

## 4.1 GARAGE EQUIPMENT

L T P  
4 - -

### RATIONALE

Management of garage forms an important function of automobile technicians. To perform such functions, knowledge of service station equipment, tuning equipment, engine repair tools, electrical repair equipment and reconditioning and fabrication of equipment is very essential. Hence the subject.

### Learning Outcomes :

On completion of this course, a learner should be able to:

- Use general tools for required application.
- Use appropriate tuning and testing equipment for given situation.
- Use engine repair tools.
- Use Electrical Repair equipment.
- Use reconditioning/testing equipment for chassis and body.

### DETAILED CONTENTS

1. General Tools (6 hrs)  
Specifications and applications of
  - Screw drivers
  - Spanners and wrenches
  - Pliers
  - Hammers
  - Chisels
  - Files
  - Hacksaw
  - Tools for tubes flaring
  - Taps and dies
  - Reamers
  - Soldering tools
  - Measuring tools- vernier calipers, inside and outside micrometers
  - Feeler gauge
  - Tommy bar
  - Nut runner
  - Cleaning tools
  - Nipple forming tools
  
2. General Equipment (12 hrs)  
Specifications and applications of
  - Drilling machine (portable) along with set of drills
  - Bench grinder
  - Air compressor and pneumatic gun
  - Hydraulic and electric hoists

- High pressure washing equipment (Car washer, Car vacuum cleaner, Buffing tool)
  - Oil sprayers
  - Grease Guns-manual and bucket type, pneumatic
  - Tyre inflation gauge (Manual and Digital type automatic)
  - Tyre Changer (Manual and Automatic)
  - Creepers
  - Electric and gas welding equipment
  - Fire extinguisher
  - First aid box
3. Tuning and Testing Equipment (6 hrs)  
Specifications and applications of
- Vacuum Gauge
  - Compression Gauge (Pressure Gauge)
  - Distributor Tester, cam (dwell) angle tester, r.p.m. tester.
  - Battery Tester
  - Spark plug cleaner and tester
  - Ignition timing light
  - Fuel injector tester
  - Fuel consumption tester
4. Engine Repair Tools/Measuring and Testing Equipment (12 hrs)  
Specifications and applications of
- Torque wrench, pneumatic wrench
  - Piston ring compressor
  - Valve lifter and valve spring tester
  - Piston ring files, groove cleaner
  - Scrappers
  - Piston ring remover
  - Cylinder Dial gauge
  - Smokemeter
  - Exhaust gas analyzer
  - Engine Analyser/Scanner
  - Part degreasing tank
5. Electrical Repair Equipment (6 hrs)  
Specifications and uses of
- Electrical Test Bench
  - Battery Charger
  - Head Lights Beam Aligner and Tester (Electronic and Digital type)
  - Growler

6. Reconditioning/Testing Equipment for Chassis and Body (6 hrs)

Use of

- Brake Efficiency Tester (Chassis Dynamometer) or brake testing equipment
- Clutch Fixtures and Brake Line Rivetters, pop riveting gun
- Crane and Chain Pulley Block
- Jacks – mechanical, hydraulic, trolley type
- Paint chamber
- Paint Spray Gun
- Paint Drying Equipment
- Tools for tyres, automatic tyre remover
- Trolleys
- Axle/chassis stands
- Steering work stands
- Jib crane
- Spring tester
- Frame strengthening equipment
- Chassis alignment equipment
- Computerized wheel balancer –static and dynamic
- Computerized wheel alignment equipment

7. Engine Reconditioning and Testing Equipment (16 hrs)  
Specifications and use of

- Cylinder Boring Machine and Honing Machine
- Crankshaft Machine and Camshaft Grinding Machine
- Connecting Rod Aligner
- Line Boring Machine and Arbor Press
- Nozzle Grinding and Lapping Machine
- Fuel Injection Pump Calibrating Machine
- Valve Refacer, Valve Seat Cutting and Grinding
- Radiator Tester
- Cylinder head leakage testing fixture
- Fuel injector tester
- Nozzle cleaning equipment

### **INSTRUCTIONAL STRATEGY**

Teacher should lay emphasis on proper handling and use of garage equipment. Demonstration should be made in the workshop for clarity of ideas. Visits to garage should also be planned.

**RECOMMENDED BOOKS**

1. Automotive Mechanics by Srinivasan; TMH, Delhi
2. Automobile Engineering Vol. I and II by Dr. Kirpal Singh; Standard Publishers, Delhi.
3. Automotive Mechanics by WH Crouse and Donald Anglin; Tata Mc Graw Hill Publishing Co. Ltd., Delhi.
4. Garage Equipment by G.S. Aulakh, Eagle Prakashan, Jalandhar.

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	6	10
2	12	20
3	6	10
4	12	20
5	6	10
6	6	10
7	16	20
<b>Total</b>	<b>64</b>	<b>100</b>

## 4.2 AUTO ENGINE - I

**L T P**  
**3 - 2**

### 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 engine terminology basic concept of 2 stroke and 4 stroke engine, classification of engines, constructional details of petrol engine, fuel system, cooling system, lubrication system and ignition system,.

### Learning Outcomes :

On completion of this course, a learner should be able to:

- Explain the principles of operation of an internal combustion engine
- classify various types of engine
- Explain the principles of operation of fuel supply systems
- Explain the principles of operation of engine cooling and lubrication systems
- Carryout servicing of lubrication and cooling system
- Test I.C engine.

### DETAILED CONTENTS

#### 1. Introduction

(08 hrs)

- Engines, internal and external combustion Engines, Engine terminology including Bore, Stroke, dead centres, Compression Ratio, Swept volume, clearance volume, compression ratio, Engine capacity, Engine torque, Indicated power, Brake power, Friction power
- Classification of engines as per stroke, cycle, fuel, ignition, cooling, speed, number and arrangement of cylinders, governing, reciprocating and rotary,
- Concept of 2-stroke and 4- stroke engines and their comparison.

#### 2. Engine Components

(08 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.

#### 3. IC Engine Testing

(06 hrs)

Testing of I.C. engine and determination of Indicated Power and Brake Power. Mechanical Efficiency, Volumetric efficiency, Thermal Efficiency, Relative Efficiency, Mean Effective Pressure and Specific fuel consumption. Heat balance sheet, Morse Test.

4. Fuel System in spark Ignition Engine (10 hrs)

Fuel System: types of fuel feed system, gravity and pump feed. Fuel injection system, Fuel tank, fuel lines, fuel filters, carburetion, working of simple carburetor and its limitation.

Circuits of complete carburetor: Float circuit, starting and choke circuit, idling, low speed, high speed part load and full load circuits. Construction and working of solex carburetor dry and wet air cleaners. Intake and exhaust manifold, mufflers.

Petrol Injection: - Introduction, Comparison with Carburetor method, Description and working of multipoint fuel injection (M.P.F.I.), Advantages and disadvantages of M.P.F.I., Sensors.

5. Ignition system (06 hrs)

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

6. Cooling System (05 hrs)

Cooling system, necessity, types(air, water), pump circulation cooling., Advantages & Disadvantages of Air cooling & water cooling, Components of Water cooling system- Radiators, thermostat, water pump, Fan, Pressure cap, Water jackets, anti-freeze solution, trouble shooting and remedies.

7. Lubrication System (05 hrs)

Necessity and types of Lubrication system (Splash System, Pressure system), wet and dry sump, Components used, oil pump, oil lines, oil filters, oil coolers, crankcase ventilation, characteristics, classification and service ratings of lubricating oil, additives for lubricants.

### LIST OF PRACTICALS

1. Sketching and working of basic components of an automobile engine such as cylinder block, cylinder head, piston, connecting rod and crankshaft.
2. Testing of mechanical fuel pump.
3. Servicing of water-cooling system, radiator, fan, and pump, thermostat.
4. Identification of each part and working of two-wheeler carburetor
5. Servicing of lubrication system.
6. Find IP ,BP ,Mechanical efficiency of multi-cylinder petrol engine by using Morse test.
7. Testing and cleaning of Fuel injector (Petrol Engine).

## INSTRUCTIONAL STRATEGY

The Teacher should lay emphasis in making the students conversant with the principles and practices related to various types of engines. Audio visual aids should be used to show engine features and working. Demonstrations should be made in automobile shop to explain various engine components.

## RECOMMENDED BOOKS

1. Automobile Engineering – Vol. II by Dr. Kirpal Singh; Standard Publishers Distributors.
2. Automobile Engineering by R.B. Gupta; Satya Prakashan, New Delhi
3. Automotive Engines by Srinivasan, TMH, Delhi
4. Automobile Engineering by Chikara, Dhanpat Rai and Sons, New Delhi
5. Automobile Engineering by KM Gupta, Umesh Publishers, Delhi
6. Auto Engine –I by G.S. Aulakh, Eagle Prakashan, Jalandhar.

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	8	18
2	8	18
3	6	12
4	10	20
5	6	12
6	5	10
7	5	10
<b>Total</b>	<b>48</b>	<b>100</b>

### 4.3 STRENGTH OF MATERIALS

L T P  
4 - 2

#### RATIONALE

Diploma holders in this course are required to analyze reasons for failure of different components and select the required 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, columns and springs. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles in the solution of applied problems to develop the required competencies.

#### Learning Outcomes

After undergoing this course, the students will be able to:

- Interpret various concepts and terms related to strength of materials
- Calculate stresses in thin cylindrical shells.
- Calculate energy stored by materials subjected to axial loads.
- Calculate moment of inertia of different sections.
- Draw and calculate bending moment and shear force diagrams of beam under given loading
- Interpret the concept of bending and torsion and calculate stresses on different section of materials.
- Determine the diameter of a shaft under combined bending and torsion.
- Calculate critical axial loads on column under different end constraints.
- Determine the various parameters in closed coil helical and laminated springs
- Determine conformance of given materials sample to the prescribed Indian standards.

#### DETAILED CONTENTS

- |    |   |          |
|----|---|----------|
| 1. | Stresses and Strains  | (08 hrs) |
|    | 1.1. Basic assumptions; Concept of load, stress and strain              |          |
|    | 1.2. Tensile compressive and shear stresses and strains                 |          |
|    | 1.3. Concept of Elasticity, Elastic limit and limit of proportionality. |          |
|    | 1.3.1. Nominal and true stress-strain diagrams.                         |          |
|    | 1.3.2. Hook's Law   |          |
|    | 1.3.3. Young Modulus of elasticity                                      |          |
|    | 1.3.4. Nominal stress   |          |
|    | 1.3.5. Yield point, plastic stage                                       |          |



- 1.3.6 Ultimate strength and breaking stress
  - 1.3.7. Percentage elongation
  - 1.3.8. Proof stress and working stress
  - 1.3.9. Factor of safety
  - 1.3.10 Poisson's Ratio
  - 1.3.11 Shear modulus
  - 1.3.12 Deflection and stiffness
  - 1.4. Concepts of fatigue, creep and stress concentration
  - 1.5. Longitudinal and circumferential stresses in seamless thin walled cylindrical shells.
2. Resilience (04 hrs)
- 2.1 Resilience, proof resilience and modulus of resilience
  - 2.2 Strain energy due to direct stresses
  - 2.3 Stresses due to gradual, sudden and falling load.
3. Moment of Inertia (10 hrs)
- 3.1. Concept of moment of inertia and second moment of area
  - 3.2 Radius of gyration
  - 3.3 Theorem of perpendicular axis and parallel axis (without derivation)
  - 3.4 Second moment of area of common geometrical sections :Rectangle, Triangle, Circle (without derivation); Second moment of area for L,T and I section
  - 3.5 Section modulus
4. Bending Moment and Shearing Force (10 hrs)
- 4.1 Concept of beam and form of loading
  - 4.2 Concept of end supports-Roller, hinged and fixed
  - 4.3 Concept of bending moment and shearing force
  - 4.4 B.M. and S.F. Diagram for cantilever and simply supported beams with and without overhang subjected to concentrated and U.D.L.
5. Bending stresses (06 hrs)
- 5.1 Concept of Bending stresses

- 5.2. Theory of simple bending
  - 5.3. Use of the equation  $f/y = M/I = E/R$
  - 5.4. Concept of moment of resistance
  - 5.5. Bending stress diagram
  - 5.6. Calculation of maximum bending stress in beams of rectangular, circular, and T section.
  - 5.7. Permissible bending stress Section modulus for rectangular, circular and symmetrical I section.
- 6 Columns (08 hrs)
- 6.1. Concept of column, modes of failure
  - 6.2. Types of columns
  - 6.3. Buckling load, crushing load
  - 6.4. Slenderness ratio
  - 6.5. Factors effecting strength of a column
  - 6.6. End restraints
  - 6.7. Effective length
  - 6.8. Strength of column by Euler Formula without derivation
  - 6.9. Rankine Gourdan formula ( without derivation)
7. Torsion (10 hrs)
- 7.1. Concept of torsion- difference between torque and torsion.
  - 7.2. Use of torque equation for circular shaft
  - 7.3. Comparison between solid and hollow shaft with regard to their strength and weight.
  - 7.4. Power transmitted by shaft
  - 7.5. Concept of mean and maximum torque
  - 7.6. Concept of Principal stresses, principal planes and max. shear stress.
  - 7.7. Determination of shaft diameter under combined bending and torsion.
8. Springs (8 hrs)
- 8.1. Closed coil helical springs subjected to axial load
    - 8.1.1. Stress deformation

- 8.1.2 Stiffness and angle of twist and strain energy
- 8.1.3 Proof resilience
- 8.2 Determination of number of plates of laminated spring (semi elliptical type only)

### **LIST OF PRACTICALS**

1. Tensile test on bars of Mild steel and Aluminium.
2. Bending tests on a steel bar or a wooden beam.
3. Impact test on metals
  - a) Izod test
  - b) Charpy test
4. Torsion test of solid specimen of circular section of different metals for determining modulus of rigidity.
5. To determine the stiffness of a helical spring and to plot a graph between load and extension.
6. Hardness test on different metals.

Note : All the tests need to be done as per prescribed Indian Standards.

### **INSTRUCTIONAL STRATEGY**

1. Expose the students to real life problems.
2. Plan assignments so as to promote problem solving abilities and develop continued learning skills.

### **RECOMMENDED BOOKS**

1. SOM by Birinder Singh,; Katson Publishing House, New Delhi.
2. SOM by RS Khurmi; S.Chand & Co; New Delhi
3. Mechanics of Materials by Dr. Kirpal Singh; Standard Publishers Distribution, New Delhi.
4. Elements of SOM by D.R. Malhotra and H.C.Gupta; Satya Prakashan, New Delhi.

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	08	12
2	04	06
3	10	16
4	10	16
5	06	10
6	08	12
7	10	16
8	08	12
<b>Total</b>	<b>64</b>	<b>100</b>

## 4.4 CHASSIS, BODY AND TRANSMISSION - I

**L T P**  
**3 - 2**

### RATIONALE

Chassis, body and transmission form the core of automobile engineering. The subject focuses at imparting knowledge and skills regarding chassis and body viz. clutch system, transmission system, final drive, steering mechanism.

### Learning Outcomes :

On completion of this course, a learner should be able to:

- Classify the vehicle
- Explain the function and working of clutch
- Explain the function and working of manual and automatic transmission
- Describe the functional and constructional features of final drive and its components and front axles.
- Comprehend steering geometry
- Explain the working and constructional features of steering system and their components

### DETAILED CONTENTS

#### 1. Chassis and Body (08 hrs)

Classification of vehicles, types of chassis, layout of conventional type of chassis, function and arrangement of major assemblies. Alternating arrangement used such as engine position, drive types, their merits and demerits., types of frame and body streamlining, cross members, brackets, materials of frame and body upholstery..

#### 2. Clutch (10 hrs)

Necessity, function and requirements of clutch, types of clutch - single plate clutch, multi plate clutch, hydraulic power assisted and wet and dry plate clutch, clutch plate and lining material

Constructional details and working of centrifugal, semi centrifugal clutch, diaphragm clutch and fluid coupling.

#### 3. Transmission (10 hrs)

Necessity, function and types of manual transmission- Sliding, constant mesh and synchromesh. Over drive, over running clutch, description and operation of transfer gear box. Common faults and remedies

- Types of automatic transmission and their main components

- Epicyclic gear box – construction, working and determination of speed ratio

Torque converter – construction, principle of working. Continuously variable transmission, Automated Manual Transmission

4. Final Drive (08 hrs)

Propeller shaft – function, construction details. Universal joints - functions and types. Types of final drive – hotchkiss drive, torque tube drive. Differential – principle, functions and its working. Rear axles – semi floating, three quarter floating. fully floating . Common faults and remedies

5. Front Axle (04 hrs)

Types – Stub double drop, fully dropped, load distribution, effect of braking on axle shape, steering head, Elliot and reverse elliot, steering knuckle.

6. Steering (08 hrs)

Steering mechanism, function, Davis and Ackerman’s Principle of steering. Working and constructional details of steering gear, steering linkages, sector arm, center arm, drag link and tie rod steering stops. Front wheel geometry-caster, camber, steering axis inclination, toe in and toe out. Cornering force, cornering power and self-righting torque. Over steering and under steering. Power steering – necessity, types, Construction features and working of hydraulic and electronic power steering systems, Common steering systems troubles and remedies

### LIST OF PRACTICALS

1. Demonstration and sketching of Heavy and Light vehicle chassis.
2. Identification and servicing of single plate and multi plate clutch.
3. Servicing of centrifugal clutch.
4. Servicing and overhauling of constant mesh and synchromesh gear box
5. Servicing of universal joints, slip joint and propeller shaft
6. Servicing of differential, adjustment of crown and pinion backlash.
7. Checking and adjustment of steering geometry, camber, caster, Toe-in, Toe-out, kingpin inclination.

### INSTRUCTIONAL STRATEGY

Teacher should make use of audio visual aids to show features of chassis, body and transmission. Demonstration should be made in the automobile shop to explain various aspects of chassis, body and transmission.

### RECOMMENDED BOOKS

1. Automobile Engineering, Vol. I- II by Dr. Kirpal Singh, Standard Publishers
2. Automobile Engineering by GBS Narang, Khanna Publishers, Delhi
3. Chassis, Body and Transmission-I by G.S.Aulakh, Eagle Prakashan, Jalandhar.
4. Automobile Engineering by R.B. Gupta, Satya Prakashan, New Delhi.
5. Chassis, Body and Transmission by Ishan Publications, Jalandhar.

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	8	18
2	10	20
3	10	20
4	8	18
5	4	08
6	8	16
<b>Total</b>	<b>48</b>	<b>100</b>

## 4.5 COMPUTER AIDED DRAFTING IN AUTOMOBILE ENGINEERING

L T P  
- - 6

### RATIONALE

Competency in computer-aided drafting is essential for diploma holders in Automobile Engineering. Hence this subject is required.

### LEARNING OUTCOMES :

After undergoing the subject, students will be able to:

- Apply basic cad command to develop 2D and 3D drawings of automotive components using AutoCad.
- Prepare drawings of automotive components by using autocad and other software.

### DETAILED CONTENTS

1. Introduction to AutoCAD
  - 1.1. Introduction to AutoCAD. Setting the drawing environment: Limits, Grid, Snap, Axis, Units, Ortho, Co- Ordinates ON, OFF Units and Color.
  - 1.2. 2D Drawing entities – Point, Line, Arc, circle, Ellipse, Polygon, and Trace. Object Selection using Object Snap (OSNAP).
  - 1.3. Editing commands: Selection of entities by different methods - copy, Move, Scale, Rotate, Fillet, Chamfer, and Mirror, Array-Polar, Rectangular. Measure, Divide, and Erase.
  - 1.4. Drawing Display Methods: Zoom, Pan, and View.
  - 1.5. Adding Texts and Dimensions: Text, Dimension-linear, continued, angular
  - 1.6. Pedit commands. Working on multiple layers, Layer concepts in Auto CAD -Various options with layer command - Hatch command - Creating line types, library and user made library.
  - 1.7. Preparing the schematic drawing of a workshop building in one layer, the blocks of machines in another Layer and Electrical connection on another layer.
2. Drawing of 2D views of following automotive components using AutoCAD (Any Six sheets)
  - V – belt pulley
  - Stepped cone pulley
  - Ball bearing
  - Sectional front view of screw jack
  - Spur gear



- Poppet valve
  - Wheel cylinder (sketch)
  - Valve tappet
  - Crank shaft
  - Master cylinder
  - Connecting rod
  - Piston
  - Semi-elliptic leaf spring
  - Coil spring
  - Internal expanding shoes brake (sketch)
3. Introduction to 3D features of AutoCAD

### **INSTRUCTIONAL STATREGY**

1. Teachers should demonstrate use of AutoCAD, while teaching..
2. Emphasis should be given on dimensioning and layout of sheet.
3. Teacher should ensure use of IS Codes related to drawing.

### **RECOMMENDED BOOKS**

1. AutoCAD by Shyam Tickoo, Dream Tech. Publication, Delhi
2. Computer aided drafting – Auto CAD, ISTE Nomogram, Delhi

## 4.6 WORKSHOP TECHNOLOGY-II

L T P  
3 - 7

### RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various machining processes, modern machining methods, tools, jigs and fixtures is required to be imparted. Hence the subject of workshop technology.

### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Perform turning, step turning, taper turning, threading and knurling operation on lathe machine.
- Resharpen/grind single point tool.
- Select material and tool geometry for cutting tools on lathe.
- Perform drilling, reaming, counter boring, counter sinking and tapping operations on drilling machine.
- Explain the nomenclature of a drill
- Perform filing, cutting, fitting and die tapping operations
- Perform keyway cutting and angular/step surface shaping on shaper.
- Explain geometry of single point tools, various types of lathe tools and tool materials.
- Explain uses of lathe accessories and different types of lathes.
- Explain boring operation, features of boring machine and boring tool.
- Explain the uses and features of jigs, fixtures, locating devices and clamping devices.
- Select cutting fluid for different materials and operations.
- Describe the features of various types of broaching machines.

### DETAILED CONTENTS

1. Cutting Tools and Cutting Materials (06 hrs)
  - 1.1. Cutting Tools - Various types of single point cutting tools and their uses, Single point cutting tool geometry, tool signature and its effect, Heat produced during cutting and its effect, Cutting speed, feed and depth of cut and their effect
  - 1.2 Cutting Tool Materials - Properties of cutting tool material, Study of various cutting tool materials viz. High-speed steel, tungsten carbide, cobalt steel cemented carbides, stellite, ceramics and diamond.
2. Lathe (10 hrs)
  - 2.1 Principle of turning
  - 2.2 Description and function of various parts of a lathe

- 2.3 Classification and specification of various types of lathe
  - 2.4 Drives and transmission
  - 2.5 Work holding devices
  - 2.6 Lathe tools: Parameters/Nomenclature and applications
  - 2.7 Lathe operations :- Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling, form turning, spinning.
  - 2.8 Cutting parameters – Speed, feed and depth of cut for various materials and for various operations, machining time.
  - 2.9 Speed ratio, preferred numbers of speed selection.
  - 2.10 Lathe accessories:- Centers, dogs, different types of chucks, collets, face plate, angle plate, mandrel, steady rest, follower rest, taper turning attachment, tool post grinder, milling attachment, Quick change device for tools.
  - 2.11 Brief description of capstan and turret lathe, comparison of capstan/Turret lathe, work holding and tool guiding devices in capstan and turret lathe.
3. Drilling (06 hrs)
- 3.1 Principle of drilling.
  - 3.2 Classification of drilling machines and their description.
  - 3.3 Various operation performed on drilling machine – drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping.
  - 3.4 Speeds and feeds during drilling, impact of these parameters on drilling, machining time.
  - 3.5 Types of drills and their features, nomenclature of a drill
  - 3.6 Drill holding devices.
  - 3.7 Types of reamers.
4. Boring (04 hrs)
- 4.1 Principle of boring
  - 4.2 Classification of boring machines and their brief description.
  - 4.3 Specification of boring machines.
  - 4.4 Boring tools, boring bars and boring heads.
  - 4.5 Description of jig boring machine.
5. Shaping and Planing (08 hrs)
- 5.1 Working principle of shaper and planer
  - 5.2 Type of shapers
  - 5.3 Type of planers
  - 5.4 Quick return mechanism applied to shaper and planer machine.
  - 5.5 Work holding devices used on shaper and planer
  - 5.6 Types of tools used and their geometry.
  - 5.7 Specification of shaper and planer .
  - 5.8 Speeds and feeds in above processes.

6. Broaching (04 hrs)
- 6.1 Introduction
  - 6.2 Types of broaching machines – Single ram and duplex ram horizontal type, vertical type pull up, pull down, push down.
  - 6.3 Elements of broach tool, broach tooth details – nomenclature, types, and tool material.
7. Jigs and Fixtures (06 hrs)
- 7.1 Importance and use of jigs and fixture
  - 7.2 Principle of location
  - 7.3 Locating devices
  - 7.4 Clamping devices
  - 7.5 Types of Jigs – Drilling jigs, bushes, template jig, plate jig, channel jig, leaf jig.
  - 7.6 Fixture for milling, turning, welding, grinding
  - 7.7 Advantages of jigs and fixtures
8. Cutting Fluids and Lubricants (04 hrs)
- 8.1 Function of cutting fluid
  - 8.2 Types of cutting fluids
  - 8.3 Difference between cutting fluid and lubricant
  - 8.4 Selection of cutting fluids for different materials and operations
  - 8.5 Common methods of lubrication of machine tools.

## **PRACTICAL EXERCISES**

### **Turning Shop**

- Job 1. Grinding of single point turning tool.
- Job 2. Exercise of simple turning and step turning.
- Job 3. A composite job involving, turning, taper turning, external thread cutting and knurling.

### **Advance Fitting Shop**

- Job 1. Exercise on drilling, reaming, counter boring, counter sinking and tapping
- Job 2. Dove tail fitting in mild steel
- Job 3. Radius fitting in mild steel
- Job 4. Pipe threading with die

### **Machine Shop**

- Job 1. Prepare a V-Block up to  $\pm 0.5$  mm accuracy on shaper machine
- Job 2. Exercise on key way cutting and spline cutting on shaper machine.

## INSTRUCTIONAL STRATEGY

1. Teachers should lay emphasis in making students conversant with concepts and principles of manufacturing processes.
2. Focus should be on preparing jobs using various machines in the workshop.
3. Foreman Instructor should conduct classes of each workshop explaining use of tools, jobs to be made and safety precautions related to each workshop prior to students being exposed to actual practicals.

## RECOMMENDED BOOKS

1. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Sons; Delhi
2. Elements of Workshop Technology by SK Choudhry and Hajra; Asia Publishing House
3. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi

## SUGGESTED DISTRIBUTION OF MARKS

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5	08	16
6	04	08
7	06	12
8	04	08
<b>Tot1al</b>	<b>48</b>	<b>100</b>

## **ENTREPRENEURIAL AWARENESS CAMP**

This is to be organized at a stretch for two to three days during fourth semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject

1. Who is an entrepreneur?
2. Need for entrepreneurship, entrepreneurial career and wage employment
3. Scenario of development of small scale industries in India
4. Entrepreneurial history in India, Indian values and entrepreneurship
5. Assistance from District Industries Centres, Commercial Banks, State Financial Corporations, Small industries Service Institutes, Research and Development Laboratories and other financial and development corporations
6. Considerations for product selection
7. Opportunities for business, service and industrial ventures
8. Learning from Indian experiences in entrepreneurship (Interaction with successful entrepreneurs)
9. Legal aspects of small business
10. Managerial aspects of small business