joining practice by gas welding

2. Exercises of gas welding on the following

2.1 Aluminum

2.2 Brass

2.3 Copper

2.4 C.I.

3. Gas cutting of the following types

3.1 Preliminary gas cutting practice

4. Making following types of joints by arc welding:

4.1 Preliminary joining practice by arc welding

4.2 Butt and lap joint (in vertical position, travel up and down)

5. Exercise on spot welding

6. Exercise on TIG/MIG welding

7. Testing & Inspection of welding defects visually

8. Pattern making:
 8.1 Preparation of solid pattern (single piece)
 8.2 Preparation of split pattern
 8.3 Preparation of mould

RECOMMENDED BOOKS

1. Welding Technology by R.L. Agarwal and Tahil Maghanani; Khanna Publishers, Delhi.
2. Principles of Foundry Technology by Jain; Tata Mc Graw Hill Publishers, New Delhi.
3. Workshop Technology by B S Raghuvanshi; Dhanpat Rai and Sons, Delhi.
4. Manufacturing Technology by M Adithan and AB Gupta, New Age International (P) Ltd., Delhi.
5. Elements of Workshop Technology by SK Chaudhry and Hajra; Asia Publishing

SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted for Lecturers and Tutorials (Hrss) | Marks Allotted (%) |
|------------------|---|---------------------------|
| 1 | 6 | 12 |
| 2 | 4 | 12 |
| 3 | 6 | 10 |
| 4 | 3 | 8 |
| 5 | 3 | 8 |
| 6 | 6 | 12 |
| 7 | 5 | 6 |
| 8 | 7 | 16 |
| 9 | 4 | 8 |
| 10 | 4 | 8 |
| TOTAL | 48 | 100 |

RATIONALE

Engine forms the base of Automobile Engineering. As the scope of auto engines is very wide, it has been divided into two subjects, Auto Engine –I and Auto Engine-II. This subject deals with basic concept of 2 stroke and 4 stroke engine, classification of engines, constructional details of petrol engine, combustion phenomenon, fuel system, cooling system, lubrication system and ignition system,.

DETAILED CONTENTS

1. Introduction (06 hrs)
 - Basic of tractive power sources viz Mechanical (reciprocating and rotary engine, gas turbines)
 - Concept of two stroke and 4 stroke petrol and diesel engines, their application to automobiles, various terms and specifications of auto-engines.

2. Classification of Engines (04hrs)

Classification of engines as per stroke, cycle, fuel, ignition, cooling, speed, location, placement, number, arrangement and position of cylinders, governing, cam placement, function, type of valve placement, reciprocating and rotary, Internal and external combustion, ports and scavenging.

3. Engine Components (04 hrs.)

Construction details, specification, function and working of components, cylinder block, head, cylinder liner, piston, piston rings, wrist pin, connecting rod, crankshaft bearing, camshaft, valves and valves mechanisms. flywheel and dampers.

4. Fuel Combustion and Combustion Chambers (06hrs)

Combustion phenomenon: Phases of normal combustion, delay hrs, flame propagation, detonation, pre-ignition, Octane rating.

5. Fuel System in spark Ignition Engine (12 hrs)

Fuel System: types of fuel feed system, gravity and pump feed, fuel lines, fuel filters, theory and types of carburetion.

 - Circuits of carburetor: Float circuit, starting and choke circuit, idling, low speed, high speed part load and full load circuits, dry and wet air cleaners. Intake and exhaust manifold, exhaust pipes and mufflers, turbocharger and Air filters.

- Petrol Injection: Introduction to petrol injection, comparison with carburetor method, Types of petrol injection, Multi-point fuel injection system(MPFI) and its types and control.

6. Ignition system (06 hrs)

Concept of ignition system, types of ignition systems, coil and magneto. Function and working of coil, distributors, condenser, advance mechanisms, C.B. Point and gap, spark plugs and gaps pertaining to Indian vehicles.

7. Cooling System (04 hrs)

Cooling system, necessity, types(air, water) thermo syphon and pump cooling. Viscous fan, Cooling fans, blowers, jackets, water pump, and its devices, hoses, thermostats pressure cap anti-freeze solution, scales and corrosion, anti-corrosion treatment, radiator shutters, trouble shooting and remedies.

8. Lubrication System (06 hrs)

Necessity and types of lubrication systems (splash and pressure) wet and dry sump. Components used, oil pumps, oil lines, filters, coolers, crank case ventilation. Characteristics, classification, service rating of lubricating oil.

LIST OF PRACTICALS

1. Study, sketching and working of basic components of an automobile engine such as
cylinder block, cylinder head, piston, connecting rod and crankshaft.
2. Study, sketching and working of Petrol engine fuel system- tank, fuel pump.
3. Study, sketching and working of fuel pump.
4. Study, sketching and working of electrical fuel pump
5. Study, sketching and working of water cooling system- radiator, fan, pump
6. Identification of each part and working of solex carburetor
7. Study, sketching and working of scooter carburetor

SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|------------------|----------------------------|---------------------------|
| 1 | 06 | 12 |
| 2 | 04 | 06 |
| 3 | 04 | 12 |
| 4 | 06 | 12 |
| 5 | 12 | 22 |
| 6 | 06 | 12 |
| 7 | 04 | 12 |
| 8 | 06 | 12 |
| Total | 48 | 100 |

RATIONALE

Diploma Holders are required to read and interpret drawings. Therefore it is essential that they have competency in preparing drawings and sketches of various machine parts. Therefore this subject is essentially required.

DETAILED CONTENT

1. Introduction

Limits and Fits: Limit system – tolerance, limits, deviation, allowance, basic size, design size. Tolerances-fundamental tolerances, fundamental deviation, method of placing limit dimensions.

Fits: Clearance fit, transition fit, interference fit, hole basis system, shaft basis system, tolerance grades.

Calculating values of clearance/interference, hole tolerance and, shaft tolerance with given basic size for common assemblies like H7/g6, H7/m6, H8/u7.

Surface Roughness

Introduction-actual profile, reference profile, datum profile, mean profile, peak-to-valley height, mean roughness index, surface roughness number.

Use of machining symbols in production drawings, indication of surface roughness-indication of special surface roughness characteristics, indication of machining allowance, indication of surface roughness, symbols on drawings, method of indicating surface roughness on given components.

Indicating roughness on a component for: -

- i) Surface to be obtained by any production method.
- ii) Surface to be obtained without removal of material.

2. Shaft Couplings (2 sheets)

Oldham coupling
Universal coupling

3. Bearings (5 sheets)

Bush bearing
Foot step bearing

| | | |
|----|---|------------|
| | Plummer block | |
| 4. | Pipe Joints | (3 sheets) |
| | Symbols for piping and layout plan of piping | |
| | Flanged joint | |
| | Socket and spigot joint | |
| | Union joint | |
| 5. | Screw Jack | (1 sheet) |
| 6. | Shovel and Sweeps of cultivators | (1 sheet) |
| 7. | Seed metering devices like fluted rollers, cup feed type and inclined plate type. | (1 sheet) |
| 8. | Mould board and disk plough components | (2 sheets) |
| 9. | Sectional view of hand pumps. | (1 sheet) |

RECOMMENDED BOOKS

1. Machine Drawing by P.S. Gill; S.K. Kataria and Sons, Delhi.
2. Machine Drawing by R.K. Dhawan; S. Chand and Company, Delhi.
3. Machine Drawing by R.B. Gupta; Satya Parkashan, New Delhi.
4. Elements of Agriculture Engg.
5. Machine Drawing by N.D. Bhatt; Charotar Publishing House.

- Note:**
1. The drawings should include dimensions with tolerances, wherever necessary, and material list according to B.I.S. specifications as per SP46: 1988.
 2. 25% of the drawing sheets should be drawn using AutoCAD.

3.4 MECHANICS OF MATERIALS

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03 -- 03

RATIONALE

Diploma holders in this course are required to analyze reasons for failure of different components and select the material for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts and springs. Hence this subject has been introduced.

DETAILED CONTENTS

1. Introduction to Material Properties (06 hrs)

Mechanical properties of materials such as elasticity, plasticity, ductility, brittleness, toughness, hardness, tenacity, fatigue, malleability, stiffness. Elastic bodies, plastic bodies and rigid bodies, deformation, stress concentration factor

2. Stresses and Strains (10 hrs)

2.1 Force, its definition and types, units, different types of loads.

2.2 Definition of stress and strain, axial loading, different types of stresses and strains, tensile and compressive stress and strain, elastic limit, Hooke's law, stress-strain curve for ductile and brittle material, salient features of stress-strain curve. Young's modulus of elasticity

2.3 Factor of safety, safe stresses, ultimate stress

2.4 Stress and strain in straight bars

2.5 Temperature stresses for single section

2.6 Shear load, shear stress and strain, modulus of rigidity, lateral strain, Poisson's ratio

2.7 Volumetric strain, bulk modulus. relation between modulus of elasticity, modulus of rigidity and bulk modulus

3. Shear Force and Bending Moment (11 hrs)

3.1 Types of beams and types of supports and loads

3.2 Concept of shear force and bending moment, sign convention

3.3 Shear force and bending moment diagram for cantilever and simply supported beams subjected to point load and uniformly distributed loads only.

4. Torsion (10 hrs)

4.1 Pure torsion, torsion equation (relation between twisting moment, shear stress and angle of twist), polar modulus of section

4.2 Assumptions in theory of pure torsion

4.3 Strength of circular solid shaft and hollow shaft in pure torsion

4.4 Power transmitted by shaft

4.5 Torsion in helical springs

4.6 Simple numerical problems

5. Column and Strut (11 hrs)

5.1 Definition of column and strut, classification

5.2 Buckling, slenderness ratio, buckling factor

5.3 Euler's formula and Rankine formula

5.5 Simple numerical problems

LIST OF PRACTICALS

1. Tensile test on bars of mild steel and aluminum.
2. Shear test on specimen of two different metals.
3. Bending test on a steel bar or wooden beam.
4. Perform following impact test:
 - (a) Izod impact test
 - (b) Charpy test
5. Torsion test on specimen of different metals for determination of angle of twist for a given torque.
6. Determine the stiffness of a helical spring and plot a graph between load and extension.
7. Hardness test on metal and find Brinell hardness, Rockwell Hardness.

SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|------------------|----------------------------|---------------------------|
| 1. | 6 | 10 |
| 2. | 10 | 20 |
| 3. | 11 | 25 |
| 4. | 10 | 20 |
| 5. | 11 | 25 |
| Total | 48 | 100 |

3.5 MEASUREMENT ,INSTRUMENTATION & CONTROL

L T P

03 -- 03

RATIONALE

A diploma holder should have knowledge of measurement systems, various sensors, transducers and devices for measuring various parameters. Hence this subject.

DETAILED CONTENTS

1. Measurements and Measurement Systems (03 hrs)
Definition, significance of measurement, generalized measurement systems, definitions and concept of accuracy, precision, calibration, sensitivity, repeatability, linearity, loading effect, sources of errors in measurement, classification of errors
2. Sensors, Transducers and Strain Gauges (02 hrs)
Introduction, classification, primary sensing elements, photo sensors, resistance transducers, variable inductance type transducers, capacitive transducers, piezoelectric transducers, introduction to strain gauges, gauge materials,
3. Measurement of Force, Torque, Shaft Power, Speed and Acceleration (08 hrs)
Introduction, force and weight measurement systems, measurement of torque, shaft power, speed and velocity, acceleration, pressure measurements
4. Temperature and Strain Measurement (08 hrs)
Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, optical pyrometer, strain measurements, strain gauge.
5. Comparators and Angular Measurement (08 hrs)
Introduction to comparators, characteristics, classification of comparators, mechanical comparator, electric and electronic comparators- principles. LVDT, pneumatic comparators, angular measurements, bevel protractor
6. Determination of Count and Measurement of Time, Time Interval and Frequency (08 hrs)
Introduction, counters, time and frequency standards, clock and watches, frequency interval and frequency
7. Measurement of Process Variables -Pressure, Temperature, Flow and Level (02 hrs)
Introduction, pressure, temperature, flow rate, level measurement, thermometers, bimetallic thermocouples, thermistors and pyrometers.
8. Automation and Control (03 hrs)
Definition, types, need of automation, advantages and disadvantages of automation, introduction of control system terminology introduction to numerical control, basic concepts of NC, CNC and DNC. PLC and its applications in automotive industry

Lists of Practicals:

1. Study of strain gauges.
2. Study of optical pyrometer.
3. Study of LVDT.
4. Study of Comparators.
5. Study of Thermocouples.
6. Study of NC and CNC machines.

SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|------------------|----------------------------|---------------------------|
| 1 | 03 | 12 |
| 2 | 02 | 08 |
| 3 | 08 | 12 |
| 4 | 08 | 12 |
| 5 | 08 | 22 |
| 6 | 08 | 12 |
| 7 | 08 | 12 |
| 8 | 03 | 10 |
| Total | 48 | 100 |